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Annotated Bibliography of Farm Animal Wastes

Technical Appraisal
Report EPS 3-WP-72-1

Water Pollution
Control Directorate
December, 1972

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AN ANNOTATED BIBLIOGRAPHY

OF

FARM ANIMAL WASTES

by

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PREFACE

Farm animal manure has formed the basis for very many years of various successful intensive farming systems in some areas of the world, notably in parts of Europe. Earlier research and experimentation concerned with this material was devoted almost entirely to its plant nutrient value and its value as a soil conditioner. With increasing mechanization of agriculture, the emphasis in animal manure research shifted to developing handling systems within livestock and poultry operations aimed at minimizing the labour input associated with the traditional methods of housing and cleaning. The success of this work, together with developments in other facets of animal production including feeding, breeding and disease control, has been reflected in a rapid 'urbanization' of the livestock and poultry industries over a space of some 10 - 15 years. As a result, very large numbers of animals frequently are maintained at high stocking densities on one location.

With the ready availability of relatively cheap inorganic fertilizers, the manure from these large scale animal operations came to be regarded as a major nuisance, being often considered a waste product and a liability. As such, its management and disposal received scant attention until little more than a decade ago when some research was initiated to find solutions to some pressing problems in these areas. The realization that farm animal wastes can be a significant factor in environmental quality provided further stimulus to the development of more active research programmes in the whole subject area. With environmental quality in many countries now considered a priority issue, funds have been channelled at an increasing rate to support steadily expanding, comprehensive programmes of research into animal wastes and their associated problems in addition to other areas of environmental concern.

This expansion has resulted in a proliferation of literature and knowledge within the last four or five years at a rate which perhaps has few equals in agricultural research. Relevant material has appeared in a very wide range of periodicals, in government, university and research station reports and publications and in conference proceedings, from various parts of the world. Animal waste research, by its very nature, has resulted to some extent in the breakdown of traditional lines of demarcation between disciplines and produced, of necessity, more cooperation between the various fields of specialization involved. The location and retrieval of relevant material poses a problem to those researchers who have been working in the field for some years. This problem, however, is compounded for the many researchers becoming involved for the first time as research programmes expand. Extension personnel and others concerned with the dissemination of information and with the development of efficient production systems within an environment conscious society face a similar problem.

A comprehensive bibliography of farm animal wastes, containing an abstract with each reference citation, would appear to offer at least a partial solution to these problems. In its initial concept, this bibliography was intended to provide an up-to-date listing of published material *concerned with engineering aspects of farm animal wastes for use within the Department of Agricultural Engineering, University of Alberta. Because of the difficulty in making the distinction between what was strictly the concern of the agricultural engineer and those of other disciplines, the scope of the material referenced gradually widened. An increasing number of requests for published references from colleagues on campus in various disciplines and from individuals within the Province finally prompted the decision to treat animal wastes as a 'discipline' in its own right. This bibliography is the outcome of this decision.*

The bibliography is divided into seven sections on the basis of the sources from which the material was located. It contains 2,352 reference citations, each with an abstract containing the pertinent information or content of the publication. Since abstracting involves a personal interpretation and evaluation of the subject matter, and as the significance of the material may not always be apparent to the individual preparing an abstract, particularly when the material is foreign to his own discipline, the advisability of locating the original publication to verify information and data should be stressed.

Relatively few references to animal wastes appear in the literature prior to about 1960. The value of an exhaustive search for material prior to this time did not appear warranted in view of the many technological developments in animal production which have taken place since then. The bibliography, therefore, covers the period from 1960 to the end of 1971. In the last sections some 1972 publications are listed as these sections were the most recently completed.

Although the bibliography citations are very largely associated with the findings of research into the many aspects of animal wastes and related problems, other areas such as extension recommendations in the animal waste field also are included. Because such material is subject to change as a consequence of technological developments, only material considered relevant to current patterns of animal production was listed.

A subject-author, cross-reference index forms the eighth and final section. The use of an extensive list of keywords was considered advisable because of the multidisciplinery nature of the bibliography and because of the problems of terminology associated with material originating from various countries. Procedures for the use of the index are given in the introduction to the section. The index in conjuction with the reference sections hopefully should be useful to researchers, extension personnel and others interested in farm animal wastes in locating information on specific aspects or topics in addition to indicating the extent of available knowledge.

Ernest M. Barber
J. Brian McQuitty

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Acknowledgement is made to the Alberta Cattle Commission and the Alberta Agricultural Research Trust for their financial support of a project, entitled "A study of pollution arising from beef cattle operations in Alberta", which provided the opportunity to initiate the preparation of this bibliography. Acknowledgement also is due to Dr. K.W. Domier, Chairman, Department of Agricultural Engineering, University of Alberta, for his cooperation in administrative matters to permit its continued progress and completion.

Sincere thanks are due to many individuals, too numerous to name, in universities, research stations and government agencies across North America and in Europe for their valuable cooperation in promptly locating and forwarding reprints and other material. Special thanks are due to Mrs. Pam Kupsch and Mrs. Betty Horton for their excellent work in typing the various drafts and final manuscript, and to Miss Elsieanne Symons who cheerfully carried the extra office work while typing was in progress.

Finally, grateful acknowledgement is made to the Environmental Protection Service, Canada Department of the Environment, Ottawa, for their interest in and willingness to publish this bibliography.

CONTENTS

SECTION A

This first section contains references listed in abstracting journals and bibliographies. For the most part, each abstract is reproduced as it appeared in these sources. In a few cases, an abstract was abbreviated by elimination of subject matter not considered relevant to farm animal wastes. Occasionally it was necessary to re-write an abstract where deletions in the original created some ambiguity.

A-001 Nikishkina, P.I. 1957. (The effect of crop rotation involving systematic application of manure on changes in the agrochemical characteristics of turf-peat-podzolic soils.) Trudy Pochv. Inst. Akad. Nauk SSSR, 50: 32-54. (cited in Biol. Abstr., 35: Abstr. No. 2592.)

"Years of work by the Dolgoprudnaya Agrochemical Testing Station have proven the highly beneficial consequences of systematic application of manure in crop rotation. The total absorbed Ca, Mg, and K is increased, as is the easily soluble P as well as humus. Of the total quantity of manure applied to the soil 72% is mineralized and 28% retained in the form of humus. In a vegetation experiment performed on soils taken from manured plots the application of N resulted in a sharp increase in the yield while that of PK had little effect."

A-002 Larvor, P. and M. Brochart. 1959. Le rythme nycthéméral de la concentration en minéraux de l'urine et des fèces chez les bovins. (Nocturnal rhythm in the mineral concentration of urine and feces in cattle.) Ann. Inst. Natl. Rech. Agron. Ser. D. Ann. Zootech., 8(1): 57-80. (cited in Biol. Abstr., 35: Abstr. No. 3753.) .... France

"Samples were tested every 4 hr. through the 24 hr. cycle. Total dry weight of urine was at a minimum at 10 A M and at a maximum at 11 P M. The concentration of K and the K/Na ratio paralleled the previous statement, while Na concentrations were minimum at 11 P M with 2 maxima at 2 P M and 2 A M; Cl was maximum at 6 P M and 6 A M. P levels were low between 2-4 P M and high between 6 A M and 2 P M. Dry fecal material had maximum weight at 2-4 P M and minimum weight at 10 A M; Ca value varied little while Na, K and P varied according to the atmospheric temperature. Ca, Cl and K had maximum excretion at 2 P M while Na and P had a maximum at 6 P M. The product of the means of urinary Ca and P remained constant. The correlation between urinary Ca and P corrected as a function of the dry material may be expressed by Ca = 0.0055/P. The roles of hormones and outside temperature differences in excretion were discussed."

A-003 Zagorodnyy, G.P. 1956. (Manure as a plant nutritive in irrigation.) Trudy Dagestansk. S-kh. Inst., 1956(9): 30-35. (cited in Biol. Abstr., 35: Abstr. No. 5687.)

"Both passing irrigation water through natural troughs filled with manure and using trench sprinklers require excessive labor and result in uneven distribution of the nutritive elements on the field. It is proposed that a hole with a volume of up to 3 cubic meters be dug not far from the irrigating ditches and that in this hole one ton of manure be mixed with one cubic meter of water. Then the irrigation waters can be passed through this mixture. When manure was used in a dose of 4-5 T/hectare, a grain harvest of 18.4 centners/hectare was achieved (as against 10.6 centners/hectare in the control). The technical basis of this method is described and the labor expenditure is calculated; as a method it is rated very highly on the basis of four years of observations."

A-004 Zakharov, I.S. 1956. Vliyaniye navoza na mikrofloru nekotorykh poley sevooborota na chernozemnykh pochvakh Moldavii. (The effect of manure on the microflora of several crop-totaled fields in the Chernozem Soils of Moldavia.) Izv. Moldavsk. Fil. Akad. Nauk SSSR, 1956(2): 85-95. (cited in Biol. Abstr., 35: Abstr. No. 5688.)

"At the Kishinev Agricultural Institute Test Station, the application of manure on the fallow in ordinary carbonate chernozem soil sharply raised the amount of bacteria, which develop on meat peptone agar, and phosphoric bacteria, this suppressing the development of nitrogenous bacteria. The quantity of nitrifiable microorganisms, actinomycetes and cellulose decomposing bacteria increased at an insignificant rate. The action resulting from manure on a field with winter wheat was considerably weaker in regard to the development of bacteria.

A-005 Kawakami, Y. et. al. 1958. Miyagawanella: Psittacosis-lymphogranuloma group of viruses. 5. Isolation of a virus from feces of naturally infected sheep. Jap. J. Exp. Med., 28(1): 51-58. (cited in Biol. Abstr., 35: Abstr. No. 10816.)

"A virus which belongs to Miyagawanella was readily isolated from feces of apparently healthy sheep in Hokkaido, Japan. In total 25 sheep were tested and the virus was isolated from 8 of them. This finding, together with a high incidence of complement-fixing antibodies against the virus indicate a high incidence of infection of the sheep with this virus. The virus is closely related with the bovine psittacosis-lymphogranuloma virus and goat pneumonitis virus. Preliminary examination seems to show that the virus is more closely related with the former virus than the latter. It is considered to be of importance to know the relation among those closely related viruses and furthermore the relation of this virus to the virus of enzootic abortion of sheep and the sheep pneumonitis virus. It is not known what types of disease the virus can produce in the sheep, since those strains of the virus were isolated from apparently healthy sheep. . . ."

A-006 Anon. 1956. (Several ways to increase the effectiveness of manure and mineral fertilizers.) Sbornik Nauchn. Trudov Est. S-kh. Akad., 1956(2): 76-86. (cited in Biol. Abstr., 35: Abstr. No. 11309.)

"Methods of increasing the effectiveness of manure were studied in experiments conducted on poor podzolic soils. In experiments with oats the grain crop increased 13% when treated with manure which had been composted with 2% by weight of phosphate fertilizer. Manure on a peat base increased the crop by 43%, compared with phosphate fertilizer on a straw base. In field experiments with winter rye, adding manure composted with 4.7% phosphate fertilizer and 3.3% KCl gave 33.9 centners of rye per hectare. In experiments with spring wheat the effectiveness of fresh manure increased two times when mineral N was added; in this experiment P and K were not effective. Analogous results were attained in field experiments with winter rye. When manure was composted for four months with 2-15% of shale ash the losses of N were reduced almost two times; shale ash when composted with manure increases microbiological activity in the compost."

A-007 Suemaga, O. 1958. (Ecological studies of flies. 1. On the amount of larvae of housefly and stablefly breeding in animal manure.) Nagasaki Med. J., 33(11): 124-133. (cited in Biol. Abstr., 35: Abstr. No. 14471.) .... Japan
Manure from cattle and pigs was examined for fly larvae for one year. 8 fly species were isolated from both manures. Housefly, stablefly, and the 6 other species accounted for 40.35%, 59.18% and 0.47%, respectively, of the total population in cow manure. The corresponding figures for pig manure were 2.65%, 90.40%, and 6.95%, indicating less breeding of houseflies in pig manure. The larvae of houseflies were effectively killed by holding the manure in liquid form, whereas this treatment did not completely kill all stablefly larvae.

A-008 Manell, E. 1958. Försök med stallgödsel. I. Försök med stallgödselns fordeling i växtföljden. (Manure experiments. I. Distribution of stable manure in the rotation of crops.) K. Lantbrukshögskolan Stantens. Jordbruksförsök, Meddel, 95: 1041. (cited in Biol. Abstr., 35: Abstr. No. 22094.)
"Working with 2 different crop rotation cycles, manure was added at different points in the cycle. The experiments were carried out on both mineral and organic soils in different parts of Sweden. The increase in yield on mineral soils was greater when the manuring was divided on 2 years in the rotation cycle than when the manuring was done in 1 operation. On organic soils the reverse was the case. Manuring had no significant effect upon the crude protein content or the weight per hl of grain of barley and oats."

A-009 Butkevitch, V.V., N.Z. Laiykov and V.M. Perepilitsa. 1956. (Effect of phosphorite, superphosphate and manure on the fertility of lixiviated black earth.) Vestn. S-Kh. Nauki, 1956(3): 34-42. (cited in Biol. Abstr., 35: Abstr. No. 22172.)
"In continuous experiments (from 1912 to the year 1946) on lixiviated black earth of the Experimental Station of Shatilov, the following fertilizer placements have been made: phosphorite, computed at the rate of 135 kg/ha P_2O_5 after every 3 years and superphosphate in the amount of 45 kg/ha P_2O_5 every year, with manure foundation and without it. The latter was placed at the rate of 18 tons/ha after every 3 years. Over a 20-year-period, the average increase of yield in grain of rye amounted to 4.9 in the case of phosphorite, 4.2 - superphosphate, and in case of manure, correspondingly to 6.6 and 6.2 c/ha. As a result of a continuous interaction with soil, P_f is subjected to decomposition and its assimilability is constantly increasing; on the other hand, the assimilability of P_s decreases without interruption. Pulverization and draining of soils leads to the increase of P_2O_5 - soluble in water in them. An important role played by manure and phosphates, particularly combined, in the accumulation of N by clover on lixiviated black earth, has been established."

A-010 Koshel'kov, P.N., U.G. Oksent'yan, Z.M. Osipova and D.V. Khar'kov. 1958. Importance of manure and mineral fertilizers in raising fertility of sod-podzolic soils. Pochvovedenie (Transl.) 6: 667-673. (cited in Biol. Abstr., 35: Abstr. No. 39237.)

"This work gives the results of a field experiment extending over a period of years in which different quantities of mineral fertilizers were applied to land with and without manuring. The experiment was begun in 1937 on a fine clay loam sod-podzolic soil of the Dolgoprudnaya Agrochemical Experiment Station, Scientific Research Institute for Fertilizers and Insecticides. . . . The addition of manure to the mineral fertilizers had the same result as simply increasing the quantity of the latter. Manure is less effective than an equal quantity of mineral fertilizer containing the same amount of nitrogen. . . . The application of manure and mineral fertilizers led to an increase in the soil content of total and hydrolyzable humus and nitrogen compounds, available phosphates and potassium. With respect to the physico-chemical soil properties manure proved to have a certain basic action on it. Mineral fertilizers, applied to previously limed soil in combinations designed to avoid side effects, did not exert any material influence at all on the physico-chemical properties of sod-podzolic fine clay loam. . . . The application of manure has a favorable effect on the activities of the soil microorganisms. However, mineral fertilizers in large quantities have an inhibiting action on the microflora. . . . The wide use of mineral fertilizers combined with the mobilization by all possible means of manure and other local organic fertilizers will make it possible to increase the effective fertility of sod-podzolic soils and to increase sharply the yields."

A-011 Ivanov, P.K. 1957. (The effectiveness of manure and mineral fertilizers in different groups of crop rotation.) Udobrenie i Urozhai, 1957(6): 39-42. (cited in Biol. Abstr., 35: Abstr. No. 48814.)

"Three methods of applying fertilizers (manure 36 t/ha, also $N_{65}P_{90}K_{90}$) have been investigated at the Bezenchuk Experimental Station in a series of experiments over several years. The tests were made at the same time on three uniform systems of field rotation: fallow, rye, wheat with subsequent sowing of grass, grass, grass, hard wheat, soft wheat, sunflower and oats. (1) The fertilizer is applied in the fallow period; we call this group I; (2) Application together with the wheat when grass is following (group II); (3) Application together with the sunflowers (III). The after-effect has been determined for manure and NPK-fertilizer up to the fifth crop. The application of the fertilizers in I and II, near the grass period, resulted in a higher effectiveness of manure and NPK-fertilizer, the after-effects of manure and NPK remained high up to the 4th crop. For instance, the grass harvest was higher by 21%. The 5th crop yield dropped in comparison with the 4th, to a considerable extent, however, only in the case of hard wheat. In the other crops the NPK-fertilizer effectiveness decreased only with comparison with manure fertilization."

A-012 Ponnamperuma, F.N. 1958. Response of potato to fertilizers, manure, lime and trace elements. Trop. Agr. (Ceylon), 114(2): 99-114. (cited in Biol. Abstr., 35: Abstr. No. 64575.)

"Fertilizer experiments with potato in the hill country of Ceylon have shown that striking increases in yield can be obtained by the use of fertilizers, manure, and lime. On the deep, strongly acid, well drained lateritic soils of medium texture and good structure, at

Rahangala, the responses to N, P, cattle manure, and lime have been spectacular. At this station, responses as high as 2.8 tons per acre to 100 lb. N, 5.2 tons per acre to 200 lb. P_2O_5, 1.8 tons per acre to 10 tons cattle manure and 1.9 tons per acre to 10 cwt. dolomitic limestone have been obtained with the variety "Up-to-date". The response to potassium was appreciable only during one season when it was 1.7 tons to a dressing of 100 lb. K_2O per acre. . . . On the acid, humic loams fairly well supplied with plant nutrients, of the cool humid stations, Ambewela and Bopatalawa, the responses to fertilizers were less conspicuous than at Rahangala. . . ."

A-013 Van Weerden, E.J. 1959. Over de osmotische waarde en de gehalten aan enige opgeloste bestanddelen van de darminhouden de mest bij het rund, in verband gebracht met de resorptie der mineralen. (The osmotic pressure and the concentration of some soluble components of the intestinal contents and the feces of the cow, in relation to the absorption of the minerals.) Mededel. Landbouwhogesch. Wageningen, 59(1): 1-99. (cited in Biol. Abstr., 35: Abstr. No. 66089.)

The concentration of some osmotically-active elements in bovine intestinal contents and feces were measured. Na concentrations in the feces were only 1/7th that of the blood. Concentrations in NH_4 and some anions were also lower in the feces than in the blood.

A-014 Chu, Y.S. and C.Y. Wang. 1958. (The experiment on the action of fermentation upon viable eggs of S. japonicum in composted manure.) Chinese Vet. J., 11: 505-513. (cited in Biol. Abstr., 36: Abstr. No. 2798.)

"Under a definite procedure and certain ratio, compact piles are built with materials such as bovine manure, bedding, green weeds, drainage and sewage from barns. Through the process of aerobic or anaerobic fermentation, a high temperature (sometimes up to 71°C) will be generated after a few days. Since the temperature can be maintained for many days above 42°C, the viable eggs of schistosomes will be killed. . . . Under different temperature the lethal durations of viable eggs of S. japonicum of bovine origin were tested in laboratory as follows: 53.5°C 30", 52.5°C 1', 51.5°C 3', 50.5°C 3', 49.5°C 5', 48.5°C 20', 47.5°C 60', 46.5°C 100', 45.5°C 150' and 44.5°C 210'. The disposal of bovine manure in the villages is in different ways. The essential features are suggested as follows: (1) the "keeping of cattle in the barns, hogs in the pens" should be promoted, and viable eggs of schistosomes should be destroyed; (2) chemical fertilizers should be used to compensate when the amount of fermented manure is not enough; (3) utilization of fresh manure as fertilizer should be strictly prohibited in order to prevent the viable eggs of schistosomes from artificial distribution."

A-015 Olds, J. 1960. Processing poultry manure for fertilizer use. Compost Sci., 1(2): 24-27. (cited in Biol. Abstr., 36: Abstr. No. 25038.)

"Poultry manure is the richest in plant food value of the farm manures. Correctly conserved and marketed, it is worth as much to the broiler raiser as an extra 1½ cents per pound on the selling price of broilers he raises. To the egg producer, it is worth as much as an extra dozen eggs per hen for the year. To the poultry industry, this can mean hundreds of millions of dollars of extra income annually. Greater effort is being made on the part of individuals, cooperatives and state experiment stations to develop more efficient and practical methods for processing poultry manure into salable fertilizer. Methods tried to date include composting and drying, artifical drying, and more recently, pelleting."

A-016 Rigor, E.M. 1957. Relative viability of swine kidney-worm larvae in plain water and water polluted with urine or manure. Philippine J. Anim. Ind., 18(1/4): 9-19. (cited in Biol. Abstr., 36: Abstr. No. 25645.)

"A preliminary study on the relative viability of swine kidney-worm larvae in plain tap water, in water polluted with pig urine or with pig manure as well as wet animal charcoal is presented. Viability in plain tap water of the Metropolitan Water District which had been sedimented, chlorinated, and aerated, was 27 days; in wet animal charcoal, 34 days; and in wet animal charcoal with 10% pig manure, 27 days. In tap water polluted with pig urine at concentrations of from 1 to 6%, the viability ranged from 14 to 17 days; in water with urine concentration ranged from 14 to 17 days; in water and urine concentration from 7 to 10%, the viability ranged from 7 to 12 days. Thus the presence of urine in water tended to shorten the viability rather than increase it, and above 6% pollution the viability tended to shorten abruptly. The viability of the kidney-worm larvae in tap water polluted with manure tended to increase progressively from 24 to 111 days, with the longest viability at concentrations of 5 to 6%, that is, 108 and 111 days, respectively. This may be explained on the basis of nutrition and other favorable ecological factors. But the viability tended to shorten at concentration of 7 to 10% of the pig manure in water, and these may be due to the hypertonic condition of the liquid medium making it possibly less favorable to the larvae. The hydrogen ion concentration of the media studied did not seem to affect the viability of swine kidney-worm larvae since variations were very slight."

A-017 Jansson, S.L. 1960. (On the humus properties of organic manures. I. Actual humus properties.) Kungl. Lantbrukshögskolans Ann., 26: 51-75. (cited in Biol. Abstr., 36: Abstr. No. 28490.)

"An attempt is made to determine the humus properties of organic manures, represented by fresh cow dung, well-rotted farmyard manure, and digested sewage sludge. . . . The manures are biologically decomposed and this decomposition causes a relative increase of their ligninous complex and their organic N content. The N content of the ligninous complex is very high in the farmyard manure and the digested sludge. The size of the ligninous complex in these materials lies between that of fresh plant residues and developed humus types. In this respect the fresh cow dung is very similar to fresh plant residues. The acid-base condition of the test materials is favorable for humus formation, but since they are formed under prevailingly anaerobic conditions their oxidation rates are low. The oxidation rate of the farmyard manure and the sludge is similar to that of the humus of an acid podzol. The actual humus properties of the test materials are weak. Their relatively large ligninous complex, their high N content, and their favorable acid-base condition indicate, however, that their potential humus properties may be favorable."

A-018 Jansson, S.L. 1960. (On the humus properties of organic manures. II. Potential humus properties.) Kungl. Lantbrukshögskolans Ann., 26: 135-172. (cited in Biol. Abstr., 36: Abstr. No. 28491.)
"The purpose of the investigations described in the present paper was to examine the potential humus properties of the test materials, fresh cow dung, well-rotted farmyard manure, and digested sewage sludge, the actual humus properties of which were reported in an earlier paper. Compared with reference materials (litter and humus types) investigated by Mattson and Anderson the potential humus properties of the test materials were weak. Their acidoid character was less pronounced and their ammonia fixation considerably smaller. . . ."

A-019 Misterski, W. and W. Loginow. 1960. Badania nad próchnica cześć. III. Komposty obornikowo-mineralne. (Investigations of humus. III. Manure-mineral composts.) Rocz. Nauk Rolniczych Ser. A, 80(4): 675-698. (cited in Biol. Abstr., 36: Abstr. No. 32153.)
"The authors discuss the effect of adding clay, lime and superphosphate to manure on the process of fermentation. It was found that the addition of lime, clay, and clay with lime, greatly decreased N loss. Lime (especially in the form of calcium carbonate) did not check the intensity of the process. In the presence of superphosphate and lime, humus-phosphorus complexes were formed during fermentation. Humus substances extracted from manure fermented with the addition of clay were similar in properties to acids of humus soils. They contained more ash components and coagulated with greater difficulty than humus acids from pure manure under the influence of hydrogen ions."

A-020 Kuszelewski, L. 1960. Studia nad stosowaniem obornika. Cześć II. Wplyw sposobu umieszczenia obornika w glebie na plonowanie przy róžnej agrotechnice ziemniaków. (Study on manure application.) Rocz. Nauk Rolniczych Ser. A, 81(3): 577-619. (cited in Biol. Abstr., 36: Abstr. No. 32212.)
"When manure is applied in small doses its effect on a potato crop depends upon the method of potato cultivation, as well as on its manner of application. The highest yield of potato tuber and starch was obtained when manure application either above and below the potato planting level or only below was combined with deeper and earlier planting."

A-021 Bestagno, G. 1960. Danni da cromo contenuto in un concime misto su colture di garofano. (Injuries from chromium contained in a manure mixture applied in carnation culture.) Notiz. Mal. Piante, 32-33 (53/54): 217-226. (cited in Biol. Abstr., 36: Abstr. No. 32330.)
"The abnormalities caused in carnation plants by an organic nitrogen manure containing 0.24% chromium are described. Several chromium derivatives are toxic to the carnation plant. Sodium and potassium chromates and bichromates are more toxic than chromium sulphate and chloride containing the same amount of metal. The symptoms caused by the above named compounds are not the same as those observed with organic manure containing chromium. It is supposed that the difference is caused by different derivatives, the manure possessing unknown organic compounds with ammonium and organic bases."

A-022 Arutiunian, A.S. 1959. O Podvizhnosti P_2O_5 superfosfata, vnesenogo sovmestno s navozom. (The mobility of P_2O_5 superphosphate, introduced in combination with manure.) Agrobiologiia, 6: 936-938. (cited in Biol. Abstr., 36: Abstr. No. 38711.)

"A study of the mobility of P_s was carried out on soil monoliths. The monoliths, 60 cm in length and 6 cm in diameter, were placed in cardboard tubes and sealed with a 2-3 mm layer of paraffin. P_s and P_s combined with manure were inserted to a depth of 30 cm. The mobility of P_2O_5 was studied under conditions of complete saturation of the soil and exposure to water. With complete saturation P_2O_5 was transferred in 25 days by means of diffusion to levels of 10 cm above and below the place of introduction. One exposure to water, the mobility of the P_2O_5 markedly increased in comparison with mobility by means of diffusion. The soil monoliths, in which the P_s was introduced in combination with the manure, were submitted to washing with water and the content of water-soluble P_2O_5 was determined; it was established that in this case the mobility of P was greatest; this is evidence of the advantage of the introduction of P_s in combination with manure in the soils of Armenia. In field experiments it was shown that the grape harvest and P_2O_5 content in berries with the introduction of P_s combined with manure was significantly higher than with the introduction of P_s alone."

A-023 Lamont, P.H. and A.O. Betts. 1960. Studies on enteroviruses of the pig. IV. The isolation in tissue culture of a possible enteric cytopathogenic swine orphan (ECSO) virus (V 13) from the faeces of a pig. Res. Vet. Sci., 1(2): 152-159. (cited in Biol. Abstr., 36: Abstr. No. 65366.)

"The isolation in tissue culture of a virus (V 13) from the faeces of a pig is reported. In a growth curve experiment in monolayer cultures of swine kidney cells this virus reached a maximum titre of $10^{4.7}$ $TCID_{50}$ per ml. 78 hours after inoculation. The characteristic cytopathic changes were contraction of the cytoplasm and the formation of cytoplasmic protrusions. The size of the virus, as determined by filtration, was between 35 mμ. and 40 mμ. The virus was immunologically distinct from the T 80 strain of polio-encephalomyelitis virus. No distinct clinical disease was produced in experimental pigs by V 13, but the virus was recovered from the faeces of pigs following oral inoculation. This virus may therefore be an ECSO virus."

A-024 Luque, J.M.S. 1959. Hallazgo de ooquistes de Eimeria arloingi en feces de ovidos. (Oocysts of Eimeria arloingi found in the feces of sheep.) An. Inst. Invest. Vet., Madrid, 9: 85-90. (cited in Biol. Abstr., 36: Abstr. No. 78292.)

"The oocysts were found in 22 out of 100 samples from animals slaughtered in the Municipal slaughterhouse of Zaragoza. All were apparently healthy. The morphology of these oocysts is described and a catalogue is presented of the principal species of coccidia found to date in sheep, with their distinguishing characters. Attention is called to the probable epizootologic importance of the "healthy" carriers of

Eimeria arloingi and the need of careful vigilence with regard to dysenteric infections in young sheep, in order to determine the actual limits of the presence or absence of coccidiosis in sheep in Spain."

A-025 Batista, A.C., C.T. de Vasconcelos, O. Fischman and F. Staib. 1961. Fungos leveduriformes e filamentosos de fezes de bovinos, no Recife. (Yeasts and filamentous fungi from bovine feces in Recife.) Univ. Recife, Inst. Micol. Publ., 325: 1-27. (cited in Biol. Abstr., 37: Abstr. No. 19166.)
"A total of 1058 isolates was obtained from fecal samples of 629 animals. Yeasts predominated (78%), the most frequent being *Candida tropicalis*, *Trichosporon cutaneum*, *Candida krusei*, and *C. guilliermondii*. The most common of the filamentous fungi was *Geotrichum candidum* (13% of total isolates). Particular attention in this study was paid to the correlation of incidence of each yeast species with the incidence of associated species of yeast or filamentous fungi. Extensive tables contain these data. The exclusive incidence of one species of yeast was not high except for *Candida tropicalis*, which occurred alone in 32% of its isolations. Only 5 samples of the 1058 were negative for isolates of fungi."

A-026 Batista, A.C., O. Fischman, C.T. de Vasconcelos and I.G. de Rocha. 1961. Leveduras e outros fungos das fezes de ovinos, caprinos, suinos, galináceos e animais cativos, no Recife. (Yeasts and other fungi from feces of sheep, goats, swine, chickens and captive animals, in Recife.) Inst. Micol. Univ. Recife Publ., 327: 1-27. (cited in Biol. Abstr., 37: Abstr. No. 23925.)
"Samples of freshly deposited feces of 155 different animals were plated in Sabouraud-dextrose Agar with "ledermicine". Identifications were made of subsequent isolates of yeasts and filamentous fungi. *Candida tropicalis* was the most frequent isolate (45% of the animals) and was found among all groups of animals studied. *Trichosporon cutaneum* occurred in 5-23% of individuals in different groups of the domesticated animals. Among the several other spp. of *Candida* seen *C. albicans* was isolated only once (on poultry feces). Special mention is made of *Geotrichum candidum* although several other spp. of filamentous fungi were found. Captive animals were relatively poor in numbers of fungus spp. isolated. It is emphasized that domestic animals are primary reservoirs of intestinal yeasts, some of which undoubtedly must be considered in relation to studies of human diseases."

A-027 El-Kifl, A.H. 1958. The arthropod fauna of the Egyptian farmyard manure. Bull. Soc. Entomol. Egypte, 42: 477-500. (cited in Biol. Abstr., 38: Abstr. No. 7893.)
"Farmyard manure is used as an important fertilizer in Egypt, but methods of preparing and storing it differ in different districts. Studies were made on various kinds of manure, at different temperatures. Both in winter and summer, cow manure ranked first as to the total number of arthropods in a given quantity, as well as in the total number of insects and particularly of Diptera. Tables are given showing the faunal analyses of different arthropod groups in every manure examined. Insects other than Diptera or Coleoptera were scarce. Mites composed a large percentage of the total arthropod fauna in these manures."

A-028 Lundblad, K., R. Lagerquist and L.S. Agerberg. 1961. Ett fastliggande försök med stall-och handelsgödsel. (Effect of farmyard manure and chemical fertilizers on peat soil.) K. Lantbrukshögskolan Statens. Jordbruksförsök, Meddel, 120: 1-58. (cited in Biol. Abstr., 38: Abstr. No. 11352.)

"The effect of fertilizer variations on peat soil was studied for 24 years. A standard NPK dressing was compared with dressings containing N only, P only, K only, manure only, manure + P, and no dressing. . . . The ley yields, in per cent of that produced by the NPK treatment, were 20% (P only and unfertilized ley), 25% (N only), 50% (K only), and 80% (P + K or manure). Combinations of manure and chemical fertilizers gave yields comparable to those of chemical fertilizing with equivalent nutrients. Cereal yields were unfavorably affected by fertilization restricted to N, but manure dressings had a very favorable effect. The botanical composition of the leys deteriorated rapidly with an insufficient nutrient supply, but both manure and its combination with chemical fertilizers had a conserving effect on the botanical composition. . . ."

A-029 Bastos, W.D. de A. 1957-1959. Ovos de Schistosoma mansoni em fézes de suino (Sus scrofa) na Bahia, Brasil. (Eggs of Schistoma mansoni in the feces of swine (Sus scrofa) in Bahia, Brazil.) Bol. Inst. Biol. Bahia, 4(1): 34-36. (cited in Biol. Abstr., 38: Abstr. No. 11809.)

"Collections were made of 1000 samples of hog feces in the municipal slaughterhouse of Salvador; the animals came from a number of municipalities where mansoni schistosomosis is endemic. Schistosoma mansoni was found in 8 of the samples."

A-030 Wisselink, G.J. 1961. Een vijftienjarige proef met stalmest en stoppelgewassen op humeuze zandgrond te Heino. (A fifteen-years' experiment with farmyard manure and secondary crops on humiferous sandy soil at Heino.) Verslag. Landbouwk, Onderzoek., 66(17): 1-79. (cited in Biol. Abstr., 38: Abstr. No. 15873.)

The effect of stable manure on the fertility of an old arable sandy soil was tested, using a regular crop rotation of potatoes-rye-oats. A dressing of 30,000 kg/ha of stable manure had the same effect as 48 kg/ha of fertilizer N; the residual effect of the manure amounted to 8 kg N/ha for rye and 5 kg N/ha for oats. The humus content of the soil remained unchanged with 25,000 kg/ha of stable manure per year. Manure had no acidifying effect and was helpful in maintaining the MgO content of the soil. 1000 kg of manure was considered equivalent to 4 kg of K_2O fertilizer and 2.25 kg of P_2O_5 fertilizer.

A-031 Kortleven, J. 1959. De stikstofvoeding van de aardappel door middel van stamlest en van kunstmest. IV. (The nitrogen supply of potatoes by means of farmyard manure and artificial fertilizers. IV.) Verslag. Landbouwk, Onderzoek., 65(19): 5-83. (cited in Biol. Abstr., 38: Abstr. No. 15903.)

The role played by N in spring-ploughed vs autumn-ploughed FYM was investigated by application of manure and nitro-chalk (N fertilizer) to potatoes. Spring FYM behaved most like nitro-chalk and autumn FYM as soil N. Moisture content was reduced by nitro-chalk, reduced to a lesser extend by spring FYM and unaffected by autumn FYM. The N uptake terminated at an earlier date for spring FYM than for autumn FYM. The occurrence of progressive mineralization of N in FYM was noted.

A-032 Onufriev, A.F. 1962. Opyt prigotovleniya i primeneniya navozno-zemlyanogo komposta. (Experiments on the preparation and use of manure-soil compost.) Zemledelie, 1: 64-65. (cited in Biol. Abstr., 39: Abstr. No. 8030.)
"In 1960-61 tests were run on the effectiveness of preparing and applying manure-soil composts which were enriched with mineral fertilizers on the UL'yanovka strain of winter wheat. At the end of spring field work relatively level areas of old arable soil at the edges of the fields which were to be fertilized were selected. On an area of 0.5 ha, 300 tons of fresh manure, 20 tons of phosphorite meal, and 30 tons of limestone were spread into uniform layers. At the beginning of July all of this was ploughed under to a depth of 13-15 cm and then harrowed. During the process of composting 30 tons of liquid manure were added and a disc plough harrow was used. Winter wheat was planted, compost was applied, and the soil was cultivated. By applying 20 tons of compost/ha, an increase in the yield of winter wheat by 5.1 metric cntr/ha was obtained. . . ."

A-033 Bui, G.D. 1962. Navozno-zemlyanye komposty na polyakh V'etnama. (Manure-soil composts in the fields of Vietnam.) Agrobiologiya, 1: 121-124. (cited in Biol. Abstr., 39: Abstr. No. 11868.)
"The author describes a method for producing manure-soil compost, which was devised to help solve the problem of the rapid depletion of the soils of Vietnam when they are used for a succession of 3 crops annually. It is stated that the method makes possible the preparation within a month of an amount of manure-soil compost which is 4 - 5 times greater than the original amount of stable manure used in its production. Data are presented showing that fertilization with the compost resulted in just as good yields of rice as did fertilization with the same amount of stable manure."

A-034 Likholat, V.D. 1962. Vliyane navoza i organo-mineral'nykh smesei na urozhai i sakkaristost' sakharnoi svekly na vyschelochennom chernozeme. (The effects of manure and organo-mineral mixtures on the yield and sucrose content of sugar beets growing in leached chernozem.) Agrobiologiya, 1: 115-121. (cited in Biol. Abstr., 39: Abstr. No. 16368.)
"The author reports experiments which completely refute the theory of threshold concentrations advanced by Ulrich and others, since these experiments showed that comparatively high yields of sugar beets were produced by plants in which the nitrate content of the leaves and other tissues was below the value which the latter authors believed necessary for good yields. It also was found that manure applied in large amounts with a cultivator increased the yield of beets and their sucrose content. Similar applications of organo-mineral mixtures produced as great increases in the yield of sugar beets and their sugar content as did the applications of manure."

A-035 Kuszelewski, L. and A. Pentkowski. 1962. Dxialanie obornika po fermentacji metanowej w swietle doświadczeń polowych. (Effect of farmyard manure after methane fermentation in the light of field experiments.) Rocz. Nauk Rolniczych Ser. A, Roślinna, 85(2): 261-275. (cited in Biol. Abstr., 39: Abstr. No. 16485.)

"Field experiments were undertaken in order to establish the fertilizing action of manure after methane fermentation in the 1st season and its after-effect in the following year. The manure was fermented on a production scale in a special installation which assured good fermentation conditions and a high yield of the gas. Yard manure after methane fermentation was compared in the experiments with equal dosages of manure kept in the usual way for chemical composition and crop yield. . . . The effect of manure after methane fermentation ploughed over after spreading was compared with that of the same manure when only spread without being covered. The experiments were set up on light podzol formed on boulder clay soil, slightly acid and with moderate N, P and K content, so that it reacted distinctly to fertilization with manure. N loss during methane fermentation was negligible. In comparison to the N losses in ordinary storage conditions, those in methane fermentation were reduced by 8 kg/100 q of fresh manure. Manure after methane fermentation contains more assimilable N. The effect of manure after methane fermentation in the 1st year and its after-effects are similar to those of manure kept in the usual way. No definite superiority of manure after methane fermentation over ordinary farm manure could be established in any of the experiments. Fermented manure, when ploughed over after spreading on the field, had a similar effect as when covered. . . ."

A-036 Kuszelewski, L. and A. Pentkowski. 1961. Dzialanie obornika po fermentacji metanowej w świetle doświadczeń wazonowych. (The properties of manure submitted to methane fermentation according to flower-pot tests.) Rocz. Nauk Rolniczych Ser. A, Roślinna, 82(3): 715-737. (cited in Biol. Abstr., 39: Abstr. No. 20500.)

"The manure submitted to methane fermentation was compared with equal doses of manure kept in dunghills. The effects of manure covered with earth directly after spilling, after 7 days, and left uncovered were compared. Losses of nitrate in manure submitted to methane fermentation were much smaller than losses of nitrate in manure from dunghills. The difference in the amount of nitrate in the compared manures depended on the duration of the fermentation process. Due to differences in the fermentation processes, the losses of dry substance in the methane fermentation were more rapid than losses in the dunghill. Despite higher quantities of nitrate in manure submitted to methane fermentation, its effect on crops was similar to that of manure from dunghills. In general, manure submitted to methane fermentation, whatever the time of covering it with earth, had a similar effect on the crops. The indirect effect of manure, submitted to methane fermentation, is similar to that of manure from dunghills. A distinct increase of crops was noted only in the case when the manure was not covered with earth. In all other methods of application, the differences in crop height were insignificant."

A-037 Bockmann, H. 1959. Über die Infektionswirkung von Ophiobolus graminis Sacc. an Weizen bei partieller Bodensterilisation und organsicher Düngung. (Effect of infection of wheat by O. graminis Sacc. after partial sterilization of soil and organic manuring.) Zeit. Pflanzenkrankh., 66(9): 582-588. (cited in Biol. Abstr., 39: Abstr. No. 20622.)

"Artificial infection tests with O. graminis on wheat showed that the effect of infection is increased by partial soil disinfection and decreased by organic manuring (stable manure or green manure)."

A-038 Ambo, S., T.M. Masubuchi and S. Horii. 1962. (Nutrient losses due to drying of cow's feces.) Bull. Nat. Inst. Agr. Sci., Ser. G, Anim. Husb., 21: 167-173. (cited in Biol. Abstr., 40: Abstr. No. 2557.)

". . . Average loss of crude protein due to drying was 3.23% for crude protein content of the fresh feces in Expt. I, and 4.79% in Expt. II. The losses were highly significant. The average loss of carbon due to drying of feces in Expt. II. was 1.32%. The average crude fiber content of the air-dried feces was higher than that of the fresh feces. The difference of the crude fiber content between fresh feces and air-dried feces was -0.14% (non-significant) in Expt. I, and -0.42% (highly significant) in Expt. II. Crude fat content in the fresh feces was higher than in the air-dried feces in Expt. II, but in Expt. I that in the fresh feces was lower than in the air-dried feces. The difference of the crude fat content between the fresh feces and air-dried feces was -0.07% in Expt. I and 0.39% in Expt. II. Both differences were highly significant. Both in Expt. I and II, the crude ash contents of the air-dried feces were lower than in the fresh feces. The difference of the crude ash contents between fresh feces and air-dried feces was 0.38% (highly significant) in Expt. I and 0.07% (non-significant) in Expt. II."

A-039 Saez, H. 1959. Aspergillus Isolés dans les Fèces de Quelques Animaux du Parc Zoologique de Vincennes. (Aspergillus isolated from the feces of some animals in the zoological park of Vincennes.) Bull. Mus. Natl. Hist. Nat. (Paris), 31(3): 277-284. (cited in Biol. Abstr., 40: Abstr. No. 7661.)

"A list of mammals and birds from whose feces Aspergillus has been cultured is given."

A-040 Berezova, E.F., T.A. Sorokina, E.D. Novogrudskaya and L.V. Sudakova. 1962. Mikrobiologicheskie protsessy v navozno-zemlyanykh kompostakh. (Microbiological processes in manure-soil composts.) Zemledelie, 4: 63-67. (cited in Biol. Abstr., 40: Abstr. No. 8005.)

"A table is presented showing the counts of the various groups of compost bacteria at different times during an 85-day composting period. The peak periods of development were as follows: butyric acid bacteria, between the 15th and 20th days and again between the 60th and 85th days; bacteria decomposing $Ca_3(PO_4)_2$, between the 15th and 20 days; ammonifying bacteria, between the 7th and 10th days; nitrifying bacteria, between the 45th and 50th days; aerobic cellulose-decomposing bacteria, between the 15th and 20th days, followed by a plateau and then another rise between the 75th and 85th days; anaerobic N-fixing bacteria, by far the greatest numbers in fresh manure, with a rapid decrease up until the 20th - 30th day, followed by a rise to about ½ the original number between the 30th and 50th days. Total CO_2 production was greatest at the start of the composting and rapidly decreased thereafter. Assays for some B vitamins showed significant increases in pantothenic acid, pyridoxine and biotin during the 1st 35 - 45 days followed by a slight decrease thereafter. In terms of its positive effects in increasing the yields of crops of corn and barley, the compost was most effective for corn on the 40th day and for barley on the 20th day of composting."

A-041 Morimoto, T., G. Tokuda, T. Omori, K. Fukusho and M. Watanabe. 1962. Cytopathogenic agents isolated from the feces and the intestinal content of pigs. I. Their isolation and serological classification. Natl. Inst. Anim. Health Quart., 2(2): 59-65. (cited in Biol. Abstr., 40: Abstr. No. 20234.)

"Nine cytopathogenic agents were isolated from the feces or the intestinal content of pigs and were divided into 2 types by their antigenicity."

A-042 Khar'kov, D.V. 1959. Vliyanie dlitel'nogo vneceniya navoza i mineral'nykh udobrenii na urozhai kul'tur sevooborotov. (The effects of prolonged application of manure and mineral fertilizers on the harvests of rotated crops.) Udobrenie i Urozhai, 10: 26-31. (cited in Biol. Abstr., 40: Abstr. No. 24893.)

"In field experiments started in 1931 in soddy podzolic heavy-loam soil the effects on the harvests and the properties of the soil of yearly applications 12 metric tons/ha of manure or of mineral fertilizers containing an equivalent amount of basic nutrient elements were studied. At the end of 25 years the humus content of the fields treated with mineral fertilizers was greater (1.57%) than that of the untreated control fields (1.48%) and less than that of the fields treated with manure (1.82%). The mineral fertilizers increased, and the manure decreased the acidity of the soil. The mineral fertilizers produced higher yields of winter rye than did the manure; and the yields of potatoes in fields treated with mineral fertilizers were somewhat higher than those in fields treated with manure. However, manure produced higher yields of fodder beets than did the mineral fertilizers, this is attributed to the acidifying effect of the mineral fertilizers on the soil. This effect also explains the higher yields of perennial grasses which were obtained by fertilization with manure. When the acidifying effects of the mineral fertilizers were corrected, they were more effective than manure."

A-043 Morimoto, T., G. Tokuda, T. Omori, K. Fukusho and M. Watanabe. 1961. (Studies on enteroviruses of swine. I. Isolation and preliminary characterization of cytopathogenic viruses from feces of swine.) Jap. J. Vet. Sci., 23(Suppl.): 508. (cited in Biol. Abstr., 41: Abstr. No. 3118.)

A-044 Miura, S., G. Sato, T. Miyamae and A. Ito. 1961. (Fecal excretion of Salmonella newington or Salmonella gallinarum-pullorum in the naturally infected growing chickens.) Jap. J. Vet. Sci., 23(Suppl.): 467. (cited in Biol. Abstr., 41: Abstr. No. 3119.)

A-045 Gizzatullin, S.G. and M.P. Chmelev. 1959. Vliyanie sideratov i navoza na podvizhnost' margantsa v legkikh dernovo-podzolistykh pochvakh Bashkirskoi ASSR. (The effect of green crop fertilizers and manure on the nutrient availability of manganese in the light-textured soddy podzolic soils of the Bashkir ASSR.) Sb. po Pochvam Bashkirii Bashkirsk. Otdel. Vsesoyuz. Obshchestvo Pochvovedov pri Akad. Nauk SSSR. Ufa, 1959: 40-43. (cited in Biol. Abstr., 41: Abstr. No. 3524.)

"Green crop fertilization significantly increased the nutrient availability of Mn during the vegetative growth of the plants and after ploughing. Manure was much less effective in this respect. Among the plants used for green crop fertilization the most effective for increasing the nutrient availability of Mn was spring vetch; and the next most effective plants were maple peas and lupine."

A-046 Wöhlbier, W., M. Kirchgessner and W. Schneider. 1962. Die Gefriertrocknung von Rinderkot. (Freeze drying of cattle feces.) Arch. Tierernährung, 12(1): 5-10. (cited in Biol. Abstr., 41: Abstr. No. 15266) .... Germany

"Contents of dry matter, carbon and calories were determined in 7-14 pooled samples dried for 48 hours at 80°C in 2 kg lots, or after 24 hours freeze drying in 1 kg lots. N contents were compared with those determined in fresh samples. Freeze drying resulted in higher average contents for dry matter: 0.39% ($P < 0.01$), nitrogen: 0.015%, carbon 0.41%, and lower average calorie contents: -14 ± 10. The consequences for balance trials were calculated to be about 3% higher carbon, 2% higher energy, and 4% higher N excretion in feces, when freeze drying was used instead of the other methods."

A-047 Biskup, J. 1962. Wplyw roznych terminow stosowania obornika oraz pelnego nawozenia mineralnego na wysokość i jakość plonu liści Virginii Skroniowskiej. (Influence of different periods of manuring and of full mineral fertilizing upon the quantity and quality of Virginia Skroniowski leaf yield.) Rocz. Nauk Rolniczych Ser. A, Roślinna, 86(2): 309-317. (cited in Biol. Abstr. 42: Abstr. No. 3223.) .... Poland

"Six fertilizer combinations were compared: spring manuring; spring manuring + NPK; spring manuring + PK; autumn manuring; autumn manuring + NPK; and autumn manuring + PK. The experiments were conducted on light sandy loam on a deep layer of sand. The following doses were applied: manure, 200 q/ha; P_2O_5, 36 kg/ha; K_2O, 45 kg/ha (as leaf dressing in 2 doses). For Virginia Skroniowska cultivated on light sandy soil manuring is recommended; probably the time of ploughing (autumn or spring) has no influence on the quantity and quality of the yield. Only N had a marked influence on the quantity of yield, but at the same time it decreased the quality of leaves (less of the I and II class)."

A-048 Vercoe, J.M. 1962. Some observations on the nitrogen and energy losses in the feces and urine of grazing sheep. Proc. Fourth biennial conference of Australian Society of Animal Production, 4: 160-162. (cited in Biol. Abstr. 42: Abstr. No. 14454.)

"A series of observations was made from May to December, 1961, on the nitrogen and energy losses in the feces and urine of three Merino wethers grazing an annual pasture consisting of Wimmera ryegrass, (Lolium rigidum Gaud.) and subterranean clover (Trifolium subterraneum L.)."

A-049 Kurihara, H. and T. Ōkubo. 1962. (Studies on the growing process of potato plant. VI. Effects of heavy applications of stable manure and phosphorus on the growth and yield of potato plant in deeply plowed field.) Proc. Crop Sci. Soc. Jap., 31(1): 65-68. (cited in Biol. Abstr., 42: Abstr. No. 15449.)

"Various treatments with manure (M) and P (P = light and 3P = heavy) were used on a virgin volcanic ash soil. Stem length was greater with 3P and 3P + M during the early stages of growth, but after flowering P + M and 3P + M gave longer stems than 3P and P. The leaf area and number of leaves and branches responded to fertilizer in the same order as stem length. Production of dry matter followed the order P + M > 3P > 3P + M > P. Balance of nutrients in the leaf was higher with P + M and 3P + M after flowering time. The 3P plot produced more starch in the tubers, followed by P + M > 3P + M > P while the yield of tubers was in the order P + M > 3P > 3P + M > P, although the early development of tubers was best in the P plot."

A-050 Lavee, S. 1962. The effect of ammonium sulfate and farmyard manure on young M-II apple rootstocks infected with Sclerotium rolfsii Sacc. Israel J. Agr. Res., 12(2): 89-90. (cited in Biol. Abstr., 42: Abstr. No. 19560.)

"Nitrogenous fertilizers did not reduce the infection of M-II apple rootstocks with S. rolfsii. The mortality of inoculated plants did not decrease with the application of farmyard manure ($6m^3/1000m^2$, $8m^3/1000m^2$) and ammonium sulfate (60 $kg/1000m^2$, 80 $kg/1000m^2$), separately or in combination.

A-051 Grimes, R.C. and R.T. Clarke. 1962. Continuous arable cropping with the use of manure and fertilizers. E. African Agr. Forest. J., 28(2): 74-80. (cited in Biol. Abstr., 42: Abstr. No. 23613.)

"In a rotation of sorghum, sweet potatoes, maize and cassava, there were large responses to farmyard manure and artificial fertilizers. The largest response to farmyard manure was found with sweet potatoes. The additional response to 9 tons farmyard manure over an application of 3 tons was smaller with cassava than with the other crops. Artificial fertilizers were as effective as farmyard manure in sustaining crop yields. There is no clear difference between the effect of applying 3 tons farmyard manure annually and applying 9 tons once every 3 years."

A-052 Verdiev, K.Z. 1961. Vliyanie mineral'nykh udobrenii i navoza na dinamiku pitatel'nykh veshchestv v pochve i urozhainost' khlopchatnika. (Effect of mineral fertilizers and manure on the dynamics of nutrient substances in the soil and on the yield of cotton.) Izvest. Akad. Nauk Azerb. SSR. Ser. Biol. i Med. Nauk, 10: 91-96. (cited in Biol. Abstr., 43: Abstr. No. 11686.)

"The effect of fertilizers on the productivity of cotton was studied in 1954-1955 on the sierozem-meadow soils of the Shirvan steppe in the Azerbaijanian SSR. Average increase in the yield of cotton over the 2-year period, compared to a control yield of 30-33 metric cntr/ha, was (in metric cntr/ha): 6.4 with $N_{90}P_{90}$, 8.6 with $N_{90}P_{90}K_{60}$, and 8.2 with $N_{60}P_{60}$ plus 10 metric tons/ha of manure. The residual effects of the fertilizers during the 2nd year were also high. The author considers any decrease or increase in these amounts to be inadvisable."

A-053 Majumdar, B.N. and S. Jang. 1963. Comparative manurial value of the excreta of some farm animals. Ann. Biochem. Exp. Med., 23(3): 91-94. (cited in Biol. Abstr., 43: Abstr. No. 11786.) .... India

"The manurial constituents of faeces and urine of 4 species of ruminants (buffalo, cattle, sheep and goat) were compared on an identical plane of nutrition and under similar feeding regimen. On a fresh basis, goat faeces was the richest source of all the fertilizing constituents followed by that of sheep, except for K content, in which the buffalo faeces showed the highest value even on a dry basis. On a dry matter basis, goat faeces had the highest P and Ca; there was little difference in the content of these nutrients among the rest. None showed any significant variation in N. Ruminants, as a group, do not differ from each another in the manurial constituents of their urine, except for Ca."

A-054 Kasem Ali, M. and S.D. Chaudhury. 1961. The effect of N, P, K, and F on the growth and yield of jute plants. Pak. J. Biol. Agr. Sci., 4(1): 32-35. (cited in Biol. Abstr., 43: Abstr. No. 16015.)

"Two jutes commonly cultivated in East Pakistan (Corchorus capsularis and C. olitorius) were used. The application of ammonium sulphate (N), muriate of potash (K) and farmyard manure (F) significantly increased height, thickness, green weight and fiber weight; the effect of farmyard manure was particularly marked. A dose of 180 lb. N/acre gave a significant increase in growth and yield over the next 2 lower doses of 120 lb. and 60 lb. N. P fertilizer either alone or in combination showed comparatively less effect on jute plants. Fertilizer treatments showed no effect on the retention of leaves by a plant; the factor involved in retention was the plant's age."

A-055 Chernova, N.M. 1962. Dinamika chislennosti bespozvonochnykh v zemlyano-navoznykh kompostakh. (Population dynamics of invertebrates in earth-manure composts.) Agrobiologiya, 6: 879-881. (cited in Biol. Abstr., 43: Abstr. No. 16072.)

"In earth-manure compost, intense aerobic decay of manure causes a reproduction explosion of invertebrates resulting from intensive decay of vegetative remains (Pygmephorus spp., larvae of Scatopsidae and Tendipedidae, and Oxytellus spp.). These invertebrates participate in the decay of the manure and cause its rapid conversion into humus. The population of these invertebrates decreased with the tapering-off of decay of the manure. However, the population of invertebrates which proliferate in the plow layer of soil does not increase in the compost during the short period of its preparation for use. This results from the inhibitory effect of rapidly decaying manure on the soil fauna, but since this period of manure decay occurs entirely during the time of compost formation, the application of earth-manure compost to soil has no unfavorable effect on soil organisms."

A-056 Turčány, J. 1962. Správne obdobie a správna hĺbka zaorania maštalného hnoja. (Proper time and depth of ploughing-in farmyard manure.) Pol'nohospodárstvo, 9(8): 575-586. (cited in Biol. Abstr., 44: Abstr. No. 3788.) .... Czechoslovakia

"During 1954-1959 investigations with different time and depth of ploughing-in of farmyard manure were carried out in maize, beet, and potato production under different weather conditions in different years. . . . On the basis of the analysis of relations between the different methods of ploughing-in the farmyard manure, course of dynamics of soil properties and microflora, and the yields of potatoes and sugar beet, these methods of ploughing-in of farmyard manure might be recommended in our production conditions: (a) in medium humid conditions of maize and beet production on heavier soil the farmyard manure should be ploughed in to a depth of 15-18 cms in late Aug. or early Sept., and a deep autumn ploughing to the full depth of the mold in late autumn; (b) in drier conditions (on lighter soils) in maize production later and deeper ploughing-in; (c) in the more humid conditions of potato production the manure should be ploughed-in also to a depth of 15-18 cms in later summer, followed by a deep autumn ploughing in Oct. and another towards the beginning of Nov.; (d) the spring ploughing-in of manure should be avoided in maize and beet production. In potato it should be done only as an emergency measure."

A-057 Silenko, Z.V. 1958. Vliyanide podkormki navoznoi zhizhei i mineral'nymi udobreniyami na urozhai kormovoi morkovi. (Effect of top dressing with liquid manure and other mineral fertilizers on the yield of fodder carrots.) Udobrenie i Urozhai, 6: 25-26. (cited in Biol. Abstr., 44: Abstr. No. 16616.)

"Experiments were made on the effect of liquid and dry top-dressing on the yield in relation to methods, dates, and forms of the fertilizers applied. The most effective of the 3 kinds of top-dressing proved to be liquid manure; a double top-dressing increased the yield by 113%. Top-dressing with dry mineral fertilizers did not have any significant effect on the yield capacity of carrots. When fertilizers were dissolved, a double top-dressing of N75 P60 K60 increased the yield by 80%, and a single one by 44%; a triple top-dressing increased the yield by 41%."

A-058 Sladovnik, K. 1960. Kejda a ostatni druhy hnojive zavlahy statkovymi hnojivy. (Utilization of dung and other manures in fertilizing.) Socialisticke Zemedelstvi, 10(11): 985-994. (cited in Biol. Abstr., 44: Abstr. No. 16653.) . Czechoslovakia

"Faulty manipulation of organic fertilizers causes considerable losses of valuable nutrients. To increase the value of manure, composting and storing in special areas allowing fermentation is recommended. To conserve ammonia in liquid manure, water was found to be most satisfactory. Described experiments brought increases of 50% in yields."

A-059 Kuszelewski, L. 1962. Studia nad stosowaniem obornika. IV. Wykorzystanie skladnikow pokarmowych przy roznych sposobach stosowania obornicka w plodozmianie czteropolowym na glebach lekkich. (Study on manure application. IV.) Rocz. Nauk Rolniczych Ser. A, Roślinna, 86(4): 543-572. (cited in Biol. Abstr., 44: Abstr. No. 25074.)

"In part three of this work, on the basis of field experiments, it was concluded that with regard to the yields obtained, the system of placing barnyard manure in rows and dividing a ration of the manure in a 4-crop rotation on light soils was better than the system generally applied hitherto. The investigations were continued further, and this paper presents results concerning the utilization of nutrients by all the plants in a crop rotation using different systems of barnyard manure application. The conclusions are based on 2 rotations of a 4-crop rotation, and on 4 1-year field experiments. When the barnyard manure was placed in rows, regardless of the quantity applied, a better utilization of nutrients by the plants was rated than when the manure was broadcast. With a small quantity there was better utilization of N and P; with full dosage, of N and K. Using 200 q of barnyard manure in a crop rotation, the best utilization of N and K was obtained by row placement or of a single or split application. With the latter the barnyard manure was utilized by all the plants in a crop rotation; with an undivided application the manure was utilized mainly by the 1st two plants in a crop rotation."

A-060 Trivelin, A.P. 1961. Emprêgo de fezes de pintos na alimentação de leitões. (Use of chicken feces in feeding of pigs.) An. Esc. Super. Agr., Luiz de Queiroz, 18: 206-216. (cited in Biol. Abstr., 45: Abstr. No. 2334.)

"The author studied the application of chick's feces from battery brooder in the feeding of weaning pigs. A basal ration substituted with 5%, 10% and 15% of that basal ration was used with similar proportions of chicks' feces. Statistical significance among treatments was not observed. Results measured in terms of average daily gain and feed conversion indicated that substitution of 5% to 10% by equal proportions of chicks' feces produced satisfactory results, the 5% proportion being the most advantageous."

A-061 Kroll, U. 1963. The effect of fertilizers, manures, irrigation and ridging on the yield of pyrethrum. E. African Agr. Forest. J., 28(3): 139-145. (cited in Biol. Abstr., 45: Abstr. No. 7743.)

"The results of experiments with fertilizers, irrigation and ridge planting on pyrethrum are discussed. Phosphorus appears to be in short supply on many soils in the Kenya Highlands as well as in Southern Tanganyika. . . . Farmyard manure, except in nurseries to stimulate the initial growth of seedlings, is not recommended. . . ."

A-062 Kuznetsova, L.V. 1963. Vnesenie dernovo-navoznykh kompostov pod kartofel'. (Application of turf-manure composts on potatoes.) Vest. Sel'skokhoz. Nauki, 8(8): 31-36. (cited in Biol. Abstr., 45: Abstr. No. 21603.)

"Turf-manure composts are more efficient if they contain more manure. Hill application is the best method of fertilization, giving higher yields than broadcast application during spring ploughing or cultivation."

A-063 Omori, N., O. Suenaga, S. Ori and M. Shimagama. 1962. (A method of destroying the maggots of housefly and stablefly in animal manure by airtight vinyl cover.) Endemic Dis. Bull., Nagasaki Univ., 4(1): 52-56. (cited in Biol. Abstr., 45: Abstr. No. 21936.) .... Japan

"An air-tight vinyl cover for destroying housefly and stabblefly maggots in animal manure was devised by the senior author. The cover, 80cm by 110cm and 100cm high, is put on the heap of 7 days' liter from a cattle-shed piled on lattice which is placed on logs laid in water on a half area of the basin. 100cm by 150cm and 10cm deep. The cover is left untouched with the litter by the aid of wire framework and the free end of the cover is submerged under water so as to shut off air completely. The cover is often inflated by the septic gas within 2 or 3 days and all the larvae in the manure are killed at least within 3 or 4 days in summer, and 4 or 5 days in autumn. This is apparently due to the deficiency of O_2 and increase in quantity of methane, and unknown but probably poisonous gases. The decomposition of manure is also arrested by use of the cover probably because of deficiency of O_2 and the eggs especially of the stablefly are not killed by the procedure. The most effective use of the cover is as follows: Air should be supplied through a sleeve for a few days to allow the hatching of eggs and then sealed off for 3-5 days to kill all the larvae within the manure and again should be supplied for about 10 days to allow the complete decomposition of the manure."

A-064 Wilcke, D.E. 1962. Untersuchungen uber die Einwirkung von Stallmist und Mineraldungung auf den Besatz und die Leistungen der Regenwürmer im Ackerboden. (Investigations of the effects of stable-manure and mineral fertilizer on the presence and effectiveness of earthworms in tilled soils.) Monogr. Angew. Entomol., 18: 121-167. (cited in Biol. Abstr. 45: Abstr. No. 30412.) .... W. Germany

"Mineral and organic fertilizers have a considerable effect on earthworm fauna, depending on the particular combinations. The effects of these combinations are expressed through their actions on plant growth and hence the physical and chemical structure of the soils, within certain limits. Population densities in areas treated with stable manure are considerably higher than in those not so treated, while the combination of manure and mineral fertilizer (complete fertilization, N, P, K Ca) was far superior to all other combinations. Population densities were lowest in those parcels from which both N and organic fertilizers had been withheld. However, if total weight of the earthworm population is taken into account, the highest weight densities were registered on the manured parcels receiving also P, K, Ca, but no N, rather than on those which had received N fertilizer as well. Lowest values (in the fertilizer + manure parcels) were registered on the parcel receiving manure only. . . ."

A-065 Davidescu, D., L. Reichbuch and E. Davidescu. 1962. Eficienta dozelor de gunoi de grajd aplicat singur sau cu ingrasaminte chimice la porumbul Hinganesc. (The efficiency of manure doses applied as such or with chemical fertilizers in Hinganesc maize.) Lucrari Stiint. Inst. Agron. "N. Balcescu" Ser. A, 6: 13-22. (cited in Biol. Abstr., 45: Abstr. No. 43616.)

"Experiments were completed at the Experiment Station Suceava on leached chernozem with manure as such or associated with chemical fertilizers applied in different doses. By using 40 t/ha (V_2), 30 t/ha (V_3) or 20 t/ha (V_4) of manure, there was a yield increase of 29 kg, 31 kg and 29 kg of grains/ton of manure respectively, during the 1st year. When 60 kg/ha of P_2O_5 (V_5) per 20 t/ha of manure was added, the total yield increase was as high as 824 kg/ha (31%). In this case, for each kg of P_2O_5 used as superphosphate, an increase of 3.9 kg was obtained. Complex chemical fertilizers $N_{80}P_{60}K_{60}$ (V_8) increased the harvest average by 534 kg grains, amounting to 2.6 kg/kg active substance of fertilizer. The results of this variant are similar to those in which 20 t/ha manure (V_4) were used."

A-066 Balla, A. 1963. Az istállótrágyázás és a műtrágyázás hatásának össze-chasonlítása vetésforgó trágyázási kisérletben. III. Az istállótrágya és a műtrágyák tápanyagainak hasznositása a vetésforgó körforgása soran. (Comparative study of the effects of farm manure and mineral fertilizers in fertilizer tests with rotation of crops. III. The employment of nutritional elements of manure and mineral fertilizers during the course of a crop rotation cycle.) Agrokemia es Talajtan, 12(1): 21-29. (cited in Biol. Abstr., 45: Abstr. No. 48273.)
.... Hungary

"The yield of nutrient elements was studied in crop rotation under the effect of different modes of fertilizing. In maize, wheat, vetch, and oats fertilizers increased N and K yield more than did farm manure, while P yield was the same with both. The yield of nutrient elements was 1½ times as great in maize as in wheat. In both maize and wheat, the surplus in nutrient elements absorbed as a consequence of fertilizing was nearly equal. Both vetch and oats gave the greatest yields as a result of fertilizing, which was well utilized, particularly artificial fertilizer. According to the balance sheets for the principal nutrients, N and K in fertilizer were absorbed 1½ times - - twice during drop rotation - - in comparison with those in the manure; the utilization of P was the same in both cases. The P in an organic-mineral mixed fertilizer was very poorly utilized, while the utilization of N and K was considerable, because of the unfavorable composition of the mixed fertilizer (considerable P, very little N and K)."

A-067 Wood, R.A. 1963. The composition of manures produced in open and covered kholas in Nyasaland. Trop. Agr., 40(4): 269-273. (cited in Biol. Abstr., 45: Abstr. No. 48362.)

"The 2 main types of manure produced in Nyasaland were examined for their N, P and K contents. The larger group traditionally produced in an open khola (yard) with no bedding, was found to have an average dry matter content of 85%. Ten tons of this manure supplied the equivalent of 907 lb sulfate of ammonia, 741 lb superphosphate (18.6% P_2O_5) and 475 lb muriate of potash. The smaller group produced in covered kholas with bedding averaged 46% dry matter. Fertilizer equivalents from 10 tons were 661 lb sulfate of ammonia, 627 lb superphosphate and 449 lb muriate of potash. These data are discussed and compared with those obtained from farmyard manure in the U.K.."

A-068 Chernova, N.M. 1963. Zoologicheski protsessy pri sozrevanii torfo-navoznogo komposta. (Zoological processes during the maturing of peat manure compost.) Pochvovedenie, 9: 95-102. (cited in Biol. Abstr., 45: Abstr. No. 49563.) .... USSR

"The maturing of a peat-manure compost is characterized by 3 successive stages of its animal population. During the first stage at a high temperature inside the pile only upper layers of the compost are populated, saprophagic mites being dominant. The second stage is characterized by an increase in number of invertebrates penetrating into deeper soil layers. Among microarthropods, Collembola prevail; Proisotoma minuta dominates. An equilibrium complex composed of species characteristic of the soil is formed in a mature compost."

A-069 Lyubarskaya, L.S., L.K. Shevtsova and N.L. Grishina. 1963. Nakoplenie i prevrashchenie fosfora v pochvakh pri dlitel'nom primenenii navoza i mineral'nykh udobrenii. (Phosphorus accumulation and transformation in soils with continuous application of manure and mineral fertilizers.) Vest. Sel' shokhoz. Nauki, 8(5): 54-61. (cited in Biol. Abstr., 45: Abstr. No. 52727.) .... USSR

"Regular and continuous application of farmyard manure and superphosphate (in the NPK complex) results in higher content of total soil phosphate and greater amount of mobile combinations, P mobility also being higher (the phosphate soil level after Karpinsky-Zamyatina)."

A-070 Shtina, E.A. 1963. Razvitie pochvennykh vodoroslei v navoznozemlyanykh kompostakh. (Development of soil algae in manure-soil composts.) Agrobiologiya, 4: 585-588. (cited in Biol. Abstr., 45: Abstr. No. 61270.)

"Experiments in 8 variants were carried out to determine the significance of individual components of the compost for the development of microflora. The activity of the soil algae is a factor in the preparation of soil-manure composts. While the soil is the source of the algae, the manure and mineral fertilizers provide conditions intensifying their development. Soil-manure composts differ from the original soil by an increased content of algae, especially the blue-green N accumulating forms. The vital activity of soil algae increases the fertilizing value of the compost directly, by N-fixation and accumulation of organic matter, and indirectly by stimulating the activity of useful microorganisms."

A-071 Sahadevan, P.C. and N.N. Ramankutty. 1963. Manuring of upland rice with farm waste. Rice News Teller, 11(1): 20-21. (cited in Biol. Abstr., 45: Abstr. No. 70409.) .... India

"The treatments used were: 1. no manure; 2. compost to supply 60 lb. N/acre; 3. farmyard manure to supply 60 lb. N/acre. The plots that received no manure were found to be definitely inferior to the other two treatments in stand and growth, while the plots that received compost and farmyard manure did not show any marked differences. The flowering duration was normal in plots that received compost and farmyard manure and was extended by 2 days in plots that received no manure. In the first 2 seasons the results did not satisfy the "Z" test. In both seasons compost manure was as good as farmyard manure. In the first season application of compost and farmyard manure resulted in 22.8% and 23.7% increase in yield. In the second season the increases were 7.8% and 6.3%, respectively. In either case, the difference between the two treatments was not more than 1.5%. The results of the third season, when the treatment differences satisfied the test of significance, show that the application of farmyard manure resulted in a 29.3% increase in yield, while with compost the increase in yield was only 11.4% over the control. The combined analysis for the treatments shows that in 2 out of the 3 seasons, compost was as good as farmyard manure. Further, compost and farmyard manure were on par with each other."

A-072 Finkelshtein, M.Y. 1958. Povyshenie udobritel'noi tsennosti navoza i organo-mineral'nykh smesei putem bakterizatsii. (Increasing the value of manure and or organic-mineral mixtures by means of bacterization.) Tr. Vses. Nauchn. -Issled. Inst. Sel'skokhoz. Mikrobiol., 14: 209-212. (cited in Biol. Abstr., 45: Abstr. No. 84081.)

"The effect of azotobacterin on winter rye on a background of manure and organic-mineral mixtures was studied. The experiments were done on a dark medium loam on which a vetch-oats mixture was previously grown. By a pre-sowing azotobacterin treatment of rye with 30 tons/hectare of manure, the largest increase of the yield (70%) was obtained. On a background of an organic-mineral mixture (3 tons/hectare of compost plus 3 metric centners/hectare of dolomitic meal), azotobacterin was less effective (the yield increase was 27-30% as compared with the control). The amount of ammonifying bacteria and fungi increased with inoculation of the seed particularly in variants with organic-mineral mixture, and the amount of Azotobacter increased in the manure variant."

A-073 Muromskii, A.G. 1959. Dernovo navoznye komposty. (Soddy-manure composts.) Zemledelie, 4: 30-34. (cited in Biol. Abstr., 45: Abstr. No. 84085.)

"For the preparations of soddy-manure composts, a plot of land with well developed sod was cultivated with a disk harrow. Manure and liquid manure (80-100 tons/hectare) were evenly distributed over the area and plowed to a depth of 12-15 cm. After the plowing, 175 tons/hectare of the thoroughly mixed manure was applied together with calcareous tuff and phosphate. The prepared mass was collected by a bulldozer into heaps with trough-shaped depressions, which in autumn were filled with liquid manure and manure until the compost mass was thoroughly soaked. About 2000 tons of soddy-manure compost can be obtained from 1 hectare. According to analyses by the All-Union Institute of Fertilizers and Agricultural Soil-Science, the compost contained 10-18% organic matter, 0.4-0.5% total N, 0.19-0.24% P_2O_5: the pH was 6.9. Twelve tons per hectare applied to potato increased the yield by 50 centners/hectare. When 15 tons of compost/hectare were applied to winter wheat, the increase of yield amounted to 7 centners/hectare."

A-074 Popov, N.V. 1959. O primenenii organo-mineral'noi smesi, navoza i fosforitnoi muki pod ozimye. (The application of organic-mineral mixture, phosphorite meal and manure to winter crops.) Udobrenie i Urozhai, 8: 32-34. (cited in Biol. Abstr., 45: Abstr. No. 92997.)
"Data of a 2 year study (at the Khimki raion of the Moscow Oblast') on the effectiveness of the application of fertilizers to winter rye and winter wheat was collected. When winter wheat was sown on a clean fallow, good results have been obtained by the application of granulated superphosphate or of phosphorite meal; when sown in an occupied fallow, silage sunflower, organic-mineral mixture, applied to the presowing tillage, as well as manure combined with a row application of granulated superphosphate proved to be the best fertilizers."

A-075 Kott, S.A. 1963. Ochishchenie navozno-zemlyanykh kompostov ot sornyakov. (Clearing weeds from soil-manure composts.) Agrobiologiya, 6: 886-892. (cited in Biol. Abstr., 45: Abstr. No. 93077.) .... USSR
"Soil-manure composts should be prepared by mixing them into the soil to be used during the previous summer for spring crops and during the summer for fall crops. The weeds should be allowed to grow and be cleared by cultivation before sowing of the crop. The most commonly occuring weeds are listed."

A-076 Boros, I. 1963. Néhány adat a Liszenko-féle istállótrágyásföldes komposzt hazai kipróbálásáról. (Some data on trials in Hungary with the soil-manure compost prepared by the Lisenko method.) Agrokemia es Talajtan, 12(2): 245-254. (cited in Biol. Abstr., 45: Abstr. No. 97248.)
"The Lisenko compost and its effect on principal crops was studied. The quality was increased uniformly to the end of the preparation period. Assimilable N increased from 0.2-20.8 mg, assimilable H_3PO_4 from 6.9-184.5 mg and K from 39.2-88.3 mg/100 g of soil. A 4-mo. fermentation period was beneficial. More favorable precipitation conditions may result in an earlier attainment of the maximum assimilable nutrients. The problem of mechanizing the preparation of the compost requires further study. The results are similar to those from farm manure. Taking the harvest excess as unity for farm manure, the effect of the compost is 1.7 during the first yr. and 1.6 during the second. This compost may be used to compensate for the lack of sufficient fertilizer."

A-077 Janik, J. 1962. Nicienie (Nematoda) nawozowe Wyzyny Lodzkiej. (Manure Nematoda from the Lodz upland.) Fragmenta Faunistica (Warsaw), 9(25): 391-415. (cited in Biol. Abstr., 45: Abstr. No. 106789.)

"The paper deals with the occurrence of manure nematodes found in the Lodz Upland. Samples for examinations were taken from cow, horse, pig and mixed manure, both dry and moist. In the material under investigation 42 species were found, 9 of them new to the Polish fauna. They were: Rhabditis oxycerca, Rh. icosiensis, Rh. pellioides, Rh. inermis, Rh. longispina, Rh. dolichura, Diplogaster nudicapitatus, D. similis and Psilenchus hilarulus."

A-078 Tupenevich, S.M. and I. Egamov. 1963. Vliyanie navozno-zemlyanykh kompostov na vertitsillioznyi vilt khlopchatnika. (Effect of manure-soil composts on verticilliosis in cotton.) Khlopkovodstvo, 13(9): 37-39. (cited in Biol. Abstr., 46: Abstr. No. 4142.)

"Manure-soil compost improved cotton nutrition and helped increase its resistance to wilt disease. When this fertilizer was applied at 30 tons/ha there was a great increase in the development of microorganisms including many which are antagonistic to Verticillium dahliae. The total number of microorganisms in the soil, including bacteria, actinomycetes, and saprophytic fungi increased 1.5-2 times."

A-079 Novogrudskaya, E.D. 1963. Nakoplenie fermentov pri sozrevanii navozno-zemlyanykh kompostov. (Accumulation of enzymes during aging of soil-manure composts.) Agrobiologiya, 6: 880-885. (cited in Biol. Abstr., 46: Abstr. No. 8385.) .... USSR

"Enzyme activity was determined in soil-manure composts. The invertase activity cannot be used as an indicator of the biological activity of the composts since it remains below that of the soil controls throughout the composting period. The urease and phosphatase activity exceeded that in the control soil, reaching a maximum after 30 days of aging. Uraease activity was affected little by the application of mineral fertilizers, but increased greatly after the application of manure. These indices do not reflect the rate of development of certain groups of microorganisms (nitrifying, aerobic cellulose-decomposing) which are important in mobilizing nutrients and in plant nutrition. There is a bibliography with 7 references."

A-080 Kofoed, A.D. and P.S. Klausen. 1964. Forsog med stigende maengder kvaelstof til staldgodet of ikke-stalkgodet jord. (Field experiments using increasing amounts of nitrogenous fertilizers on farmyard-manured and non-farmyard-manured land.) Tidsskrift. Planteavl., 68(1): 23-58. (cited in Biol. Abstr., 46: Abstr. No. 12970.)

"The residual effect of farmyard manure was determined by the yields of subsequent cereal crops. Barley as the first crop showed a higher yield when farmyard manure was applied to previous root crops. The maximal yield was higher where farmyard manure was applied to the root crops. A second crop of rye was slightly greater after farmyard-manure than that of controls, particularly on loamy soils. Farmyard manure as a basis for supplementary mineral N fertilizer is limited or no value."

A-081 Aitken, J.B. 1963. Manure disposal ponds. Queensland Agr. J., 89(10): 608-610. (cited in Biol. Abstr., 46: Abstr. No. 21624.)

"In April, 1962, a trial pond for disposal of pig manure was established at the Biloela Research Station. For each growing pig 15 square feet of pond surface and for each sow with litter 45 square feet were allowed. The depth of the pond is maintained at 3 to 4 feet. A pond no deeper than this allows aerobic bacterial action whereas a deeper one would also permit anaerobic action with offensive odors. Manure, urine and wash water are pumped to the pond from a collection pit at the piggery. The pumping action breaks up solid matter except straw which must be screened out. Straw or other floating matter will allow breeding of flies. This trial pond, located 1 chain from the Station Office has given no offense from odors during the wet season. Three other ponds on commercial properties were also operated successfully."

A-082 Nishiiri, K., S. Kuro and M. Kinebuchi. 1964. (Studies on the growing process of soybean plant with stable manure and three nutrient elements in the virgin volcanic ash soil.) Proc. Crop Sci. Soc. Jap., 32(3): 213-216. (cited in Biol. Abstr., 46: Abstr. No. 26798.)

"To establish the effect of stable manure and 3 nutrient elements (nitrogen, phosphorus, potassium) on the growth of soybean plant (Norin No. 4), the growing process was examined for 3 years rotation system of soybean-potatoes-corn in virgin volcanic ash soil. Higher yields were obtained in the 2nd and 3rd year than in the 1st year. . . . The effects of the stable manure plant growth were observed on the 1st year. There was an increase in the P and K contents in the plants, and the yields became higher. In the 2nd and 3rd year such tendencies were greater, and in the 3rd year due to this vigorous growth branches were broken."

A-083 Sarkadi, J., B. Gyorffy and H. Balla. 1964. Wirkung der Duengersysteme ohne Anwendung von Stallmist auf ungarischen Tschernosemboeden. (The fertility of Hungarian chernozem soils as affected by soil nutrition systems without farmyard manure.) Agrokemia Talajtan, 13(Suppl.): 129-138. (cited in Biol. Abstr. 46: Abstr. No. 58822.)

A report on trials comparing FYM to chemical fertilizers on chernozem soils with 2.5%-3.5% humus content, S.W. of Budapest. FYM and chemical fertilizers increased yields 16% and 25%, respectively, as compared to unfertilized plots. The nitrogen efficiency of FYM was 25% while that of chemical N fertilizer was 50%. Superphosphate and sodium salts gave as good results as the P and K compounds of FYM. Under the conditions described, FYM is not required for maintenance of soil fertility.

A-084 Ortlepp, H., A. Fuhrmann and E. Wagner. 1964. Die pflanzenphysiologisch Wirkung des Gemisches Superphosphat-Stallmist I. (The plant-physiological effect of superphospate-farmyard manure mixture. I.) Landwirt. Forsch., 17(3): 178-188. (cited in Biol. Abstr. 46: Abstr. No. 63416.) . W. Germany

"The effect of a superphosphate-farmyard manure mixture on plant growth was compared to that of usual separate applications of manure and mineral phosphate. Pot experiments showed that application of powdered superphosphate to the mixture of excrements, urine and straw in the stable provides a means for improving the efficiency of mineral phosphorus. Crop yields on the soils investigated were considerably higher following application of manure treated with superphosphate than those following separate dressings of manure and superphosphate. There was also a increase in P_2O_5 uptake. The utilization of phosphorus was 32% higher with application of manure treated with superphospahte than with separate dressings of farmyard manure and phosphate fertilizer. Results of 114 field trials with potatoes showed the effects of manure treated with superphosphate on crop yields under practical conditions of growth. A statistically significant yield increase of 8% was obtained by application of manure treated with superphosphate."

A-085 Bochet, J., R. Fesneau and P.F. Ceccaldi. 1964. Un fumier de cheval non tétanigène. (A non-tetanigenic horse manure.) Arch. Mal. Prof. Med. Trav. Securite Soc., 25(12): 697-702. (cited in Biol. Abstr., 46: Abstr. No. 67183.) .... France
"Tetanus is not found among fungiculturists. An attempt was made to identify the tetanus bacillus in manure by classical bacteriological methods and by techniques of immunofluorescence. The results indicate that the bacillus and its spore exist in the manures of mushroom beds; bacillus development is irregular and seems to be influenced by treatments applied to the manure. The bacillus was never found in parasitized and fermented manure or in blanc de champignon, the commercially used mycelium. More work is needed to determine the factors responsible for the absence of tetanus among mushroom cultivators."

A-086 Chardez, D. 1963. Thécamoebiens des fumiers. (Thecamobae of manure.) Bull. Inst. Agron. Station Recherches, Gembloux, 31(1): 17-20. (cited in Biol. Abstr., 46: Abstr. No. 68458.)
"No single sp. was typically found in manures of various animals; several were able to adapt to the medium the pH of which varied between 7 and 9; most genera and individuals occurred at pH 7.5 and 8. They were eurytopic forms habitually found in soils and mosses and included Centropyxis aerophila, Phryganella acropodia, Tracheleuglypha acolla, Trinema enchelys, T. enchelys biconvexa, T. lineare, and T. complanatum globulosa. Two additional reports of Centropyxis laevigata and Heleopera sylvatica found by another author are made."

A-087 Smibert, R.M. 1965. Vibrio fetus var. intestinalis isolated from fecal and intestinal contents of clinically normal sheep: Isolation of microaerophilic vibrios. Amer. J. Vet. Res., 26(111 Pt. 1): 315-319. (cited in Biol. Abstr., 46: Abstr. No. 76772.)
"Microaerophilic vibrios similar to Vibrio fetus var. intestinalis were isolated from the feces and intestinal content of clinically normal sheep 3 months to 8 years of age. Vibrios were isolated from contents of the rectum, colon, cecum, and ileum-jejunum of sheep. They were isolated from feces of sheep 3 to 20 months old more frequently than from the feces of sheep 2 to 8 years of age. The isolation of vibrios was accomplished by the selective filtration of emulsified fecal and intestinal samples through membrane filters."

A-088 Smibert, R.M. 1965. Vibrio fetus var. intestinalis isolated from fecal and intestinal contents of clinically normal sheep: Biochemical and cultural characteristics of microaerophilic vibrios isolated from the intestinal contents of sheep. Amer. J. Vet. Res., 26(111 Pt. 1): 320-327. (cited in Biol. Abstr., 46: Abstr. No. 76773.)

"Microaerophilic vibrios isolated from the fecal and intestinal content of clinically normal sheep were identified as Vibrio fetus var. intestinalis. The vibrios were all catalase-positive, oxidase-positive, reduced nitrate to nitrite, reduced sodium selenite, grew in a medium containing 1.0% bile, grew in the presence of 1.0% glycine, and did not grow in a medium containing 3.5% NaCl. They grew at 42 and 45 C., but not at 25 C. The vibrios grew in chemically defined mediums and MacConkey's agar. Most strains hydrolyzed casein when the plate test was used but did not hydrolyze gelatin. The vibrios neither oxidized nor fermented carbohydrates. The vibrios also did not have phosphtase or arylsulfatase activity when tested after 2 days of incubation. The vibrios did not produce H_2S when grown on triple sugar iron agar, but did produce H_2S when cysteine was added to the medium and lead acetate impregnated strips of filter paper were used to detect H_2S."

A-089 Aslanyan, S.A. 1959. K voprosu o vliyanii navoza na urozhai i kachestvo klubnei kartofelya v usloviyakh Nagornogo Karabakha. (The problem of the influence of manure on the yield and quality of potato tubers under the conditions of Nagornyi Karabakh.) Tr. Vses. Nauchn. -Issled. Inst. Udobrenii i Agropochvovedeniya, 32: 103-113. (cited in Biol. Abstr., 46: Abstr. No. 77374.)

"In experiments during 2 years in kolkhozes, direct applications of manure (10 tons/ha) increased the yield of the varieties Rannyaya Roza and Lorch by 1.5-2.5 tons/ha (the yield of the control plot was 5-7 tons). The contents of starch and raw protein also increased."

A-090 Ortlepp, H. and E. Wagner. 1965. Die pflanzenphysiologische Wirkung des Gemisches Superphosphate-Stallmist. (The plant-physiological effect of a superphosphate-farmyard manure mixture.) Landwirt. Forsch., 17(4): 260-266. (cited in Biol. Abstr., 46: Abstr. No. 91101.) .... W. Germany

"Changes in the N-composition of manure after mineral-phosphate application in the form of powdered superphosphate were studied. Though laboratory trials showed a conservation of N in the manure, little if any decrease in N losses occurred under practical conditions. However, superphosphate applied to the stable always reduced losses of organic matter, resulting in a marked absolute gain in N in decomposed manure per animal. Four pot experiments indicated that application of powdered superphosphate to the stable improved the efficiency of N in the farmyard manure. The improved efficiency of N compounds in manure treated with superphosphate may be attributed primarily to a shift in composition for the benefit of NH_4-nitrogen."

A-091 Romanenkova, M.M. 1958. Effektivnost' razlichnykh sposobov sochetaniya navoza s izvest'yu. (The effectiveness of different methods of combining manure with lime.) Tr. Vses. Nauchn.-Issled. Inst. Udobrenii i Agropochvovedeniya, 32: 105-108. (cited in Biol. Abstr., 46: Abstr. No. 104878.)

"In field experiments on highly acidic turfy-podzolic heavy loam, manure and lime were applied in the following ways: manure after scattered lime, lime after scattered manure, as a compost, and as a mixture. Lime and manure were plowed into the soil simultaneously. All of these methods resulted in equal increases in the yield of a vetch-oats mixture and of perennial grasses."

A-092 Palevitch, D., N. Kedar, H. Koyumdjisky and J. Hagin. 1965. The effect of manure and fertilizer treatments on the yields of winter tomatoes in the western Negev. Israel J. Agr. Res., 15(2): 65-72. (cited in Biol. Abstr., 46: Abstr. No. 104987.)
"Nitrogen fertilizer and manure improved yield distribution and increased total yield, weight per fruit and height of plants of winter tomatoes, var. Moneymaker, grown in the loamy sand of Mivtahim, in the semi-arid northwestern part of the Negev. The soil was low in organic matter and available nitrogen and rich in available phosphorus and potassium. . . . Cow manure applied in addition to N and P fertilizers significantly increased yields by 14-41% in comparison with plots which received the same amounts of N and P but without manure."

A-093 Bosman, M.S.M. 1964. Copper fractions in grass, rumen contents and faeces of cattle. Mededel Inst. Biol. Scheikundig Onderz Landbouwgewassen, 235/256: 125-131. (cited in Biol. Abstr., 46: Abstr. No. 108310.) .... Netherlands
"Samples of fresh grass, rumen contents and feces of cattle were extracted with different solvents. In the fractions obtained Cu was colorimetrically determined after destruction with sulphuric and nitric acid. Cu-pheophytin was found in very small amounts only. From feces of grazing cows a fraction was obtained containing a porphyrin (probably phylloerythrin-monomethylester) and Cu. This porphyrin could not be detected in rumen contents from grazing animals, nor in rumen contents and feces from barn-fed cows. In fresh grass a part of total Cu (average 48%) is soluble in acetic acid 0.1 N. In the rumen this Cu has been converted into a less soluble form, possibly CuS. The results of our extraction-experiments are not in disagreement with the supposition that a great proportion of total Cu is present as CuS in the rumen."

A-094 Sladka, A. 1965. Biocenoza vezoveho filtru. (Biocenosis of a trickling filter.) Vodni Hospodar, 15(6): 263-267. (cited in Biol. Abstr., 47: Abstr. No. 13686.) .... Czechoslovakia
"The paper deals with biologic observation of a trickling filter for poultry farms and dairy waste water. The biologic community of several filter layers (surface, 10 cm, 2 m, 6 m below the surface and the bottom) was observed for a year in a filter of the filling level of 6.60 m and 1.10 m in diameter. In the community the protozoa (Rhizopoda, Flagallata, Ciliata), macrofauna (Nematoda, Rotatoria, Oligochaeta, Acarina, Diptera) and sewage fungi were observed. The number of organisms was related to the dry solids of the growth. The work proved that the actual quantitative evaluation of the individual organisms and their groups must be carried out, in order to compare them within the community of the individual layers and the entire filter as well. Analyses proved that during the entire observation period an alpha-mesosaprophyte biota persisted in the filter. With

the stabilized community the filter did not get clogged even with the appearance of sewage fungi. The biological equilibrium of the filter community was disturbed only with the temperature dropping below 10°C, where the filter got clogged and a poly-saprophyte biota developed. The low temperature limited the development of macrofauna. It is apparent that a lower organic load must be considered in winter. Occasionally flushing must be carried out in order to compensate for the lack of continuous disposal of growth by biological factors. Among the infusoria the genera Aspidisca and Opercularia are considered as indicators of good filter function."

A-095 Meerson, G.M. and A.A. Suchilina. 1958. Vnesenie navoza v lunki pri posev kukuruzy. (Application of manure in holes, during sowing of corn.) Udobrenie i Urozahai, 4: 26-28. (cited in Biol. Abstr., 47: Abstr. No. 14102.)

"Application of decomposed manure at the bottom of holes (with a 4-5 cm layer of soil separating the manure and seeds) produced 23 days after sowing, a greater yield of green mass than placement of seeds within the manure or beneath it. Application of fresh manure led to a sharp drop of the weight of plants (by 50-86%)."

A-096 Moussa, R.S. 1965. Type distribution of coliforms isolated from fecal and non-faecal habitats. Indian J. Med. Res., 53(7): 629-637. (cited in Biol. Abstr., 47: Abstr. No. 23438.)

"The study of 5,183 coliform strains isolated from human and animal feces, sewage, water, soil and vegetation showed each of these habitats to comprise more than a single IMViC type. Fifteen types were characterized; a number of these appeared fecal, while the others were probably of the intermediate-aerogenes coliform groups. Irregular combinations of IMViC (including odd indole, MR, VP and citrate, as well as the 44.5°C reactions), were equally encountered with coliform strains of various habitats. Sanitary bacteriologists should put more emphasis on the coliform counts than on the routine differentiation of these organisms into fecal and non-fecal groups."

A-097 Amor-Asuncion, M.J., R. Wolanski, R. Ghelfi, J.J. Olivieri and F.J.B. Nobile. 1963. Algunos efectos del estiércol sobre el suelo. I. Influencia sobre el contenido de fósforo soluble. (Some effects of manure on the soil. I. Influence on the content of soluble phosphorus.) Rev. Fac. Agron. Veterinaria Univ., Buenos Aires, 15(3): 3-10. (cited in Biol. Abstr., 47: Abstr. No. 34355.)

"Four plots were tried with each kind of manure. Samples were taken from these plots and from controls, before manuring and 2 months later. The results indicate a high and rapid increase of soluble P of the soil with each of the manures used, and in some cases a solubilization from insoluble P of the soil."

A-098 Zimny, H. 1964. (The influence of chemical fertilizers and manure upon the presence of Clostridium and Azotobacter in the peat soil of meadows.) Ekol. Polska Ser. A., 12(1): 1-9 (cited in Biol. Abstr., 47: Abstr. No. 49196.) .... Poland

"Investigations were made of the influence of mineral fertilizers and stable manure on the amount of Clostridium and Azotobacter in the peat soil of a meadow. The results obtained show that Clostridium is an organism less sensitive than Azotobacter to habitat changes."

A-099 Talati, R.P. 1965. Improvement of local manures in western India. Indian J. Agr. Sci., 35(2): 134-140. (cited in Biol. Abstr., 47: Abstr. No. 69193.)

"On the sandy and silty loams of Western India the addition of superphosphate (up to 10 lb P_2O_5 to 50 ft^3 of farm refuse) gave a balanced manure when composted in trenches with moisture maintained at 40 to 48%."

A-100 Zimny, H. 1965. (The influence of mineral fertilizer and cow manure on the distribution of microflora in peat soil under meadow.) Ekol. Polska Ser. A., 13(6): 57-72. (cited in Biol. Abstr., 47: Abstr. No. 74349.) .... Poland

"The results obtained show that basic fertilization and micro-elements act chiefly on the preservation of the structure of the soil, and the slight variations in the abundance of microflora were caused by the intensified development of the plant cover."

A-101 Wittke, E. and O. Paladines. 1965. Variación diurna en la excretión de nitrógeno fecal. (Diurnal variation in the fecal nitrogen excretion.) Turrialba, 15(3): 247-248. (cited in Biol. Abstr., 47: Abstr. No. 90601.) .... Costa Rica

"Twelve castrated free grazing sheep were subjected to an experiment in which digestibility and metabolic stages were measured using the fecal indexes of a mixture of while clover (Trifolium repens) and several species of Gramineae (Dactylis glomerata, Lolium multiflorum and Bromus sp.). Feces were collected every 3 hours during a 24-hour period in the feces. Percentages of dry matter and nitrogen were determined. No significant differences were found between 8 a.m. and the other hours in which the fecal sampling was performed."

A-102 DeRoux, R.G. and R.O. Diaz. 1964. Utilizacion de estiercol seco de gallina como factor de crecimiento en aves. (Dry chicken manure as a factor in the growth of chickens.) Acta Agron., 14(1/4): 23-45. (cited in Biol. Abstr., 47: Abstr. No. 108327.) .... Columbia

"Addition of dry chicken manure in amounts up to 3% to the regular ration of chickens resulted in live weight gain up to 11% in a 12-week period."

A-103 Hamdi, H., A.E.H.E. Damaty and M.A. Omar. 1963. (Influence of fertilization on cotton plant.) Beitr. Trop. Subtrop. Landwirt. Tropenveterinarmed, 1(1): 42-52. (cited in Biol. Abstr., 47: Abstr. No. 114289.)

"Four experiments were designed at Bahtim Farm of the Egyptian Agricultural Organization in 1959 and 1960 to study: (a) the effect of farmyard manure with and without superphosphate on cotton yield; (b) the effect of farmyard manure, gypsum and calcium nitrate on cotton yield; (c) the effect of P and its time of application with the combined effect of time of N application on cotton yield; and (d) the effect of K and its time of application with and without gypsum on cotton yield. There was only a slight increase in yield due to the increasing amounts of farmyard manure, but this increase was not significant. Superphosphate when applied with or without farmyard manure had no significant effect on yield. The addition of 16 kg of N resulted in a significant . . . increase over the yield of the untreated plots of 0.78 kentars (109 kg) per feddan (1.038 acres). . . ."

A-104 Amor-Asuncion, M.J., J.J. Olivieri, R. Ghelfi, R. Wolanski and F.J.B. Nobile. 1964. Algunos efectos del estiércol sobre el suelo. II. Influencia sobre el contenido de potasio de cambio. (Some manure effects on soils. II. Its influence on the exchangeable potassium content.) Rev. Fac. Agron. Veterinaria, Univ. Buenos Aires, 16(1): 161-166. (cited in Biol. Abstr., 47: Abstr. No. 114314.)

"In Buenos Aires a field experiment was made applying different kinds of manure in order to consider its effects on the content of exchangeable K in the soil. Four plots were tried with each kind of manure leaving aside 4 plots as controls. Samples were taken from the tried plots and controls before and after 2 months of being manured. Exchangeable K was determined in the samples and the results were considered and discussed. The results point to a high and quick increase of K of exchange in the soil after manure use. Highest and lowest increase of exchangeable K were given by horse and cow manures, respectively."

A-105 Monnier, G. 1965. Action des matières organiques sur la stabilité structurale des sols. II. (Effect of organic matter on the stability of the soil structure. II.) Ann. Agron. (Paris), 16(5): 471-534. (cited in Biol. Abstr., 48: Abstr. No. 35393.)

"This study showed the interest of a fragmentation, on one hand into free substances which only represent the potentiality of a stability amelioration and on the other, into bound substances, responsible for the immediate properties of the soil. . . . It appears that the 3 types of stabilization, corresponding to the successive phases (microbial agents, prehumic products, humus) of the evolution of the organic matter, are also found in the field. Their relative importance varies in a similar way, according to the nature and mass of the vegetal matter buried and to the conditions of their incorporation and of their fermentation. Some very fermentable additions which have a very low humus yield or even none at all (young green manure) give very intense effects, but they are of short lasting and only correspond to the 1st stage of evolution. Others, such as a well disintegrated manure, have only long term effects and take part in the keeping of a basic level of stability, in connection with the humic content in the soil. . . ."

A-106 Janowski, H., K. Wasinski and B. Kowalik. 1965. (Effects of nutrition on the number and quality of Escherichia coli and Lactobacillus in feces of pigs at their weaning age.) Bull. Veterinary Inst., Pulawy, 9(4): 161-170. (cited in Biol. Abstr., 48: Abstr. No. 49701.) .... Poland

"In 23 piglets that belonged to 2 litters of various breeds the number of Escherichia coli bacteria in feces at the time of weaning was many times lower than the number of bacteria of the Lacto group. In 50% of the examined piglets after their weaning there was an increase in number of E. coli between the 5th and 12th day. The number of bacteria of the Lacto group remained unchanged. No effect of tetracycline addition to food (60 mg/1 kg of stuff food) was found with regard to the number of bacteria of E. coli and Lacto group in feces. At the time of 1-38 days after the weaning there were haemolitic E. coli bacteria in feces of piglets, in a quantity of 1 to 100%. Most of bacteria were found at the time of 5-10 days after the weaning, then they gradually used to disappear. The results similar to those after the weaning were found in control pigs after the change of their diet, when the increase in number of E. coli and Lacto in feces was greater then in normally fed pigs, while the number of haemolitic bacteria much lower, and their time of occurrence in particular animals was only 1-2 days. It was found that from among 217 strains of E. coli the greatest number was sensitive to Chloromycetin (99%), to Streptomycin (69.6%) and to Neomycin (55.3%), the smallest figures were those of sensitive to penicillin (0%), erythromycin (0.5%), terramycin (4.1%) and tetracycline (0.46%)."

A-107 Asarov, Kh. K. 1959. Primenenie mestnykh udobrenii v Kitae. (Preparation of local fertilizers in China.) Udobrenie i Urozhai, 1: 57-59. (cited in Biol. Abstr., 48: Abstr. No. 61770.)

"In China, a preparation is distributed of manure earth compost of animal stables at a ratio of 1 part animal excrement to 5 parts of earth. In making raw compost the ingredients used are: sod or leaves, garbage sewage, farmyard dung, feces, and earth. Decomposition of the compost takes place under anaerobic conditions. During the period of preparation, the compost is mixed 3-4 times; such composts usually contain 0.1-0.3% N. The method of preparation varies with the district, but is usually as follows: the compost is stored in a pit 1 m deep, surrounded by a ridge 50 cm in width and 60 cm in height; a thick layer of green manure is spread at the bottom; the other components are then added in layers and stamped down; and the pit is then flooded by water from the top. Garbage is composted sometimes as it is, or, more often, with added feces of phosphorite. From the decomposed compost of garbage a debris-mineral granular fertilizer is obtained by the addition of 10-20% ammonium sulfate to the sifted compost; granular fertilizers are also obtained by the addition of 20% superphosphate and subsequent granulation."

A-108 Campan, M. 1966. Étude quantitative du pouvoir attractive de l'odeur du purin pour les larves et les adultes d'Eristalis tenax (Dipteres, Syrphides). (Quantitative study of the attraction power of liquid manure odor for larva and adults of Eristalis tenax (Diptera, Syrphida).) Compt. Rend. Seances Soc. Biol. (Paris), 160(2): 411-415. (cited in Biol. Abstr., 48: Abstr. No. 62459.)

"The attraction power of liquid manure odor on larva and adults of Eristalis tenax varies with age, sex, and physiologic state of the animals. Adult males are indifferent and the female working bees are unequally sensitive. By contrast, the females laying eggs unanimously attracted by this olfactory stimulus, as well as hatching larva; larva ready to enter the chrysalis stage show strong adverse reactions. The odor therefore appears as a direct stimulus on egg-laying behavior and larva migrations."

A-109 Amor-Asuncion, M.J. 1964. Influencia del agregado de estiercol al suelo sobre el desarrollo del azotobacter en placas de tierra moldeada. (The influence of manure addition to soil on the development of Azotobacter in molding plates of ground.) Rev. Fac. Agron. Veterinaria, Univ. Buenos Aires, 16(1): 167-173. (cited in Biol. Abstr., 48: Abstr. No. 66412.)

"The influence of the application of different kinds of manures to the soil on Azotobacter in an open field was investigated. The nature of the trial, characteristics of the soils, types and quantities of the manure used, number and size of the plots and repetitions performed in this experiment are described. The incorporation of manure increases highly the amount of assimilable P of the soil, according to results when the Winogradsky's microbiological method of molding plates of ground is used. The development of the microorganisms in the plates of ground belonging to the manured plots begins late, reaching its maximum at the 20th-25th days. The results of the contents of soluble P, determinated by means of the chemical method of Truog-Peech, show a notable increase of this element in manured plots, so that a close relationship between the soluble P contents and the presence of P assimilable by Azotobacter is thought to exist."

A-110 Didychenko, A.P. 1958. O diestvii fosforitnoi muki i defekata na urozhai kul'tur zerno-sveklovichnogo sevooborota. (The effect of phosphorite and manure on the yield of crops in a cereal-beet crop rotation.) Udobrenie i Urozhai, 10: 8-10. (cited in Biol. Abstr., 48: Abstr. No. 66805.)

"An experiment on dark gray podzolized soil of the Chartoriiskoe Experimental Field in the Zhitomir Oblast' showed that the effect of superphosphate and phosphorite on the yield of sugar beet, winter wheat, peas, barley, perennial grasses (for hay), and vetch-oats mixture is approximately the same. It was assumed that with bulk application, it is advisable to replace superphosphate with phosphorite meal. Application of manure once during an 8-course rotation resulted in an increase of yield from 3 courses of winter crops, 2 courses of spring crops, and 2 courses of grasses. Top dressing of manure for potato did not raise the yield of next course (barley), but it effected a considerable increase in the yield of perennial grasses. It is advisable to apply manure on occupied fallow followed by a vetch-oats mixture without manure, and to sow perennial grasses on the 3rd year."

A-111 Ryabchuk, D.I. 1959. O preimushchestve primeneniya navoza, kompostirovannogo s mineral'nymi udobreniyami. (The advantage of application of manure, composted with mineral fertilizers.) Udobrenie i Urozhai, 1: 25-29. (cited in Biol. Abstr., 48: Abstr. No. 66818.)

"In experiments, performed from 1953 to 1957 on leached out medium-clay loamy chernozems of Kiev Oblast', a considerable effect was observed on the sowing of cereal crops when manure composted with mineral fertilizers was applied. Fresh manure was mixed with mineral fertilizers at the rate of 20 tons of manure/ha and of NH_4NO_3 45 superphosphate 60, potassium sulfate 45, and stored in trenches all year around, this ensured a content of mobile N up to 4.5 mg, of P_2O_5 15 mg; of K_2O 12 mg; per 100 g of soil in the upper 30-cm soil layer. The increase in the yield of sugar beet was 54 centners; potato 26, corn 74; and fodder beet 74 centners/ha, as compared with the yield of these crops with separate applications of these fertilizers. The accumulation of dry matter in corn increased 1.2 times, that of sugar beet and potato 1.1 times, as compared with the total increase obtained with separate applications of manure and of complete mineral fertilizers. An increase in the nitrifying properties of soils and in the accumulation of P and K in them was also observed."

A-112 Desai, A.J. and S.A. Dhala. 1966. Isolation and study of thermophilic actinomycetes from soil, manure and compost from Bombay. Indian J. Microbiol., 6(1/2): 53-58. (cited in Biol. Abstr., 48: Abstr. No. 87283.)

"Thermophilic actinomycetes growing between 35° and 65° C were isolated from samples of soils, composts and manures from Bombay. They belonged to the genera Streptomyces, Thermomonospora and Thermoactinomyces. Members of the last genus were most common. The isolates differed markedly from the described species. They were highly proteolytic and amylolytic. Only one strain of Thermoactinomyces viridis inhibited Staphylococcus aureus. The active principle of the antagonist appears to be different from Thermoviridin secreted by T. viridis."

A-113 Vinkalne, M.O. 1965. Sposoby povysheniya mikrobiologicheskoi aktivnosti torfonavoznykh kompostov. (Means of increasing the microbiological activity of peat-manure composts.) In: Rol' mikroorganizmov v pitanii rastenii i povyshenii effektivnosti udobrenii. (Role of microorganisms in plant nutrition and raising fertilizer effectiveness.) Kolos, Leningrad. pp. 160-170. (cited in Biol. Abstr., 48: Abstr. No. 87906.)

"Composted peat applied with manure increases the biological activity of the peat. Composts treated with the bacterial preparations AMB (autochthonic microflora of group B - - a fertilizer), azotobacterin, and phosphorobacterin increase the yield of the cabbage, potato, and other plants, and the vitamin C level in cabbage heads; they decrease the morbidity of clubroot in Cruciferae. Bacterialization with thermophilic cellulos-decomposing bacteria and Pseudomonas culture No. 6 (isolated by D.B. Gurfel') had no such effect."

A-114 Akalan, I. 1964. Effect of adding farm manure on the moisture retention capacity of soils. Univ. Ankara, Fac. Agr. Yearbook, 1964, pp. 154-160. (cited in Biol. Abstr., 48: Abstr. No. 98301.).

"Increasing amount of farm manure in the sandy soil cause a decrease of volume, weight and specific gravity and an increase in porosity, total water content, infiltration rate and permeability. The available water content stays about constant in the 1st month after farm manure application."

A-115 Sharif, M., F. Muhammad and M.A. Chaudry. 1966. Effect of farm yard manure on the availability of superphosphate. Proc. Agricultural Symposium, Dacca, Pakistan. pp. 63-66. (cited in Biol. Abstr., 48: Abstr. No. 108702.)

"A pot culture experiment was conducted to study the availability of superphosphate with and without premixing it with farm yard manure. Superphosphate labelled with P-32 was used so that P from superphosphate could be differentiated from that of soil and farm yard manure. The wheat plants were harvested after 35 days and at maturity when they were 105 days old. Chemical analysis of both harvests indicated that P uptake from superphosphate was higher where superphosphate and farm yard manure were mixed together. Mixing the 2 fertilizers also had beneficial effect on dry matter yield of the plants. The fixation of superphosphate was reduced when it was thoroughly mixed with the farm yard manure. The degree of fixation reduction was calculated from superphosphate-P uptake by plant. The 35 days and 105 days harvest indicated a reduction of fixation by 21.6 and 35% respectively. Reactions of superphosphate with soil and farm yard manure are to be studied. Some possible ways of studying these complex reactions are discussed."

A-116 Owssia, I., E. Wilberg and G. Michael. 1967. Die Wirkung einer 30 jahrigen Mineral- und Stallmistdungung auf den Phosphorsaure-Bindungszustand eines Filderlehmbodens. (The effect of 30 years of inorganic and farm yard manuring on the P-binding status of a filder loam soil.) Z Pflanzenernahrung Dungung Bodenk., 113(2): 159-169. (cited in Biol. Abstr., 48: Abstr. No. 108757.) .... W. Germany

"P-binding-status and P-availability of a loam soil were investigated at the end of a 30 year field experiment with varied mineral fertilization and with or without FYM (farm yard manure.) Organic manuring and increasing amounts of mineral P-fertilization caused a significant increase in total P and a higher lactate P-content in comparison to plots without or with only low P-fertilizer. The above mentioned FYM increased the lactate P value relatively more than the total P-content of the soil. 35-50% of the total P in the investigated soil is bound in organic form. FYM did not influence the amount of organic bound P, fertilizing with mineral P increased this P fraction. Fractionation of the inorganic P by the method of Chang and Jackson resulted in 15% Ca-P, 30% Al-P and 55% Fe-P. Inorganic P was increased more by P-fertilizer and FYM than the organic P. This increase is mainly due to Al-P. . . ."

A-117 Grant, P.M. 1967. The fertility of sandveld soil under continuous cultivation: I. The effect of manure and nitrogen fertilizers on the nitrogen status of the soil. Rhodesia Zambia Malawi J. Agr. Res., 5(1): 71-79. (cited in Biol. Abstr., 48: Abstr. No. 124152.)

"Changes in the N status of a light granitic sand during the 1st 5 years of cultivation were measured on plots treated with factorial combinations of manure and fertilizer N. Total N content in the ploughed layer was 0.04% at the outset and did not decrease. Nitrifiable N equivalent to only a few pounds N per acre accumulated during the dry winter and crops were dependent on annual applications of N. There was no further deterioration in the N status during cultivation even on plots receiving only 20 lb. N per acre annually. Organic matter in this virgin sand was a minor source of N and changes in the N status could not be an important factor in any decline in soil fertility. Manure increased the total N content of the soil but did not increase the proportion of N that was slowly available. Most of the nitrifiable N from manure was released early in the season and losses of nitrates by leaching severely reduced this available N before the period of maximum growth. In most seasons the readily available N was better maintained by split applications of calcium ammonium nitrate fertilizer than by manure. Nitrate persisted in the sub-soil, particularly in plots receiving fertilizer N."

A-118 Dorr, R. 1965. Zur Charakterisierung der organischen Substanz in Düngemitteln II. Einteilung der organischen Düngemittel und Abfallstoffe sowie Vorschlag für einen einfachen Analysengang auf der Grundlage des oxydierbare Kohlenstoffs. (The characterization of the organic substance in manures. II. Groups of organic manures and residues, and a proposed scheme of a simple analysis based on the oxidizable carbon.) Landwirt. Forschung., 18(3/4): 238-246. (cited in Biol. Abstr., 49: Abstr. No. 10096.) .... W. Germany

"This method characterizes organic substances according to their susceptibility to decomposition. Total organic matter is determined by means of oxidation with potassium dichromate and sulfuric acid, and is calculated as oxidizable carbon (Cox). The organic manures can be grouped according to the value of their organic matter by means of fractionating with 0.5% sodium hydroxide and 80% sulfuric acid and determining the insoluble residue of Cox after treatment. On the basis of investigations conducted so far, it is proposed that organic manures with less than 3% Cox residue be regarded as "easily decomposable organic manures without persistent effect in improvising soil properties"; manures with 3% Cox or more after fractionation should be regarded as "organic manures with a high capacity of loosening the soil"."

A-119 Polheim, P. 1965. Zur Charakterisierung der organischen Substanz in Düngemitteln I. Einteilung der organischen Düngemittel auf Grund der Löslichkeit der organischen Substanz und des organisch gebundenen Stickstoffs. (Characterization of the organic matter in manures. I. Classification of organic manures on the basis of the solubility of organic substance and of nitrogen in organic bond.) Landwirt. Forschung., 18(3/4): 228-237. (cited in Biol. Abstr., 49: Abstr. No. 10099.) .... W. Germany

"Investigations in collaboration with 4 Agricultural Research Institutes aimed at a certain classification of organic manures by utilizing the analytical technique developed by Hofmann. Fifteen samples of organic manures and organo-mineral fertilizers were investigated. The solubility of organic substance and of N in organic bond in 3.125% and 72% sulfuric acid and in 0.5% sodium hydroxide was determined, and was related to total organic matter (loss on ignition) and total organic (water-insoluble) N. Results and microscopic examination of samples produced standard values for a preliminary characterization of organic manures; manures consisting of predominantly plant material may by these values differentiated from manures mainly of animal origin."

A-120 Dougall, H.W. 1966. The solvent effect of acid digestion on the nitrogen contained in ruminant feeds and faeces. E. African Agr. Forest., 32(1): 54-57. (cited in Biol. Abstr., 49: Abstr. No. 13768.) .... Kenya

"The solvent effect of sulfuric acid on the protein associated with the acid-fiber of feeds and their respective feces is described. No matter how the acid concentration changes, the crude protein and the true protein associated with the acid-fibre change in the same way in feeds and feces. The fecal crude protein in feces was separated into a fraction that is associated with, and a fraction that is not associated with, the fiber resulting from N-H_2SO_4 digestion. The former fraction is assumed to consist of residual feed nitrogen."

A-121 Dinu, M., S. Serban, B. Vilcu and N. Dumitrasc. 1966. Folosirea microelementelor amino-acizilor si fecalelor de pasari in stimularea cresterii tineretului aviar. (Trace elements, amino acids and poultry feces as growth stimulators in chickens.) Lucr. Stiint. Ser. C, 9: 163-177. (cited in Biol. Abstr., 49: Abstr. No. 35363.)

"The experiments were conducted on 9 groups, including 280 Rhode Island chickens, 15-87 days old. Besides the basal rations, the following dry poultry feces were tried: 5 as ration substitute in one group, and ration supplement in another; 8% methionine, Co, Fe, Cu, and Mn, separately applied to 4 groups in the following doses: 9 mg $CoCl_2$ (Cobalt chloride), 200 mg $FeSO_4$ (Iron sulfate), 36 mg $MgSO_4$ (magnesium sulfate) per kg fodder, and in cumulative doses of 9 mg $CoCl_2$ plus 36 mg $CuSO_4$ in another group. The best effect was obtained with dry poultry feces due to the high B_{12} percentage, growth factors and specific nutritive value; Co and Cu in cumulative doses enhanced growth and vitality; Mn, separately applied, enhanced the chickens growth, but less than the other 2 trace elements cumulatively applied. Co, Cu and Fe, in the mentioned doses when given separately had little or no effect."

A-122 Grant, P.M. 1967. The fertility of sandveld soil under continuous cultivation: II. The effect of manure and nitrogen fertilizer on the base status of the soil. Rhodesia Zambia Malawi J. Agr. Res., 5(2): 117-128. (cited in Biol. Abstr., 49: Abstr. No. 42167.)

"The effect of continuous cropping, with various manurial treatments, on the exchangeable base status of an acid granite sand was measured. . . . Annual applications of 3 or 6 tons manure raised the fertility of the soil, by progressively increasing the cation exchange capacity, the exchangeable bases and pH; this increased the weight and mineral concentration of maize plants. It appears that, provided Mg is applied with the normal N, P, K, S fertilizers, sustained cropping on these coarse-grained sands is possible. The sands have little natural fertility and the level of crop production that can be maintained will depend on the availability of nutrients added in fertilizers or manure."

A-123 Witter, R.L. and B.R. Burmester. 1967. Transmission of Marek's disease with oral washings and feces from infected chickens. Proc. Soc. Exp. Biol. Med., 124(1): 59-62. (cited in Biol. Abstr., 49:. Abstr. No. 51514.) .... U.S.A.

"The infectious agent of Marek's disease (MD), a disease of the avian leukosis complex, was present in oral washings and feces obtained from 4-week-old donor chickens infected with the JM strain of MD. These materials induced MD in 100% of intraperitoneally inoculated, day-old line 7 chicks. Disease did not occur in uninoculated chicks. All lots were held 10 weeks in Horsfall-Bauer isolators and the disease status of individual chicks determined by necropsy or histopathology. Transmission occurred inconsistently when oral washings and feces were instilled intranasally. Direct transfer of oral fluids from donor chicks to the mouths of recipient chicks with a swab did not induce disease. The significance of excreted MD agent in the natural transmission of MD is discussed."

A-124 Amor-Asuncion, M.J., R. Wolanski, R. Ghelfi and F.J.B. Nobile. 1966. Efectos de distintos estiércoles sobre el cultivo del maiz. (Effects of different manures on corn cultures.) Univ. Buenos Aires, Fac. Agron. Vet. Rev., 16(3): 37-45. (cited in Biol. Abstr., 49: Abstr. No. 53181.)

"Manures do not affect the production of corn but do modify its composition. Manures increase the P and K content of the plants. The composition variation that manures produce could be connected favorably to the nutrient value of the corn and to the quality of the seed."

A-125 Salontai, A. and Z. Nagy. 1965. Cercetari privind eficienta ingrasamintelor verzi asupra productiei la sfecia de zahar si cartof. (Green manuring, its effect in the second year after application, and its efficiency on potato and sugar beet crops versus farm manure and chemical fertilizing.) Inst. Agron. Dr. Petru Groza Cluj. Lucr. Stiint. Ser. Agr., 21: 201-208. (cited in Biol. Abstr., 49: Abstr. No. 53324.)

"_Lupinus albus_ (cultivated on stubbles), _Ornithopus sativus_ and _Melilotus albus_ (both companion crops of winter wheat) were used as green manure material. . . . In 1962, 20 t/ha of green mass of _L. albus_ was obtained, which applied in the furrow (although inferior to the same amount of farm yard manure), gave a significant increase in yield (14.3% with sugar beet and 28.2% with potatoes). . . ."

A-126 Daporta, M.R. 1967. Indoor water pits with cages for chicken manure disposal. J. Agr. Univ. Puerto Rico, 51(3): 266-267. (cited in Biol. Abstr., 49: Abstr. No. 57333.)

"Indoor water pits are feasible for manure disposal, needing little care, preventing fly proliferation, and doing no harm to the chickens."

A-127 Kanwar, J.S., G.S. Skkhon and D.R. Bhumbla. 1967. Manuring requirements of a fixed crop rotation: I. Direct, residual and cumulative effects of nitrogenous, phosphatic and potassic fertilizers and bulky organic manure on the yield of wheat. J. Res. Punjab Agr. Univ., 4(2): 162-165. (cited in Biol. Abstr., 49: Abstr. No. 58890.)

"An experiment was laid out to find out the manuring requirements of a fixed crop rotation-maize-wheat-cotton-senji. The treatments consisted of 3 levels each of farm-yard manure, N, P and K. The experiment was laid out according to a $3^4 \times 3$ factorial confounded design, in 2 series. Yield data of the wheat crop for 4 years. 1956-57 to 1959-60, were discussed. N application had a significant direct, residual and cumulative effect on wheat. Farm-yard manure had only a cumulative effect. Phosphate application had a small, though significant, direct effect but no residual effect. Potassic application had no effect."

A-128 Gutstein, Y. and B. Karadavid. 1968. Yield and quality responses of irrigated sugar beet to manure, nitrogen and phosphorus fertilizers on three soil types in Israel. Israel J. Agr. Res., 17(4): 199-212. (cited in Biol. Abstr., 49: Abstr. No. 64561.)

"The interrelated effects of cow manure, N and P fertilizers on yield and quality constituents of irrigated sugar beet, investigated in field experiments on 3 principal soil types in Israel, are represented by response surfaces, estimated according to the general multiple polynomial regression equation. The maximal requirements of fertilizer elements and their optimal rate combinations required for maximum production were estimated and are presented here. N fertilizer affected the yield of beets positively, and the quality of the beet juice negatively; the requirement of N was higher for beet yield than for sucrose yield. Superphosphate provided high yield responses on a highly calcareous rendzina soil and on terra rossa, but a very restricted response on an aeoliane loess soil. Yield response to cow manure was restricted to the low N fertilizer applications, and the manure affected only slightly the yields of beets or sucrose at optimum rates of fertilizer combination. Its most striking effect was in improving the quality composition of the beet juice."

A-129 Fliegel, H. and H.J. Oslage. 1966. Über die N- and C-Verluste im Schweinekot bei verschiedenen Trocknungsverfahren. (Losses of N and C in pig manure, due to different methods of drying.) Landwirt. Forsch., 19(2): 154-159. (cited in Biol. Abstr., 49: Abstr. No. 64636.) .... W. Germany

"The N and C contents were determined, and analytical values compared, for fresh pig manure dried by means of hot-air and by freezing. Drying with hot air resulted in losses of 10% N and 2% C, as compared to the daily amounts excreted in fresh droppings. Freezing decreased losses by about 50% resulting in losses of 5% N and 1% C."

A-130 Smith, L.W. Jr. and W.R. Enns. 1967. Laboratory and field investigations of mosquito populations associated with oxidation lagoons in Missouri. Mosquito News, 27(4): 462-466. (cited in Biol. Abstr., 49: Abstr. No. 86325.)

"Egg rafts, larvae and adult mosquitoes breeding in, or associated with, animal waste, municipal, residential, school, slaughterhouse, and trailer court oxidation lagoons in central Missouri in 1965 and 1966 were reared and identified using standard techniques. Egg rafts were recovered from artificial oviposition blocks each yielding a total sampling area of 1 $Ft.^2$. While emergent and overhanging vegetation were major factors leading to mosquito breeding in lagoons in some instances, alternate major factors were discovered including types of wastes discharged into lagoons, dissolved oxygen content, available food, and presence of predators. Phytotoxic wastes which killed algae further enhanced mosquito production. Improper effluent disposal contributed greatly to mosquito production outside of the lagoons proper. The characteristic mosquito population consisted of 12 species, of which only 5 were found to breed in the lagoons. These were, in order to prevalence, Culex pipiens complex, Culiseta inornata, Clux salinarius, Culex tarsalis, and Anopheles punctipennis."

A-131 Goodman, N.L. and H.W. Larsh. 1967. Environmental factors and growth of Histoplasma capsulatum in soil. Mycopathol. Mycol. Appl., 33(2): 145-156. (cited in Biol. Abstr., 49: Abstr. No. 90934.) .... U.S.A.

"The influence of some environmental factors on the growth of H. capsulatum in soil was studied. Sterile soil cultures of the fungus, grown under high relative humidity, were studied under varied conditions. The role of temperature and moisture in the growth of the fungus was critical. It can tolerate very low temperatures if the soil moisture content is high but cannot withstand temperatures of 40°C, or above, for an extended period. Dry, sterile chicken manure and an extract of unsterile chicken manure showed an inhibitory effect on the growth of the fungus. Morphological studies of the fungus in soil showed that it grows within the upper 2 inches of soil. Sporulation predominately occurs within the upper ½ in. In the presence of chicken manure or chicken manure extract, there is a marked decrease in mycelial production and an increase in the number of microconidia and macroconidia. Growth of H. capsulatum could not be demonstrated in soil cultures with a soil pH above 10 or below 5. There was no definite pH range within these values in which the fungus grew more abundantly."

A-132 Jee, R.C. and S.K. De. 1967. A szervestragya, komposzt es humuszsav hatasa a talajok jodid-ion adszorpeiojara. (Effect of farmyard manure, compost and humic acid on the adsorption of iodide by soils.) Agrokema Talajtan, 16(4): 629-634. (cited in Biol. Abstr., 49: Abstr. No. 96868.) .... India

"Compost has a greater efficiency in reducing negative iodide adsorption by soils than farmyard manure; humic acid has the least efficiency."

A-133 Gawronska-Kulesza, A. 1968. Wplyw nawożenia organicznego I mineralnego, stosowanego w zmianowaniu 3- I 4-polowym, na nicktóre właściwości chemiczne gleby wysokość I jakość plonu. (The influence of farmyard manure and mineral fertilizers on some chemical properties of the soil on the crops yields in the 3- and 4-years rotations.) Rocz. Nauk Roln. Ser. A, Roslinna., 92(3): 405-438. (cited in Biol. Abstr., 49: Abstr. No. 101887.)

"Periodical farmyard manuring plays an important role in accumulation of organic matter and in hampering the decomposition of soil organic matter. The influence of this manure on the N-total N-NO_3, P_2O_5 available depends on the rapidity of its decomposition. Mineral fertilizer has some influence on the decomposition of native organic matter. The mineral fertilization plays a greater role in the mobilization of N-NO_3, P_2O_5 available in the soil than the farmyard manure. The influence of fertilizers upon the changes of organic matter, total N and available P may be diminished by growing plants. Changes in content of total N, nitrates and available P_2O_5 under the influence of farmyard manure are limited. The influence of mineral fertilizers on the mobilization of soil nitrates and soil P is greater than the influence on the rate of organic matter decomposition."

A-134 Oke, O.L. 1967. Availability to plants of residual phosphorus in manure. W. African J. Biol. Appl. Chem., 9(2): 27-30. (cited in Biol. Abstr., 49: Abstr. No. 102029.) .... Nigeria

"The residual effect of P from different manures was investigated. Pig manure gave the best performance as judged by yield, height and amount of phosphorus absorbed by <u>Cenchrus cilliaris</u>. It was inferred from the results that organic P in manures might be available to plants."

A-135 Ilkov, D., V. Klevtsov and I. Khrostov. 1968. Sravnitelna efektivnost na organichnoto i mineralnoto torene pri izluzhen chernozem-smolnitsa. (The effect of manures and fertilizers on leached smolnitzas.) Pochvozn. Agrokhim., 1968. (cited in Biol. Abstr., 50: Abstr. No. 4647.) .... Bulgaria

"A 5 yr. study (1960-1964) was conducted in an experimental field in the village of Bozhourishte, District of Sofia, on leached smolnitza to test the efficiency of FYM (farm yard manures) and fertilizers at 2 rates of nutrient element: 20 and 40 tons/ha. of FYM and their equivalents in fertilizers and manure-fertilizer mixtures at which half of the nutrient elements were applied as FYM and the other half as fertilizer. FYM was applied once every 4 years to maize and in the next 3 years its residual effect was followed up; the fertilizer was introduced at ¼ of the rate annually for 4 years to all crops in the rotation. . . . The application of FYM, fertilizers and manure-fertilizer mixtures produced a similar effect on the leached smolnitza for a period of 4 years of manuring. The yield was defined by the amount of nutrients, and not by their form introduced. No changes occurred in the humus, the soil reaction, available P, K and hydrolysable N in the soil. Manuring with all 3 forms of nutrients favored the growth of the crop, the maize, tasseling, an improvement in wheat grain and the baking properties of the flour."

A-136 Simeonov, B. 1968. Ustanovyavane na nai-podkhodyashcha d''lbochina za zaoravane na oborskiya tor pri slabo izluzhen chernozem. (Establishing the most suitable depth for ploughing in FYM.) Pochvozn. Agrokhim., 3(1): 109-114. (cited in Biol. Abstr., 50: Abstr. No. 10168.)

"Experiments were performed to establish the most suitable depth for ploughing in FYM at the Institute of Wheat and Sunflower near Tolbuhin, on slightly leached chernozem in the 1961-1965 period. Thirty tons of FYM, worked with basis tillage, were given to maize at the following 3 depths: 20 to 25, 30 to 35 and 40 to 45 cm. The deep ploughing of FYM, down to a depth of more than 30 cm, reduced its effect on maize yields, and on the yields of wheat which followed the maize. FYM should be ploughed down to a depth of 20-25-30 cm in the slightly leached chernozems of the Dobroudja. This secures its maximum benefit after both the 1st and the 2nd years."

A-137 Grenet, E. 1966. Les particules végétales des fèces de Mouton. (Plant particles in the feces of sheep.) Ann. Zootech. (Paris), 15(4): 303-312. (cited in Biol. Abstr., 50: Abstr. No. 20210.)

"Twenty-two samples of feces of sheep fed on 5 grasses and 2 legumes cut at different stages of growth and from the 1st, 3rd and 4th cycles, were studied. The size of the particles in feces was measured, and the nature and lignification of the plant particles in feces were observed from microscopical examination. The distribution of particles in feces on 3 screens with mesh of 0.400, 0.160 and 0.100 mm, respectively, and at the bottom the seive is shown. It differed during growth of the forage. The percentage of dry matter of feces retained by the 3 meshes increased regularly during the 1st cycle. The average size of particles in feces ranged from 0.108 to 0.206 mm. In all samples of feces it increased during the 1st cycle and varied inversely with digestibility of organic matter and crude fiber of the forages (r = -0.582 and -0.569). In all samples, particles larger than 0.400 mm were composed essentially of lignified tissue (vessels, sclerenchyma). The presence of shreds of epidermis depended on the stage of growth and on the species studied. They were found in all samples of feces from sheep given grasses but only in the 3rd and 4th cycles with legumes. The proportion of lignified tissue in the large particles increased as the proportion of leaf diminished and the plant grew older. It varied inversely with digestibility and directly with crude fiber contents of forage and feces. The presence of epidermis was some sub-epidermal cells in feces from herbage cut in autumn could explain the increase in N content of feces in autumn; with due regard to the digestibility of the plant ingested."

A-138 Venkobarao, K., P.K. Nair, S.B. Prabhanjan Rao and S. Chattopadhyay. 1967. Ineffectiveness of farm yard manure in improving soil aggregation in black soils of Bellary. Ann. Arid Zone, 6(2): 138-145. (cited in Biol. Abstr., 50: Abstr. No. 21656.) .... India

"Application of 12,000 kg/ha. of well rotten farm yard manure over a 6 yr. period neither increased the yield of jowar cotton nor improved soil aggregation in the black soils of Bellary area. Under laboratory conditions even an application of 50,000 kg/ha. of well rotten farm yard manure did not materially improve aggregation. Possible reasons for lack of crop response and soil aggregation are discussed."

A-139 Peter, V., E. Kociova and S. Koci. 1966. Pouzitie suseneho hydinoveho trusu v krmnych zmesiach pre vykromove kurcata. (Application of dried poultry manure in feed mixtures for

fattening chickens.) Ved. Pr. Vysk. Ustavu Chov Hydiny Ivanke Pri Dunaji, 3: 117-131. (cited in Biol. Abstr., 50: Abstr. No. 25971.) .... Czechoslovakia
"Where 18, 10 and 5% soybean meal was replaced by equal quantities of dried manure, no statistically significant differences were found in the growth of the chicken as compared with the group of chickens receiving only soybean meal. When 5% dried dung was added to the basic diet of a lower, biologically less valuable nutritional level, the live weight of the chickens increased by 30% as compared with the control animals. Feeding of manure had no unfavorable effect on the willingness of chickens to feed. As regards the consumption of feeds per 1 kg of weight increase, substantial differences were found only in the groups receiving a feed mixture of a lower nutritional value. Addition of dried manure to this mixture decreased feed consumption per 1 kg of weight increase by 25.3%. In the case of a mixture with 18% dried manure, the coefficients of digestibility of the various nutrients were the same as in the case of the control mixture with the exception of fat which had a higher coefficient of digestibility in the mixture containing manure. The biological value of proteins of both mixtures was similar. The carcass quality was highest in the group receiving 5% dried manure, however, 18% manure lowered the carcass quality. The vitality of chickens receiving feed and dried manure rose only in the case of the mixture with low nutritive value. In the other groups, the index of efficiency showed no substantial difference."

A-140 Kang, B.J., H.J. Kown and D.K. Park. 1965. (Characterization of cytopathogenic viruses isolated from the feces of pigs.) Res. Rep. Office Rural Develop., 8(3): 105-108. (cited in Biol. Abstr., 50: Abstr. No. 37692.) .... Korea
"Through tissue culture technique, 16 enteric cytopathogenic viruses of a single homotype were isolated from the feces of 54 healthy pigs. These agents were biologically and antigenically related to a prototype. Serological testing proved that 31% of 65 pigs possessed neutralizing antibody for the virus."

A-141 Palevitch, D. and N. Kedar. 1968. Effect of fertilizer treatments and manure on hollowness of winter tomatoes. Israel J. Agr. Res., 18(3): 113-116. (cited in Biol. Abstr., 50: Abstr. No. 44063.)
"A rise in the level of N fertilizer increased the percentage of hollow fruits in winter tomatoes grown outdoors on sandy soil in the Besor district of Israel. Potassium at a rate of approximately 60 kg/100 m2 caused a decrease in the proportion of hollow fruits but phosphate level had no effect on hollowness. When manure was applied in addition to high rates of N and P fertilizer there was a higher proportion of hollow fruits than with identical treatments without manure."

A-142 Kosters, J., D. Strauch, W. Muller and H. Weyers. 1968. Das Abfall-problem in der landwirtschaftlichen Nutztierhaltung: II. Spezielle Fragen der Abfallbeseitigung in der Geflugelwirtschaft. (Waste disposal problems in agricultural

farming: II. Special problems of waste disposal on poultry farming.) Berlin. Munchen Tierarztl. Wochenschr., 81(13): 256-259. (cited in Biol. Abstr., 50: Abstr. No. 49313.)
.... W. Germany

"In poultry farming in the German Federal Republic an annual amount of about 112,745 tons of birds, rubbish from breeding farms and slaughter houses has to be dealt with. There are no legal regulations governing the removal of this rubbish. Methods of its disposal are discussed, on the basis of an anonymous questionnaire sent out in Central Hessen. Legal regulations for rubbish disposal in large undertakings should be worked out."

A-143 Bastiman,B. 1967. The values of layers' deep litter manure as a source of nitrogen for grassland. Exp. Husbandry, 15: 48-52. (cited in Biol. Abstr., 50: Abstr. No. 60998.)

"Litter is evaluated in terms of the comparative efficiency of the N it contains. The effects of phosphate and potash in the litter were minimized by balancing them with inorganic dressings. The N in well rotted deep litter was as efficient as inorganic N when both were applied in late summer and the plots cut in autumn. The N in deep litter containing many unrotted shavings was less efficient than inorganic N when both were applied in the spring and cut 3 times through the season."

A-144 Webber, J. and B. Bastiman. 1967. Experiments testing poultry manure as a source of nitrogen for grass. Exp. Husbandry, 15: 11-18. (cited in Biol. Abstr., 50: Abstr. No. 61040.)

"Poultry manure or fertilizer dressings (2 parts of poultry manure with 4 parts fertilizer N) applied in late Aug. gave immediate yield response. When applied later or in the following summer, the effects were small. Spring treatments of poultry manure were about 50% as efficient in terms of total N as fertilizer put on at the same time. The efficiency of fertilizer was higher if the dressings were applied in spring and then in early summer after the 1st cut of grass was taken."

A-145 Noguchi, K., T. Kitamura, H. Yamanaka, Y. Akimoto and E. Yoshida. 1968. (Studies on the changes of manure and its effects to tobacco growth in the sand-dune fields: I. The effects of decomposition of manure on the growth and nutrients uptake of tobacco plant.) Proc. Crop Soc. Jap., 37(4): 472-481. (cited in Biol. Abstr., 50: Abstr. No. 61047.)

"The cultivation without manure reduced the yield of fluecured tobacco by about 10% in a year, and about 15% in 2 yr. Fifty to 60% of added organic material was consumed in a year. In non-manured fields it was about 10% less than in the manured fields. Added organic matter in the non-manured fields was consumed in 2 yr. NO_3-N in the soil decreased markedly by early summer. The amount in manured soil was slightly higher than in that without manure in the later stage of growth. In soil without manure, N and Mg uptake and dry weight of the tobacco plant were markedly decreased in the later stage of growth. Manure serves as an important source of mineral N in the later stage of growth."

A-146 Haban, L. 1965. Vplyv hlbky zaorania mastal'neho hnoja na podnu mikrofloru. (Influence of the depth of plowing in farm-yard manure on the soil microflora.) Ved. Pr. Vysk. Ustavu Rastlinnej Vyroby Piestanoch, 3: 91-101. (cited in Biol. Abstr., 50: Abstr. No. 71761.)

"The depth of plowing of farm-yard manure can be an important regulator of its decomposition. With shallow plowing followed by a deep tillage microbial action begins in autumn and mainly at the beginning of sugar beet growth. When farm-yard manure is plowed into the whole depth of the plow layer (30-32 cm) the decomposition of the organic matter in the 1st half of the sugar-beet vegetative period is considerably lower and the most intensive mineralizing action appears at the 2nd half and at the end of the vegetative stage. The curve of the soil micro-flora development is influenced to a considerable extent by soil moisture."

A-147 Gawronska-Kulesza, A. 1967. Wplyw nawożenia organicznego I mineralnego stoswanego w zmianowaniu 3 - I 4-polowym na niektóre właściwości chemiczne gleby oraz wysokość i jakość plonu cześć II. Wplyw nawożenia organicznego i mineralnego stosowanego w zmianowaniu 3 - I 4-polowym na wysokosć i jakość plonu. (The influence of farmyard manure and mineral fertilizer on some chemical properties of the soil and on the crops yields quality in the 3- and 4-year rotations. II. The influence of farmyard manure and mineral fertilizers on the crops yield quality in the 3- and 4-year rotations.) Rocz. Nauk Roln. Ser. A, Roslinna, 92(4): 575-593. (cited in Biol. Abstr., 50: Abstr. No. 72077.) .... Poland

"The effect of periodical application of manure depended on the rate of mobilization of nutrients. It is influenced by climatic conditions. Mineral fertilization carried on every year makes the yield more independent of weather conditions."

A-148 Kunstyr, I., I. Mikula, A. Sokol and V. Stavarek. 1968. (Changes of drug resistance of coliform fecal microflora in pigs after total-body X-irradiation.) Strahlentherapie, 135(5): 632-638. (cited in Biol. Abstr., 50: Abstr. No. 73478.) .... Czechoslovakia

"Conventional healthy piglets (11-15 kg) kept in a group were fed a diet without antibiotics. From their feces coliform organisms have been cultivated and tested, as a whole population, for the resistance to 7 antibiotics before and after total-body X-irradiation of the animals by sublethal (550 R) and a half-lethal (600 R) doses. Nearly 100% resistance to tetracyclines before exposure, induced by previous feeding doses of chlortetracycline, was depressed 24 hr after irradiation to 30 to 35%. Later on the resistance rose gradually again, reached the normal on about 20th day and by the 28th day it was even somewhat higher (resistance to a greater number of antibiotics) than before irradiation of the animals. Equally, the associated resistance of isolated resistance strains was higher in the postir-radiation period. Neither quantitative changes nor changes in bio-chemical properties of strains isolated in the postirradiation period of resistance depression were detected."

A-149 Hojovec, J. and A. Fišer. 1968. Mikroflora der Stalluft in Broilermastanlagen. (The microflora of the atmosphere in chicken houses for broilers.) Deut. Tierarztl. Wochenschr., 75(19): 453-486. (cited in Biol. Abstr., 50: Abstr. No. 82904.) .... Czechoslovakia

"The number of Escherichia coli and mesophylic bacteria was determined in the litter and atmosphere of broiler chicken houses. The number of bacteria depends on the quality of the litter. The number of E. coli bacteria increases up to the 35th day."

A-150 Strauch, D. and G. Hahn. 1968. Untersuchungen uber die Tenazitat von Krankheitserregern in tierischen Fakalien. 1. Mitteilung: Die Tenazitat von Solmonellen in Flussigmisten. (Studies on the viability of pathogens in animal fecal wastes. I. Communication: The viability of salmonellae in liquid manure.) Berlin. Munchen Tierarztl. Wochenschr., 81(22): 441-44. (cited in Biol. Abstr., 50: Abstr. No. 82906.) .... W. Germany

"The viability of 5 different salmonella types in 4 different mixtures of liquid manure was investigated at summer and winter temperatures. The bacteria were inactivated between 23 and 345 days. In the winter the viability of salmonellae is in the average 84% longer than in the summer. It is necessary to develop economic and simple methods for the disinfection of large amounts of liquid manure."

A-151 Bubnov, V.D. 1968. Vyzhivaemost' virusa yashchura pri metanovom brozhenii navoza. (Survival rate of the foot and mouth disease virus during methane fermentation of manure.) Tr. Vses. Nauch-Issled. Inst. Vet. Sanit., 30: 40-44. (cited in Biol. Abstr., 50: Abstr. No. 93736.)

"Foot and mouth disease virus, type O, is inactiviated in manure during methane fermentation at 30 C for 12 days, at 32 C for 8 days, at 34 C for 3-5 days, and at 50 C for the 1st day."

A-152 Marmol-del Puerto, M. and F. Lopez-Pacios. 1967. Contribución al estudio de la gallinaza en la alimentación del vacuno de carne. (Chicken manure in foodstuffs for fattening calves.) Rev. Patronato Biol. Anim., 11(1): 79-91. (cited in Biol. Abstr., 50: Abstr. No. 99067.) .... Spain

"Friesian calves were submitted to fattening tests in which the only difference was the addition of 20% chicken manure to the ration of concentrates in the control batch. Results were favorable to chicken manure producing greater beef per animal."

A-153 Takahashi, K., K. Nakano, T. Kubota and S. Suzuki. 1968. (Effects of the prolonged application of barnyard manure on the productivity of paddy field with low organic matter in the warmer region of Japan.) Bull. Shikoku Agr. Exp. Sta. (Japan), 18: 15-68. (cited in Biol. Abstr., 50: Abstr. No. 100336.)

"The effects of the application of barnyard manure on the growth of transplanted rice plant, irrespective of transplanting time, appeared rapidly at the early growth stage of the rice plant. With the increase in amount of applied manure and the grain/straw ratio decreased. The yield of the grains were found to be closely correlated with the numbers of ears produced in all years. The manure as well as the mineral N fertilizers contributed to the increase in the yield mainly by making the early growth of the rice plant vigorous and by increasing the numbers of tillers and ears. The influence of manure application on the growth of the direct sown rice plant appeared more slowly and gradually than on the transplanted rice. Potassium and silica content and absorbtion increased in-proportion to the manure applied. The Ca and Mg contents in the straw, decreased by application of manure. The effects of barnyard manure on the growth of the naked barley seemed to appear more slowly than on that of the rice plant under the flooding conditions. The yield of grains increased by increasing the amount of manure. The content of organic N and C in the soil increased almost linearally in proportion to the amount of applied manure. With the increase in the content of organic matter in soil, the manured soils became very porous and the moisture-holding capacities increased. Cation-exchange capacities increased nearly in proportion to the amount of the manure applied."

A-154 Ostrowski, R. and A. Parfianowicz. 1968. Czestotliwosc nawozenia lak obornikiem. (Frequency of fertilizing meadows with manure - grass, legume, sedge.) Pamiet. Pulawski, 32: 7-20. (cited in Biol. Abstr., 50: Abstr. No. 106018.)
.... Poland

"Experiments were carried out in the Experiment Station Wielichowo Koscian, Poznan, with the aim of investigating the frequency of effective manuring and how manure might replace mineral fertilization. The yield increase per 1 (quintal) of manure amounted to about 7 kg in the 1st yr, about 4 kg in the 2nd yr and about 1 kg of hay,in the 3rd yr. A manure dose of 200 q gave as much yield increase as full mineral (NPK) fertilizing. The addition of mineral fertilizers especially that of P and K in the year of manure treatment raised the yield significantly. Fertilizing with manure only or in addition to P and K did not cause any significant changes in botanical composition; except an increase of the papilionaceous group. Mineral fertilizers may be applied every year; manure every 3rd year."

A-155 Prophet, C.W. 1969. River pollution by feedlot runoff. Proc. Oklahoma Acad. Sci., 48(1967): 207-209. (cited in Biol. Abstr., 50: Abstr. No. 122329.)

"Commercial feedlot operations in Kansas have increased 10-fold over the past decade, and uncontrolled runoff from large feedlots is one of the most serious pollution problems to develop in recent yr. Since 1963, 125 separate fish kills were reported in Kansas and 46% of these kills were attributed to feedlot runoff. Depending upon conditions, feedlot runoff produces low oxygen, high ammonia, and elevated fecal coliform bacteria counts in the river."

A-156 Coculescu, G., D. Isfan, E. Triboi and R. Badea. 1966. Cercetari privind influenta gunoiului de grajd in rotatia griu-porumb. (About the effect of barnyard manure in a wheat-corn rotation.) An. Inst. Cercet. Pentru Cereale Plante Teh. Fund. Ser. B Agrochim. Agrotehn. Pasuni Finete, 34: 217-227. (cited in Biol. Abstr., 50: Abstr. No. 122932.)

"Experiments on fresh and fermented manure applied at 20 and 40 t/ha rates, single or together with mineral fertilizers ($N_{64}P_{64}$) were carried out on a prograded chocolate chernozem at Ileana-Lehliu (South Romania) in a wheat-corn rotation. Corn yield increased by 16% or 7.4 q/ha with direct application of the manure. When the fertilizers were applied to wheat, the 5 yr average gains in corn were 9% or 4.2 q/ha in the 2nd yr. Barnyard manure was better converted both in the 1st and in the 2nd year of application (gains were over 50% or 19 q/ha). Non-fermented barnyard manure affected yields as favorably as did fermented manure. A systematic fertilization with organic fertilizers raised the humus content, P_2O_5 and K_2O, and also the pH value slightly. The chemical fertilizers brought about a slight acidification and a stronger mineralization of the organic matter. Fertilizer improved wheat and corn quality, increasing the protein and P_2O_5 contents in grains and decreased starch percentage."

A-157 Loomis, E.C. 1969. Domestic fly control by application of DOW liquid fly larvicide (O(2, 4 dichlorophenyl)-O-methyliso-propyl phosphoramidothioate) to animal manures. Down Earth, 25(1): 27-31. (cited in Biol. Abstr. 50: Abstr. No. 123240.)

"DLFL was shown to be highly effective when applied to various animal manures on a weekly or bi-weekly schedule. A 0.36% spray made bi-weekly to horse stall bedding gave excellent fly control, whereas similar efficacy was obtained with weekly 0.72% sprays to calf pen bedding and poultry droppings. Poultry ranches employing a DLFL seasonal program greatly reduced on-ranch fly production. DLFL, like other larvicides, was found to be more effective against muscoid species than those of _Fannia_."

A-158 Lobanov, A.M. 1969. K morfologii i ekologii lichinok l'vinok podsem. Sarginae (Diptera, Stratiomyidae). (Morphology and ecology of larvae of chameleon flies (Sarginae) (Diptera, Stratiomyidae).) Entomol. Obozrenie, 48(1): 104-107. (cited in Biol. Abstr., 50: Abstr. No. 123494.) .... U.S.S.R.

"In the Ivanovo region 6 species of Sarginae were found: _Microchryza polita_ L., _M. flavicornis_ Mg., _Sargus flavipes_ Mg., _S. cuprarius_ L., _S. iridatus_ Scop., _Chloromyia formosa_ Scop. The species develop in the following biotopes. _S. cuprarius_ in manure of cows, _M. flavicornis_ and _S. iridatus_ in manure of cows and pigs., _Ch. formosa_ in soil containing decomposed aboveground parts of plants, _M. polita_, besides the above biotopes, in dust-holes, heaps of decomposed herbaceus plants and in dumps, _S. flavipes_ only in dung of cows in pastures. . . ."

A-159 Skovbaek, J. 1968. Landbrugets interesse i vandlobenes frem-tidige benyttelse. (Agricultural interest in future use of the rivers.) Grundforbattring, 21(12): 39-45. (cited in Biol. Abstr., 51: Abstr. No. 5856.)

"The agricultural interest in rivers has 2 aspects: the river as a source of water for the fields, and as an acceptor for waste water. A calculation shows that the water consumption by farming is 210 x 10^6 m^3/yr, 20% of the total water consumption in Denmark. For maximal plant production on the farm land almost 4 times as much would be required. Waste water may be divided into "dangerous waste water" and "soil water". Outlet of the former, mainly ensilage liquid and liquid manure, is restricted and requires special permission. Ensilage liquid is under control and will hardly pose any problems in the future. Liquid manure becomes a problem mainly because of the locations of the dunghills: rain water from the surroundings flows through these, bringing pollution into the rivers. The cost of solving this problem will be the greatest difficulty in the present development towards larger cattle stocks. Soil water is generally accepted into the rivers; it may be let out freely insofar it does not interfere with the natural conditions of the water."

A-160 Strauch, D. and W. Muller. 1968. Untersuchugen uber die Tenazitat von Krankheitserregern in tierischen Fakalien: 2. Die Tenazitat von Salmonellen in Huhnerbatteriekot. (Studies on the viability of pathogens in animal fecal wastes: 2. The viability of salmonellae in chicken manure from automatic laying batteries.) Berlin. Munchen Tierarztl. Wochenschr., 81(23): 468-471. (cited in Biol. Abstr., 51: Abstr. No. 15731.) .... W. Germany

"Salmonellae in feces fron chickens kept in automatic laying batteries are inactivated without special treatment, in both winter and summer, in a much shorter time than they are inactivated in built-up litter."

A-161 Mitsuoka. T. 1969. Vergleichende Untersuchungen uber die Laktobazillen aus den Faeces von Menschen Schweinen und Huhnern. (Comparative studies on lactobacilli from the feces of man, swine and chickens.) Zentralbl. Bakteriol. Parasitenk. Infektionskr. Hyg. Abt. Orig., 210(1): 32-51. (cited in Biol. Abstr., 51: Abstr. No. 15757.) .... Japan

"A comparative study was performed on a total of 1,099 strains of lactobacilli, including 60 representatives of already named strains, 235 freshly isolated from human feces, 335 from swine and 469 from chickens, taking their morphological, physiological and biochemical characters as a basis for differentiation and classification. Lactobacillus acidophilus, L. salivarius and L. fermenti were identified as indigeneous lactobacillus flora of the feces of man, swine and chickens. In addition, L. plantarum, L. casei, L. lactis and L. brevis were also occasionally isolated from human feces. These 4 species may be considered to be transient flora, because the lactobacillus counts in the human intestine were not as high as those in the animal intestine. Difficulties were encountered in the indentification and classification of the animal strains. Many of them did not sufficiently correspond to the established species or biotypes and intermediates were also detected. In order to classify such atypical strains from animals into the established species, amended species descriptions were introduced. L. acidophilus biotype X, L. salivarius biotypes Va and Vb, L. lactis biotype IV and L. delbrueckii biotypes III and IV were tentatively designated. Further intensive study will be necessary until a precise taxonomic position can be assigned. Furthermore 23 strains, which could not be placed in any established species, were not classified as new species or biotypes, because they were isolated only once."

A-162 Kolenbrander, G.T. and L.C.N. de la Lande Cremer. 1967. Stalmest en Gier: Warde en mogelijkheden. (Stable manure and liquid manure: Theory and possibilities.) H. Veenman and Zonen N.V., Wageningen, Neth. 188 p. (cited in Biol. Abstr., 51: Abstr. No. 16750.)
"The influence of stable manure on soil fertility, separate and mixed storage, the use of manure in agricultural operations and the average and norms of production with these manures are discussed. A bibliography and subject index are included."

A-163 Ose, Y. 1967. (Studies on the Vibrio parahaemolyticus isolated from excrements: III. Isolation of Vibrio parahaemolyticus from bird excrement.) Ann. Proc. Gifu Coll. Pharm., 17: 132-136. (cited in Biol. Abstr., 51: Abstr. No. 21761.)
"V. parahaemolyticus was isolated from bird excrement. Most of them are analogous to biotype 1 except that they grow in 1% peptone broth. They are pathogenic for mice. A strain isolated in June 1966 was identified as V. parahaemolyticus biotype 2. The birds had been raised in the Gifu and Higashiyama Zoos and were healthy."

A-164 Cheng, C.M., M.G. Tung, Y.C. Yeh, A. Ikeda and Y. Aoki. 1969. (Distribution of salmonellae in Taiwan, especially among animals.) Chin. J. Microbiol., 2(1/2): 13-23. (cited in Biol. Abstr., 51: Abstr. No. 33621.) .... Taiwan
"A total of 5799 specimens collected from cattle, horses, swine, dogs, rodents, poultry, eggs and snakes in Taiwan were examined for salmonellae during 1963-1967, from which 422 Salmonella and 21 Arizona strains were isolated. They were identified together with 56 Salmonella strains isolated from man, laboratory animals etc. in the Taiwan Serum Vaccine Laboratory. S. potsdam, S. enteritidis, S. typhimurium, S. weltevreden, S. newport, and S. derby showed a considerable high isolation rate, covering a wide range of sources. S. gallinarum-pullorum, S. cholerae-suis, and S. typhi were peculiar to an adapted host. In addition to these serotypes, S. wandsworth and S. panama were isolated in rather high percentage from some animals. This occurrence and distribution and the isolation of some other salmonellae belonging to rare groups are explained and discussed with reference to Oriental literature. The strains of the Arizona group, found only in snakes, were divided into 8 serotypes, including 3 hitherto undescribed."

A-165 Chouteau, J. 1969. Influence des apports de fumier de ferme sur la teneur en chlorures des tabacs et leur combustibilite. (Influence of the fertilization with farm manure on the content of choride in tobaccos and on their combustibility.) Seita (Serv. Exploit Allumettes) Ann. Dir. Etud. Equip., Sect. 2, 5: 25-37. (cited in Biol. Abstr., 51: Abstr. No. 45864.)
"Analyses of more than 1000 samples from France show that the percentage contents of chlorides in manures vary greatly; they range from 0 to 8.5 of Cl per thousand; 40% of the contents are between 1 and 2%, 30% are inferior to 1% and 30% are superior to 2%. At 1.5% as an average, the soil receives from 60 to 240 kg of chloride/ha. for applications varying from 40 and 160 tons of manure. Spring applications of manure increase the Cl content and decrease the combustibility. The influence of the autumn application is noticeable only in soils with low permeability."

A-166 Luostarinen, H. 1967. Vaaramoreenin lannoitus-ja Kalkituskokeen tuloksia. (Results from a fertilizing and liming test on hill moraine.) Maataloustieteellinen Aikak., 39(4): 193-204. (cited in Biol. Abstr., 51: Abstr. No. 51624.) .... Finland
"The effects of N, P and K given in artificial fertilizers on the crop yield were observed both without liming and when liming and farmyard manure were applied. . . . Farmyard manure increased the soluble K and P quantities. Farmyard manure dressing increased the crop yields of the treatments given onesided fertilizer additions, while its effect remained low in association with NPK fertilization . . ."

A-167 Abe, I., N. Abe. H. Ono and G. Suzuki. 1968. (Effects of deep tillage and heavy application of stable manure on the growth and yield of several plants.) Aomori Agr. Exp. Sta. (Japan) Bull. No. 13: 19-30. (cited in Biol. Abstr., 51: Abstr. No. 51637.)
"Increase of yield was observed in sugar beet, potato, rape-seed, soybean, corn, and turnip, planted in different rotations."

A-168 Razvi, I.Y.A. and S.A.P. Jagirdar. 1967. Effect of organic manures and ammonium sulfate on cauliflower. Agr. Pakistan, 18(3): 293-298. (cited in Biol. Abstr., 51: Abstr. No. 51805.)
"There was no significant difference in the yield of cauliflower, when different manures such as farmyard manure, goat manures, cotton dust and ammonium sulfate were applied at the same level of N nutrient."

A-169 Flippenko, I.V., V.M. Perepilitsa, T.E. Egorushkina, Z.F. Nikolaeva and I.P. Taranevskii. 1968. O poteryakh azota iz navoza. (Nitrogen losses from farmyard manure.) Sb. Nauch. Tr. Beloruss. Nauch-Issled. Inst. Zemled., 12: 45-53. (cited in Biol. Abstr., 51: Abstr. No. 80750.) .... U.S.S.R.
"Farmyard manure spread on polyethylene film lost considerable N after 4 hr; the loss from liquid dung being larger than from peat dung. N losses from farmyard manure distributed over the soil in small heaps were smaller than when uniformly spread over the soil surface. In this case, peat dung lost smaller amounts of N than straw dung. Freezing of farmyard manure caused considerable losses of N. During thaws the frozen dung accumulated NH_3. No losses of N-NH_3 by farmyard manure were detected during its distribution in summer or spring."

A-170 Mba, A.U. 1967. Studies of the effect of drying fresh poultry excreta upon the total, faecal and urinary N contents. African J. Biol. App. Chem., 10(1): 24-27. (cited in Biol. Abstr., 51: Abstr. No. 90805.)
"From the results of the total N content, it may be concluded that if the drying of poultry excreta at 60°C or 100°C is to be adopted, boric acid treatment is essential. Frequent or infrequent sampling makes very little difference if poultry excreta is sprayed regularly with boric acid."

A-171 Janac, K. 1968. Podlahy a ich vplyv na prostredie v objektoch pre intenzivny chov hydiny. (Floors and their influence on environment in housing for intensive poultry rearing.) Polnohospodarstvo, 14(4): 312-322. (cited in Biol. Abstr., 51: Abstr. No. 90806.)

"In chicken coops for caged layers a slanted floor with a rigid surface without seams is recommended. Best suited are poured concrete or asphalt floors with a syphon-type drainage system. A loss of heat occurs in such floors near the walls of the coops and these areas are cold in winter and should be used as walks. Cages should be at least 2 m away from a wall. Calculation of loss of heat revealed that a floor strip 0.75 m wide loses in winter up to 453 kcal per hour per running m. The most widespread method of raising laying chickens is on deep litter with roosts and dropping pits. The ammonia formation in the dropping pits has an antiparasitic effect and is thus beneficial. These pits are also a source of heat, but also of humidity, CO_2, H_2S and dust. Calculation revealed that deep litter contributed up to half the amount of heat that is generated by the chickens at 4-5 laying chickens per m^2 floor space. Thus deep litter in winter helps to limit the magnitude of temperature fluctuations. Floor framing in chicken coops is hygienic because it prevents contact between the birds and their droppings. A disadvantage is the accumulation of droppings under the floor framing and its effect on the atmosphere in the coops."

A-172 Oke, O.L. 1969. Studies on Nigerian manure: III. Mineralization of organic phosphorus from manures. Nigerian J. Sci., 3(1): 27-31. (cited in Biol. Abstr., 51: Abstr. No. 104050.)

"The rate of mineralization of organic P from different manures was studied alone and on addition of soils. Those manures high in organic P showed immobilization through the 8 wk. Mineralization took place with all the manures when incubated with soil. Addition of sucrose, ammonium sulfate, sodium nitrate or calcium carbonate for 2 wk did not make any appreciable difference on the mineralization."

A-173 Mandal, R.C. and V.N. Saraswat. 1968. Manurial requirement of sweet yam in laterite soils of Kerala. Indian Agr., 12(1): 25-28. (cited in Biol. Abstr., 51: Abstr. No. 104135.)

"Three field trials on sweet yam were carried out with varying levels of FYM, N, K and potash singly and in different combinations. Results obtained suggest that 40 kg of N, 40 kg of P and 80 kg of potash with a basal dressing of 25 tons of FYM/ha is the optimum requirement for high corn yield, though 25 tons of FYM in addition to 80, 80 and 120 kgs of N, P_2O_5 and K_2O respectively recorded maximum yield."

A-174 Arikawa, K., T. Matsuzaki and N. Nishiyama. 1967. (Studies on the rapid manure producing method from livestock excrement.) Kanagawa Agr. Exp. Sta. (Japan) Bull. No. 105: 21-30. (cited in Biol. Abstr., 51: Abstr. No. 115888.)

"The screw-press method proved best to press excess water from livestock excrement. The nature of the excrement caused difficulties in the action of the machine: slipping of the screw; counter current of livestock excrement in the screw drum and irregularity of moisture content in the pressed material. Excrement was from swine raised with concentrated fodder. Moisture content of the pressed material was 65-70%, approximately. High porosity resulted in a rapid temperature increase from bacteriological oxidation within 24 to 48 hr. After 5 days, high quality manure with low content of moisture was produced. Organic and mineral nutritional content were relatively high in comparison with common compost."

A-175 Yamashita, K. 1967. (The effects of the prolonged application of farmyard manure on the nature of soil organic matter and chemical and physical properties of paddy rice soils.) Kyushu Agr. Exp. Sta. (Japan) Bull. No. 13: 113-156. (cited in Biol. Abstr., 51: Abstr. No. 115893.)

The following characteristics of manured as compared to non-manured soils were reported: (1) richer in humus by 0.8-3.0%; increased contents of humic and fulvic acids; increase in extractable humic acids; intensification of the alphatic nature of humic acids. (2) increased fine particle content, moisture content, aeration and water holding capacity and decreased bulk density. (3) decreased free Fe content; increased soil pH and decreased exchangeable acidities; increased buffer capacity and C.E.C.; increased total exchangeable bases, Ca, and K; decreased exchangeable Na; exchangeable Mg unchanged; release of N from manure greater than release of P but less than release of K; total available N, P, K and Si increased.

A-176 Parigi-bini, R. 1969. (Utilization of Toplan (dried poultry manure) by sheep.) Aliment. Anim., 13(5): 277-281. (cited in Biol. Abstr., 51: Abstr. No. 119821.) .... Italy

"Digestibility trials and N and energy balances were performed in order to study the utilization of Toplan by sheep. The apparent digestibility of nutrients was lower in a diet containing barley and 32% Toplan than in a control diet of barley and soya bean meal. With the Toplan diet, more N was excreted in feces, but no more in urine. Molar proportions of volatile fatty acids and the pH of rumen liquor were not greatly modified by Toplan. Toplan was estimated to supply 2217 kcal metabolizable energy/kg dry matter, or 51.8 starch units or 74.0 Scandinavian feed units per 100 kg D.M.."

A-177 Borgioli, E. and M. Tocchini. 1969. (Research on the use of the sterilized poultry litter on beef-bullocks feeding.) Aliment. Anim., 13(5): 263-276. (cited in Biol. Abstr., 51: Abstr. No. 119822.) .... Italy

A diet containing 25% poultry litter was fed to Chianina bullocks and the effects of this diet on growth and carcass quality were compared to a diet without poultry litter. Better feed conversion and greater gain was obtained with the poultry litter diet, whereas slaughtering rate, carcass quality and yield of 11-12th rib sample cut did not differ. No liver, kidney, or rumen mucosae lesions were observed in the experimental animals. The substitution level of the N carried from poultry litter was 35-40%. The nutritive value of the litter was appreciated at 61.7 Scandinavian units per 100 kg.

A-178 Corsalini, T. 1969. Richerca degli enterobatteri nelle feci di vitelli importati. (Search for enterobacteria in the feces of imported calves.) Vet. Ital., 20(11/12): 686-708. (cited in Biol. Abstr., 51: Abstr. No. 120324.)
"Fifty calves imported to Italy from Poland were studied. Among the 40 strains isolated, there were 11 species: Salmonella typhimurium (2.5%) Escherichia coli (10%) Citrobacter freundii (12.5%), Escherichia intermedium (2.5%), Enterobacter aerogenes (5%), Proteus rettgeri (35%), P. vulgaris (10%), P. mirabilis (7.5%), P. morganii (7.5%), Providencia A (2.5%) Providencia B (5%)."

A-179 Singh, U.B., G.S. Shekhawat and D.C. Sharma. 1968. Studies on appropriate combinations of organic and inorganic forms of nitrogen for potato cultivation. Indian Agr., 12(1): 1-5. (cited in Biol. Abstr., 51: Abstr. No. 121314.)
"Among all the combinations of N studied, FYM 25% + oil cake 25% + inorganic N 50% was most effective in raising the yield by 90% over application of N in organic form only. Maximum profit is obtained with the combination mentioned above at the fertility level 120:60: 60 but maximum cost benefit ratio is available from the same combination at the level of 80:40:40 (NPK)."

A-180 Kosters, J. 1969. Probleme der Beseitigung von Abfaellen aus der Gefluegelwirtschaft. (Waste disposal problems in the poultry industry.) Wien. Tierarztl. Monatsschr., 56(4): 169-171. (cited in Biol. Abstr., 51: Abstr. No. 131577.)
"In the Federal German Republic poultry industry wastes (with the exception of excretions and manure) amounted to about 112,800 tons in 1966. Safe disposal of these wastes is a major hygienic problem. The only adequate and economic method of disposal is the delivery to rendering plants at regular intervals."

A-181 Ivanova-Todorova, B. 1969. (The effect of fertilizer, farmyard manure and combined dressing on the biological activity of the soil.) Pochvozn. Agrokhim., 4(6): 79-84. (cited in Biol. Abstr., 51: Abstr. No. 132514.) .... Bulgaria
"Data are reported on the changes in CO_2 production of cellulose-decomposing microorganisms and the intensity of cellulose decomposition in the soil. Fertilizer, FYM and combined dressing, particularly when higher rates are used, increase the biological activity of smolnitza and cinnamonic forest types. Manuring raised the biological activity of leached cinnamonic forest soils. The biological activity, indicated by the intensity of cellulose decomposition, best reflects the complex soil conditions, which affect the plants, because higher maize yields agree well with the higher biological activity of the soil."

A-182 Godefroy, J., J.M. Charpentier and P. Lossois. 1969. Action de la fumure organique sur les caracteristiques chimiques et structurales d'un sol de bananeraie. (Effect of organic manure on the chemical and structural characteristics of soil in a

banana plantation.) Fruits (Paris), 24(1): 21-42. (cited in Biol. Abstr., 51: Abstr. No. 133056.)
"Changes in the physical and chemical characteristics of a ferralitic soil cultivated with bananas caused by 3 treatments (1) straw (2) manure and (3) straw + manure, were compared. The chemical characteristics of treatments (1) and (2) were similar, except for P which was higher with manure. Treatment (3) raised the levels of C and organic N, and the capacity for fixation, but had no effect on the other chemical properties. The effect of the treatments appeared in the 2nd to 3rd yrs; afterwards the contents remained at the same level, without any apparent cumulative effects. The structural characteristics were clearly improved by the addition of manure especially when accompanied by the addition of straw (3). The effects on the crop (yield, mean weight of bunches, circumference of stems) were identical for all 3 treatments."

A-183 Il'in, S.S. 1969. (Effect of fertilizer system on the accumulation of organic matter and crop yields in rotations on medium thick calcareous chernozem.) Tr. Inst. Biol., Bashkir Univ., 1: 192-205. (cited in Biol. Abstr., 51: Abstr. No. 138553.) .... U.S.S.R.
"In a grass-arable rotation on calcareous chernozem, the greatest accumulation of humus in soil was observed on application of 30 tons/ha farmyard manure to bare fallow, or in the variant requiring 10 tons/ha farmyard manure with $N_{20}P_{30}K_{30}$ on bare fallow and $N_{20}P_{30}K_{30}$ for spring wheat. The soil humus content had remained stable over 5 yr of fallow row-crop rotation, without manuring. It increased by 0.23% on application of 20 tons/ha farmyard manure and by 0.18% on application of P. In a row-crop rotation (4 yr.), the humus content increased by 0.40% without manuring by 0.82% after 40 tons/ha farmyard manure, by 0.60% after 20 tons/ha farmyard manure, by 0.64% after 10 tons/ha farmyard manure and P_s and by 0.56% after P_s alone."

A-184 Chowdhury, M.D.M. 1968. Manurial value of the "city wastes" composts. Dacca Univ. (E. Pak.) Stud., Part B, 16: 59-65. (cited in Biol. Abstr., 51: Abstr. No. 138720.)
"Organic wastes collected from different localities of Dacca were subjected to decomposition under different aeration conditions viz aerobic, waterlogged and the one under constant CO_2 atmosphere. The manurial value of the "city waste" composts was compared to that of horse manure and cow dung. The composts (90 day period with an enoculum) should form a product having as high a manurial efficiency in energy-yielding material and superior N content as compared to horse manure. "City wastes" are 10 times as rich in N and K and 3 times in P as cow dung."

A-185 Mathur, S.B. and S. Sinha. 1970. Role of manuring in control of root-rot of guar (Cyamopsis psoralioides DC.) and wilt of gram (Cicer arietinum L.) caused by Sclerotium rolfsii Sacc. Mycopathol. Mycol. Appl., 40(2): 155-159. (cited in Biol. Abstr., 52: Abstr. No. 4492.) .... Denmark
"The 2 diseases were significantly reduced by manuring with municipal farm manure (compost). Disease incidence in root-rot of guar was 71.9%

in the untreated garden soil. Use of soil mixed with double the amount of compost reduced root-rot to 54.7%. Similarly, incidence of wilt in gram was 82.1% in untreated soil, and addition of compost in 1:1 ratio (soil:compost) significantly reduced the disease to 64.3%."

A-186 Anwarullah, M. and B.A. Khan. 1970. A new species of Rhizoglyphus from Pakistan (Acarina: Tyroglyphidae). Pak. J. Sci. Ind. Res., 13(1/2): 71-74. (cited in Biol. Abstr., 52: Abstr. No. 8512.)
.... W. Pakistan
"Rhizoglyphus karachiensis, collected from the manure of dairy cattle in Karachi is described and illustrated."

A-187 Srivastava, O.P., G.S. Mann and I.S. Bhatia. 1969. Effect of organic manures on the availability of native and applied phosphate. J. Res. Punjab Agr. Univ., 6(3): 620-625. (cited in Biol. Abstr., 52: Abstr. No. 11382.)
"Farm-yard manure and compost deplete the soil content of calcium phosphate and increase the amounts of saloid-bound phosphate and aluminum phosphate. P combined with these manures, also increases these compounds. Conversion of calcium phosphate into saloid-bound phosphate and aluminum phosphate enhances availability of P, as shown by the increased utilization of soil and fertilizer P by paddy."

A-188 Hristov, A., D. Kovachev and K. Petkov. 1970. Efektivnost na udalbochavaneto na orniya sloi za tsarevitsa, torena s oborski tor i mimeralni torove pri tipichen chernozem. (The efficiency of deepening the top-soil for maize, dressed with FYM and fertilizers on typical chernozem.) Pochvozn. Agrokhim., 5(2): 107-115. (cited in Biol. Abstr., 52: Abstr. No. 11734.)
.... Bulgaria
"The deepening of top-soil in a 4-course rotation of a vetch-oats mixture (wheat, maize, and wheat) was studied. Various tillage depths were studied with and without fertilizer application, with 30 tons of FYM (farmyard manure), and $N_{150}P_{60}$ kg per ha. The manure was introduced at the seed bed preparation for maize, while the fertilizers were applied as 200 kg of superphosphate and 350 kg of ammonium nitrate per ha for maize, 80 kg of superphosphate and 100 kg of ammonium nitrate for wheat after maize, and 80 kg of superphosphate per ha for maize, grown after the vetch mixture. All plots had been tilled to a depth of 30-35 cm. After the 1st course was completed, the effect of fertilizers with deeper plowing tended to decrease. After the 2nd course, fertilizer efficiency was significantly lower with plowing to a depth of 45 cm, and highest, where plowing was to 18 cm. Shallow plowing continuously for 8 yr on a cultivated top-soil layer and regularly dressed with FYM and fertilizers has not decreased maize yields."

A-189 Pareek, R.P. and A.C. Gaur. 1969. Effect of dichlorodiphenyl-trichloro-ethane (DDT) on nodulation, growth, yield and nitrogen uptake of Pisum sativum inoculated with Rhizobium leguminosarum. Indian J. Microbiol., 9(4): 93-100. (cited in Biol. Abstr., 52: Abstr. No. 14169.)

"DDT up to 40 ppm, applied to the soil, significantly increased nodulation, growth, yield and N uptake of P. sativum inoculated with R. leguminosarum. Higher levels were injurious to plants. Application of 1.0% farmyard manure reduced the toxicity of higher levels of the insecticide."

A-190 Kumanov, S., B. Jankov and H. Paliev. 1970. Izsledvaniya varkhu izpolzuvaneto na nesmenyaemata postelya ot brailernoto proizvodstvo kato furazh: II. Proizvodstvo, prerabotka i khranitelna stoinost na postelyata. (Investigations on the use of permanent litter from broiler production as fodder: II. Production, preparation and fodder value of the litter.) Zhivotnovod. Nauki, 7(4): 41-50. (cited in Biol. Abstr., 52: Abstr. No. 29374.)

"A series of technological investigations and 5 control tests with wethers were carried out at the Institute for Animal Breeding in Kostinbrod (Bulgaria). From 1 m^2 of broiler floor (with 3.8-4 kg straw as litter/m^2), 13.600-13.800 kg permanent litter (1.200-1.250 kg/broiler) was produced at a humidity of 20-24%. During the 56 day process of the formation of the permanent litter the content of water, protein, ash, Ca and P increased. The content of fiber decreased. The addition of 0.9% $CaCO_3$ or 0.45% superphosphate did not significantly change the chemical composition of the litter, but the content of vitamin B_{12} increased 20-21% (from 827 to 962-991 mkg/kg). The tested fodder mixture including the permanent litter contained 585-636 g/kg digestible material, 0.70-0.90 fodder units and 87-110 g digestible protein."

A-191 Varis, E. 1970. Variation in the quality of table potato and the factors influencing it in Finland. Acta Agr. Fenn., 118(3): 7-99. (cited in Biol. Abstr., 52: Abstr. No. 37293.)

". . . Starch content was lower in peat than in clay and sandy soils. The mealiest potatoes were obtained in peat soil. Potatoes grown in peat soil were poorer in flavor than those grown in clay and sandy soils. Blackening was most intense in sandy soil. An increase in soil $CaCO_3$ increased starch content and improved mealiness and flavor. The changes in blackening varied. Increased P or K reduced starch content, mealiness, flavor and blackening. Increased N reduced starch content, mealiness and flavor, and increased blackening. Farm-yard manure reduced starch content, mealiness and blackening. . . ."

A-192 Shul'man, E.S., V.P. Volosyuk, I.Y. Zhelomud', M.G. Lyubavina, I.F. Levchenko, D.G. Voronina and V.F. Polishchuk. 1970. Nekotorye itogi izucheniya organizatsii bor'by s gel'mintozami v Rovenskoi i Chernovitskoi oblastyakh Ukrainskoi SSR. (A study of organization of helminthic disease control in Rovno and Chernovtsy oblasts of the Ukranian SSR.) Med. Parazitol. Parazit. Bolez, 39(3): 356-359. (cited in Biol. Abstr., 52: Abstr. No. 45718.)

"State control of sanitary conditions in rural communities is well organized; owing to this and regular dehelminthization measures, the infestation-rate of ascariasis was reduced considerably in a number of areas. Helminthic disease control measures are planned for each settlement. A number of methods for better organization of helminthic diseases control, such as participation of rural councils in realization of sanitary measures; enlisting cooperation of rural medical workers and public sanitary workers in control of sanitary conditions especially, of disinfection of fecal fertilizers; combination of helminthic disease control measures and measures for control of enteric infections, etc., are discussed."

A-193 Singh, K., I.S. Gill and O.P. Verma. 1970. Studies on poultry manure in relation to vegetable production: I. Cauliflower. Indian J. Hort., 27(1/2): 42-47. (cited in Biol. Abstr., 52: Abstr. No. 48892.)

"Experiments were conducted to find out the best stage of decomposition and optimum level of poultry manure for cauliflower production. The treatments consisted of application of 3, 6, 9, and 12 mo-old poultry litter in 1967-1968 and 42.4, 84.8, 127.2, and 196.6 Q (quintal)/ha doses of 9-mo-old litter compared with the control in 1967-68. Increased decomposition of litter up to 9 mo increased yield and growth of cauliflower and beyond this, there was a marked decline. The increase in the level of poultry manure application from 0 to 169.6 Q/ha caused a progressive increase in yield and growth of cauliflower. Moisture and vitamin C contents of cauliflower curds were higher at higher levels of poultry manure. The carbohydrate content of the curd increased slightly at lower level (42.4 Q/ha) and then decreased with increasing levels of poultry manure. Protein content of the curd increased considerably with increasing levels of poultry manure. Mg and ash contents of the curd increased with the addition of poultry manure to the soil but P and K contents were not influenced significantly."

A-194 Thélin, L. 1970. L'influence des substances toxiques sur le fonctionnement des stations d'épuration biologiques. (The influence of toxic substances on the functioning of biological purification plants.) Z. Praventivemed, 15(3): 203-205. (cited in Biol. Abstr., 52: Abstr. No. 51739.) .... Switzerland

"Procedures of biological purification-bacterial filters or activated sludge-make use of the action of a population of microorganisms to destroy foreign matters in used water. In order to maintain this population in an active condition and to obtain sufficient purification, rapid variations in the charge or discharge of used water should be avoided. The influx of toxic residual products should also be avoided. Examples of agricultural water: arrival of liquid manure, and industrial water: discharge of acid, cyanide or heavy metal are discussed."

A-195 Castro, G.S.De P., T. Igue and E.S. Freire. 1968. Efeitos do esterco, dos residuos de desfibragem e da adubacao mineral com NPK, sobre a producao de rami. (Responses of ramie to NPK fertilizer, manure and residues from ramie decortication.) Bragantia, 27(8): 93-102. (cited in Biol. Abstr., 52: Abstr. No. 52531.) .... Brazil

"The effects of some fertilizing materials on the yield of ramie (Boehmeria nivea Gaud.) grown on recently broken fertile soil were studied through 8 consecutive cuts. Satisfactory responses to some treatments were obtained only after the 5th cut. In the last 3 cuts, the increases in the yield of air-dried, crude fibers due to the applications of residues from mechanically decorticated ramie stalks, manure or mineral NPK + residues were not significant; those due to NPK alone and NPK + manure were 45 and 51%, respectively."

A-196 Vig, A.C. and D.R. Bhumbla. 1970. Effect of manuring in a fixed crop rotation on some chemical properties of soil. J. Res. Punjab Agr. Univ., 7(2): 171-177. (cited in Biol. Abstr., 52: Abstr. No. 64236.)

"The long-term (8-yr) effect of manuring in a cotton-senji (a legume)-maize-wheat rotation was studied. Soil samples, collected from an experimental field at Nasirpur (Patiala), were analyzed for soil reaction, salt content, organic C, total N, available P and K. The highest increase in organic C was observed when bulky organic manure was applied. The application of nitrogenous, phosphatic and potassic fertilizers also resulted in a significant increase of organic C. The total N content of the soil also followed a similar trend, except in the case of potassic fertilizers, where it was significantly reduced. The manuring of every crop in the rotation indicated a significantly higher amount of organic matter and the total N content of the soil than alternate manuring. The application of bulky organic manure, phosphatic and nitrogenous fertilizers resulted in a significant increase of available P in the soil. The continued use of inorganic phosphatic fertilizer resulted in much greater reserves of available P than the application of farmyard manure. The available (exchangeable) K content showed a significant decrease with the application of nitrogenous fertilizers. Plots receiving farmyard manure and muriate of potash showed a slight increase in the exchangeable potash content. There was not any appreciable influence of different levels of fertilizers and bulky manures on the soil reaction and salt concentration."

A-197 Hasebe, T., S.I. Osanai and T. Ogawa. 1970. (Response of winter wheat to fertilizer on the main types of soils in Hokkaido. I. Effects of three elements, cauterized phosphatic fertilizer, and stable manure.) Bull. Hokkaido Perfect Agr. Exp. Sta. (Japan), 20: 12-31. (cited in Biol. Abstr., 52: Abstr. No. 64303.)

"The mean grain yield in plots with N, P and K fertilizers together was arbitrarily defined as 100% of grain yield. The responses on the other plots were: no N and no P 88%, no K 97%, cauterized phosphate fertilizer 100%, and barnyard manure 107%. The response to the fertilizers varied between locations and climatic conditions in the 4 regions: the southwestern section of Ishikari plain, Kamikawa district, Kitami district, and Tokachi district."

A-198 Ivanov, M.M. and Y.M. Skhiladze. 1969. Vyzhivaemost' mikobakterii v razlichnykh substratakh vneshnei sredy. (The survival of mycobacteria in different substrates of the environment.) Tr. Gos. Nauch-Kontr. Inst. Vet. Prep., 16: 142-144. (cited in Biol. Abstr., 52: Abstr. No. 63431.)

"Determinations were made of the survival rate of mycobacteria of the avian type in distilled and tap water, milk, and bird manure. Samples (100 ml) were stored at 4 and 20 C for 16 mo and aliquots of these were taken at 4, 8, 12 and 16 mo. intervals and plated on Petranyana's medium; pH was also determined. Mycobacteria die within 8 mo. in milk, viability in water is retained for more than 16 mo."

A-199 Löhr, E. and J. Olsen. 1969. The thermophilic fungus Humicola lanuginosa. Friesia, 9(1/2): 140-144. (cited in Biol. Abstr., 52: Abstr. No. 64966.) .... Denmark

"The thermophilic imperfect fungus Humicola lanuginosa was isolated from compost and farmyard manre. Optimal growth was obtained at 45-50 C. The fungus excretes amylase and a deep red, water-soluble pigment."

A-200 Feigin, A., B. Shakib, Z. Singer and S. Hidash. 1970. Effects of manure and nitrogen fertilizer on yields of onion grown in a light brown loessial soil in the Negev. Israel J. Agr. Res., 20(4): 159-162. (cited in Biol. Abstr., 52: Abstr. No. 66597.)

"The effects of manure and N fertilizers on yields of onion of the early ripening varieties 'Granex' and 'Grano' were examined during 3 growing seasons. Yields increased after manuring or fertilizing only, the effect of either 1 decreasing at the higher levels of the other. It is suggested that the crop response to manuring was due in part to the fact that organic matter served as a store for available nutrient elements, mainly N, and in part to the improvement of soil structure."

A-201 Henriksen, A. 1970. Om inshold af bor i danske landbrugsafgroder. (The boron content of agricultural crops in Denmark.) Tidsskr. Planteavl., 74(3): 372-377. (cited in Biol. Abstr., 52: Abstr. No. 75259.)

"The annual removal of B in crops from the whole agricultural area of Denmark was estimated at a total of 125 tons, or approx. 42 g/ha. The total annual supply was estimated at about 468 tons, roughly 156 g/ha, by assuming an 85% return of ingested plant B in solid and liquid manure, plus amounts of B, in industrial fertilizers, in agricultural lime, and amounts derived from precipitation and atmosphere. The supply of B from these combined sources thus exceeds crop removal by 3-4 times. The average loss of B through leaching might be 115 g/ha/yr, before a negative B balance may occur."

A-202 Davies, H.T. 1970. Experiments on the fertilizing value of animal slurries: I. The use of cow slurry on grassland. Exp. Husbandry, 19: 49-60. (cited in Biol. Abstr., 52: Abstr. No. 75876.) .... England

"Significant increases of dry matter and crude protein were obtained; these were attributed to the N content of the slurry. The efficiency of N in the slurry at about 3000 gal/acre was determined from comparisons of yields obtained with fertilizer N and analyses of slurry samples. When applied in late winter or early spring, about half the total N in cow slurry becomes available for spring and early summer grass growth; when applied in mid-winter about ¼ is available, and when applied in early winter, about 1/6. The N content of herbage is raised less by N in slurry than by fertilizer N. Some effects on the sward and field drainage water when cow slurry was applied at 12,000 gal/acre are described."

A-203 Davies, H.T. 1970. Experiments on the fertilizing value of animal slurries: III. The use of poultry and mixed slurries on grassland. Exp. Husbandry, 19: 65-68. (cited in Biol. Abstr., 52: Abstr. No. 75882.) .... England

"Good responses in yield, generally significant, were obtained from fertilizer N and the N in slurries. At the Yorkshire site, there was no difference in yield from applying increments of poultry slurry at intervals in winter than from applying the total amount in spring. The efficiency of the N in the slurry was estimated at 68%. At the Shropshire site, there were small differences, not statistically significant, between times of application indicating efficiency of the N content increasing from 50% for application in Oct. to nearly 100% for application in Feb. Soil and rainfall data are given."

A-204 Davies, H.T. 1970. Experiments on the fertilizing value of animal slurries: II. The use of pig slurry on spring barley. Exp. Husbandry, 19: 61-64. (cited in Biol. Abstr., 52: Abstr. No. 75931.) .... England

"Significant increases in grain yield were obtained each year. Values for the efficiency of the N in slurry varied widely. When applied in mid-winter about a quarter of the N became available to the barley crop; when applied in spring immediately before sowing, 1-3 quarters were available. Slurry applied at low rates was more efficient than that applied at high rates; the highest rate did not depress yields."

A-205 Miller, R.W. 1970. Larvicides for fly control: A review. Bull. Entomol. Soc. Amer., 16(3): 154-158. (cited in Biol. Abstr., 52: Abstr. No. 77416.)

"Despite extensive research on larvicides against flies breeding in animal manure, no insecticides are registered for commercial feed-additive use with poultry and only 1 for use with lactating cows. Three insecticides have registration for feed-additive use with beef cattle. Twelve insecticides, 9 of which are organophosphorus compounds, are registered for use as larvicides to be applied directly to poultry and/or cattle manure. The use of larvicides as feed-additives or applied directly to manure is effective but few compounds have been registered and few new compounds for use as feed-additives are likely to be registered in the near future."

A-206 De Haan, S. 1969. De stikstofvoeding van de aardappel door middel van stalmest en van kunstmest. V. Resultaten van de proeven op kleigrongen vergeleken met die op zandgronden. (Nitrogen feeding of potatoes by means of stable manure and artificial fertilizer. V. Results of the trials on clay soils compared with those on sandy soils.) Inst. Bodemvruchtbaarheid Haren-Groningen Rapp., 7: 1-43. (cited in Biol. Abstr., 52: Abstr. No. 78126.) .... Netherlands

"From the standpoint of equal leaf development at the moment of highest results, yields were better with stable manure than with artificial fertilizer. For equal leaf development at the time this development reached its peak, tuber production was highest at the time of harvesting when stable manure rather than artificial fertilizer was used. The moisture content of foliage and tubers was greater with stable manure and the average type of the tubers was coarser. The rate of N absorption was lower for stable manure N than for artificial fertilizer N. This may be the explanation of the observations referred to above."

A-207 Prasad, C.R., K.C. Gulati and M.A. Idnani. 1970. Changes in biochemical constituent of some organic waste materials under anaerobic methane fermentation. Indian J. Agr. Sci., 40(10): 921-924. (cited in Biol. Abstr., 52: Abstr. No. 81332.)

"Changes in the percentage composition of holocellulose, cellulose, hemicellulose, lignin, pentosans and methoxyl contents of organic materials after fermentation of various systems like cowdung alone, cowdung-gum arabic, cowdung-wheat straw, cowdung-groundnut shells and cowdung-sugarcane bagasse by methane organisms indicated that the systems which had holocellulose:lignin in a ratio of 3:1 or less before fermentation showed a greater decrease of hemicellulose fraction than of cellulose fraction. The percentage of lignin (18.41-22.03) and pentosans (0.292-5.129) increased after fermentation, except in cowdung-gum arabic, which showed a decrease of pentosan content. Methoxyl contents also decreased after fermentation, indicating a positive role of the methyl group of methoxyls in the formation of methane by methane-formers."

A-208 Pieniazek, S.A. and K. Slowik. 1968. Wplyw roznych sposobow utrzymywania gleby w sadzie na jej strukture i prochnicznosc. (The influence of some orchard soil management systems on its structure and organic matter content.) Pr. Inst. Sadownictwa Skierniewicach, 12: 211-221. (cited in Biol. Abstr., 52: Abstr. No. 84346.) .... Poland

"Steady improvement of soil structure was noticed during the duration of the sod in the apple orchard. After 1½ yr of red clover - grass sod the soil had better structure than when farm manure was given once in 3 yr but there was no sod. Two years after plowing under the clover - grass sod the good structure was still noticeable although not significant statistically. The soil organic matter content was slightly higher in the sod kept for 15 yr with no farm manure added than in the 3 yr rotation manure once in 3 yr but with no sod."

A-209 Dijkstra, R.G. 1971. (Investigations on the survival times of Listeria bacteria in suspensions of brain tissue, silage and faeces and in milk.) Zentralbl. Bakteriol. Parasitenk. Infektionskrankh Hyg. Abt. I Orig., 216(1): 92-95. (cited in Biol. Abstr., 52: Abstr. No. 84992.) .... Netherlands

"Naturally infected suspensions of cattle brain tissue, silage and feces were regularly reexamined for L. monocytogenes, during storage for several years at a temperature of about +5 C. In brain tissue and in suspensions of silage and feces most Listeria survived 5-6 yr. Most Listeria in naturally infected milk generally disappeared after 2-3 yr."

A-210 Krishnamoorthi, T. and M.S. Rao. 1970. Note on the method of application of superphosphate to cigar tobacco (Nicotiana tabacum L.). Indian J. Agr. Sci., 40(10): 864-866. (cited in Biol. Abstr., 52: Abstr. No. 87624.)

"Superphosphate mixed with well-powered and sieved farmyard manure was applied as a basal lump beneath each transplant before planting. N and K were also tried as top-dressings. Eight treatments of N, P and K and their combinations were also tried along with a control of farmyard manure only as basal lump. The experiment was carried out for 4 yr. . . . The mixing of superphosphate with farmyard manure is an effective method for increasing the availability of P in calcareous soils with a high pH, when the usual methods of broadcast application or placement of superphosphate alone fail."

A-211 Mackowiak, C. 1969. Badania nad wartoscia nawozowa kompostow torfowo-gnojowkowych: II. Doswiadczenia wazonowe. (Investigation on the fertilizing value of composts of peat and liquid manure: II. Pot experiments.) Pamiet. Pulawski, 37: 15-41. (cited in Biol. Abstr., 52: Abstr. No. 93397.) .... Poland

"In the 1st yr the direct effect of composts on oil sunflower ('Pulawski' cultivar) in the 2nd on the after effect on mustard plant yield were investigated. The effect of peat-liquid manure composts depended on the content of mineral N (from manure) as well as on the time and conditions of storage (mainly on the temperature). . . . The fertilizing effect of compost was limited to 1 yr only. Composting of peat with liquid manure depends on the season; composts prepared in autumn must be used for fertilizing in the next spring, and composts prepared in the spring and summer ought to be used directly after saturation with liquid manure or 6-8 wk after preparing them."

A-212 Meelu, O.P. and N.S. Randhawa. 1970. Response of maize (Zea mays L.) to various zinc sources. J. Res. Punjab Agr. Univ., 7(4): 454-459. (cited in Biol. Abstr., 52: Abstr. No. 93408.)

"In sierozem soil, which was low in available Zn, responses of maize to $ZnSO_4$, ZnO, Zn dust, Zn rayplex and spartin with 3 levels of farmyard manure, 0, 5, 10% were studied. Highly significant responses in terms of yield, Zn concentration and total uptake of Zn were recorded irrespective of the source of applied Zn except spartin which proved a poor Zn carrier. The yield and Zn uptake was further increased by the application of increasing levels of farmyard manure."

A-213 Chaudhuri, B.B. and K.S. Yawalkar. 1969. Effect of nitrogen, phosphorus and potash along with farmyard manure on cauliflower Hort. Sci., 1(1): 33-37. (cited in Biol. Abstr., 52: Abstr. No. 95839.) .... India

"Yield of marketable heads of cauliflower was significantly increased by doses of N, P and farmyard manure. Addition of each kilogram of N and P gave an additional yield of 0.476 and 0.277 quintals respectively per hectare. Yield of total produce was also significantly increased by doses of N, P and farmyard manure."

A-214 Kamata, S. and K. Uchida. 1969. (Chemical treatment of swine's feces and urines press-swage.) Bull. Nippon Vet. Zootech. Coll. (Japan), 18: 98-103. (cited in Biol. Abstr., 52: Abstr. No. 104280.)

"Fecal and urine samples were collected from swine and diluted 5 times to be subjected to the screw-press. An experiment was conducted on the chemical treatment of these samples. The chemicals used for agglutination-precipitation were $Ca(OH)_2$ and $FeSO_4$. The resulting supernatant was analyzed and the result of purification judged. The BOD (biological oxygen demand) removal ratio was 52.6% when 25 g/l of $Ca(OH)_2$ was added. It was 14 - 18% when 0.2 - 0.6 g/l of $FeSO_4$ was added. Addition of $FeSO_4$ alone brought about a low purification effect. The BOD removal ratio was 61 - 63% when 30 g/l of $Ca(OH)_2$ and 0.4 g/l of $FeSO_4$, or 35 g/l of $Ca(OH)_2$ and 0.6 g/l of $FeSO_4$ were used together. The SS (suspended solids) removal ratio was more than 99% when both 10 - 35 g/l of $Ca(OH)_2$ and 0.4 - 0.6 g/l of $FeSO_4$ were used. The COD (chemical oxygen demand) removal ratio was 82 - 86% when both 10 - 35 g/l, of $Ca(OH)_2$ and 0.4 g/l of $FeSO_4$ were used. A simultaneous use of more than 30 g/l of $Ca(OH)_2$ and more than 0.4 g/l of $FeSO_4$ gave the best results."

A-215 Stefanescu, A. 1969. Influenta ingrasamintelor organice si chimice asupra pajistilor naturale de Agrostis tenuis si de Nardus stricta de la Dedulesti judetul Arges. (The effect of mineral and organic fertilizers on the pastures under Agrostis tenuis and Nardus stricta of Dedulesti-district of Arges.) Lucrari Stiint. Inst. Agron. "N Balcescu", Ser. A, 12: 349-358. (cited in Biol. Abstr., 52: Abstr. No. 105033.) .... Romania

"The highest yields were obtained with farmyard manure associated to moderate rates of chemical fertilizers. This way of fertilizing increased the yield of Agrostis tenuis by 573% and that of Nardus stricta by 486%. Higher yield were also obtained with NPK fertilizers (358% of A. tenuis and 257% of N. stricta). Single application of N did not result in significant yield increase while a K application was beneficial. The floristic composition of the pastures was affected by fertilizing. Farmyard manure application alone, or associated with P and K fertilizers increased the percentage of the legumes which in some instances attained 60% of the crop."

A-216 Garner, H.V. 1970. Experiments with kiln-dried poultry manure on agricultural crops and vegetables at Rothamsted, Woburn and other centres in 1933-39. Exp. Husbandry, 19: 13-28. (cited in Biol. Abstr., 52: Abstr. No. 118932.) .... England

"Poultry manure (PM) containing 85.9% dry matter, 3.6% N, 3.6% P_2O_5, 1.8% K_2O was compared with ammonium sulfate (AS) in field experiments on farm crops and vegetables. Effects on the quality of crops were generally small: AS was more effective in increasing the percentage ware of potatoes and of 1st grade Brussels sprouts: PM produced a larger percentage of saleable cabbage and of 1st grade strawberries. Young strawberry plants wintered better on plots with PM. A strong negative interaction of PM with AS in all crops indicated that it was behaving mainly as a nitrogenous manure. On a P-deficient boulder clay Brussels sprouts responded much better to PM than to AS when no other P was supplied. There was also a strong negative interaction between PM and superphosphate. Superphosphate plus AS gave larger yields than equivalent PM with potatoes, Brussels sprouts and kale. The residual effects of PM and AS after 1 crop had been grown were measured. The actual difference between the residues from the 2 materials were usually small and never significant in individual experiments. Maincrop potatoes, runner beans, mangels and vegetable marrows yielded slightly more where PM had previously been applied, but kale, carrots and early potatoes yielded slightly more after AS. Only runner beans and vegetable marrows gave a bigger return from PM than from AS."

A-217 Muhammed, S. and M.S. Sandhu. 1969. Influence of various soil conditioners on the availability of nitrogen, phosphorus and potassium. Pakistan. J. Sci. Res., 21(3/4): 76-80. (cited in Biol. Abstr., 52: Abstr. No. 122585.)

"The effect of 3 doses of farm yard manure (FYM), gypsum and chaffed wheat straw on the availability of N, P and K to maize plants, from 3 texturally different soils in pots, was evaluated. The N percentage in maize plants increased with the increasing dose of gypsum, decreased with application of wheat straw, and gave mixed results with the application of wheat straw and FYM and increased significantly with gypsum application. Application of FYM increased the percentage of P in plants but the total uptake decreased in 1 soil. The gypsum application gave mixed results as regards P percentage in plants but resulted in increased amounts of P uptake. The uptake of P was decreased significantly by FYM K percentage as well as uptake increased in plants with FYM for 2 soils and gave mixed results for the 3rd soil. Application of gypsum increased the total uptake of K while wheat straw markedly reduced it."

A-218 Knabe, H., M. Poch, G.P. Schmidt, S. Schwarz and S. Zunk. 1971. Abwasserbehandlung und -vertertung in landwirtschaftlichen Gebieten aus hygienischer Sicht. (Treatment of sewage and evaluation in agricultural areas from a hygienic point of view.) Z. Gesamte. Hyg. Grenzgeb, 17(4): 257-261. (cited in Biol. Abstr., 52: Abstr. No. 127630.) .... W. Germany

"Starting from the prognostic development of the agricultural areas, and particularly of the big plants for animal production, a critical assessment of sewage treatment and utilization from the hygienic point of view is made. Plants for partial and complete biological sewage treatment, especially the oxidation and stabilization ponds, are of great advantage for the treatment of fouled sewage, oils and fats, silo seepages and liquid manure. A preliminary biological treatment seems to be necessary because special types of parasites are subject to a regular change of host and the sewage may promote their spreading. Spray irrigation of sewage, which is the main form of the utilization of sewage in the agricultural areas, is discussed. Suggestions for improving cooperation between hygienists, experts in water economy, technicians, and agriculturits, are made."

A-219 Ryabchuk, D.I. and V.P. Lyashinskii. 1969. O povyshenii effektivnosti osnovnogo udobreniya v zernovo-sveklovichnom sevooborote na vyshchelochennom chernozeme. (Increasing the efficiency of ground fertilizer in grain sugar beet rotation on leached chernozem.) Nauch. Zap. Belotserk S-Kh Inst., 15(2): 69-73. (cited in Biol. Abstr., 52: Abstr. No. 128364.)
"Application of 20 tons compost (consisting of farmyard manure with peat (1:1) with NPK) to winter wheat, in field experiments, produced greater yields than application of other manuring mixtures, composted and uncomposted (taking into account the after effect on sugar beet)."

A-220 Strauch, D., G. Hahn and W. Muller. 1969. Ueber die Lebensfaehigkeit von Salmonellen in Guelle and Huehnerbatteriekot. (Survival of Salmonella in semi-liquid manure and feces from hen batteries.) Wien. Tierarztl. Monatschr., 56(4): 167-169. (cited in Biol. Abstr., 52: Abstr. No. 131343.) .... W. Germany

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"Samples of semi-liquid manure of varying composition (I: feces, urine, water, straw; II: feces, urine, water; III: as II + 10% sewage sludge; IV: as II + 0.2% superphosphate) were inoculated with 5 different types of Salmonella and kept at 8 and 17 C, respectively. Salmonella survived for a longer period in samples of mixture I and IV than in those of mixture II and III. The survival time of Salmonella in chicken feces varied with the amount of bacteria inoculated, the temperature within the stored feces and according to the type of Salmonella tested. Under the conditions of the experiment the length of survival was from 5-25 days."

A-221 McElwee, E.W. 1970. Poultry manure as a soil amendment for container-growth Ligustrum japonicum and Podocarpus macrophylla maki. Proc. Fla. State Hort. Soc., 83: 427-432. (cited in Biol. Abstr., 52: Abstr. No. 136540.)
"Three rates of manure by volume, 5%, 7.5% and 10%, were used with each level consisting of untreated manure or amended with gypsum, superphosphate, colloidal phosphate, or Emathlite. After about 6 mo. observations were made. The best and safest treatments were 5 and 7.5% by volume of manure amended with gypsum and 5% manure amended with superphosphate. These treatments produced good plant growth."

A-222 Mil'chevs'ka, L.Y. 1969. Vyvchennya efektyvnosti dobryv na erodovanykh hruntakh Donets'koyi oblasti. (Studies of the efficacy of fertilizers on eroded soils in the Donetsk region.) Ahrokhim. Hruntoznavstvo Resp. Mizhvid. Temat. Nauk. Zb., 11: 119-124. (cited in Biol. Abstr., 52: Abstr. No. 139570.)
"P fertilizers greatly increased crop yields on ordinary chernozems eroded to varying extents. The efficiency of N fertilizers was only half that of P fertilizers. K fertilizers were ineffective in the presence of N and P. The effect and after-effect of fertilizers were stronger on eroded than on noneroded soils. Large yield increases were obtained with the application of 20 t/ha farmyard manure and 20 t/ha farmyard manure + $N_{45}P_{60}K_{45}$."

A-223 Krups'kyi, M.K., P.P. Levenets' and Z.I. Luk'yanchykova. 1969. Vplyv bahatorichnoho vnesennya dobryv na yakisnyi sklad humusu temno-sirykh opidzolenykh hruntiv. (Effect of prolonged manuring on the qualitative composition of humus in dark gray podzolized soils.) Ahrokhim. Hruntoznavstvo Resp. Mizhvid. Temat. Nauk. Zb., 11: 103-110. (cited in Biol. Abstr., 52: Abstr. No. 139571.)

"Prolonged (since 1931) application of organic fertilizers to dark gray podzolized soils in the Sumy Region (Ukraine) caused an increase in the total content of humus and an improvement in its qualitative composition. Mineral fertilizers reduced the total humus content, and at the same time converted it to the low-molecular forms of fulvic acids both in the arable and the subarable horizons."

A-224 Hordiyenko, P.O. and K.P. Yurko. 1969. Vykorystannya osadu mis'kykh stichnykh vod dlya udobrennya sil's'kohospodars'kykh kul'tur. (Sewage sludge as an agricultural fertilizer.) Ahrokhim. Hruntozn. Resp. Mizhvid. Temat. Nauk. Zb., 11: 79-84. (cited in Biol. Abstr., 52: Abstr. No. 139572.)

"Thermally processed sludge contains 10.2 C, 1.3 N, 1.4 P_2O_5 and 0.5 K_2O (percent oven-dry matter). The loss of organic C and N in the thermal treatment of sludge is small. Mechanically dehydrated and thermally dried sludge is lower in total C, N, K than farmyard manure, but higher in total P. The N in the sludge is more mobile than that found in the farmyard manure and is more fully assimilated by the plants. Sewage sludge produced considerably higher crop yields in the field experiment than an equivalent amount of farmyard manure."

A-225 California Farmer. 1970. Composting poultry wastes. Calif. Farm., 233(8): 18. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1PC-0068.)

"For many years composting procedures have been the methods used in the natural biological decomposition of organic matter. Today this procedure is receiving renewed interest as a possible means of modifying poultry waste material. Aerobic composting is usually without odor, is rapid, can be accelerated by simple management, destroys pathogens and weed seeds if the temperature is permitted to rise, and reduces obnoxious fresh manure to a stable, innocuous humus."

A-226 Hensler, R.F. and O.J. Attoe. 1970. Rural sources of nitrates in water. Univ. Urbana Bull., Illinois, 68(2): 86-98. 26 ref. 3 tab. 4 fig. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1TB-0038.)

This literature review indicated that rural contributions of nitrates to surface runoff are quite low. Runoff from manure spread on forzen ground contains varying amounts of nitrates depending on snow depth, depth of frost penetration, rate of snowmelt, and occurrence of rainfall on frozen soils. Relatively high nitrate concentrations can be found in soil profiles taken from barnyards, feedlots and their associated seepage areas. In most cases, high nitrate wells are located near barnyards, feedlots, or animal housing units, and in areas of shallow, coarse-textured soils.

A-227 McAllister, J.S.V. 1970. Collection and disposal of farm wastes. Water Pollut. Contr., 69(4): 425-429. 4 ref. 6 tab. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1TF-0002.)

"Handling and disposal of farm wastes in Northern Ireland are reviewed. Methods of disposal studied are: drying of excreta; incineration and wet combustion of excreta; aeration treatments; disposal to public sewage systems; and synthesis of feeding stuffs."

A-228 Loehr, R.C. 1970. Control of nitrogen from animal waste waters. Univ. Urbana Bull., Illinois, 68(2): 177-189. 22 ref. 1 tab. 4 fig. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1TF-0041.)
Pollution contributions from confinement feeding of livestock and highly concentrated feedlots are outlined. Engineering control of the wastes begins with containment so that further treatments may be used. The most suitable method for disposal of these treated wastes is to spread them on the land. Cooperation among sanitary and agricultural engineers and soil scientists is needed to optimize this method of disposal.

A-229 Dugan, G.L., G.G. Golueke, W.J. Oswald and C.E. Rixford. 1970. Photosynthetic reclamation of agricultural solid and liquid wastes: Second progress report. Univ. Calif., Berkeley Report No. 70-1. numerous ref. 60 tab. 24 fig. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1TF-0195.)
"The overall objective of this research project was to convert into useful materials agricultural wastes now causing severe environmental problems. The specific objective was to determine the energy, organic loadings, balance of water and nutrients, and overall performance of an animal waste treatment system consisting of an anaerobic reactor preceding an algal growth pond. The major effort of the research was concerned with chicken manure."

A-230 Laak, R. 1970. Cattle, swine and chicken manure challenges waste disposal methods. Water Sewage Works (Chicago), 117(4): 134-138. 29 ref. 8 tab. (cited in Pollut. Abstr., 2(1): Abstr. No. 71-1TG-0029.)
"The revolution in the methods of raising farm stock - the change to mass production, the decrease in volume of manure per animal, and the changing characteristics of that manure - is forcing a change in the treatment process principles for manure disposal. Average manure characteristics are reported and methods of manure disposal are outlined."

A-231 Pryor, A. 1971. Dairymen working to stop pollution. Calif. Farm., 234(7): 32. (cited in Pollut. Abstr., 2(2): Abstr. No. 71-2GB-0340.)
"A study commissioned by 365 dairy farms in the Chino-Corona Valley of California shows that water from domestic wells is still safe for drinking, but shallow groundwaters exceed the 45 ppm of nitrate considered safe by the Public Health Service. Farm Advisor S.E. Bishop of Riverside advised farmers to keep all "manure water" on dairy property; to spread manure and waste water over as many acres as possible in order to dilute the runoff solution; and to keep corrals as clean and dry as possible. If mannure cannot be spread on the land immediately it should be stockpiled in an area where it will have maximum protection from rain so that runoff will be minimal."

A-232 California Farmer. 1971. Barn waste for feed? Calif. Farm., 234(5): 11. (cited in Pollut. Abstr., 2(2): Abstr. No. 71-2GD-0284.)

"In feeding trials at Beltsville, Md., the Agricultural Res. Service (USDA) blended barn wastes into dehydrated and pelleted rations for livestock. They also tested chemical treatments that make barn wastes, as well as other fibrous material, more digestible for ruminant animals. Early tests showed that the animals accepted the barn wastes rations and ill health has not been observed in untreated or chemically treated waste-fed animals."

A-233 Anon. 1971. Pollution workship special. Canadian Council of Resource Ministers. 1 fig. (cited in Pollut. Abstr., 2(2): Abstr. No. 71-2GD-0314.)

"The Canadian Council of Resource ministers, with the assistance of its Intergovernmental Committee on Pollution, sponsored a pollution workshop in Banff, Alberta, from Oct. 26-29, 1970. About 80 senior advisers and experts in environmental problems from the eleven governments in Canada participated in this event, held in partial answer to the Prov. Premiers' requests during their meetings of Aug. 1969 and 1970, and to instructions given by Council at its Annual Meeting in Sept., 1969. Discussions dealt with specific problems of pollution control in Canada, and the legislation needed to cope with them."

A-234 Loehr, R.C. 1970. Alternatives for the treatment and disposal of animal wastes. Proc., 9th Environmental and Water Resources Engineering Conf., Nashville, Tenn. 10 ref. 2 tab. 2 fig. (cited in Pollut. Abstr., 2(2): Abstr. No. 71-2TD-0147.)

"Aeration systems such as oxidation ditches are gaining acceptance among livestock producers for waste handling and treatment. It is unlikely that current processes will produce effluents that can be discharged into surface waters. The traditional land disposal of animal wastes is a definite part of a total waste treatment program. Promising methods of reducing nitrogen and phosphorous concentrations include ammonia release, controlled nitrification and denitrification, and crop or land management."

A-235 Cowen, R.C. 1971. Farm pollution and a nation's future. Technol. Rev., 73(6): 6-7. 1 fig. (cited in Pollut. Abstr., 2(3): Abstr. No. 71-3GD-407.)

"Agricultural pollution resulting from high yield farming is seen by some British experts as calling for radical changes in the country's total development strategy. The problems of animal wastes, nitrates, and the loss of farmland to urbanization have created this challenge to rethink the philosophy of maximum yields and look to the adoption of a new ethic."

A-236 Small, W.E. 1971. Agriculture: the seeds of a problem. Technol. Rev., 73(6): 48-53. 6 ref. 5 fig. (cited in Pollut. Abstr., 2(3): Abstr. No. 71-3GD-409.)

"Farming and forestry produce far more waste and contamination in the United States than do cities. The volume of wastes from livestock and poultry production alone is estimated at 1.7 billion tons annually - four times the amount of municipal wastes. Then there are crop and orchard wastes, food processing wastes, wastes from forestry, pulp and paper production, textiles, tanneries, and a host of agrindustries. As world population has increased, the demands on agriculture have not only intensified - requiring greater outputs - but have forced changes in the practices whereby this output is produced. To see the impact of the progressive departure from natural cycles which has typified the agricultural revolution, the solid waste problem is examined."

A-237 Smith, C.B. 1970. A decade of Ralston Purina lagoon experience. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 93-95. 3 fig. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-867.)
"A brief description is given of the waste stabilization ponds used by the Rolston Purina Co. to treat various kinds of animal wastes at their processing plants."

A-238 Loehr, R.C. and D.D. Schutle. 1970. Aerated lagoon treatment of Long Island duck wastes. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 249-258. 10 ref. 2 tab. 7 fig. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-882.)
"The duck production operations on Long Island have contributed to the pollution problems in the off-shore waters. The duck farmers have been required to develop adequate wastewater treatment systems. These systems, which now include aerated lagoons, settling ponds, chlorination, and will implement some mechanism of phosphate removal, constitute one of the most sophisticated systems now being utilized by an animal production operation in the United States. Data from laboratory and pilot plant studies have shown that aerated lagoons of five day detention time can treat the wastes to meet the requirements of the New York State Department of Health. Full scale aerated lagoons designed on the basis of the pilot plant data have performed satisfactorily with 35% of the influent BOD and 50% of the systems removing 85% or greater in September 1969. The aerator power relationships in the actual aerated lagoons varied from 0.008 - 0.04 nameplate horsepower per 1000 gallons lagoon capacity. Studies are underway to develop an integrated chemical and biological treatment system to remove phosphates as well as organic matter."

A-239 Hart, S.A. 1970. Animal manure lagoons, a questionable treatment system. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 320-325. 27 ref. 1 tab. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-889.)
"The development and use of manure lagoons are reviewed. Design, loading rates, and operation of anaerobic lagoons, aerobic lagoons, and oxidation ditches for the treatment of poultry, swine, and cattle manure are discussed."

A-240 Hammer, M.J. and C.D. Jacobson. 1970. Anaerobic lagoon treatment of packinghouse wastewater. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 347-354. 17 ref. 3 tab. 6 fig. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-893.)
"Wastewater characteristics and waste loads from meat processing plants in the U.S. are summarized. Anaerobic treatment and the process involved are described as background to the laboratory study conducted at the University of Nebraska to evaluate anaerobic lagoon treatment of packinghouse wastewaters. Results of the experiments, considerations in pond design, and design criteria are presented."

A-241 White, J.E. 1970. Current design criteria for anaerobic lagoons. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 360-363. 12 ref. 4 tab. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-895.)
"Anaerobic lagoons have played a major role in the treatment of wastes containing high suspended solids and organic concentrations. These lagoons have been compared to uncovered digesters. Current design criteria has, quite often, been based on operating experiences of earlier lagoon installations. Increasing interest is being placed on anaerobic lagoons due to the strict water quality standards imposed by the various government water pollution control agencies. Anaerobic lagoons have been attempted at very wide range of loading rates, at depths of 1½ ft. to 20 ft., and under all types of weather conditions. Current design criteria presently accepted by various government agencies and operation data of existing anaerobic lagoon installations are discussed."

A-242 Dornbush, J.N. 1970. State of the art - anaerobic lagoons. In R.C. McKinney (ed.). Proc. Int. Symposium on Waste Treatment Lagoons, Kansas City. pp. 382-404. 12 tab. 3 fig. (cited in Pollut. Abstr., 2(4): Abstr. No. 71-4TF-899.)
"The state of the art for anaerobic lagoons in the treatment of sewage, industrial wastes, and animal manure is reviewed. The mechanism of anaerobic digestion is explained. The development of design criteria and operational considerations for various waste classifications and environmental conditions are presented."

A-243 Denver Post. 1971. Manure pollution topic of seminar. Denver Post, Oct. 27, 1971, p. 46. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6GB-770.)
"Areas under study by an Environmental Protection Agency research center in Ada, Oklahoma were outlined at an October workshop held in Denver. The studies of manure treatment systems, water runoff systems, collection ponds and reservoirs are being made to determine the extent of water pollution caused by animal wastes."

A-244 McNabb, C.G. 1970. Pollution and livestock feeding in Missouri. Paper presented at 46th Annual Conf. for Veterinarians, Columbia, Mo. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TG-619.)
"Pollution problems related to agriculture and alternatives for resolving them are discussed. Comments are divided into three parts: Trends in confinement feeding of livestock; alternatives for regulating feedlots

and their consequences; and implications and questions concerning livestock production and pollution."

A-245 Jones, K.B.C. and C.T. Riley. 1970. Origins and nature of farm wastes. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 7-14. 9 tab. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1101.)
"A discussion of the origins and nature of farm wastes is presented. Statistics on the size of the farm wastes pollution problem are reported to emphasize the necessity of action. The sources and character of various types of farm wastes are analyzed including animal excretia, waste water and waters polluted by animal wastes, and food processing wastes. Disposal methods and planning procedures are covered as are non-degradable wastes, pesticides, and other chemical residue handling problems."

A-246 Berryman, C. 1970. The problem of disposal of farm wastes, with particular reference to maintaining soil fertility. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 19-23. 3 ref. 4 tab. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1102.)
"The effect of farm waste, particularly in the form of animal slurry, on soil fertility is reviewed. It was found that slurry can supply an important part of the NPK requirements on the farm. The application of slurry to land is the most convenient and practical method of disposal, but problems due to a breakdown of soil structure can occur if an unsuitable soil receives excessive applications of slurry. The soil type is important when assessing the effect slurry disposal will have on the fertility of soil."

A-247 Venn, J.A.J. 1970. The problem on the farm: Animal health. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 24-32. 39 ref. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1103.)
"The problem of health hazards to farm animals from waste effluents and toxic chemicals is reported. Bacterial, viral, and parasitic agents are studied as sources of disease in cattle effluent and in slurry fertilizers. Chemicals and toxic waste materials used on the farm are also discussed as problem sources. Possible ways of limiting these hazards are suggested."

A-248 Bartrop, T.H.C. 1970. Farm wastes: Public health and nuisance problems off the farm. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 33-37. 4 ref. 1 tab. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1104.)
"A discussion of farm wastes in England as related to public health and as a nuisance source is presented. The problem of odors is analyzed and methods for odor control are reported. Flies,rats, and other disease bearing organisms are discussed as health hazards. Recent legislation related to farm wastes and nuisances are outlined. It is concluded that to eliminate nuisances and public health problems related to farm activities, it is necessary to couple good siting and design with good animal husbandry."

A-249 Fish, H. 1970. Water pollution prevention requirements in relation to farm-waste disposal. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 38-43. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1105.)

"A review of the sources and effects of farm wastes on water supplies is made. Effluents such as silage, animal compound, food processing, and fertilizer and pesticide runoff are studied including specific effects on surrounding land and water tables and streams. The need for pollution control measures is emphasized; the legal requirements for water quality and the enforcement of these regulations in England are discussed."

A-250 Simpson, J.R. and R.L. Hibberd. 1970. Sewers and sewage treatment. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 44-51. 14 ref. 1 tab. 2 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1106.)

"The general nature of sewage system design and waste treatment processes in England is presented, including detailed descriptions of several treatment methods. An analysis of how various types of effluents will effect the design, efficiency, and costs of sewers, treatment plant facilities, and treatment operations is made. Coverage of the effects of recent regulations on farm wastes and treatment processes is given."

A-251 Riley, C.T. 1970. Minimizing poultry waste problems. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 66-72. 5 tab. 3 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1108.)

"A study on minimizing poultry wastes is presented. The types of poultry wastes, the chemical and physical properties of wastes including BOD, and poultry processing wastes are analyzed in reference to the various methods of handling them to reduce waste load and odor. In general, good animal husbandry and planning are recommended for minimizing wastes; specific rules are summarized for best results."

A-252 Pointer, C.G. 1970. Minimizing the waste problem with pigs. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 73-80. 1 ref. 7 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1109.)

"Methods for minimizing wastes from pigs is described. For new systems, it is suggested that the choice of site for the pig unit is very important, particularly as the facility increases in size. Subsequently the management and housing systems selected must be suited to the site. Specific recommendations as to design of facility, space requirements, feeding, manure handling, watering, odor control, and other aspects of raising are discussed in reference to waste reduction."

A-253 Cooper, M.M. 1970. Minimizing the waste problem with cattle. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 81-83. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1110.)

"A brief description of minimization of cattle wastes is presented. Attention is given to the handling of dairy cow wastes and housing during the winter."

A-254 Weller, J.B. 1970. Building design. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 84-93. 6 tab. 2 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1111.)

"A study of how building design can facilitate farm waste handling is made. Methods for efficient removal, storage, and use of cattle manure and other wastes are reported relative to various parameters including costs per animal for building, waste handling, bedding, equipment, operating costs, and other factors. Treatment methods for effluents are also briefly discussed."

A-255 Quick, A.J. 1970. Land disposal and storage of farm wastes. I. Planning and choice of system. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 106-109. 5 ref. 1 tab. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1112.)
"A discussion of the various types of dairy farming waste disposal systems and planning criteria are presented. Wet farms, fairly dry farms, and dry farm situations are analyzed with the costs of different effluent handling systems for each detailed. Storage and eventual use of slurries is also covered."

A-256 Payne, J.I. 1970. Land disposal and storage of farm wastes. II. Handling and distribution. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 110-121. 1 ref. 2 tab. 1 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1113.)
"The three basic systems for distribution of farm wastes onto the land are described. These include handling farm wastes as a solid manure, as a dense slurry, and as a diluted slurry, with application method depending upon the physical state of the original waste product, the type of farm, and the housing system. Various types of equipment for handling manure, equipment costs, storage, and organic irrigation systems are reviewed. It is concluded that the least amount of problems occur in using solid manure."

A-257 Robinson, K., S.H. Baxter and J.R. Saxon. 1970. Aerobic treatment of farm wastes. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 122-131. 26 ref. 1 tab. 9 fig. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1114.)
"A review of aerobic waste disposal methods that are commercially avoidable is presented, including descriptions of oxidation ditches, surface aerators, and aerobic lagoons. A second portion discusses the characteristics of pig wastes, its oxygen demands, and the influence of copper on bacterial activity. The factors influencing the growth and metabolic activity of micro-organisms are outlined."

A-258 Baines, S. 1970. Anaerobic treatment of farm wastes. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 132-137. 19 ref. 1 tab. (cited in Pollut. Abstr., 2(6): Abstr. No. 71-6TF-1115.)
"Study indicates that anaerobic degradation of farm waste is a possibility. A satisfactory methane fermentation can be established and maintained. The process would appear to follow the same pattern as in digestion of sewage sludges and results in a reduction of solids up to 50%. The digested sludge is relatively inert, free from nuisance, and more amenable to dewatering. It also enhances manurial properties."

A-259 AP. 1971. Nitrate fear unjustified, U.S. reports. Los Angeles Times, Dec. 26, 1971, p. 9A. (cited in Pollut. Abstr., 3(1): Abstr. No. 72-1GC-16.)

"A new report published by the Agriculture Department suggests that the public need not be concerned about the build-up of nitrates resulting from use of chemical fertilizers and accumulation of manure in large feedlot operations. The Agricultural Research Service 'evaluation of the available information on nitrate in soil, water, foods, and feeds is that the potential for nitrate accumulation does not pose a threat of an environmental crisis.'"

A-260 Veirs, C.E. 1971. Cattle feedlots and alternatives for waste management. Seminar on Technology and Management of the Environment, Oregon State Univ., Water Resources Research Institute, Corvallis. pp. 65-79. 9 ref. (cited in Pollut. Abstr., 3(1): Abstr. No. 72-1GC-26.)

"Undesirable characteristics of the wastes from cattle and other animals include oxygen demanding wastes, total solids, nutrients, including nitrogen and phosphorus, and the pathologic organisms such as bacteria, virus, fungi, and parasites, and are of concern because of the effects on man and animals, particularly in relationship to water quality both surface and subsurface. These pollution problems are developing because of more cattle and because of the concentrated confinement and feeding. Waste management alternatives are given, costs analyzed, and management guidelines presented."

A-261 Anon. 1971. Australien braucht Mistkaefer. Frankfurter Allgemeine, Nov. 18, 1971. (cited in Pollut. Abstr., 3(1): Abstr. No. 72-1GC-32.)

"Australia must import a foreign dung-beetle to decompose livestock excrement. The existing dung-beetles are limited to excrement from marsupials, which results in an ecological imbalance in an increased amount of vermin (noxious insects). In Queensland, the Onthophagut gazella has proved successful but must be limited to this region because it is only adapted to sandy soils."

A-262 Willson, G.B. 1971. Agricultural waste management. Proc., 1st. National Conf., Composting-Waste Recycling, Denver, Colorado. pp. 73-78. 1 ref. 16 tab. (cited in Pollut. Abstr., 3(1): Abstr. No. 72-1GD-13.)

"Considerations attendant upon the utilization of human and animal wastes as part of an agricultural renovation program are explored."

A-263 Cason, C. 1970. Economic benefits from chemurgy in poultry production. Proc., 32nd. Annual Conf., Chemurgy for Better Environment and Profits, Washington, D.C. pp. 81-83. (cited in Pollut. Abstr., 3(1): Abstr. No. 72-1TF-248.)

"An economic review of poultry production and processing in the United States is presented. The industry endeavors to recover the maximum waste reusable in by-products such as animal feed and fertilizer. Water is reused where possible. The efficiencies practiced by the industry have resulted in lower costs to the consumers."

A-264 Butler, R., J. Parsons and R. Wirtz. 1964. Waste disposal on hog farms. Official Bull. N. Dakota Water Works Sewage Conf., 32(4): 12, 24. (cited in Water Pollut. Abstr., 39: Abstr. No. 1179.)

This paper reports on trials conducted with the lagoon system, for pigs. Preliminary results indicate that lagooning can reduce the BOD value by 89%.

A-265 Webber, L.R. 1966. You can't bury a waste and just forget it. Water Pollut. Contr., Ont., 104(2): 35-37. (cited in Water Pollut. Abstr., 40: Abstr. No. 530.)
"The author stresses the dangers of indiscriminate and continuous use of soil as a disposal medium for wastes; there are possible hazards to health resulting from spray irrigation of wastes, the persistence of toxic compounds and pesticides in soils, and restricted decomposition of wastes under anaerobic conditions. One criterion for a disposal system is the ability of soil to use a loading of up to 200 lb. of BOD per acre per day, and in disposal of water-borne wastes the texture, density, structure and depth of the soil are important factors."

A-266 Chitkara, N.L., T.D. Chugh and R.K. Arya. 1966. Biochemical types of coliform organisms in human and animal stools. Indian J. Pathol. Bacteriol., 9: 128-133. (cited in Water Pollut. Abstr., 40: Abstr. No. 547.)
"Studies on the biochemical reactions of coliform organisms isolated from a number of human and animal faeces confirmed the results obtained by previous workers, that Escherichia coli is the commonest organism present and that it is not possible to use the biochemical reactions to differentiate between coliform organisms of human origin and those of animal origin."

A-267 Braga, A. 1964. Research on the survival of salmonellae in farmyard effluent used in a fertilizing irrigation plant. Igiene Moderna, 57: 635-657. (cited in Water Pollut. Abstr., 40: Abstr. No. 845.)
"Studies on the survival of salmonellae in farm drainage which was collected in a tank and then used for irrigation, after dilution with well water, indicated that to prevent possible contamination the waste waters should be held for at least 20 days in summer and 60 days in winter before use; for this purpose a larger storage tank or a series of tanks would be required."

A-268 Pruel, H.C. 1967. Underground movement of nitrogen. Proc., 3rd. Int. Conf. Water Pollut. Res., Munich, 1: 309-328. (cited in Water Pollut. Abstr., 40: Abstr. No. 1369.)
"From 1962-1964 studies were carried out in Minnesota on nitrate contamination of ground water, and the author reports the results of studies on ground water in the vicinity of 6 soil adsorption systems for septic tank effluents. From observations on the movement of ammonia and net rate in the ground it is concluded that ammonia-nitrogen is rapidly nitrified by biological oxidation; this occurs at a high rate initially and to a great extent within a few feet of the point of release of the septic-tank effluent in well aerated soils. . . . The nitrate concentration may be reduced by dilution with ground-water or soil moisture and possibly by denitrification in the deeper anaerobic layers of the soil. . . . Laboratory experiments showed that ammonia ions can be removed readily in soil by adsorption, but under aerobic conditions nitrification occurs before the flow can contact a sufficiently effective volume of soil. . . ."

A-269 Robertson, J.S., J.M. Croll, A. James and J. Gay. Pollution of underground water from pea silage. Monthly Bull. Minist. Health (London), 25: 172-179. (cited in Water Pollut. Abstr., 40: Abstr. No. 1556.)

"Seasonal pollution by Escherichia coli I of water from a deep chalk borehole at Barrow-on-Humber was found to be due to the manufacture of pea silage locally, the juice from the stacked haulms yielding high contents of Esch. coli. Tests on the juice from a stack treated with molasses showed that a marked reduction in numbers of Esch. coli occurred 2-3 weeks after treatment. Attention is drawn to the fact that pollution of water in a chalk borehole by juice from pea haulms may also facilitate the growth of filamentous iron organisms."

A-270 Mann, C.W. 1966. Disposal of farm wastes. Public Health Inspect., 74: 337-340. (cited in Water Pollut. Abstr., 41: Abstr. No. 491.)

Three methods of disposal of farm waste which do not contravene the terms of the Rivers Acts of 1951 and 1961 are: (1) discharge to a public sewer; (2) treatment at the farm and discharge to a water-course; (3) land disposal. Legislation on land use planning is re-required. Redesign of cattle pens to give an increase in dry manure and a minimal volume of slurry disposal is recommended.

A-271 Resnick, J.H. 1966. The influence of the discharge of dairy waste waters on surface waters. Water, 50: 99-102. (cited in Water Pollut. Abstr., 41: Abstr. No. 691.)

"The characteristics of dairy waste waters and their effects on receiving waters are considered. The organic constituents of the waste waters cause a more rapid depletion of oxygen than domestic sewage of similar strength, and their nitrogen, phosphorous and potassium contents enhance eutrophication. The contribution of nutrients discharged with dairy waste waters is compared with that of domestic sewage, pig manure, and runoff from agricultural land."

A-272 Cute, E., E. Juriari and C. Murgoci. 1967. Investigations on the treatment of waste waters from pig breeding. Studii Prot. Epur. Apel., Buc., 9: 305-328. (cited in Water Pollut. Abstr., 41: Abstr. No. 865.)

". . . Analytical data are tabulated for waste waters from 3 pig-breeding farms and 1 large pig-breeding combine in Romania. At older piggeries, waste waters are treated by sedimentation and sludge digestion in Imhoff tanks. In more recent establishments, treatment comprises primary sedimentation followed by storage of the settled waste waters in ponds to be used for irrigation, and separate digestion of sludge in open tanks. . . ." Operational features of both systems are discussed.

A-273 Arnold, K.H. 1968. Nutrient transport from agricultural areas. Fortschr. Wasserchem. Grenzgeb., 8: 131-142. (cited in Water Pollut. Abstr., 41: Abstr. No. 1139.)

"The author considers that, although soil erosion can have a noticeable effect on agricultural areas, its importance in contributing to eutrophication of surface waters should not be over-estimated in the Erzgegirge area, Germany. In this area, heavy rainfall, which causes soil erosion, is relatively rare and occurs mainly in summer when the soil is protected by vegetation. In the drainage area of the Saidenbach impounding resevoir, the amounts of phosphate and nitrate transported annually in runoff are only 38 gm. and 56.8 kg. per hectare, respectively, which is much less than the amounts contributed by domestic sewage."

A-274 Löwe, G. 1968. Measures for preventing import of nutrients from drainage areas used for agriculture. Fortschr. Wasserchem. Grenzgeb., 8: 257-267. (cited in Water Pollut. Abstr., 41: Abstr. No. 1141.)
"The author discusses the problems of eutrophication caused by agricultural activities and methods of controlling such pollution. Animal manure and silage can be stored under cover to prevent wash-out of nutrients by rain and can be treated properly before disposal. Runoff from fields is, however, more difficult to control and it is recommended that manure should not be applied to fields near streams. Measures to reduce soil erosion can also reduce the entry of plant nutrients into surface waters."

A-275 Conley, J.D., R.T. Marshall and A.D. Ray. 1967. Survival of pathogenic bacteria in waste-stabilization ponds. J. Environ. Health, 29: 428-432. (cited in Water Pollut. Abstr., 41: Abstr. No. 1167.)
"Investigations made in connection with the effects of pathogenic bacteria in lagoons on livestock which drank or contacted the water showed that organisms similar to Staphylococcus aureus and Serratia marciscens did not survive for any significant period in the aerobic zone of facultative lagoons, although the die-away rate in the anaerobic zone might be quite small."

A-276 Dalrymple, W. and D.E. Proctor. 1967. Feasibility of dairy manure stabilization by anaerobic digestion. Water Sewage Works, 114: 361-364. (cited in Water Pollut. Abstr., 41: Abstr. No. 1501.)
"The efficiency of anaerobic digestion of cow manure was studied in the laboratory; loading and performance data are given. It was found that volatile matter was reduced by about 50%, but that the volume of gas produced was low in comparison with that from digestion of sewage sludge; the gas contained 20-25% carbon dioxide. The digested manure contained more nitrogen per unit weight of solids than did the fresh manure, and would therefore be of more value as a fertilizer."

A-277 Niles, C.F. 1967. Egg laying house wastes. Water Sewage Works, 114: 407-410. (cited in Water Pollut. Abstr., 41: Abstr. No. 1689.)
"A description is given of arrangements at the Berry Best Egg Co., Rockport, Ind., for the treatment of droppings and dead hens from laying houses. The droppings, amounting to about 1000 lb wet weight per day from each of 41 laying houses, are collected by a mechanical loader and conveyed to a receiving pit in a drying house containing 6 driers fired with natural gas, the drier hoppers being charged automatically from the pit and manually with dead hens brought directly from

laying-house cages. The dried waste is pulvarized and blown into bags. Waste drinking water from laying houses is used for irrigation between them. Results of analyses of the various wastes are tabulated."

A-278 Arnhem. 1968. Gov't Dairy Products - agricultural wastewater service (Rijks Zuivel - Agrarische Afvalwaterdienst). Report for the period 1959-1964. 76 pp. (cited in Water Pollut. Abstr., 41: Abstr. No. 1690.)
This report of the R.A.A.D. contains information on the organization and control of waste water disposal in Netherlands; charges for treatment of trade waste-waters; reduction of water demand by dairies through water reuse; waste-water problems in other agricultural processing industries; apparatus for proportional sampling of waste-water; maintenance of drinking water supplies for cattle, with particular reference to the use of oxidation ditches to treat piggery wastes; methods for treatment of waste-waters; and the use of oxidation ditches to treat dairy waste-waters.

A-279 Nehrkorn, A. and H. Reploh. 1966. Operational experiences with oxidation channels for the treatment of dairy waste waters. Gesundheitsingenieur, 87: 143-146. (cited in Water Pollut. Abstr., 42: Abstr. No. 367.)
"Full biological treatment of dairy waste waters by means of oxidation channels is described and details are given of observations and of operational results obtained, which were based on previous experiences. Owing to the prolonged periods of aeration the organic substances become mineralized, thus producing very little excess sludge. A good reduction in BOD was obtained and bacteriological tests also showed a considerable reduction in coliform organisms. An added advantage is the minimal operational cost and the low maintenance required."

A-280 Wass Abwass. 1965. Water and waste water in agriculture and forestry. Winkler & Co., Vienna. 221 pp. (cited in Water Pollut. Abstr., 42: Abstr. No. 371.)
"This book contains papers presented at a meeting of the Federal Council for Water Biology and Sewage Research, on the pollution of ground and surface water by waste waters from agriculture and forestry, and the effects of pesticides and herbicides on soil and aquatic organisms. Details of methods and techniques used for the treatment and control of these waste waters are reviewed and discussed in order to show how to solve the problems and avoid possible health hazards."

A-281 Vogel, H.E. 1967. The danger to Swiss waters from silage waste waters. Städtehygiene, 108: 378-379. (cited in Water Pollut. Abstr., 42: Abstr. No. 601.)
"The author discusses the technical and legal aspects of pollution of Swiss watercourses in connection with the treatment and disposal of silage waste waters and the measures which are required owing to the unsatisfactory methods and treatment facilities in Switzerland. With the exception of Lucerne canton, where special measures have been introduced to reduce the bulk of solids before their discharge to

receiving waters, the control measures for the discharge of silage waste waters are inadequate and often result in fish mortality."

A-282 Bunešová, S. and M. Dvořák. 1968. Dairy waste waters and their aerobic treatment. Vod Hospod., 18: 466-467. (cited in Water Pollut. Abstr., 42: Abstr. No. 815.)
"A description is given of the performance of an activated-sludge plant at Kruh, Czechoslovakia, which treats waste waters from a dairy. For a BOD loading of 300 gm/cu. meter per day, a reduction of 97% has been effected. Excess sludge is used as fertilizer or is dewatered without digestion. For low BOD loadings of 1-1.5 gm/cu. meter per day, a reduction of 85-90% was found."

A-283 Riley, C.T. 1968. A review of poultry waste disposal possibilities. Symposium on Effluent Treatment for the Food Industries. Water Pollut. Contr. (London), 67: 627-631. (cited in Water Pollut. Abstr., 42: Abstr. No. 1023.)
"The quantities and characteristics of wastes produced in the poultry industry, including both the manure from rearing units and the waste waters from packing stations, were described and methods of disposal, their advantages and disadvantages, were outlined."

A-284 Pontin, R.A. and S.H. Baxter. 1968. Wastes from pig production units. Symposium on Effluent Treatment for the Food Industries. Water Pollut. Contr. (London), 67: 632-638. (cited in Water Pollut. Abstr., 42: Abstr. No. 1023.)
"Methods for the treatment and disposal of the large volumes of slurry produced in intensive pig rearing units were outlined and a description given of a full-scale oxidation channel system constructed at Tealing, Angus, after pilot-scale studies had shown the feasibility of this method of treatment for piggeries waste waters. Examination of the mixed liquor from both the primary and secondary oxidation channels showed a normal floc without filamentous growth, but there was less protozoal activity than in activated sludge treating domestic sewage. Dewatering of the excess sludge on beds has proven disappointing; it has been suggested that frequent application of a thin layer of sludge to a solid floor would be more effective."

A-285 Gibbons, J. 1968. Farm waste disposal in relation to cattle. Symposium on Effluent Treatment for the Food Industries. Water Pollut. Contr. (London), 67: 622-626. (cited in Water Pollut. Abstr., 42: Abstr. No. 1023.)
"The problems of waste disposal caused by modern methods of farming, particularly the intensive rearing of cattle and the production of silage, were discussed and factors affecting the choice of method of disposal were indicated."

A-286 Anon. 1968. The farm role in water quality management. Water Sewage Works, 115: 463-464. (cited in Water Pollut. Abstr., 42: Abstr. No. 1057.)
"The problem and extent of the pollution of surface waters by sediment, fertilizers, and animal wastes from farm land are discussed, and recommendations for control of this pollution are offered."

A-287 Kshirsagar, S.R. 1968. Oxidation ditches of Netherlands. Environ. Health (India), 10: 97-105. (cited in Water Pollut. Abstr., 42: Abstr. No. 1184.)
"The design, operation, performance, and running costs of oxidation channels are discussed, with particular reference to those operating in the Netherlands. Loading, mixing liquor, and effluent characteristics are tabulated for (several) oxidation channels. . . . Of the 125 channels in operation in the Netherlands, 100 are treating domestic sewage for communities with populations ranging from 1,000-10,000, 4 plants treat dairy waste waters, and a large plant treats waste waters from state mines."

A-288 Berridge, H.B. 1969. Rural trade wastes. J. Institution Public Health Eng., 68: 85-93. (cited in Water Pollut. Abstr., 42: Abstr. No. 1417.)
"The sources, characteristics, and volumes of waste waters from rural industries, typified by those from malthouses, breweries, dairies, creameries, cheese factories, canneries, farms, poultry packing houses, beet-sugar factories, slaughter houses, tanneries, and potato processing, are discussed."

A-289 Isotalo, I. 1969. Extract from silage and its effect on the recipient. Vesitalous, 10(2): 18-21. (cited in Water Pollut. Abstr., 42: Abstr. No. 1665.)
"The volume and composition of sludge liquor from cwt sugar-beet tops was investigated and it was found that 42% of the initial weight of material was pressed out during filling of the silo and the liquor had a BOD of 19,400-40,600 mg/l. and contained 105-371 mg of P and 883-1455 mg of N per liter. Although the silo was filled more slowly than is usual, to reduce the daily polluting load, one day's BOD could amount to that from 500 persons. Since there is no inexpensive method of treatment, it is recommended that the liquor should be discharged to sludge basins and then spread on land."

A-290 Webber, L.R. and D.E. Elrick. 1966. Research needs for controlling soil pollution. Agr. Sci. Rev., 4(4): 10-20. (cited in Water Pollut. Abstr., 42: Abstr. No. 1732.)
"The authors describe the physical, chemical and biological properties of soil and its uses in the purification of waste waters. Dangers arising from contamination of crops, animals, or water supplies as a result of pest control or waste disposal, and the need for rigorous control are stressed. Suggestions for further studies, controlled collection of background information on soils, and establishment of permissible levels of pollutants are discussed."

A-291 Riley, C.T. 1969. Disposal of farm waste. Surveyor Local Gov't Tech., 133(40007): 40. (cited in Water Pollut. Abstr., 42: Abstr. No. 2087.)
"A paper on current trends in the disposal of farm waste waters, presented at a meeting of the Metropolitan and Southern branch of the Inst. of Wat. Poll. Control in Jan., 1969, is discussed, with particular reference to intensive pig rearing and discussion provoked on this subject."

A-292 Long, D. 1969. Farm waste. I. Lagoons - do they work? Farmer's Weekly, 71(10): 61-65. (cited in Water Pollut. Abstr., 42: Abstr. No. 2272.)
"Lagoons are now being used at some farms in England for disposal of waste waters, and details are given of the performance of some of these, based on observations carried out in 1966 and again in 1969. The results indicate that most organic polluting matter should decay during storage in a lagoon for a period of a few months, and if the effluent from the lagoon is passed through small aeration and sedimentation tanks, it should be acceptable to river authorities, without too much difficulty or expense."

A-293 Long, D. 1969. Farm wastes. III. Bubble guns and brushes. Farmer's Weekly, 71(11): 66-67. (cited in Water Pollut. Abstr., 42: Abstr. No. 2273.)
"The author describes three methods for mechanical aeration of farm waste waters which are currently being investigated, namely oxidation channels, aeration in tanks equipped with bubble guns, and extended aeration process. These methods have been found effective, but expensive for treating the crude wastes, but might be more economical if used to treat effluent from lagoons."

A-294 Stephenson, J. 1969. Factory farming revolution creating new problems. J. Municipal Eng., London, 146: 935. (cited in Water Pollut. Abstr., 42: Abstr. No. 2503.)
"Some methods for treatment and disposal of chicken manure are discussed, including the use of underground slurry tanks to hold battery droppings, disposal on land, drying, composting, and storage in lagoons."

A-295 Stephenson, J. 1969. Intensive farming creating difficult manure problems. Municipal Eng., London, 146: 979-980. (cited in Water Pollut. Abstr., 43: Abstr. No. 169.)
"Problems of the disposal and treatment of farm waste waters are discussed, including the nuisance effect of airborne droplets during the spray irrigation of diluted manure, the relatively high cost of treatment by biological filtration owing to the strength of these wastes, and the polluting effects of silage effluents."

A-296 Tenu, A. 1968. The pollution of groundwater. Hidrotehnica, 13: 84-91. (cited in Water Pollut. Abstr., 43: Abstr. No. 217.)
"Details are given of the main causes of groundwater pollution such as the effect of pesticides and fertilizers used in agriculture and the pollution caused by drainage from garbage dumps, by hydrocarbons, by radioactive substances, and by detergents in domestic sewage. Factors affecting the processes of seepage and distribution of contaminants in the groundwater stratum and in the karst are outlined."

A-297 Stundl, K. 1968. The processes of decomposition in soil and their effect on ground-water quality. GasWassWäime, 22: 142-147. (cited in Water Pollut. Abstr., 43: Abstr. No. 219.)

"Detailed studies have been carried out on the effect of decomposition processes in soil on the ground-water quality and the author reviews and compares the findings of other investigators on the factors which affect the diffusion and dispersion of polluting material infiltrating . . . The effect of micro-organisms in bottom soils on the seepage of water, their movement in groundwater and the purifying effect of surface soil and deep layers of soil in relation to the action of, for example, protozoa in bacteria, are discussed."

A-298 Black, S.A. 1967. Farm animal waste disposal. Ontario Water Resources Commission, Res. Publ. No. 28. 44 ref. (cited in Water Pollut. Abstr., 43: Abstr. No. 383.)
"The problem of pollution of waters by farm wastes in Ontario is discussed. As the use of intensive pig and poultry breeding units and cattle feedlots has increased, the volume of manure for disposal or treatment has greatly increased. The problems of handling and storage are described and the value of manure as fertilizer is assessed - its chemical and physical properties depend largely on the type of food provided and the environment in which the animals are kept. Various methods of disposal which are used for domestic sewage are suggested for situations where use as a fertilizer is impossible, although the use of antibiotics in foodstuffs sometimes interferes with biological treatment. . . ."

A-299 Scheltinga, H.M.J. 1969. Farm wastes. J. Water Pollut. Contr. (London), 68: 403-413. (cited in Water Pollut. Abstr., 43: Abstr. No. 583.)
"Further studies have been carried out in the Netherlands on aerobic biological treatment of farm waste waters, and descriptions are given of three additional experimental plants which came into operation in 1967, namely an oxidation tank for the manure from 160 pigs and two oxidation channels for the manure from 130 and 3,000 hens, respectively. The characteristics of the crude wastes and of the effluent after biological treatment are discussed, and factors to be considered in designing oxidation channels for farm wastes are indicated."

A-300 Hope, H. 1970. Now - a farm slurry tower. Farmer's Weekly, 72: xi. (cited in Water Pollut. Abstr., 43: Abstr. No. 1012.)
"A high-rate bio-filtration tower to treat farm slurry works on a circulation principle, slurry being pumped from a base tank and circulated continuously at a rate of 700 gal/hr. through the 12 ft. high tower, while untreated slurry is pumped in at a rate of 200 gal/day. After 24 hrs. circulation the effluent has a BOD of about 200 ppm. Half the filter is fitted with square wooden battens and the remainder is filled with porous aggregate. Solids are removed from the effluent by sedimentation in a straw-walled container which allows the clean effluent to seep from the base. So far the plant has performed reliably and needs little attention."

A-301 McManus, J.A. and A.J. Zalfa. 1969. The problem of agricultural pollution in water treatment. J. New England Water Works Assoc., 83: 311-321. (cited in Water Pollut. Abstr., 43: Abstr. No. 1046.)

"Problems of severe pollution of sources of potable water in Rhode Island, and the methods of water treatment at Pawtucket water works, are discussed. Pollution is caused by runoff from bordering agricultural land, mainly affecting Abott. Run, a stream which is a link in a series of resevoirs, the land being used for depositing and stockpiling large quantities of cattle manure; legal limitations hinder the effective control of such pollution."

A-302 Jensen, H.L. 1967. Silage effluent and its disposal. Grundförbättring, 20: 81-83. (cited in Water Pollut. Abstr., 43: Abstr. No. 1405.)
"Laboratory experiments in Denmark have shown that the polluting effect of silage effluent is due to the extremely high concentrations of readily decomposable organic matters (sugars, organic acids, and amino acids). It is recommended that silage liquor should be collected in storage tanks and disbributed on fields in amounts of not more than 30 tons per hectare, thus making use of the nutrient content of the liquor and reducing pollution of ground water."

A-303 Griffith, C.C. 1970. BOD poses problems for poultry growers and processors. Water Sewage Works, 117(1): IW9-IW14. (cited in Water Pollut. Abstr., 43: Abstr. No. 1610.)
"Past criteria for the BOD of poultry processing waste waters, assessed from studies of Kansas and Alabama plants . . . are re-assessed, and statistical analysis shows that the size of the bird should be considered in conjuction with the BOD value of a production unit of 1000 lb live weight, since heavier birds produce a higher BOD value."

A-304 Vercouter. 1968. Purification of piggeries waste waters. Revue Tech. Vet. Abattoirs Hyg. Aliment., 7(51): 34-35. (cited in Water Pollut. Abstr., 43: Abstr. No. 1611.)
"Problems associated with the purification of piggeries waste waters, such as the wide variation in strength, are discussed. Experimental treatment in an extended-aeration plant, in admixture with cheese manufacture waste waters, has proved successful, removing 98% of the polluting load. Methods for preliminary treatment of the piggery waste waters have been investigated."

A-305 Riley, C.T. 1970. Current trends in farm waste disposal. Water Pollut. Contr. (London), 69: 174-179. (cited in Water Pollut. Abstr., 43: Abstr. No. 2411.)
"The author outlines the volume and composition of farm wastes and discusses various methods of disposal."

A-306 Wheatland, A.B. and B.J. Borne. 1970. Treatment, use, and disposal of wastes from modern agriculture. Water Pollut. Contr. (London), 69: 195-208. (cited in Water Pollut. Abstr., 43: Abstr. No. 2412.)
"The authors give tabulated data on the volume and composition of waste waters from agricultural industries, including animal wastes and waste waters from washing vegetables before processing, and discuss various methods for treatment and disposal of these wastes."

A-307 Glerum, J.C., A.P.S. Jong and H.R. Poelma. 1970. Building design and manure disposal. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 94-100. (cited in Water Pollut. Abstr., 43: Abstr. No. 2426.)
"Systems for disposal of livestock manure involve either separate or mixed storage of dung and urine. In general, slurry or mixed-storage systems are preferable, and these are described for cattle housings, piggeries and poultry houses. Costs are also considered. Poultry manure flows less readily and is more difficult to pump than mixed manure from pigs and cattle and it is usually necessary to add water."

A-308 Smith, R.J., T.E. Hazen and J.R. Miner. 1970. Piggery cleaning using renovated wastes. Proc. Symp. Farm Wastes, Newcastle-upon Tyne. pp. 101-105. (cited in Water Pollut. Abstr., 43: Abstr. No. 2427.)
"Modern methods of livestock production, the economic advantages of chemical fertilizers, and the need to avoid polluting run-off and other public nuisance are making it less practicable to dispose of manure on land and alternative methods are being considered. In addition, the large volumes of water required for the hydraulic removal and transport of manure cannot always be provided by rural water supplies. A closed system has therefore been developed for the treatment of piggeries waste waters and has been tested at the Iowa State University. The waste waters are treated in an anaerobic lagoon, oxidation ditch, and sedimentation tank, from which sludge is returned to the ditch and effluent is re-used for the transport of crude waste. The oxidation ditch is equipped with a Pasveer rotor and covered with plywood to prevent severe icing. . . . The cyclic system resulted in little or no demand on fresh water, and the recycled effluent was, at all times, stable and sanitary, with no adverse effects on the animals exposed to it; it had an earthy odour and the BOD was less than 100 mg per litre even in February when the ditch temperature was only 1°C. Studies are also to be made discharging the crude effluent direct to the oxidation ditch."

A-309 Scheltinga, H.M.J. and H.R. Poelma. 1970. Treatment of farm wastes. Proc. Symp. Farm Wastes, Newcastle-upon-Tyne. pp. 138-142. (cited in Water Pollut. Abstr., 43: Abstr. No. 2431.)
Methods for disposal of farm wastes suitable for use in the Netherlands are considered, with special attention given to biological treatment of manure slurries and urine. Owing to weather conditions and scarcity of land, lagoons are not successful, even with mechanical aeration. Costs are compared for oxidation ditches and aeration pits. Both capital costs and operating costs are much higher for the oxidation ditch as compared to aeration pits, but the higher costs may be justified by better performance. Biological treatment of slurry is economically advantageous compared with costs for storing and hauling dung and urine. Several proposals for increasing the efficiency of oxidation ditches are given and include reduction of the effluent BOD to 20 mg./l., the addition of ferric chloride to precipitate the phosphorus, and further reduction of dissolved oxygen, resulting in denitrification, providing the bacterial flora and temperature are suitable. Biological treatment of calf wastes and pig urine is very successful, pig slurry less successful, and poultry wastes least successful.

A-310 Smith, G.E. 1969. Nitrate pollution of water supplies. Proc., 3rd. Annual Conf., on Trace Substances in Environmental Health, Univ. Missouri. (cited in Water Pollut. Abstr., 44: Abstr. No. 15.)

"Examination of water supplies in Missouri showed that 42% of the samples analysed contained 5 ppm or less of nitrate-nitrogen, but some shallow wells contained 300 ppm. Ground water in loess-covered glacial areas contained rather more nitrate than in karst areas. Nitrogen applied to clay and sandy soils at rates of 100 lb. and 200 lb. per acre, respectively, did not penetrate deeper than 9 ft. and no accumulation occurred. However, there was evidence of accumulation of nitrogen under livestock feeding lots, the concentration and penetration depth depending on the period of existence of the lots, which varied from 25 to 100 years, and the nature of the soil. Accumulation of nitrate was attributed to the low organic content of the soils."

A-311 Loehr, R.C. 1968. Pollution implications of animal wastes - a forward oriented review. U.S. Federal Water Pollut. Contr. Administration, Robert S. Kerr Water Res. Centre. 141 ref. (cited in Water Pollut. Abstr., 44: Abstr. No. 162.)

"The author reviews available information on trends in animal production, the production of manure, pollution hazards caused by animal wastes, methods for treatment and disposal of the wastes, the costs of animal production and waste treatment, and legislation, and indicates aspects on which further research is required."

A-312 Moore, J.A. 1969. Managing livestock waste to control pollution. Water Resources Res. Centre, Univ. Minnesota, WRRC Bull. No. 13: 29-34. (cited in Water Pollut. Abstr., 44: Abstr. No. 163.)

"In an article on the treatment and disposal of animal wastes, methods described include drying which causes no sanitation problems, treatment in lagoons, and use as fertilizer. Nutrient leaching should be prevented during long storage periods."

A-313 Rousev, I. and K.Z. Scherb. 1971. The treatment of liquid manure from large-scale pig and calf-rearing units. Wass. Abwass. Forsch., 4: 99-102. (cited in Water Pollut. Abstr., 44: Abstr. No. 1415.)

"Methods of collecting, mixing and storing farm manure from large-scale pig and calf units are outlined. Problems arising from the disposal of liquid manure from pigs, calves and other farm animals can be solved by the installation of the farm's own sewage-treatment plant. Extended-aeration plants which operate with a sludge load of 40 g BOD per kg of mixed-liquor suspended solids per day and detention periods of 20 days and over are particularly suitable. Details of design and costs of such plants are discussed."

A-314 McLachlan, S.M. 1971. The rate of nutrient release from grass and dung following immersion in lake water. Hydrobiologia, 37: 521-530. (cited in Water Pollut. Abstr., 44: Abstr. No. 1687.)

"Following chemical changes in shallow water of lake Kariba after a rise in water level, experiments were carried out on the release of ions to lake water from dry grass and wild-animal dung. Phosphate and potassium were released most rapidly, followed by nitrate, calcium, magnesium, and sodium. Dung derived from grass released ions more rapidly than did grass itself. The importance to the lake of nutrients released by grass and dung following immersion under natural conditions is discussed."

A-315 Inst. LandbBedrijfsgeb., Wageningen. 1961. Verslag over het jaar 1960. (Report for the year 1960.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 10. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 1st Supplement, Abstr. No. 280.)
"This general report included interim reports on various projects. Trials of mechanical systems for manure handling in piggeries and of a prefabricated system of constructing concrete floors for livestock which gave promising results."

A-316 Dölling, M. 1959. Untersuchungen über das Absetzen von Schweinekot in wässriger Aufschlämmung. (Investigations into the sedimentation of pig dung in an aqueous suspension.) Arch. Landtech., 1(2): 111-144. 13 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 1st Supplement, Abstr. No. 281.)
"Report on trials to determine the desirable characteristics of a settling tank in sludge cleaning installations for piggeries. A settling tank with a surface area of 376.7 sq. ft. (35 sq. m.) with a 5:1 length/width ratio was recommended for a piggery holding 2,000 pigs."

A-317 Pig Farming. 1960. Muck lagoon. Pig Farming, 8(11): 57. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 1st Supplement, Abstr. No. 282.)
"Report on studies by Missouri University of the lagoon system for collecting pig manure in artificial ponds. Advisory recommendations on the dimensions and siting of these lagoons were given."

A-318 Negucescu, A., S. Gurghis and D. Popescu. 1961. (A contribution to the study of micro-flora in cowhouses and piggeries.) Lucr. Inst. Agron. Bucaresti, Ser. C, 5: 239-245. 10 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 45.)
"Report on studies. The number of bacteria in the atmosphere of cowhouses was considerable and included large numbers of fungal spores presumably introduced in the bedding. The number of bacteria in the atmosphere of piggeries was four to five times greater than that in cowhouses because of the constant movement of the animals."

A-319 Dept. Scientific Industrial Res. 1964. Some further observations on waste water from farms. Notes on Water Pollution, No. 24. 5 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 91.)
"Review of available information on farm wastes from dairy buildings, roofs and yards, piggeries and poultry batteries."

A-320 Ministry of Agriculture, Fisheries & Food, England and Wales. 1963. Handling manure in liquid and semi-liquid form. N.A.A.S. Tech. Rep., No. 13. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 94.)
"Report on survey. Quantities of undiluted pig manure collected were found to average 1.6 gallons per head per day. Equipment used, labour requirements and the fertiliser value of the material were determined. Advisory recommendations were given."

A-321 Lisle, A. 1963. A lagoon for the muck. Farmer's Weekly, 57(12): 103. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 96.)
"This general article refers to a survey of pig lagoons by Missouri Agricultural Experiment Station. Allowance per pig in successful lagoons varied from 30 to 7½ sq. ft."

A-322 Henriksson, R. 1961. Lantgårdens avloppsvatten. (Farm wastes.) Medd. ForsknAnst. LantmBygg., Lund, No. 52. 11 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 97.)
"Report on studies. The amount and chemical analysis of waste liquids from different types of stock and from silage were determined. Disposal by irrigation with and without neutralisation and by 'sewage farm' methods of purifying water with a minor degree of contamination were investigated. Results were given in detail and recommendations made."

A-323 McAllister, J.S.V. 1962. Slurry. Agr. N. Ire., 37(1): 12-14. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 100.)
"This general article contained a reference to the average manurial content of samples of pig slurry in Northern Ireland, which was 40 lb. nitrogen, 21 lb. phosphate and 22 lb. potash per 1,000 gallons."

A-324 McAllister, J.S.V. 1964. Pig slurry. Pig Progress, N. Ire., 7(9): 13-17. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 102.)
"This general article included reference to trials which showed that the average composition of pig slurry in N. Ireland was 3.6% dry matter, 0.4% nitrogen, 0.2% phosphate and 0.2% potash; and to trials at Hillsborough on the manurial value of slurry on grassland which showed that the nitrogen in pig slurry was 66% as efficient, and in farm yard manure 20% as efficient, as the nitrogen in sulphate of ammonia."

A-325 N. Scot. College Agr. 1964. The manurial value of sludge. Rep. Field Trials N. Scot. College Agr., July 1964. pp. 10-11. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 103.)
"Interim report on trials. Yield and quality of grass were better from the highest rate of fertiliser application than from the highest rate of sludge application and were comparable when the sludge supplied 3½ times as much nitrogen as that supplied by fertiliser. Pig sludge produced more forage at the first cut and less at the second than cattle sludge."

A-326 Agr. Inst., Dublin. 1964. Manurial value of pig sludge. Farm Res. News, Dublin, 5(6): 127-128. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 104.)
"This general article referred to analyses of sludge from Galtee Cattle Breeding Station and Moorepark Experimental Station, showing that sludge from meal fed pigs contained 20.5% nitrogen, 8% phosphate and 80% potash. Sludge from whey fed pigs contained half these amounts of nutrients."

A-327 McAllister, J.S.V. 1964. Slurry changes in composition during storage. Farm Bldg. Assoc. J., No. 8: 32-36. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 105.)
"Report on various trials in Northern Ireland, mainly on pig slurry but including some cattle slurry. The nutrient content of the slurry and the effects on it of ventilation and temperature were shown. Some fermentation took place in channels but the tank was the main centre of this process."

A-328 Browne, G. 1964. Manurial value of pig sludge. Tech. Bull. Agr. Inst., Dublin, No. 4-64. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 106.)
"Report on trials. The plant nutrients value of sludge from meal fed pigs was 3.3% nitrogen, 0.9% phosphate and 2.5% potash and from whey fed pigs 1.55% nitrogen, 0.55% phosphate and 1.2% potash. Recommended figures for storage capacity were given as ½ - 1 cu. ft per pig per day."

A-329 McAllister, J.S.V. 1964. Investigations into the storage of slurry. 1. The nutrient content of slurry produced in Northern Ireland. Res. Exp. Rec. Minist. Agr. N. Ire., 12(2): 123-135. 9 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 107.)
"Report on survey. The average nutrient content of slurry, mostly from piggeries, was 0.37% nitrogen, 0.20% phosphate, 0.20% potash and 3.6% dry matter. A system of collecting and storing slurry from slatted floors in piggeries was described and the composition of the slurry thus collected analysed in detail."

A-330 N. Scot. College Agr. 1959/60. Use of pig sludge. Investigations N. Scot. College Agr., 1959-60. p. 46. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 108.)
"This report on the use of pig sludge as a manure referred to the tendency of the urine and water to remain at the top and dung at the bottom of the holding tank. This made assessment of its manurial value difficult."

A-331 McAllister, J.S.V. 1964. Investigations into the storage and use of slurry. 2. Changes in the dry matter and content of slurry during storage. Res. Exp. Rec. Minist. Agr. N. Ire., 12(2): 135-140. 1 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 109.)
"Report on experiments on changes in fresh samples of faeces and urine from cows and from pigs. Exposure to the atmosphere increased nitrogen losses. Under anaerobic conditions, losses and changes in the nitrogen content may be negligible for at least three months. Pig slurry fermented more rapidly than cow slurry."

A-332 N. Scot. College Agr. 1964. Portable sludge agitator. Rep. Investigations & Res. N. Scot. College Agr., July 1964. p. 36. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 110.)
"Report on development of a portable agitator for mixing liquid with sludge under slatted floors that had become too solid for removal by pump or by gravity."

A-333 Dept. Scientific Industrial Res. 1960. Farm wastes. Water Pollut. Res. 1959. p. 49. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 111.)
"Interim report on trials of treatment of farm wastes, special reference being made to cattle and pigs wastes. Results were given in detail."

A-334 Aitken, J.B. 1963. Manure disposal ponds. Qd. Agr. J., 89(10): 608-610. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 115.)
"This general article contained a reference to trials of a pond for piggery manure at Biloela Research Station. An allowance of 15 sq. ft of pond surface for each growing pig and 45 sq. ft for each sow and litter, the depth being 3-4 ft, was satisfactory, though larger allowances were recommended in areas of low winter temperature."

A-335 Inst. LandbBedrijfsgeb., Wageningen. 1962. Verslag over het jaar 1961. (Report for the year 1961.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 15. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 116.)
"This general report on work in progress referred to trials of mechanical muck removal in piggeries which showed promising results and to trials of slatted floors in piggeries which gave good results."

A-336 Strnad, A. 1961. Výzkum permanentní podestýlky ve výkrmnách a mechanizace odklizu hnoje z vepřínů. (Permanent litter in pigsties and the mechanisation of the removal of dung.) Kostelec nad Orlicí, Výzkumný ústav pro chov prasat ČSAZV. pp. 10-11. 32 ref. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 118.)
"Report on development of equipment for removing liquid from pig manure to make the solid residues suitable for composting and so eliminate the need for litter."

A-337 Mätzold, G. 1959. The possibilities of the mechanisation of the removal of farm-yard manure by means of tractors. Paper presented at Conf. Tech. Development Animal Production, Prague. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 119.)
"This general comparison of different methods of removing manure by means of tractors from cowhouses, cattleyards and piggeries included detailed figures in tabular form on the working times required."

A-338 W. Scot. Agr. College. 1962. Housing of pigs (manure disposal). Annual Report W. Scot. Agr. College. p. 51. (cited in Bibl. Farm Bldg. Res., Part I - Buildings for Pigs, 2nd Supplement, Abstr. No. 284.)
"Report on studies. A solid lying area and a slatted dunging area were preferred to a slatted lying-and-dunging area, particularly since the advent of floor feeding."

A-339 Temperton, H. 1961. Indoor lagoon solves the manure problems. Farming Express, No. 82: 24. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 1st Supplement, Abstr. No. 165.)

"Report on trials at Nebraska University. The lagoon system, whereby poultry droppings fall through a slatted floor into water in a pit below the floor, gave good results."

A-340 Owings, W.J. and J.L. Adams. 1961. Indoor lagoon for manure disposal. Pacific Poultry, October 1961. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 1st Supplement, Abstr. No. 166.)
"Report on trials at Nebraska University. Hens kept on a slatted floor over a lagoon produced more eggs and showed a better food conversion ratio but a higher mortality than birds housed on litter. The lagoon kept the slatted floor pen warmer in the winter than the litter pen. There was no smell from the lagoon."

A-341 Chambers, C.W. and N.A. Clarke. 1964. Health aspects of poultry waste disposal. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 193-212. 18 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 57.)
"Review of available information on the micro-organisms found in poultry and their waste products which cause illness in humans."

A-342 Warden, W.K. 1963. Poultry manure disposal. Poultry Digest, 22(254): 19-21. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 67.)
"This general article included references to the studies of indoor and outdoor lagoons and of methods and costs of disposal by drying, on which it was based."

A-343 Eby, H.J. 1964. Anaerobic lagoons - Theory and practice. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 77-91. 3 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 68.)
"This general paper contained references to the research on which it was based. It also gave an account of the performance of such a lagoon at the University of Maryland which was not entirely satisfactory."

A-344 Taiganides, E.P. 1964. Theoretical considerations of anaerobic lagoons for poultry wastes. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 251-261. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 69.)
"This paper summarised information presented at the symposium and referred to the results of research on the breakdown of manure, on conditions in lagoons and on their performance."

A-345 Morris, G.L. 1964. Extended aeration waste treatment plants. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 45-56. 3 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 70.)
"This general paper included a review of available information on the extent of the use and on the performance of this system and gave the results of a study on one installation."

A-346 Johnson, C.A. 1964. Liquid handling processes for poultry manure utilization. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 161-181. 10 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 71.)
"This case study of a heated septic tank system for poultry waste disposal included a review of available information on the design and performance of such systems."

A-347 Adams, J.L. 1964. Hydraulic manure systems. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 149-160. 2 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 72.)
"This general paper included a reference to trials which found that manure from high producing Leghorns contained 18 to 22% solids."

A-348 Ministry of Agriculture, Fisheries & Food, England and Wales. 1963. Handling manure in liquid and semi-liquid form. N.A.A.S. Tech. Rep., No. 13. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 73.)
"Report on survey. Quantities of poultry manure produced were found to average 6.2 gal. per 100 head per day. Equipment used, labour requirements and the fertiliser value of the material were determined. Advisory recommendations were given."

A-349 Dept. Scientific Industrial Res. 1964. Farm wastes. Water Pollut. Res. 1963. pp. 73-77. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 74.)
"Report on survey. The amount and type of wastes from dairy cows, pigs on slatted floors and poultry were determined in detail."

A-350 Ministry of Agriculture, Fisheries & Food, England and Wales. 1962. Manurial value of deep litter or battery manure. Rev. Great Ho. Exp. Husbandry Farm. p. 23. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 77.)
"Report on studies. The manurial value of deep litter after twelve months use was nearly equal to that of fertilisers of equal unit value. After five months use, it was less than half as effective, while the value of battery manure was about two-thirds that of fertilisers of equal unit value."

A-351 Adams, J.L. and W.J. Owings. 1962. Indoor lagoons for poultry manure disposal. Paper presented at 51st Annual Meeting Poultry Sci. Assoc. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 78.)
"Report on trials. Hens housed on slats over a lagoon gave better egg production but a higher mortality than those on a litter floor. After 16 months use the dry matter content in the lagoon was 11.7%."

A-352 Ludington, D.C. and A.T. Sobel. 1964. Hydraulic collection of poultry waste. Proc. 2nd Nat. Symp. Poultry Industry Waste Management, Nebraska Univ. pp. 115-135. 3 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 81.)
"This general paper included a report on laboratory tests to determine the effects of biological activity on the breakdown of manure at various

temperatures. Results were used to present data in the form of graphs and tables for the design and performance of indoor lagoons."

A-353 Charles, D.R., C.G. Payne and G.E. Lamming. 1963. Atmospheric ammonia and the performance of laying hens. Report School Agr., Notts. Univ. pp. 93-100. 6 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 120.)
"Report on experiments. Pullets kept at 65°F showed reduced egg production and liveweight gains in an atmosphere containing 100 ppm of ammonia and a few birds showed symptoms of kerato-conjunctivitis. At 50 ppm of ammonia only liveweight gains were reduced but egg quality was not affected by either ammonia concentrations. At 84°F the effects of ammonia were more marked, feed consumption was reduced and casualties showed symptoms of calcium deficiency. Respiration rates in chicks and laying hens were significantly reduced in an ammonia polluted atmosphere."

A-354 Winter, A.R. and E.C. Naber. 1958. The use of compost litter in chicken production. Avicultura Moderna: Proc. 11th World's Poultry Congress, Mexico. pp. 608-614. 27 ref. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 160.)
"Review of available information. It was concluded that the mortality of broilers brooded on compost was lower than that of broilers brooded on frequently changed litter. Compost litter provided riboflavin, vitamin B_{12}, protein and one or more unknown factors for growth. It kept houses warmer and floors drier than frequently changed litter and required less labour."

A-355 Wirth, H. 1960. Superphosphat beeinflusst Stallklima und Stallhygiene. (The influence of superphosphate on climate and hygienic conditions in the poultry house.) Dtsch. Geflügelw., 14(2): 24. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 261.)
"Report on trials. The addition of superphosphate to litter decreased air humidity, litter humidity, the level of ammonia and the number of coccidia and oocytes in the litter. It did not affect the performance of the hens."

A-356 Brook, H.T. 1963. Lagoon ends test year with profit. Poultry Farmer & Packer, 149(3844): 17, 21. (cited in Bibl. Farm Bldg. Res., Part III - Buildings for Poultry, 2nd Supplement, Abstr. No. 326.)
"Report on trials comparing the performance of laying hens on a slatted floor over a lagoon and on a slatted floor over a dry pit. The hens over the lagoon produced more eggs and showed a greater profit."

A-357 Pechert, H. 1957/58. Untersuchungen uber den Staubgehalt in verschiedenen Rinder-und Schweinestallen. (Investigations concerning the dust content in cattle and pig buildings.) Wiss. Z.F-Schiller Univ., Jena, 7(4/5): 529-537. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 59.)
"Report on experiments to determine the incidence of dust in livestock buildings. Results were given in detail in the form of tables. It was found that both the type of building and the enterprise which it served influenced the concentration of dust, farrowing houses and piggeries being over two and a half times as dusty as cowhouses during rest periods. Activity in the

buildings increased atmospheric dust five fold. A relationship between dust content and carbon dioxide was suggested, and the cleansing action of ventilation noted. The need for further investigation on the relation of dust and bacterial infection in dairy buildings was emphasised."

A-358 Hechelmann, H. 1954. Mechanische Entmistungssysteme. (Mechanical dung clearing systems.) Landtechnik, Munch., 9(18): 538. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 194.)
"Account of the various types of semi-mechanical, mechanical and automatic equipment for cleaning cowhouses, yards and boxes."

A-359 Simons, D. and F. Traphagen. 1957. Gerateeinsatz in der stallmistwirtschaft. (The use of implements in manure handling.) LandbForsch., Volkenrode, 7(2): 32-35. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 195.)
"Report on studies comparing different methods of handling solid and liquid manure. It was found that mechanical methods, on average, needed one third of the labour requirements of manual methods. Advisory recommendations were given."

A-360 Thurm, R. 1957. Die Kosten der Stallmistausbringung. (The cost of cleaning out cowsheds.) Dtsch. Agrartech., Berlin, 7(5): 221-222. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 200.)
"Report on economic comparison of cleaning cowhouses manually, by water and mechanically. Water cleaning was the cheapest, then mechanical and then manual cleaning."

A-361 National Agricultural Advisory Service. 1952. Machinery and labour in farmyard manure handling. N.A.A.S. Tech. Rep., No. 4. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 202.)
"Report on survey of methods used in manure handling. Certain sections were relevant to building design. The labour requirements of the different systems were given in detail, notably those dealing with equipment and loading methods used."

A-362 Torp, A. 1951. Anleggsutgifter og arlige kostnader for enkelte typer av gjodseloppsamlingsanlegg. (Construction costs and annual costs of different types of manure conservation devices.) Meld. Norg. LandbrHoisk., 31: 97-187. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 203.)
"Report on studies of various methods of conserving liquid and solid manure from cowhouses. Detailed figures were given in tabular form. In most cases the manure cellar and liquid manure tank were found to be the most economic method, though on level ground where manure losses were slight and for small cowhouses a liquid manure tank alone was more economic."

A-363 Turner, R., R. Alexander, W. Wilson and R. Forsyth. 1952. Report of Committee investigating the use of liquid manure on farms. W. Scot. College Ag. 14 pp. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 205.)
"Report on survey. It was found that most of the equipment used was old-fashioned and that the liquid was applied to grassland. The chemical analysis

of the liquid, farmers' opinions on its use and costs of the system were reported. Improved methods were suggested."

A-364 National Agricultural Advisory Service. 1953. Handling liquid manure. N.A.A.S. Tech. Rep., No. 6. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 206.)
"Report on survey of methods used in liquid manure handling. Some sections, notably those on equipment and methods used, were relevant to building design. The labour requirements of the different systems were given in detail."

A-365 Turner, R., R. Alexander, R. Forsyth and R. Matthews. 1955. Second report of Committee investigating the use of liquid manure on farms. W. Scot. College Agr. 6 pp. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, Abstr. No. 207.)
"Report on studies comparing suitability of different types of pump for liquid manure systems. The centrifugal type was preferred for true liquids, the helical screw type for heavy sludge. Report on studies on methods of spreading liquid manure on dungheaps. A covered dungstead and plentiful straw or other carbon-rich material were regarded as essential prerequisites. It was suggested that crushing or chopping straw might enable it to absorb more liquid."

A-366 Ádám, T. 1960. Adatok a nyitott és zárt tehénistállók levegőjének összetételéhez. (Data on the air composition of open and closed cowhouses.) Allattenyesztes., Budapest, 9(3): 271-278. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 58.)
"Report on studies comparing in detail the carbon dioxide, ammonia and hydrogen sulphide content of the air in a cowhouse and in a covered, enclosed yard. The carbon dioxide content and ammonia content of the air of the cowhouse were generally greater than that of the air of the yard. The atmosphere in the cowhouse required improvement by ventilation, while air in the yard was almost entirely free of injurious gases. Figures of 3% CO_2 (German standard) and 0.026% NH_3 (Soviet standard) in the atmosphere in cowhouses were recommended."

A-367 Cjajkowskiasi, Z. and L. Ugorski. 1954. (Microbiology of air in farm buildings.) Med. Vet. Varsovie, 10: 320-324. 23 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 62.)
"Report on studies. Bacterial and fungal counts in stock buildings were determined in detail."

A-368 Venkrbec, L. 1961. K Otázkám úsporného podestýlání ve volných stájích pro skot. (On the problem of reducing the straw requirements of cattle yards.) Sbor. čsl. Akad. Zeměd. Věd: Zeměd. Tech., 7(4): 321-332. 4 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 102.)
"Report on studies. The efficiency of slatted floors was investigated and they were recommended for areas which produced little straw. Methods of reducing straw requirements by proper management were studied. The manurial value of yard dung was about a third greater than that of cowhouse dung. The labour requirements of the cowhouse system per ton of dung were nearly

twice as high as those of the yarding system."

A-369 Ruder, F. 1952. Der Einfluss der Art der Jaucheabführung auf den Ammoniakgehalt der Stalluft. (The effects of drainage on the ammonia-content of air in cattlesheds.) Inaug. Diss. Munich. 44 pp. 127 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 156.)

"Report on studies. The proportion of ammonia in air in cowhouses with open channels was lower than that in cowhouses with wholly covered channels or with channels covered with slatted covers."

A-370 Kalinnikov, V.G. and N.P. Chistov. 1953. (Concentration of ammonia and hydrogen sulphide in cowhouses during continuous housing of the cattle.) Sborn. Trud. Leningr. nauch.-issled. vet. Inst., 5: 115-120. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 162.)

"Report on trials. The ammonia content of air in cowhouses did not alter much seasonally. The content of hydrogen sulphide was higher in spring than in winter. An ammonia content of 0.026 parts per 1000 and a hydrogen sulphide content of 0.01 parts per 1000 were recommended."

A-371 Kalinnikov, V.G. and N.P. Chistov. 1953. (Concentration of ammonia and hydrogen sulphide in the cowhouse during summer.) Sborn. Trud. Leningr. nauch.-issled. vet. Inst., 5: 121-124. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 163.)

"Report on survey. The concentration of hydrogen sulphide in cowhouses in the summer was found to be too high. Methods of controlling this were discussed."

A-372 Heim, M. 1959. Vereinfachte Düngerwirtschaft. (Simplified manure handling.) Landtechnik, Munch., 14(17): 549. 4 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 185.)

"To reduce or obviate the need for straw litter in cowhouses, a grating with a mesh of 1.6 by 4.7 in. was placed over the dung channel having a 2% fall. Every 2 - 3 days a sluice gate at the lower end of the channel was opened and the contents fed by gravity into a mixing well. The liquid manure was then pumped to a storage pit."

A-373 Martinot, R. 1960. Nettoyage mécanique ou nettoyage hydraulique de l'étable entravée. (Mechanical or hydraulic cleaning of cowhouses.) Génie Rural, 53(10): 421-424. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 186.)

"Report on trials. The costs of various mechanical and hydraulic methods of cleaning cowhouses, including slatted dunging channels were compared in detail."

A-374 Forsyth, R.J. and J. Walker-Love. 1961. Manure disposal from byres in Western Germany. Farm Bldg. Assoc. J., No. 5: 123-127. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 188.)

"This general description of the 'Holz' manure disposal system contained a reference to trials at the Max-Planck Institute suggesting that a panel consisting of metal T-bar sections provided the best form of grating over the channel behind the cows."

A-375 Pobric, F. and A. Licina. 1959. (A contribution to the study of cattle stables in Bosanka Posavina.) Veterinaria, No. 4: 683-691. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 1st Supplement, Abstr. No. 487.)
"Report on survey. Materials used in the construction of stables were satisfactory, but the construction and interior design were poor. Hygienic conditions and facilities for drainage and manure removal were poor."

A-376 Iwanoff, P. 1963. Die Offenstallhaltung von Rindern in Bulgarien. (The loosehousing of cattle in Bulgaria.) TagBer. Dtsch. Akad. Landw-Wiss., Berlin, No. 59: 37-46. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 29.)
"This general paper included references to trials at the Zootechnischen Fakultät, Sofia, showing that loose housed calves gave as good performance, taking winter and summer together, as conventionally housed calves and to trials at the Institut für Tierzucht in Kostinbrod showing that temperatures down to 5°F had no harmful effect on milk production. The heat and ammonia output of the manure pack were determined."

A-377 Ádám, T. 1962. Újabb adatok a nyitott és zárt tehénistállók összehasonlító klimatikus vizsgálatáról. (Recent data on the comparative climatic examination of open and closed cowbarns.) Állattenyésztés, Budapest, 11(1): 33-41. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 47.)
"Report on trials. Temperature was more even in the cowhouse than in a yard. In autumn and winter relative humidity was higher in the yard than in the cowhouse. This was ascribed partly to the accumulation of manure there. Air speed averaged 0.92 ft per sec. in the yard, 0.82 in the cowhouse."

A-378 Mann, C.W. 1963. Disposal of farm wastes. Sanitarian, 71(12): 518-525. 7 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 143.)
"Review of available information, including a section on lagoons."

A-379 Wheatland, A.B. and B.J. Borne. 1964. Treatment of farm effluents. Chem. Industry, Feb. 1964. pp. 357-362. 7 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 144.)
"Account of the sources and magnitude of the farm waste problem, including reference to laboratory studies of the polluting potential of farm wastes and of methods of disposal."

A-380 Sparrow, T.D. 1964. The disposal of farm effluent: some observations and costs. Farm Management Notes, No. 32: 31-37. 7 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 149.)
"This article summarised in tabular form analyses of the manurial value of effluents from pigs, poultry and cattle. The costs of various methods of storage and disposal for a hypothetical dairy herd were compared using data

obtained from a field survey and published literature."

A-381 Hart, S.A. 1964. Sanitary engineering in agriculture. Compost Science, 4(4): 11-15. 15 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 150.)
"Review of available information on the collection, storage, management, processing and utilisation of manure, including information on the lagoon system."

A-382 Taiganides, E.P., E.R. Baumann and T.E. Hazen. 1963. Sludge digestion of farm animal wastes. Compost Science, 4(2): 26-28. 12 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 152.)
"Review of available information."

A-383 National Agricultural Advisory Service. 1962. Report on slurry removal from cowyards and sheds. N.A.A.S. Milk Group, Dec. 1962. 32 pp. 9 ref. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 155.)
"Report on survey and trials. The problem was stated, and ways of minimising it discussed. Methods of removing and storing slurry were described and tested. Findings, including findings on labour saving layouts and slurry storage tank dimensions, were given in advisory form."

A-384 Ministry of Agriculture, Fisheries & Food, England and Wales. 1963. Handling manure in liquid and semi-liquid form. N.A.A.S. Tech. Rep., No. 13. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 156.)
"Report on survey. Undiluted dairy manure averaged 5.1 gall. per head per day. Equipment used, labour-requirements and the fertiliser of the material were determined. Advisory recommendations were given."

A-385 Yalan, E. 1964. Beef cattle slatted floor yard. Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 24: 122-127. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 160.)
"This general paper included a reference to trials showing that the cost of removing and spreading solid dung was 50% higher than the cost of removing and spreading semi-liquid sludge. . . ."

A-386 Wander, J.F. 1964. Der Seilzug als Mehrzweckgerät beim Transport von Dung und Silage. (A rope-haulage system for handling dung and silage.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 24: 45-54. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 161.)
"Report on development of such a system. Results were promising."

A-387 Ministry of Agriculture, Fisheries & Food, England and Wales. 1963. Evaluation studies of manurial value of slurry on grassland. Rep. Trawscoed Exp. Husbandry Farm. p. 25. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 170.)
"Interim report on trials, showing that nitrogen in cow slurry is 96% as efficient as nitrogen in sulphate of ammonia."

A-388 Leuthier. 1961. Probleme der Abwasserbeseitigung und Abwasserverwertung im Rahmen der Offenstallhaltung bie Rindern. (The problem of effluent disposal in the loose housing system.) Dtsch. Landw., Berlin, Sonderheft, 12: 17-20. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 172.)
"This general paper included a reference to trials at Bernburg Institut für Agrarökonomie, showing that loose housed cows spent, on average, 14 hours per day in the yards and 10 in the feeding area. The importance of this in planning slurry disposal systems was noted."

A-389 Ministry of Agriculture, Fisheries & Food, England and Wales. 1962. Effects of different types of farmyard manure on yields of hay. Report Trawscoed Exp. Husbandry Farm. pp. 9-10. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 173.)
"Interim report on trials of manure from a straw yard, a sawdust yard, and from slatted floors for cows and for calves. The calf manure gave the best results, then strawyard manure, then sawdust yard manure."

A-390 Ministry of Agriculture, Fisheries & Food, England and Wales. 1963. The effect of different types of farmyard manure on yields of hay. Report Trawscoed Exp. Husbandry Farm. pp. 10-11. (cited in Bibl. Farm Bldg. Res., Part IV - Buildings for Cattle, 2nd Supplement, Abstr. No. 174.)
"Report on trials. Manure from slatted calf pens gave the best yields. Dung from slatted floor systems gave better yields than dung from yards littered with straw or wood shavings. But solid types of manure had more effect on the aftermath than the slurry type of manure from slatted floor systems."

A-391 Sutter, A. Undated. Problems of waste effluent from silage. Project Europ. Prod. Agency, Organization for European Economic Co-operation, No. 307. pp. 74-82. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, Abstr. No. 102.)
"Review of available information on this subject, of methods of minimising seepage and of preventing it from polluting the soil and drainage water."

A-392 Jones, E. and J. Murdoch. 1954. Polluting character of silage effluent. Water Sanit. Eng., London, 5(2): 54-56. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, Abstr. No. 105.)
"Report on trials to determine the volume and composition of seepage from silage. It was found that the effluent was some 220 times as polluting as settled domestic sewage. When the dry matter content of the crop ensiled was near 25% the amount of seepage was greatly reduced. When it was 30% there was little or no seepage. Elimination of seepage by protecting the silage from rain and by ensiling crops of high dry matter content, which can be secured by wilting in the field, was recommended."

A-393 Moore, W. and H.F. Walker. 1961. The disposal of silage effluent. Farm Bldg. Assoc. J., No. 5: 79-82. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, 1st Supplement, Abstr. No. 122.)
"This general article contained reference to a formula developed by Sutter of Switzerland for calculating the volume of effluent from a silo."

A-394 Hamilton, W.D. 1960. Silos and silage effluent. Scot. Agr., 40(2): 80-82. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, 1st Supplement, Abstr. No. 123.)
"Report on studies. Figures for silage effluent under different conditions were determined. The importance of protecting the walls of concrete silos against chemical action was shown and advisory recommendations on methods of protection, based on research findings, were given."

A-395 Purves, D. and P. McDonald. 1962. The potential value of silage effluent. Exp. Work Edinburgh School Agr. pp. 57-58. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, 2nd Supplement, Abstr. No. 107.)
"Report on studies. Silage effluent was found to be a useful source of plant nutrients and, in general, it was superior to Gülle in manurial value."

A-396 Baines, S. 1964. Some aspects of the disposal and utilisation of farm waste. Symposium River Pollut. Prevention, Scot. Branch Inst. Sewage Purification, Edinburgh. pp. 29-44. 39 ref. (cited in Bibl. Farm Bldg. Res., Part VI - Buildings for the Processing and Storage of Fodder, 2nd Supplement, Abstr. No. 109.)
"This general paper reviewed available information on the monetary and fertiliser value and methods of disposing of animal wastes and the requirements and methods for purification of general farm wastes. Special reference was made to the problem of silage effluent and detergent and toxic chemicals."

A-397 Organization for European Economic Co-operation. 1954. Manures and fertilisers. Potential progress in Europe. Paris, O.E.E.C., May, 1954. 117 pp. (cited in Bibl. Farm Bldg. Res., Part VII - Miscellaneous Items, 1st Supplement, Abstr. No. 30.)
"This general publication included the report of a survey of methods of conserving liquid and solid manure in Western Europe and the fertiliser value of the manure thus conserved. The economies of conserving liquid manure were discussed."

A-398 Dölling, M. 1959. Untersuchungen über das Abschwemmen von Stallmist in Kanalrohrleitungen. (Investigations into the removal of manure by swilling down into a pipe system.) Arch. Landtech., 1(1): 8-38. 13 ref. (cited in Bibl. Farm Bldg. Res., Part VII - Miscellaneous Items, 1st Supplement, Abstr. No. 34.)
"Report on trials. Results were given in detail. The depth of sludge in the pipe and not the sludge velocity or pipe gradient was found to be the factor that determined the weight of manure that could be rinsed immediately. Egg-shaped pipes allowed the removal of larger pieces of manure than circular pipes."

A-399 Schollhorn, J. 1955. (Investigations into the effect of Gülle of different storage and different dilutions.) Z. Acker-u. PflBau, 100(2): 211-238. (cited in Bibl. Farm Bldg. Res., Part VII - Miscellaneous Items, 1st Supplement, Abstr. No. 38.)
"Report on studies undertaken by the Institut für Pflanzenbau und Pflanzenzüchtung, Hohenheim and the Staatliche Versuchsanstalt für Grünlandwirtschaft und Futterbau, Antendorf. The quantity and composition of the Gulle manure conserved and used on farms was determined. Losses of nutrients in storage

were small. Recommendations on the storage and use of this type of manure were given."

A-400 Dept. Scientific Industrial Res. 1962. Waste waters from farms. Notes on Water Pollut., No. 17, June issue. 11 ref. (cited in Bibl. Farm Bldg. Res., Part VII - Buildings for Sheep and Miscellaneous Items, 2nd Supplement, Abstr. No. 95.)
"Review of available information on farmyard sewage, silage liquors and toxic chemicals, including sheep dips, and other farm wastes."

A-401 Schwartz, K. and Höde. 1963. Die Ausbringung und Ausnutzung des wirtschaftseigenen Düngers in Form der Gülle. (Conveyance and utilisation of farmyard manure in Gülle form.) Dtsch. Landw., Berlin, 14(7): 355-357. 21 ref. (cited in Bibl. Farm Bldg. Res., Part VII - Buildings for Sheep and Miscellaneous Items, 2nd Supplement, Abstr. No. 108.)
"Review of available information."

A-402 Heckl, R. 1963. Güllewirtschaft in Österreich. (The Gülle system in Austria.) TagBer. Dtsch. Akad. LandwWiss., Berlin, No. 59: 123-136. (cited in Bibl. Farm Bldg. Res., Part VII - Buildings for Sheep and Miscellaneous Items, 2nd Supplement, Abstr. No. 109.)
"This general paper included references to research findings. In the subsequent discussion on p. 132-133, E. Holke reported trials showing that the conservation of manure was economic.

A-403 Nienhaus, A. 1960. Untersuchung der Wirtschaftlicheit von Güllebetrieben in den Höhengebieten Nordrhein Westfalens. (Trials of the Gülle system in the mountainous areas of Nordrheim Westfalens.) Inaug. Diss. Bonn Univ., Nov., 1960. 249 pp. 138 ref. (cited in Bibl. Farm Bldg. Res., Part VII - Buildings for Sheep and Miscellaneous Items, 2nd Supplement, Abstr. No. 113.)
"Report on survey and trials of this system. Output, handling equipment and agricultural use of the liquid were investigated."

A-404 Ministry of Agriculture, Fisheries & Food, England and Wales. 1964. Farm effluents. A study of the subject carried out in the West Midlands 1963-4. N.A.A.S., West Midland Region. 20 pp. 17 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 15.)
"Review of available information on the manurial value of slurry and silage effluents, including information from trials undertaken by the N.A.A.S. in the West Midlands. Advisory recommendations on storage and disposal were given."

A-405 Jordbrukstek. Inst. 1965. (Annual report for 1964-65.) Medd. jordbrukstek. Inst., Uppsala, No. 313. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 19.)
"This general report included sections on haydrying, the airtight storage of grain, potato storage, manure handling and gas concentrations in livestock buildings."

A-406 Fiala, J. 1965. (The friction of agricultural materials.) Zem. Techn., 11(4): 205-220. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 20.)

"Report on experiments. The coefficients of friction of manure, compost, silage and haylage were determined. In general, the coefficients were higher in the rest position than in movement."

A-407 Inst. LandbBedrijfsgeb. 1965. Verslag over het jaar 1964. (Report for the year 1964.) Publ. Inst. LandbBedrijfsgeb, Wageningen, No. 26. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 55.)
"The flush-out system of manure removal presented difficulties in houses for dry sows. ...Growth rate was higher and feed conversion better in a Danish type house than in a piggery with an outside dung passage. ... Designs for slats for dung channels were developed. . . ."

A-408 Berryman, C. 1965. Composition of organic manures and waste products used in agriculture. N.A.A.S. Advisory Paper No. 2. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 58.)
"A summary in tabular form of plant nutrient analyses, carried out by the Ministry of Agriculture, of pig, poultry and cattle manures from different sources and subjected to different storage treatments."

A-409 Water Pollution Research Board. 1965. Farm Wastes. Water Pollut. Res. 1964. p. 103. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 60.)
"Report on studies of the volume and composition of farm wastes from dairy, pig and poultry farms. Results were given in tabular form."

A-410 Water Pollution Research Board. 1965. Treatment of piggery effluent. Water Pollut. Res. 1964. pp. 103-106. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 64.)
"Report on study of the performance of a biological treatment plant treating piggery waste by filtration and recirculation of the effluent. A considerable degree of purification was achieved, but it was difficult to produce an effluent conforming with the usual requirements for discharge to a river. Report on study of the treatment of piggery waste by the activated sludge process. It was concluded that performance in 31 litre laboratory scale plants was best at a loading of 12 lb. B.O.D./1000 cu. ft./day."

A-411 Hoffmann, H. 1965. (Air analysis comparison of fattening houses containing various numbers of pigs.) Mh. VetMed., 20(7): 241-253. 61 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 67.)
"Report on studies. The chemical composition of the atmosphere in three piggeries was determined in detail. For houses containing over 300 pigs artificial ventilation was necessary. When pens were not used, groups of 80 to 150 pigs were recommended. Larger groups were not recommended."

A-412 Comberg, G. 1964. General requisites of breeding and fattening pigs as to climatic and sanitary conditions. E.A.A.P. Commission on Pig Production, Lisbon, Ref. Annex 10, No. 1613/64. 14 pp. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 70.)
"This general paper included references to studies of gas concentrations in piggeries with slatted floors."

A-413 Comberg, G. 1965. (Management and feeding systems for pigs.) Bauen

a. d. Lande, 16(1): 1-5. 1 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 71.)
"This general paper contained figures from studies of the gas concentrations in the air of slatted floor piggeries. Increases in the NH_3, H_2S and CO_2 content of the air during removal of the manure were noted."

A-414 Reinhold, J. and H. Hölscher. 1965. (Manure handling in piggeries.) Dtsch. Landw., Berlin, 16(12): 494-497. 7 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 72.)
"Report on trials of a slatted floor system. Results were satisfactory. The problem of gas concentrations in such piggeries was discussed and evidence on it summarised."

A-415 Grub, W., C.A. Rollo and J.R. Howes. 1965. The effects of humidity, light and various litter materials upon the atmospheric dust in poultry chambers. Paper presented at 54th Annual Meeting Poultry Sci. Assoc. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 197.)
"Report on trials. Atmospheric dust declined during darkness and was inversely correlated with humidity. It was directly associated with the age of the litter, probably because of fragmentation. Increasing quantities of dust were produced by fresh shavings, peat, old shavings, fresh sawdust, old sawdust and clay in that order."

A-416 Johnson, C.A. 1965. Liquid handling processes for poultry manure utilization. Compost Science, 5(3): 18-21. 14 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 212.)
"This general paper included a case study of an integrated liquid manure handling system and references to the research on which it was based."

A-417 Charles, D.R. and C.G. Payne. 1964. The effects of ammonia on the performance of laying hens. Paper presented at Meeting of World's Poultry Sci. Assoc., Bologna. 4 pp. 2 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 281.)
"Report on trials. At 64.4°F, egg production was decreased slightly when the ammonia content of the air was 50 p.p.m., significantly when it was 100 p.p.m. At 82.4°F, birds exposed to ammonia in the atmosphere ate less than birds not so exposed. Exposure to ammonia during the rearing period reduced growth rate."

A-418 Charles, D.R. 1965. The effects of atmospheric ammonia on the performance of laying hens. Paper presented at U.K. Branch Meeting World's Poultry Sci. Assoc., London. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 282.)
"Report on trials. 100 p.p.m. of ammonia in air significantly reduced egg production after 10 weeks at 64.4°F. At 82.4°F the same concentration caused a 13% reduction in 7 weeks. Pullets reared in polluted atmospheres matured later than controls. The physiological reactions of birds to ammonia pollution were noted, including diminished appetite. A diet designed to maintain nutrient status when consumed in depressed quantities maintained production despite continued exposure to ammonia."

A-419 Thomson, J.M. and J.K. Hall. 1965. Slurry handling on the College Farm, Auchincruive. Scot. Agr., 44(4): 228-231. (cited in Bibl. Farm

Bldg. Res., 1965 Supplement, Abstr. No. 362.)
"This general article included figures on the labour requirements of spreading slurry from below slatted passageways in a dairy installation and an analysis of the chemical composition of the slurry which showed 0.22% nitrogen, 0.09% phosphate and 0.20% potash."

A-420 Water Pollution Research Board. 1965. Performance of treatment plants. Water Pollut. Res. 1964. p. 103. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 363.)
"Report on studies of the treatment of waste waters from dairy buildings and loose boxes in an extended-aeration plant and an experimental contact-stabilisation plant. Results were given in tabular form."

A-421 Water Pollution Research Board. 1965. Dewatering of certain farm slurries. Water Pollut. Res. 1964. pp. 106-108. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 364.)
"Report on study of methods of dewatering slurries from dairy farms. Drainage and evaporation were too slow for the drying bed system to be satisfactory. The use of aluminium chlorohydrate increased the rate of drainage, but the amount of moisture removed was only half that required to increase the solids content to that required for handling by standard farm equipment. A filter press was technically feasible but too complex for use on farms. The required type of cake could be produced from a simple form of plant used in dewatering sewage, but it would still be necessary to dispose of the filtrate containing nearly 2% suspended solids."

A-422 Velebil, M. 1965. (Study of some parameters for the calculation of mechanical systems for the removal of manure from cowsheds of the loose-housing type.) Zemĕd Tech., 11(7): 403-415. 13 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 367.)
"Report on trials. It was found that the removal of manure was associated with a fall in milk production. It was recommended that the period of manure removal should not exceed two days."

A-423 Hilliger, H.G. 1964. (Carbon dioxide content of the air in a cowshed.) Zentbl. VetMed., 11B: 617-632. 27 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 400.)
"Report on studies using an infra-red analyser to record the CO_2 content of the air in a cowhouse. Results were related to the air temperature and metabolism of the animals. The air changes in the cowhouse were calculated from the CO2 levels."

A-424 Verheyden, V. 1965. Hydraulic manure handling in cattle housing. Paper presented at Sect. II, Commission International du Genie Rural Seminar, Cambridge. 5 pp. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 403.)
"Report on survey of the slatted dung channel system in cowhouses. Practice was recorded in detail. Nearly all the farmers questioned were satisfied with the system. The use of a vacuum tanker was regarded as essential."

A-425 Lommatzch, R. 1965. (Experimental cow stall for cattle with slatted dung channel.) Dtsch. Agrartech., 15(10): 450-451. 6 ref. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 404.)

"Report on trials of a litterless cowhouse with a slatted dung channel. Results were promising."

A-426 Ekesbo, I. 1964. (Hygiene and animal health in cowsheds having flowing manure disposal.) Svensk. VetTidn., 16: 358-363. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 405.)
"This general paper contained references to a survey conducted by the Veterinary High School showing that damage by teat-treading was higher in cowhouses with slatted dung channels than in conventional cowhouses. It was markedly less in loose housing systems."

A-427 Bengtsson, G., I. Ekesbo and S.O. Jacobsson. 1965. (An outbreak of disease in cattle, presumed to have been chronic hydrogen sulphide poisoning.) Svensk. VetTidn., 17: 248-254. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 409.)
"Report on a case study. Cows housed in a modern building with slatted floors over an incompletely functioning underfloor channel system of drainage and with poor ventilation showed symptoms thought to be due to hydrogen sulphide poisoning. Some animals died and others had to be slaughtered."

A-428 Ádám, T. 1964. (Some bioclimatic aspects of rearing calves.) Arch. Tierzucht, 7: 409-418. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 455.)
"Report on studies. Physiological stress was least in calves kept at between 59 and 77°F for the first six days of life. Those in open pens at temperatures below freezing required more feed and used it less efficiently than those housed. Excessive heat and high concentrations of ammonia and carbon dioxide in housing reduced weight gains and feed efficiency."

A-429 Miller, W.J. and C.M. Clifton. 1965. Factors affecting seepage losses in silage preservation. Paper presented at Annual S. Div. Meeting, Amer. Dairy Sci. Assoc., Dallas. (cited in Bibl. Farm Bldg. Res., 1965 Supplement, Abstr. No. 557.)
"Report on trials with tower silos. Seepage losses were determined. Moisture content was found to be the most important determinant of seepage losses. Reference was made to a review of available information on seepage losses from silos."

A-430 Ruml, M. and S. Haš. 1966. (The influence of mechanisation on the dust content and aerial microflora content in livestock buildings.) Zemĕd. Tech., 12(11/12): 750-754. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 21.)
"Report on trials. High levels of dust and microflora were found in livestock buildings. Daily changes in these were determined and their harmful effects on piglets shown."

A-431 Rose, T.H. 1966. The agricultural value of farm effluents. Paper No. 11 in Farming and Estate Management the Future. Tech. Rep. Agr. Land Service, Minist. Agr., London, No. 9: 91-101. 19 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 24.)
"Review of available information on the production, composition and manurial value of animal wastes."

A-432 Samuelsson, S. 1966. (Liquid manure containers.) Rep. St. LantbrByggFörs., Lund, No. 203. 15 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 30.)
"Review of available information."

A-433 Muirthille, C.O. 1965. The purification of effluent. Res. Rep. Rural Econ. Div., Agr. Inst., Dublin. pp. 58-59. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 34.)
"Interim reference to studies. A comparison of the costs of six conventional systems of sewage purification showed that the lagoon was by far the cheapest, at something over £5 per pig or £15 per cow. It was concluded that area requirements were one acre per 150 pigs or 50 cows, skill was needed in its operation and the quality of effluent would not always be satisfactory. An oxidation ditch worked satisfactorily for domestic sewage, milking parlour and collecting and exercising yards washings after modifications had been made to prevent the overflow of sludge and surface debris."

A-434 Lips, J. 1966. (The mucking out of livestock buildings and spreading on fields.) XIIIth Congress Int. Organization Sci. Travail Agr., Brux. pp. 467-485. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 35.)
"Report on studies of various methods of hand and mechanised mucking out. Results were given in tabular form. Mechanical and automatic methods of handling solids decreased labour requirements by 50%, handling as a slurry by 90%, but mechanical scrapers were the only mechanical means which were cheaper than hand cleaning. Slurry systems were generally more economical than mechanical scrapers. From an ergonomic point of view, handling manure as a slurry was the most satisfactory."

A-435 Baumann, E.R. and J.L. Cleasby. 1965. Oxygenation efficiency of a bladed rotor. Paper presented at 57th Nat. Meeting Amer. Inst. Chem. Eng. Minn. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 38.)
"Report on trials. The oxygenation efficiency of a paddle wheel type of rotor for aerating an oxidation ditch was determined and found to be much greater than a hypothetical diffused air type of aerator."

A-436 Dale, A.C., W.H. Friday, P.E. Johnson, R.C. Dobson, H.W. Jones and W.H. Morris. 1966. Review of swine waste management. Paper presented at 46th Annual Indiana Swine Day, Purdue Univ. 3 pp. 5 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 62.)
"Review of available information."

A-437 Hazen, T. 1966. Current research on swine waste disposal. Paper presented at 9th Nat. Pork Industry Conf., Waterloo, Iowa. 8 pp. 25 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 63.)
"Review of available information on the properties of farm wastes and methods of treatment. Sections on lagoons and oxidation ditches were included."

A-438 Day, D.L. 1966. Research on waste management methods. Paper presented at Illinois Swine Growers' Day, Illinois Univ., No. AS-633e. 5 pp. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 65.)

"Report on studies. Treatment of the slurry under slatted floors with lime or calcium or sodium hypochlorite and then filtering through a sandbed markedly reduced the BOD value of the wastes. Gases and odours in the enclosed building were effectively prevented and filtering could greatly reduce the load on a lagoon as well as providing solids of significant fertiliser value.
Report on laboratory tests of the process employed in the oxidation ditch, which indicated that liquid wastes could be satisfactorily stabilised. The process was odourless and did not attract flies and the remaining solids were stable and easily dewatered. The final effluent had a BOD of 12-20 p.p.m. Design requirements for a treatment plant were given as 6 cu. ft of con tainer space and 2,500 cu. ft of air per lb. of BOD at 3% efficiency of oxygen utilisation."

A-439 Poelma, H.R. 1966. (Biological destruction of the liquid manure of pigs.) Landbouwmechanisatie, No. 17.05: 495-497. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 69.)
"Report on trials of systems of slurry disposal, including the oxidation ditch system. Results were promising."

A-440 Inst. LandbBedrijfsgeb. 1966. Verslag over het jaar 1965. (Report for the year 1965.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 29. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 73.)
"... Experiments with an oxidation ditch for purifying pig slurry gave satisfactory results. ...Welded bar grids gave better performance than cast iron grids for covering dung channels. Cubicles were improved by the use of a thick layer of sawdust and by the development of double R-shaped stall divisions. ...Air inlets in the floor produced almost draught free ventilation and the addition of some 6 in. of water to the dung channel markedly reduced smells."

A-441 McKinney, R.E. and K. Newton. 1966. Controlling odours and the reduction of swine wastes by the use of oxidation ditches. Paper presented at 9th Nat. Pork Industry Conf., Waterloo, Iowa. 5 pp. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 74.)
"Interim report on studies of the performance of oxidation ditches for fattening piggeries and sow houses. Results were promising though the BOD value of the effluent was not low enough for discharge directly into streams or drains."

A-442 Butler, R., J. Parsons and R. Wirtz. 1964. Waste disposal on hog farms. Official Bull. N. Dakota Water Works Sewage Conf., 32(4): 12,24. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 76.)
"Report on trials at North Dakota State University of a pig lagoon. Preliminary results indicated that lagooning reduced the BOD value by 89%."

A-443 Berry, E.C. 1966. Principles involved in the reduction of swine wastes. Paper presented at 9th Nat. Pork Industry Conf., Waterloo, Iowa. 3 pp. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 78.)
"This general paper included reference to studies of temperatures in open air pig and poultry manure lagoons at different times of the year."

A-444 Berglund, S. 1966. (Liquid versus solid manure from the labour point of view.) LandbrBygg. St. ByggeforsknInst., Kbh., No. 23: 70-75. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 80.)
"This paper was based on studies at several Swedish research organisations and included in tabular form the work content and capital and labour costs of different methods of manure storage and disposal. In discussion on p. 80, P. Keller (Denmark) presented a formula for calculating the work content of different methods of mucking out cowhouses, and data on the manure production and work content of cleaning out conventional and slatted floor piggeries. On pp. 80-81, J. Borup (Denmark) reported studies of the composition of the atmosphere in a piggery where cases of hydrogen sulphide poisoning had occurred.

A-445 Comberg, G. and H.F. Wolfermann. 1966. (Further investigation into the problem of harmful gases in the atmosphere of slatted floor piggeries.) Bauen a. d. Lande, 17(2): 46-49. 2 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 82.)
"Report on trials. The carbon dioxide, ammonia and hydrogen sulphide content in slatted floor piggeries did not reach critical levels in properly ventilated houses while the slurry was in storage. Pumping out the slurry without previous agitation caused an increase in the gas content but not to a critical level. Agitation of the slurry to homogenise it caused a dangerous increase of hydrogen sulphide. Agitation before emptying was not recommended."

A-446 Nickolić, M., I. Puhač, A. Sreckovič, N. Šijački and O. Pavlović. 1966. Influence of different environmental conditions upon growth, food conversion, carcass quality and physiological constants of fattening pigs. Sci. Programme & Abstr. 9th Int. Congress Anim. Prod., Edinburgh. p. 51. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 84.)
"Report on trials. Pigs at an average temperature of 65.7°F and an average relative humidity of 96% and average carbon dioxide and ammonia concentrations of 0.20% and 68 ppm respectively gave similar performance to pigs at an average temperature of 51°F, an average relative humidity of 88% and average carbon dioxide and ammonia concentrations of 0.06% and 46 ppm respectively. When the former group was exposed to a temperature of 91.4°F, a relative humidity of 100% and concentrations of carbon dioxide and ammonia of 0.70% and 89 ppm respectively, they showed lower daily weight gains and poorer feed conversion."

A-447 Wolfermann, H.F. 1966. (Carbon dioxide, ammonia and hydrogen sulphide content of the air in pig fattening houses.) Schweinezucht u. Schweinemast, 14(10): 226-229. 2 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 85.)
"Summary of trials to determine the concentrations of these gases in piggeries with slurry pits under the building where the slurry was stored for different lengths of time and agitated by different means. Results were given in tabular form. It was concluded that prolonged storage and disposal without agitation of the slurry did not cause a dangerous accumulation of poisonous gases, but that agitation of slurry in pits in the house or connected with the house should be avoided. The importance of good ventilation was noted."

A-448 Selyansky, V.M. 1966. Gaseous exchange, heat production and water metabolism in birds. Proc. 13th World's Poultry Congress, Kiev. pp. 275-279. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 191.)

"Report on experiments. The maximum and minimum daily production of heat, carbon dioxide, water vapour and water in droppings of chickens, ducks and geese of all ages were determined and presented in tabular form. Reference was also made to determinations of the concentration of ammonia, hydrogen sulphide and carbon dioxide in houses with poor ventilation, and their effects on bird health."

A-449 Purchase, H.G., B.R. Burmester and I. Kudych. 1966. The influence of environment on avian leucosis. Vet. Rec., 79(6): 160-162. 9 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 193.)

"Report on trials of the comparative incidence of this disease in 'clean' and 'dirty' accommodation. Reference was made to the possibility of dirty litter harbouring the leucosis virus."

A-450 Popov, A.A. 1966. Hygienic estimation of hen management systems. Proc. 13th World's Poultry Congress, Kiev. pp. 496-499. 6 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 195.)

"Report on studies of disease and parasitism in hens on deep litter, the fauna of deep litter and the microclimate in deep litter houses. It was concluded that litter did not provide an environment in which parasitic and disease organisms could thrive and that there was little difference in mortality between cage and litter systems."

A-451 Hilliger, H.G. 1966. (Formation of gases in poultry houses from deep litter and dropping pits.) Arch. Geflügelk., 30: 69-86. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 199.)

"Report on studies on six month old deep litter which had been stocked with laying hens at a density of one bird per 1.8 - 2.2 sq. ft. The litter contained 45% moisture. At an air temperature of 67.1 - 72.3°F gas production per 10.8 sq. ft. per hour was estimated to be 16.8 - 31.6 litres water vapour, 4.6 - 5.6 l carbon dioxide 0.48 - 0.56 ammonia.

A-452 West Scotland Agr. College. 1965/66. Poultry waste disposal and treatment. Annual Rep. W. Scot. Agr. College. pp. 26, 71. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 210.)

"Interim report on trials of an anaerobic manure digestion system. A peak production of 0.5 cu. ft. of gas per bird per day was found."

A-453 Charles, D.R. 1965. The effects of atmospheric ammonia on the performance of laying hens. Ph.D. Thesis, Notts. Univ. 191 pp. 176 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 259.)

"Report on studies. It was found that 100 ppm of ammonia in the atmosphere reduced egg production after 10 weeks at 65°F. At 84°F the same concentration caused a 13% reduction in egg production after seven weeks. The possibilities of controlling these harmful effects by modifying the diet were noted. It was suggested that nutrient requirement specifications should be related to environment because environment influenced feed intake. The importance of avoiding ammoniacal pollution in rearing quarters was shown."

A-454 Adam, T. 1966. Examination of the effects of microclimate on cows and calves under field conditions. Sci. Programme & Abstr. 9th Int. Congress Anim. Prod., Edinburgh. p. 109. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 314.)

"Report on studies. The 'optimal temperature zone' for lactating cows was given as 41 - 59^{o}F. Increased concentrations of carbon dioxide and ammonia decreased milk yield. The influence of environment on calves was investigated and an 'optimal temperature zone' for calves suggested."

A-455 Zuber, R. and L. Gisiger. 1966. (Air and slurry investigation in a cowhouse with a slatted dung channel.) Mitt. schweiz. Landw., 14(1): 6-9. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 354.)

"Report on studies. The composition of the slurry in the channel and the carbon dioxide and ammonia content of the air at the inlet and outlet of the channel were determined."

A-456 Muirthille, C.O. 1965. Manure handling and disposal. Res. Rep. Rural Econ. Div., Agr. Inst., Dublin. pp. 59-60. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 355.)

"Report on trials of an experimental dungstead built to receive slurry from a cubicle house. In-going water flowed away freely and the manure dried sufficiently to be handled by a front loader. The volume of slurry collected was 1.02 cu. ft. per head per day which dried out to about half this amount by August. It was concluded that it was unnecessary to cover a dungstead, that the maximum area for a split level dungstead was 1.5 sq. ft. per cow per week of storage and that sleeper walls should be 60 in. high."

A-457 Robinson, T.W. 1966. The handling of slurry from dairy cows - a comparison of some methods used with cubicles. Rec. Agr. Res. Minist. Agr. N. Ire., 15(1): 77-98. 1 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 361.)

"Report on field studies, from which five systems were evolved. Capital outlay and running costs were compared in detail. Slurry handling was found to be a fairly costly process and recommendations on possible ways of reducing costs were given."

A-458 Water Pollution Research Board. 1966. Disposal of farm effluents in a lagoon. Water Pollut. Res. 1965. p. 131. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 362.)

"Report on trials of a lagoon for cattle and silage effluents. It appeared that the reduction in BOD it secured might be as great as 86%. The possibilities of seepage from such lagoons was discussed."

A-459 Haartsen, P.I. 1966. (Be careful when agitating liquid manure in the pit.) Landbouwmechanisatie, No. 17.04: 445-447. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 366.)

"Report on trials. The agitation of slurry in a manure pit collected from a cowhouse with slatted floor dunging channels caused concentrations in the house of 0.07% ammonia and 0.012 - 0.06% hydrogen sulphide. Such concentrations were regarded as dangerous to stock."

A-460 Haartsen, P.I. 1966. (Gas poisoning in a cowhouse from the slurry

tank.) Tijdschr. Diergeneesk, 91(16): 997-1001. 5 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 367.)
"Report on study reproducing conditions under which gases overcame four cows. When slurry in a subterranean tank, connected by a channel to a slatted floor cowhouse, was agitated gas concentrations in the atmosphere of the cowhouse rose to 0.07 vol.% ammonia; 0.012 to 0.06 vol.% hydrogen sulphide; and 0.2 vol.% carbon dioxide. It was noted that German publications regarded 0.01 vol.%, 0.002 vol.% and 0.35 vol.% respectively as the maximum permissible concentrations, though other evidence showed that noticeable harmful effects were only found at much higher concentrations. Advisory recommendations were given."

A-461 Högsved, O. 1966. (Unsuspected health hazards of storing manure in liquid form.) Stenciltryck St. LantbrByggFörs., Lund, No. 1001. 10 pp. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 368.)
"Report on studies of two housing layouts and manure disposal systems in cow houses where severe poisoning and sudden death occurred. Additional ventilation in existing liquid manure storage systems was recommended. Symptoms of the poisoning were described."

A-462 Kraggerud, H. and A. Nygård. 1966. (The planning of cattle buildings with liquid manure handling.) LandbrBygg. St. ByggeforsknInst., Kbh., No. 23: 9-29. 14 ref. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 372.)
"This general account of the design of cow housing was based on the work of the Institutt for Bygningsteknikk. It included reference to comparisons of cleanliness and work content in cowhouses with solid and slatted dung channels, of behavior, cleanliness and work content in slatted floor yards and different cubicles and to a survey in Norway of the use of different types of cubicles and slatted floor yards for cows and young stock."

A-463 Dempster, D.G. and S.H. Baxter. 1966/67. The effect of silage effluent on unrendered concrete block walls at Aberdeen University Farm, Tillycorthie, Udny. Scot. Agr., 46(1): 44-46. (cited in Bibl. Farm Bldg. Res., 1966 Supplement, Abstr. No. 585.)
"Report on trials following the finding that effluent greatly reduced the cement content of concrete blocks exposed to it. It was found that such deterioration could be controlled by rendering with a high alumina cement mix and prevented by the application of chlorinated rubber paint or epoxy resin paint. Advisory recommendations were given."

A-464 Inst. LandbBedrijfsgeb. 1967. Verslag over het jaar 1966. (Report for the year 1966.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 36. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 15.)
"This general report included references to the development of prefabricated elements for farm buildings, including new types of trusses and slats. A system of air inlets in the floors of livestock buildings was developed. Recommendations on preventing the harmful accumulation of gases in slatted floor systems were given. The oxidation system for pig slurry appeared promising. ...dung disposal systems in fattening calf houses were investigated. Slatted passages were preferred to solid passages in cubicle systems. ...The flush-out system of manure disposal from hen batteries appeared promising. ..."

A-465 Hart, S.A. and W. Hillendahl. 1967. (Lagoons for German farms.) Landtech. Forsch., 17(3): 82-86. 9 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 32.)
"This general paper contained references to the research on which it was based."

A-466 Forsyth,R.J. 1967. Sluice gate design. Farm Bldg. Assoc. J., No. 11. pp. 102-103. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 41.)
"Interim report on development of sluice-gates for slurry systems. A rectangular gate angled at 60^{o} to the flow appeared promising."

A-467 Forsyth, R. 1967. Slurry channel design. Scot. Agr., 46(3): 114-117. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 42.)
"Report on trials of different types of channel for handling manure under a slatted floor. Detailed recommendations on design were given."

A-468 Winfield, R.G. 1967. Effect of baffles on small liquid manure pits. Annual Rep. Agr. Res. Inst., Ontario, 1965-1966. p. 222. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 43.)
"Interim report on trials. Various baffle spacings and clearances were evaluated."

A-469 Scholz, G. 1965. (Hygiene in buildings for cattle and pigs in the Augsburg area, with reference to modern methods of cleaning out.) Inaug. Diss. tierärztl. Fak. München. 186 pp. 133 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 51.)
"Report on survey of buildings and management systems with special reference to microclimate. The importance of proper design for cowhouses with slatted dung channels for cows was emphasised. In general, ventilation in piggeries was insufficient and relative humidity too high."

A-470 Juckes, D. 1967. Scale of enterprise and structural change in British pig farming. Rep. Dept. Agr. Econ. Exeter Univ., No. 164. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 53.)
"This study included on p. 60 the summarised results of a survey of pig housing systems used for large herds. 30% used controlled environment houses, 34% slatted floor systems and 71% removed manure by hand."

A-471 Statens Lantbruksbyggnadsforsok. 1967. (Report for 1966.) Forhandsmedd. St. LantbrByggFors., Lund, No. 306. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 71.)
"This general report included interim references to the following work in hand: The death of pigs from poisoning by gases arising from below slatted floors when manure was removed was reported. ...The use of plastic coatings on concrete decreased wear except in silage silos. ...The speed of air movement between slats was not affected by the material of which the slats were made. The temperature of a slatted floor was found to be similar to that in the building. ..."

A-472 Stibic, J. and F. Syrinek. 1967. (Comparison of the production of excreta and urine by pigs of different ages in the case of wet and dry feeding.) Ved. Prace vyzk. ust. pro Chov prasat Kostelici-Orlici, No.

2: 103-109. 1 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 72.)
"Report on studies. There were no statistically significant differences in the dry matter content of excreta or in the amount of urine voided by pigs fed wet or dry feed. The dry matter content of the excreta averaged about 25%."

A-473 Fiser, A. 1967. (Micro-organism counts in the air of large fattening piggeries during summer and winter.) Mh. Vet. Med., 22(20): 829-830. 7 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 156.)
"Report on trials. When the ventilation rate was low, the micro-organism content of the air rose above the recommended level. It was reduced when relative humidity exceeded 85%. This, however, was regarded as an undesirable method of control, since temperatures were low."

A-474 Suchanek, J. 1967. (Influence of the medium on the coziness of animals and its relation to the liveweight increase and to the consumption of food on a large fattening farm.) Collection Sci. Papers Econ. Agr. Univ., České Budějovice, polythematical Pt, 5(11): 45-50. 10 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 167.)
"Report on trials. Pigs housed in groups of 130-150 in pens from which manure was removed below the pens gave better performance than those housed in groups of 150-300 in pens from which the manure was removed by shovel."

A-475 Asaj, A. 1966. (Microclimate conditioning in poultry houses in Croatia in 1965.) Veterinaria Saraj., 15(3): 399-402. 3 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 213.)
"Report on survey. Findings on microclimate were given in detail. The question of minimum desirable concentrations of carbon dioxide and ammonia was discussed."

A-476 Devos, A. 1967. (Prevention and treatment of chronic respiratory disease of fowls with regard to air contamination.) Vlaams Diergeneesk. Tijdschr., 36: 262-271. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 220.)
"Report on trials. The bacterial counts of the air in a hatchery and in a rearing house before and after the chicks were introduced and with or without litter was determined. Various disinfectant treatments had no apparent effect on the total bacterial count, though enterobacterial counts were reduced."

A-477 Howes, J.R., C.A. Rollo and W. Grub. 1967. The production of dust from various litter materials. Paper presented at 56th Annual Meeting Poultry Sci. Assoc. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 221.)
"Report on trials. Atmospheric dust from pine shavings, sawdust, peat moss, clay, peanut hulls, chopped maize cobs, rice hulls and composted litter was reduced during darkness or by increased humidity. Clay and peat moss produced most dust, fresh shavings least, though dust production increased rapidly with the age of the shavings."

A-478 Farmers Weekly. 1967. Dung disposal. Poultry. Farmers Weekly, 67(1): 19. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr.

No. 230.)
"Summary report on survey by the Double A Group of poultry manure disposal practice. Most manure from battery houses was removed manually. Most manure of all types was spread on the land."

A-479 Wittenburg, H. and A. Chudy. 1967. (Analysis of poultry faeces.) Arch. Geflügelz. u. Kleintierk., 16(4): 221-228. 9 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 231.)
"Report on studies. Findings were given in detail."

A-480 Messer, H.J. 1967. Disposal of poultry manure in lagoons. Poultry Farmer, 156(4065): 20-21. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 234.)
"Report on trials of this system. It was unsuccessful because the temperature was too low to secure sufficient bacterial activity. Heating the lagoon was regarded as uneconomic."

A-481 Konrád, J., V. Pumpr and L. Svoboda. 1966. (Microclimatic conditions in an automatized building for broilers in the course of the fattening period.) Collection Sci. Papers Econ. Agr. Univ., České Budějovice, polythematical Pt, 4(9): 99-109. 28 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 242.)
"Report on trials. Broilers housed on metal gratings in a house temperature of 18.6 - 26.9°C showed higher mortality than those housed on wooden gratings in a house temperature of 19.6 - 30.6°C. Atmospheric moisture air flow and carbon dioxide were higher in the house with metal gratings, though the carbon dioxide content was always under the norm. Concentrations of ammonia were, however, higher than the norm in both houses, being as much as 20 times greater at the end of the fattening period."

A-482 Staryh, V.N. 1966. (The physiological state of laying hens in broad and narrow houses.) Trudy mosk. vet. Akad., 49: 190-196. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 280.)
"Report on trials. Relative humidity and the ammonia content of the atmosphere was lower in broad houses. The effects of this on bodyweight and carcass composition were shown. Egg production was higher in narrow houses."

A-483 Petrov, G. 1966. (Effect of increased concentrations of ammonia, hydrogen sulphide and carbon dioxide on laying hens.) VetMed. Nauki, Sof., 3: 351-356. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 292.)
"Report on studies. The egg production of hens housed for two months in a pen where the atmosphere contained 0.0052 - 0.008% ammonia, 0.008 - 0.01% hydrogen sulphide and 0.5 - 0.9% carbon dioxide fell by 9%."

A-484 Velebil, M. 1966. (Determination of the main characteristics of a bulldozer designed to remove the manure in covered yards for loose housing.) Zeměd Tech., 12(8): 519-523. 10 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 382.)
"Report on studies to develop a formula for calculating the performance of such a bulldozer. The characteristics of the building were a factor in this formula."

A-485 Water Pollution Laboratory. 1967. Collection of farm slurry in an oxidation ditch. Water Pollut. Res.,1966. pp. 140-141. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 384.)
"Report on trials of an oxidation ditch installation on a dairy farm receiving slurry and silage liquor. Results were given in detail."

A-486 Högsved, O. and K. Sällvik. 1967. (Liquid manure - ventilation. Ventilation studies and studies of animal health.) Forhandsmedd. St. LantbrByggFörs., Lund, No. 309. 12 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 388.)
"Report on studies in a cowhouse with a slatted dung channel comparing the performance of a conventional ventilation system and a ventilation system that removed air from the dung channel. Considerable differences in the hydrogen sulphide content of the atmosphere and in the health of the animals was found. Advisory recommendations were given."

A-487 Wormanns, G. and W. Schiller. 1967. (Equipment for removing manure from below slatted floors in cattle buildings.) Arch. Landtech., 6(3): 243-256. 16 ref. (cited in Bibl. Farm Bldg. Res., 1967 Supplement, Abstr. No. 389.)
"Report on development of an auger system for this purpose. Results were promising."

A-488 Esmay, M.L. and J.S. Boyd. 1968. Drying and incineration as means of animal waste management. Paper presented at 33rd Mid-year Meeting Div. Refining, Amer. Petroleum Inst. Philadelphia, Pa. 7 pp. 9 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 34.)
"Review of available information with special reference to poultry manure."

A-489 Högsved, O. 1968. Manure gases - a literary review and experience from practice. Forhandsmedd. St. LantbrByggFörs., Lund, No. 311. 11 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 37.)
"Review of literature on the incidence and effects of gases from slurry in slatted floor livestock buildings. Report on studies of the harmful effects of such gases in livestock buildings. The possibility that these gases might cause teat injuries was noticed."

A-490 Viehl, K. 1967. (Liquid manure and silage liquor - a new waste-water problem.) Korresp. Abwass., No. 7: 4-6. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 38.)
"Report on studies of silage liquor, liquid manure and various vegetable residues. It was found that during the peak period of beet and silage harvest the normal polluting load from certain small communities increased 11.8 times."

A-491 Strauch, D., J. Kosters, W. Muller and H. Weyers. 1968. The waste disposal problem in agriculture. I. Origin, amount and composition of manure and abattoir wastes. Berl. Münch. Tierarztl. Wschr., 81: 209-212. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 39.)
"Report on survey. It was found that in intensive husbandry the amount of dung produced could be a limiting factor in the size of the unit."

A-492 Dood, V.A. 1968. Slurry disposal and effluent treatment. Res. Rep. Rural Econ. Div. Agr. Inst., Dublin, 1967. pp. 31-32. (cited in Bibl.

Farm Bldg. Res., 1968 Supplement, Abstr. No. 41.)
"Interim report on trials. Overground dungsteads were regarded as best suited to herds of less than 60 cows. An oxidation ditch system gave a continuous performance efficiency of 92%. The importance of reliable equipment was emphasised. It was thought unlikely, however, that the system would be adopted by commercial farmers, except intensive pig farmers, because of the expense. The need of a skilled operator, and of a substantial stream to take the outfall and the harmful results of discharging silage liquor into the ditch were emphasised. Organic irrigation appeared more likely to be adopted."

A-493 Res. Inst. Agr. Eng., Praha Repy. 1968. Annual Rep. Res. Inst. Agr. Eng. Praha Repy. pp. 26-33. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 44.)
"This annual report contained references to:
... Trials of mechanical equipment for removing manure from yards and from slurry cellars. Results were given in advisory form.
Trials of slurry disposal systems. The relationship between the depth and length of slurry channels was determined. The gradient of slurry was found to vary from 1 to 6%, depending on its consistency. ..."

A-494 Ontario Dept. Agr. & Food. 1968. Experimental methods of processing liquid manure for odour control. Ont. Dept. Agr. & Food Information Leaflet. Agdex 538. 4 pp. 4 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 45.)
"Review of available information on chemical processing by lime, chlorine and deodorizing compounds and on forced aeration by oxidation ditch or other methods. Advisory recommendations were given."

A-495 Minist. Agr., N. Ireland. 1967. Mineral content of slurries. Annual Rep. Res. & Tech. Work Minist. Agr., N. Ire. p. 48. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 46.)
"Interim report on trials at Greenmount Agricultural College of aerating slurry and removing phosphorus from it by passing it through layers of earth and peat. Results were promising."

A-496 McAllister, J.S.V. 1968. A possible technique for the removal of phosphorus from waste effluents. Rec. Agr. Res., Minist. Agr., N. Ire., 17(1): 110-111. 1 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 47.)
"Report on trials of filter systems. A mixture of equal parts of soil and finely burnt ground lime between layers of peat proved promising."

A-497 Statens Lantbruksbyggnadsförsök. 1968. (Annual report for 1967.) Medd. St. LantbrByggFors., No. 312. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 51.)
"This general report included references to:
... Trials of ventilation systems in piggeries with slatted floor dunging passages. A ventilation rate of 50 cu. m. per head per hour was found to prevent hydrogen sulphide entering the piggery at mucking-out-time.
Trials of the insulating properties of slatted floors of different materials. No difference in effects on temperature were found.
Trials of plastic manure channels. Results were promising.
Trials of methods of repairing worn concrete surfaces. Concrete with a

plastic additive gave satisfactory resistance except where it was exposed to effluent from silage. ..."

A-498 Dood, V.A. 1968. Slurry disposal of farm wastes. Farm. Res. News, 9(5): 109-112. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 52.)
"This general paper included a reference to work study investigations which showed that hand scrapers and squeegees should be used to clean areas of less than 600 sq. ft. For larger areas, a tractor scraper or power hose should be used. Recommendations on type of hose were given."

A-499 Clarke, E.G. and M.L. Clarke. 1968. Poisons and poisoning. Vet. Annu., 1968. pp. 186-195. 79 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 59.)
"Review of available information. This contained references to poisoning by nitrate, including cases caused by pigs drinking condensate from ventilation shafts, and of the poisoning of cattle and pigs on slatted floors from gases arising from slurry at pumping-out time."

A-500 Högsved, O. 1968. (Animal health problems in livestock production today.) Stenciltryck St. LantbrByggFörs., Lund, No. 1016. 13 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 60.)
"Review of available information on the effects on the health of cattle and pigs of gases from slurry. Advisory recommendations on controlling this hazard were given."

A-501 Forster, A.G. 1967. (Comparative investigations of the handling of slurry in loosehousing systems.) Ber. Landtech. Dtsch. Kurat. Tech. Landw., No. 109. 110 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 81.)
"Report on studies. The inadequacy of methods of measuring the viscosity, density and dry matter content of slurry were noted. Factors affecting its condition were determined. A consistency factor to measure the degree of difficulty in coping with it was evolved and systems analysed in terms of the factor. Mechanical systems were preferred to gravity flow systems on economic grounds. Underground storage was recommended for slurry diluted with water, above ground storage for slurry to which no water had been added."

A-502 Ministry of Agriculture, Fisheries & Food, England and Wales. 1968. Slurry handling and disposal on the dairy unit. Annual Rep. Bridget's Exp. Husbandry Farm, No. 8: 11-13. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 90.)
"This general report included figures on the quantity and chemical content of winter and summer slurry from a dairy herd."

A-503 Kleven, H. 1967. (New results of temperature studies in a cowhouse with a slurry cellar.) Stensiltrykk Inst. Bygningstek., No. 68. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 91.)
"Report on studies. Results were given in detail. Temperatures in the slurry cellar were lower than those above the slats. The importance of insulation was emphasised."

A-504 Huber, S. 1966. (Hygienic studies on buildings with slatted floor and

gratings. Environmental influence of modern labour saving buildings on cattle and pigs.) Inaug. Diss. Tierarztl. Fak. München. 243 pp. 117 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 102.)
"Report on studies of environmental conditions in various types of slatted floor installation for dairy cattle, fattening cattle and pigs. The system was satisfactory in most installations, but not in a slatted yard for fattening bulls, where bone-fractures occurred and daily weight gains were poor. The importance of removing pigs from such floors at mucking-out time was emphasised."

A-505 Inst. LandbBouwbedrijfsbeb. 1968. Verslag over het jaar 1967. (Report for the year 1967.) Publ. Inst. LandbBedrijfsgeb., Wageningen, No. 42. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 123.)
"This general report included references to:
... Trials of a removable kerb between dunging and lying area in Danish-type fattening houses with slatted dunging passages to allow the use of bedding. Design recommendations were given.
... Trials of dung channels and flush-out systems in laying houses. Design recommendations were given. ..."

A-506 Szyfelbein, E., J. Karas and E. Rockicki. 1966. (The hygiene of soil yards for pigs after ten years use.) Roczn. Nauk. Roln., 87B: 555-560. 9 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 231.)
"Report on studies. It was found that the soil was too heavily contaminated to be satisfactory for pigs."

A-507 Hovmand, H.C. and P. Slot. 1968. Microbial formation in nitrite in ventilating shafts. Acta Vet. Scand., 9: 86-89. 7 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 232.)
"Report on studies. Cases of fatal nitrite poisoning of pigs resulting from the intake of condensation water from ventilating shafts were known. It appeared that the nitrite present in deposits on the inside of many piggery ventilating shafts was produced by Nitrosomonas spp. and that the NH_3 in the exhaust air formed the substrate for its production in excess."

A-508 Scott-Edeson, P.A. 1968. Cattle and pig slurry disposal and its relationship to farm building design. M.Sc. Thesis, Reading Univ. 66 pp. 61 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 240.)
"Review of available information leading to design recommendations."

A-509 Cute, E., E. Mambet, E. Juriari and C. Murgoci. 1967. (Investigations on the treatment of waste waters from pig breeding.) Studii Prot. Epur. Apel. Buc., 9: 305-328. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 241.)
"Report on trials. The composition of wastes from large pig units was determined and methods of treatment described."

A-510 Pontin, R.A. and S.H. Baxter. 1968. Wastes from pig production trials. Water Pollut. Contr., 67(6): 632-638. 11 ref. (cited in

Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 244.)
"This general paper included references to the research on which it was based and an interim report on trials of an oxidation ditch installation. Results were promising. In subsequent discussion of this paper, V.A. Dodd (Dublin) summarised findings from trials of an oxidation ditch installation. The BOD load was lower than that mentioned in the above paper. A BOD ratio to flock similar to that used in the treatment of domestic wastes was recommended."

A-511 Devos, A. 1967. (Decontamination of the atmosphere in empty poultry houses.) Vlaams Diergeneesk. Tijdschr., 36: 329-336. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 333.)
"Report on studies, including the finding that the removal of dust with an industrial vacuum cleaner reduced the bacterial content of the air to one third of the initial level."

A-512 Riley, C.T. 1968. A review of poultry waste disposal possibilities. Water Pollut. Contr., 67(6): 627-631. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 341.)
"This general paper included references to a research on which it was based and a summary report on a survey. The average annual cost of poultry manure disposal was £120 per 1,000 birds. The lack of knowledge of waste disposal and the high cost were noted."

A-513 Riley, C.T. 1968. Poultry manure: storage and disposal. In The housing requirements of layers. Rep. Farm Bldg. Cent., Kenilworth, No. 9: 147-151. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 342.)
"This general paper included a reference to a survey of costs of poultry manure disposal. These average £50 per 1,000 birds per year plus capital charges of £74 for equipment; of the £50, about £20 was for labour, £30 for overheads, electricity, water, and other material costs. It appeared that manure disposal arrangements were often not planned at the housing design stage but added later."

A-514 Bressler, G.O. and C.L. Quarles. 1968. Dry poultry can be obtained with sloping wire floor egg production system. Paper presented at 57th Annual Meeting Poultry Sci. Assoc. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 345.)
"Report on trials of this system, including drying of the accumulating droppings by air and artificial heating. Results were satisfactory."

A-515 Rockicki, E. 1966. (Influence of kinds of litter on the production of broilers from the hygienic aspect.) Roczn. Nauk. Roln., 87B: 709-723. 77 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 366.)
"Report on studies. Horsemanure litter and peat litter gave satisfactory results. The chemical, bacterial and dust contents of the atmosphere in broiler houses were analysed."

A-516 Ignatev, I.B. and V.V. Litvinenvo. 1967. (Hygienic evaluation of air in broiler houses.) Veterinariya Moscow, No. 5: 107-108. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 367.)
"Report on studies. It was found that the bacteriological content of the

atmosphere increased with the age of the birds. The dust content was greatly affected by ventilation and by the work routine."

A-517 Grishaev, I.D. 1967. Survival of the agents of pullorum disease coccidiosis and aspergillosis in broiler litter. Trudy uses. Inst. Vet. Sanit., 28: 153-161. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 376.)

"Report on trials. In peat litter, Salmonella pullorum died within 25 - 60 days but coccidial oocysts and Aspergillus fumigatus survived at least 80 days. Litter of peat mixed with shavings on sawdust or of woodshavings and sawdust removed from the house could be used after standing in stack for six days."

A-518 Ross, E. 1968. Fumigation and reuse of broiler litter. Paper presented at 57th Annual Meeting Poultry Sci. Assoc. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 377.)

"Report on trials. Fumigation reduced the bacterial population of reused litters but did not secure any significant improvement in performance."

A-519 Charles, D.R. and C.G. Payne. 1968. Atmospheric composition and regulation. In The housing requirements of layers. Rep. Farm Bldg. Cent., Kenilworth, No. 9: 33-43. 61 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 380.)

"Review of available information including sections on gaseous, including ammoniacal, pollution."

A-520 Kita, E., A. Iwata, K. Hashimeo and S. Inui. 1967. (Number of bacteria and distribution of staphylocci in the air of poultry houses.) Bull. Nat. Inst. Anim. Health, No. 55: 8-13. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 442.)

"Report on survey. The number of bacteria in the air was higher in floor systems than in battery or cage systems. In floor systems the number of bacteria increased in proportion to the density of the poultry housed."

A-521 Agricultural Institute (Dublin). 1968. New way to dispose of silage effluent. Farm Res. News, 9(6): 137-139. 2 ref. (cited in Bibl. Farm Bldg. Res., 1968 Supplement, Abstr. No. 552.)

"Reference to development by T.A. Spillane and J. O'Shea of a method of disposing of silage effluent by collecting it in a sump and conveying it in water to the fields for disposal."

A-522 U.S. Dept. of the Interior. 1969. Ammonia removal from agriculture runoff and secondary effluents by selected ion exchange. Report No. TWRC-5, Robert A. Taft Water Research Center, Cincinnati, Ohio. U.S. Dept. Interior, Federal Water Pollution Control Administration. 56 pp. 33 ref. 19 fig. (cited in Pollut. Abstr., 1(1): Abstr. No. P70-00572.)

"A selective ion exchange process was developed for the removal of ammonia nitrogen from wastewater. The process employs a natural zeolite, clinoptilolite, which is selective for ammonium ions in the presence of sodium, magnesium, and calcium ions. . . . The ion exchange equilibria of four zeolites was investigated and clinoptilolite was selected for further study on the basis of its ammonium ion selectively and low cost. Operation of the mobile plant with secondary effluent resulted in ammonia removals of 97 and 93 percent at 70,000 and 100,000 gallons per day respectively; thus demonstrating that selective ion exchange provides a highly effective means for removing ammonia from wastewater."

A-523 Stephenson, M.E. and R. Rodrique. 1969. Attenuation of selected nitrogen forms by sorption from solution onto natural soils. Completion Report, College of Engineering, Division of Engineering Research, Michigan, State University, East Lansing, Michigan. 140 pp. 87 ref. 2 tab. 5 fig. (cited in Pollut. Abstr., 1(2): Abstr. No. P70-01906.)

"The interaction of nitrates from agricultural waste disposal and other sources with soil materials was studied by equilibrating 200 solutions of nitrates with coarse-size Na and K montmorillonite particles. The literature on the physiological and chemical effects of nitrates is extensively reviewed and a bibliography is included. In the adsorption experiments, the equilibrium pH increased with increasing clay content. Increasing the nitrate concentration up to 32 mg/l caused an increase in the equilibrium pH when the average pH was greater than 8.9 and a decrease when the average pH was between 4.5 and 10.2. Increasing the nitrate concentration reversed the initial increasing trend of the negative adsorption isotherms."

A-524 Anon. 1969. Pollution Control. Report on Marine Science and Technology. Her Majesty's Stationery Office, London, England. pp. 22-27. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03038.)

"A progress report covering British research and procedures for the control of oil pollution, sewage, industrial, and agricultural wastes, and radioactive wastes in coastal waters is discussed."

A-525 Hart, S.A. and M.E. Turner. 1968. Waste stabilization ponds for agricultural wastes. In E.F. Gloyna and W.W. Eckenfelder, Jr. (eds.) Advances in Water Quality Improvement, Water Resources Symposium, Austin, Texas. pp. 457-463. 6 ref. 2 tab. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03222.)

"There is a most significant difference between stabilization ponds used for sewage and industrial wastewater, and ponds used for the disposal of livestock manures. Manure disposal ponds, in contrast, are expected to accept very large amounts of organic solid matter - often containing barely enough water to get the wastes into the pond. The objective is stabilization and disposal of the organic matter rather than water purification. There is usually no effluent and make-up water is frequently required. The BOD loading rate may be as high as 1,000 to 1,200 pounds/acre/day. Because anaerobic conditions predominate, manure disposal ponds are more appropriately compared to open-topped, unheated, municipal sludge lagoons, or perhaps even to conventional sludge digesters, than they are to sewage stabilization ponds."

A-526 Burch, L.A. 1969. Solid waste disposal and its effect on water quality. California Vector Views, 16(11): 99-112. 34 ref. 1 tab. 3 fig. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03256.)

"This paper describes the possible effect of solid waste disposal on ground water and surface water. Ground water may be adversely affected by leaching soluble materials out of a landfill resulting in the discharge of these pollutants into the ground water. Carbon dioxide gas may also cause increased hardness and corrosiveness of the ground water. Surface water can be impaired by dumping solid wastes directly into the water or by the physical erosion of portions of landfills located in flood plains during flood conditions. Measures available for control and prevention of water quality problems from solid wastes for their are also briefly discussed. . . ."

A-527 Maier, P.P. and P.A. Rogers. 1967. The California integrated solid waste management project. California Vector Views, 14(10): 60-68. 1 ref. 3 fig. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03257.)
"The California Integrated Solid Waste Management Project is an intensive study of solid waste management in an area of approximately 1200 square miles surrounding the city of Fresno, California. The objectives of the study are to investigate, plan, and design a regional solid waste management system that will handle urban, industrial, and agricultural wastes."

A-528 Shea, K.P. 1970. Blunted weapons. Environment, 12(1): 28-35, 41. 14 ref. 5 fig. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03437.)
"Antibiotics, sulfa drugs, and other medicines which kill or inhibit disease germs have created a revolution in public health. The extensive use of these medicines in agriculture, as routine animal feed supplements, may diminish their usefulness in human medicine."

A-529 Perlman, D. 1970. A challenge over farms that pollute. San Francisco Chronicle, July 7. pp. 1, 20. (cited in Pollut. Abstr., 1(3): Abstr. No. P70-03631.)
"A group of embattled rural lawyers in California moved toward the Federal courts yesterday in an effort to ban all government subsidy payments to farm operators who pollute water supplies with pesticides or excess fertilizers."

A-530 Allred, E.R. 1970. Animal waste disposal problems and trends in Minnesota. Abstract No. 11, Eutrophication Program, Water Resources Center, University of Wisconsin, Madison, Wisconsin. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04148.)
"The growing problem of animal waste disposal resulting from the trend toward concentration of livestock on fewer farms is discussed. Three reasons given for failure to solve animal waste disposal problems are: 1) reluctance to monetary expenditures on adequate methods, 2) because the problem has been considered unrelated to other parts of society, and 3) approaches have been used that are only applicable to other types of waste. Cost involved and the enormity of the problem are realized when data presented indicate a 250,000-bird poultry enterprise has a biochemical oxygen demand waste equivalent to a city population of 25,000. Since the cost of a treatment plant and storage is prohibitive to individual farmers, it is concluded that no immediate, simple solution is in sight."

A-531 Biggar, J.W. and R.B. Corey. 1969. Agricultural drainage and eutrophication. Eutrophication: Causes, Consequences, Correctives, Proc. International Symposium on Eutrophication, Madison, Wisconsin. pp. 404-445. 69 ref. 14 tab. 8 fig. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04238.)

"In this paper we are interested principally in the sources, quantities, and distribution of agricultural drainage waters and the extent to which these waters contain constituents that contribute to eutrophication. Agricultural drainage water provides the means by which constituents of eutrophication are redistributed, the destination of immediate interest being streams and lakes. Our discussion will be divided into three main sections: 1) Chemical reactions that nutrient elements undergo in soil-water systems. This part of the discussion is limited primarily to nitrogen and phosphorus. 2) Factors influencing the amounts and kinds of drainage from agricultural lands and the associated transport of nutrients. 3) Studies that provide a basis for estimating the amounts of nutrients entering lakes and streams."

A-532 Pryor, A. 1970. A headache for dairymen that won't go away. California Farmer, 232(5): 12-13. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04282.)

"W.C. Fairbank, extension agricultural engineer with the University of California, Riverside, comments on the dairyman's problem of how to get rid of manure and describes some of the more effective systems. Liquids-Solids separation, a system for mechanically screening out the fiber and debris from liquified dairy manure, simplifies irrigation disposal of the effluent from total confinement dairies, while the removed solids have by-product uses as free-stall bedding or as plant mulch, a possible substitute for peat moss."

A-533 Reihard, D.G. 1968. Recovery of usable waste products. In J.H. Austin and U. Weise. (eds.) Waste Disposal from Water and Wastewater Treatment Processes, Proc. 10th Sanitary Engineering Conference, Urbana, Illinois. pp. 99-104. 15 ref. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04592.)

"The disposal of solid wastes produced directly from the manufacture of pharmaceuticals has been accomplished by means of composting. The 1 mgd waste treatment plant discussed in this paper produces twelve tons of wet solids per day, and the production areas contribute eight tons directly in the form of antibiotic cake residues, animal cage wastes, and manures. These waste solids are trucked to a ten-acre composting site, mixed with sawdust, dried leaves in season, and older compost if necessary, and piled into windrows. . . . The product is excellent for use as a soil conditioner, and may also be used as sanitary landfill. The advantages of composting over other methods of solids waste disposal include: low investment and operations expense, minimal air pollution problems, and the conservation of natural materials. The disadvantages are land requirements, potential odors, and the absence of ready markets for the disposal of the final product."

A-534 Pryor, A. 1970. Dairy manure makes good bedding material. California Farmer, 233(4): 16. 1 fig. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04599.)

"One of the biggest problems confronting dairymen and feedlot operators is what to do with accumulated manure. One answer is to make it into litter, which then can be used as bedding material for calves, baby chicks and mushrooms. It is said to be as good as wood shaving, which are becoming hard to get."

A-535 California Farmer. 1970. Poultry manure useful as rangeland fertilizer. California Farmer, 233(4): 16. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04600.)
"Tests conducted in San Diego County showed that for each ton (approximately 2½ yards) of chicken manure applied to rangeland, 1600 pounds of additional dry forage was produced. This extra yield occurred in the three years after application and in amounts applied up to 4 tons (or 10 yards) per acre."

A-536 California Farmer. 1970. Dried poultry manure as cattle feed. California Farmer, 233(4): 16. 2 tab. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-04603.)
"The nutritional quality of dried poultry manure, used as cattle feed, varies according to the type of litter. Dried peanut hull deep litter, for example, has a different nutritional value than dried sawdust deep litter. Dried poultry waste has a protein value similar to cereals and an energy content about one-third that of grain. However, trials have shown it to be suitable and economically viable for inclusion in intensive beef rations."

A-537 Luckhardt, R.L. 1970. We are living on 'Planet N'. California Farmer, 232(2): 20B-20D. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-05005.)
"Sources and supplies of nitrogen in air, water and soil are explained by this author, who discusses, also, good farming practices to promote greater efficiency with nitrogen, irrigation water and topsoil, and to prevent pollution from excess nitrogen."

A-538 Anon. 1970. Waste perils lakes near cattle lots. Evening Tribune, San Diego, California, August 28. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-05118.)
"Lakes near big cattle feedlots may be in danger of eutrophication because of the absorption by water of air-borne ammonia which evaporates from cattle urine. A study conducted by the Department of Agriculture showed that one lake, a mile from a 90,000-head feedlot in northeast Colorado, absorbed annually 30 pounds of nitrogen per acre as a result of ammonia evaporation."

A-539 Wallace, G.D. 1970. Wonder drugs on farm pose threat to humans. Kansas City Star, June 28. p. 5G. (cited in Pollut. Abstr., 1(4): Abstr. No. P70-05258.)
"An estimated 80% of the meat Americans eat comes from animals fed or dosed with antibiotics. These drugs could make humans sick or may be making human disease harder to treat. Some humans are allergic to antibiotics. Government tests disclose a small proportion of meat with residues theoretically sufficient to sicken those persons most allergic to antibiotics. However, the medical concern is over transferrable drug resistance. Some germs were resistant to drugs. The resistant germs overwhelmed the drug-sensitive germs. Domestic animals treated with antibiotics have produced drug-resistant germs. It is theoretically possible for the drug resistance of animals' germs to be transferred to human germs. For example a drug-resistant salmonella germ was transferred from calves to farm workers, to dairy cattle, which passed it along in milk. Streptomyacin is heat resistant, and rare-cooked meats could contain that drug."

A-540 Anon. 1970. Causes of pollution listed for Congress. Evening Tribune, San Diego, California, October 23. (cited in Pollut. Abstr., 1(5): Abstr. No. P70-05524.)
"In a message to Congress, President Nixon noted that municipal, industrial and agricultural wastes are the chief causes of water pollution. Agricultural pollutants, affecting about 90% of all water used in the U.S., are the leading cause. It is impossible to monitor the runoff from every farm, and much remains to be learned about the transfer of plant, animal, and human pathogens through agricultural water use."

A-541 California Farmer. 1970. How good is your manure disposal system? California Farmer, 233(5): 22. (cited in Pollut. Abstr., 1(5): Abstr. No. P70-05822.)
"The California Porter-Cologne Water Quality Control Act defines agriculture as industry and manure as waste. All surface and ground water is State (public) water. And any hole in the ground that waste is put into is a disposal site, requiring a Report of Waste Discharge accompanied by a filing fee ranging from $100 to $1,000 depending on volume or inflow. The writer suggests several barnyard manure disposal systems for compliance with the new regulations."

A-542 Riley, C.T. 1970. Current trends in farm waste disposal. J. Inst. Water Pollut. Contr., London, 69: 174-179. 3 tab. (cited in Pollut. Abstr., 1(5): Abstr. No. P70-05876.)
"The types of farm wastes are listed. The four basic methods of handling the farm wastes are described. In two methods no water is added and the material is handled as a solid or semisolid; in the other two water is added to facilitate handling. Factors affecting waste disposal are stated. Current trends in planning waste disposal are emphasized."

A-543 Wheatland, A.B. and J.B. Borne. 1970. Treatment, use, and disposal of wastes from modern agriculture. J. Inst. Water Pollut. Contr., London, 69: 195-208. 21 ref. 12 tab. (cited in Pollut. Abstr., 1(5): Abstr. No. P70-05878.)
"Recent experimental work done on the methods of treatment and disposal of animal wastes is presented. Odour control during storage and spreading of slurries and aerobic biological treatment of these slurries are described. Possible future methods of dealing with farm wastes are studied. Primary and biological treatment of the wastewaters resulted from vegetable washings are summarized."

A-544 Day, D.L. 1970. In-the-building oxidation ditches for livestock wastes. Water Wastes Eng., New York, 7(9): E23-E24. 3 ref. 3 fig. (cited in Pollut. Abstr., 1(5): Abstr. No. P70-05887.)
"A low-odor, low-labor system of managing livestock wastes from animal to field is discussed. The system consists of a confinement building for livestock, with self-cleaning, slotted floors; an oxidation ditch beneath the slotted floors; a non-overflow aerobic lagoon of fluctuating depth, which receives the overflow of mixed liquor from the oxidation ditch; and irrigating equipment for removing surplus liquids and solids from the lagoon and distributing them on nearby land when convenient for the operator."

A-545 Hurley, D.E. 1970. Pollution problems in New Zealand. Marine Pollution Bulletin, 1(9): 133-134. (cited in Pollut. Abstr., 1(5):

Abstr. No. P70-06070.)
"Although it has a population of only 3 million and very little heavy industry, New Zealand is experiencing pollution problems. The small, scattered population adds greatly to the cost of sewage treatment, and animals, including pigs, poultry and cows, produce waste products said to be equivalent to the wastes of 36 million people. A Pollution Advisory Council, set up in 1953, has classified waters according to their uses. This was a time-consuming procedure, and led to the objection that classification is a 'license to pollute'. . . ."

A-546 Hines, N.W. 1969. Agriculture: The unseen foe in the war on pollution. Paper, Univ. of Iowa, College of Law, Iowa City, Iowa. (cited in Pollut. Abstr., 1(6): Abstr. No. P70-06511.)
"Pollution from commercial agriculture has received virtually no attention under the Water Quality Act of 1965 or other legislation despite the serious threat which it poses to water quality. The run-off of animal wastes which can result in the depletion of oxygen within the streams, increased bacterial levels in water supplies, and high nutrient levels which support flourishing algae growth are discussed. Present feedlot regulations and disposal methods are examined, as are the technological difficulties which must be surmounted before an efficient solution to this particular problem can be achieved. Comprehensive land use control is perhaps the most promising solution. . . ."

A-547 van't Klooster, A. Th. 1964. The concentration of Na, K, Ca, and Mg in the dialyzates of gut contents of conscious sheep and the distribution of these minerals in the contents of the colon and in the feces of a sheep. Tydschr. Diergeneeskd, 89(23): 1709-1723. (cited in Chem. Abstr., 64: Column 2540a.)
"In fistulated sheep, the concns. of Na, K, Ca, and Mg of intestinal contents were measured by dialysis. Cellophane bags, contg. 1 ml. 0.01M polyethylene glycol solns. were hung in the fistulas. After at least 8 hours they were removed and the contents were analyzed. Also samples of the contents of the 1st part of the large bowel and of the feces in the environment of the bags were dried and ashed. The ash was analyzed for the same elements and the results were compared with the mineral contents in the corresponding ultracentrifugates (from the contents of the colon) and in the dialyzates (from feces). Over 50% of the Na and K in the contents of large bowel and of the feces appeared to be sol. On the hay ration, 24% of Ca and 43% of Mg in the contents of the large bowel was sol. After changing to grass, only 7.4% of Ca and 24% of Mg was in a sol. form. Sol Ca and Mg in the contents of the large intestine was almost completely dialysable. The decrease of the Ca and Mg concns. in the dialyzates of the contents of various parts of the intestine after the change of the ration could not be entirely explained by this change."

A-548 Petrova, L.I. 1965. Effectiveness of manure and mineral fertilizers on soddy-podzolic soil in flax rotation. Agrokhimiya, 11: 117-123. (cited in Chem. Abstr., 64: Column 8887b.)
"By comparing yields obtained from soils fertilized with manure with those obtained from the same soils fertilized with mineral fertilizers, it was concluded that while manure principally increased the potential fertility of soil, the mineral fertilizers increased the effective fertility. . . . Max. yields were obtained by the use of a combination of manure and mineral

fertilizers. Manure increased the potential fertility of the soils and ensured a high action of the mineral fertilizers applied jointly, resulting in better soil characteristics. Tables showing effect of manure and mineral fertilizers on soil activity and quality of flax, potato, rye, and oats are presented."

A-549 Cal-Tan Research Products Corp. 1965. Free-flowing protein containing fodder. Netherlands Patent No. 298, 552. (cited in Chem. Abstr., 64: Column 11776a.)

"Hydrolysis of animal waste products to polypeptides with H_3PO_4 at pH 1-3 is followed by partial evapn. of water. $CaCO_3$ is added to a pH of 5-8 and the $CaHPO_4.2H_2O$ formed takes up the remaining water. The result is a loose and granular meal."

A-550 Ishevskaya, I.M. 1965. The effect of prolonged use of mineral fertilizers, manure, and lime on the ascorbic acid content of potato tubers. Kokl. TSKhA, No. 108: 161-165. (cited in Chem. Abstr., 65: Column 4595c.)

"The content of ascorbic acid increases considerably during prolonged application of mineral fertilizers and (or) manure. In a cold year less vitamin C was found than in a warm, dry year. Liming during permanent tilling also produced an increase in ascorbic acid contents. Tilling with crop rotation and prolonged use of fertilizers increased the ascorbic crop rotation and prolonged use of fertilizers increased the ascorbic acid content by 32-60%."

A-551 Savulescu, A., A. Puscasu, E. Constantinescu, I. Siniayschi, A. Fediuc and M. Ciacoiu. 1963. Efficiency of agrotechnical and chemical methods of potato wart control. Analele, Inst. Central Cercetari Agr., Sect. Protect. Plantelor, 1: 47-6. (cited in Chem. Abstr., 65: Column 6221c.)

"The efficiency of soil treatments by sandolin A (50% 4, 6-dinitro-o-cresol) or by org. fertilizers against the title disease was investigated. The best results were obtained by dusting with 75-100 g. sandolin A/$m.^2$. Application of 30 tons of manure/ha. showed some efficiency."

A-552 Aragon, R.H. and R. Bressiani. 1965. Effect of fertilization with minor elements on the protein value of corn and sorghum. Arch. Venezolanos Nutr., 15(2): 63-86. (cited in Chem. Abstr., 65: Column 7956b.)

"The effects of fertilizers on the yield and nutritional quality of protein of 2 varieties of corn (*Zea mays*) and one of sorghum (*Sorghum vulgare*) were investigated over 2 years. A factorial design with random blocks was used in fertilizing plots with N-P-K (19-13-7), N-P-K plus minor elements (S, Mg, Ca, Fe, Mn, B, Cl, Zn, I, and Mo), dry chicken manure with and without minor elements, minor elements alone, and with untreated plots as controls. The harvested cereals were estd. for protein content by chem. analysis, for lysine, leucine, isoleucine, and tryptophan contents by microbiol. analysis, and for nutritional value by biol. tests in which the growth of rats fed with the cereals was noted. Chicken manure and N-P-K increased the protein content but decreased the biol. quality of the cereals. Minor element fertilization was without effect on the protein content but increased the biol. quality and the contents of the amino acids tested."

A-553 Panak, H. 1966. Transformation of S in the process of manure fermentation. Agrokhimiya, 1966(7): 62-66. (cited in Chem. Abstr., 65: Column 11288f.)

"The expts. were conducted in 2 hermetically closed chambers filled with 2 kg. fresh cow manure, thoroughly mixed with $Na_2{}^{35}SO_4$ soln. The vessels were connected to absorbing flasks for collection of the fermentation gases. The reaction temp. fluctuated, 15^o-20^o, the first month and 20^o-25^o the second and final reaction month. The amt. of ^{35}S found in one chamber after reaction for 1 month and in another chamber after reaction for 2 months indicated the microbiol.-fixed org. S. (16% in the first month and 44% in the second, resp.). Apparently the higher reaction temp. contributes to a higher yield of transformed inorg. S."

A-554 Polheim, P.V. 1965. Characterization of the organic matter in manures. I. Classification of organic manures on the basis of the solubility of organic substance and of nitrogen in organic bond. Landwirtsch. Forsch., 18(3/4): 228-237. (cited in Chem. Abstr., 65: Column 19262g.)

"The detn. of org. matter in manures as a loss on ignition was considered unsatisfactory, esp. since ammonium salts, nitrates, and urea are totally, or partially destroyed, and it was considered desirable to classify the various types of N-contg. substances present. The following detns. were made on 15 samples of org. manures and mineral org. fertilizers: water; ash and loss on ignition; total, water-sol., ammoniacal, nitrate, and urea N; components sol. in 3.1 and 72% aq. H_2SO_4, and 5% aq. NaOH; total P_2O_5; and total K_2O. Correlation of the solubilities of the N-contg. substances in H_2SO_4 and NaOH gave a preliminary characterization of the fertilizer as follows (percent sol. in 3.1% H_2SO_4, 72% of H_2SO_4, and 5% NaOH, and percent water-insol. total N which was sol. in 5% NaOH): plant material, >70, 40-60, 10-20, 50-75; predominatly mineral, >50, ≤ 10, 0, >90; leatherlike waste (animal origin), 40-50, ~ 20, 0, >90."

A-555 Doerr, R. 1965. The characterization of the organic substances in manure. II. Groups of organic manures and residues, and a proposed scheme of a simple analysis based on the oxidizable carbon. Landwirtsch. Forsch., 18(3/4): 238-246. (cited in Chem. Abstr., 65: Column 19263a.)

"A method of characterizing the org. substances in manures and city garbage utilized as fertilizer was proposed. Total org. matter was detd. by oxidn. with chromic acid. Org. manures with $<3\%$ total org. matter after extn. with 0.5% NaOH and 80% H_2SO_4 were regarded as being easily decomposable without any persistent effect in improving soil properties; manures with $\geq 3\%$ total org. matter were regarded as having a soil-conditioning capacity."

A-556 Johnston, A.E. and R.G. Warren. 1965. Farmyard manure experiments at Woburn. Rep. Rothamsted Exp. Station, 1964: 40-41. (cited in Chem. Abstr., 65: Column 20790d.)

"In a microplot expt., super supplying 0 and 1.5 and 3.0 cwt. P_2O_5/acre (with basal N-K fertilizers) to carrots, sugar beets, and globe beets was compared with farmyard manure (FYM) alone and with FYM + a super supply of 1.5 cwt. P_2O_5/acre. Both amts. of fertilizer P increased early growth of carrots. The extra growth from 3.0 cwt. P_2O_5 was $\sim$2-fold that from 1.5 cwt., and the plants were larger and more uniform than those given FYM only. P fertilizer also improved carrots on the FYM plots. P did not affect early growth of globe beets and caused only small increases with sugar beets."

A-557 Buczak, E. 1966. Organic and mineral fertilization in the crop rotation of plants. II. Influence of farm manure, green manure, and mineral fertilization on soil properties. Roczniki Nauk Rolniczych, Ser. A, 91(2): 273-298. (cited in Chem. Abstr., 66: Abstr. No. 18364.)

"Comparative expts. were carried out in two crop-rotation arrangements from 1951-64, and the effect of different N-P-K fertilizers, using (kg./ha.): 60 N-50P_2O_5-80K_2O; 25-37N-50P_2O_5-180K_2O; and 30N-16P_2O_5-40K_2O, was studied. The increase of org. matter in soil in response to farm or green manure as compared with mineral fertilizers depends upon the sequence of plants crops as well as upon after-crops and cover crops selected for the specific plants. An increase of $\sim$10% C in soil can be obtained. Usage of particular mixts. with mainly rye as cover crops causes greater increases of org. matter than after-crops and it equals results obtained with farm manure. Plants cultivated for green manure should be adequately fertilized with mineral fertilizers to equal the action of farm manure. Inadequate mineral fertilization with green manure in crop rotation leads to a decrease of available P and K in the soil. Green manure from legumes, esp. from winter vetch, has a tendency to acidify the soil, contrary to farm manure and mixts. contg. much mustard and phacelia, which tend to raise the pH."

A-558 Rajagopal, G. and B.N. Pathak. 1966. Effect of volatile acid accumulation in dung digestion. Environmental Health (India), 8(3): 194-196. (cited in Chem. Abstr., 66: Abstr. No. 21951.)

"An investigation into anaerobic digestion revealed that indications of digester failure were noticeable when the volatile acids concn. in a tank reached 3970 mg./l. and a pH of 5.6. The digester had completely failed when the volatile concn. attained 6194 mg./l. and a pH of 4.4. Addn. of a water to dil. the volatile acids or the addn. of lime to neutralize the acids did not effectively reverse the process. However, on the addn. of seed (digested material), the digester returned to its original condition. These expts. were done in 4-l. digesters."

A-559 Ziolecka, A. 1966. Estimation of nitrogen losses during drying of pig feces. Rocz. Nauk Roln., Ser. B, 89(1): 45-51. (cited in Chem. Abstr., 66: Abstr. No. 26519.)

"Kjeldahl N was detd. in 57 samples of fresh and dried (at $\sim 60^{\circ}$) pig feces. During drying, N losses in dry matter were 0.25-0.71% (av. 0.46), corresponding to relative N losses in fresh feces of 7.0-17.3% (av. 13.8). Relative N losses increased with increasing N content of fresh feces. Apparent digestibility coeffs. of crude protein were higher (5.2-21.3%, av. 11.4) when calcd. on the basis of dried rather than fresh feces N."

A-560 Zameck, C. von. 1966. Effect of regular farmyard manure application on CO_2 release and nitrification ability of the soil. Albrecht-Thaer-Arch., 10(10): 939-949. 30 ref. (cited in Chem. Abstr., 66: Abstr. No. 54634.)

"CO_2 release in soils is the result of numerous biol. and biochem. processes; it indicates the level of biol soil activity. Manure provides energy-rich C and N-contg. compds. that fuel these activities. CO_2 release and NO_3^- production in manured soils were measured by incubating at 27°, samples wet to 60% of max. H_2O capacity. . . . Manured soils released 4-40 (av. 22%)

more CO_2 than controls. July gave the highest release, and May and September the lowest. CO_2 release remained high after the end of fertilizer addn.: +8-39% after 1 year, and +15-33% after 2 years, with an overall av. of +24%. Nitrification ability also was increased by manuring. Treated plot samples produced about 13% more NO_3^- during the year of application, 32% the following year, and 14% the final year. Nitrification was lowest (+6%) during the months with max. CO_2 output."

A-561 Todorova, B. 1966. Investigations into the microflora and certain organic compounds in storage of organic manures. Pochvozn. Agrokhim., 1(4): 389-396. (cited in Chem. Abstr., 66: Abstr. No. 64709.)
"The effect of superphospate on the propagation of the microflora and on the vitamin B_{12} (I) content in farmyard manure, peat, and composts was investigated. The best results were obtained with 1.5% and 3.0% of superphosphate. The microorganism no. reached a max. between the 4th and 6th month of storage. The I content was correlated to the rate of microfloral propagation. Higher amts. of superphosphate (4.5 and 10%) inhibited microfloral growth and delayed decompn. in the composts. The rate of microfloral propagation and the I content in peat was lower than in farmyard manure."

A-562 Gruev, T. 1966. Fertilizing of sugar beets with organic and mineral fertilizers under irrigation conditions on leached chernozem in the Brushlyan Sandrovo irrigation area. Pochvozn. Agrokhim., 1(4): 345-362. 20 ref. (cited in Chem. Abstr., 66: Abstr. No. 75372.)
"Reported are tests carried out during 4 years (1956-9) on leached chernozem at pH 5.8-6.3 and with 3% humus in the upper layer. Used were manure, NH_4NO_3, superphosphate, and K_2SO_4. Preceding crop was wheat. Manure and 1/3 of the mineral fertilizers were spread before sowing in early spring, the rest in 2 equal parts during growth. Separate tests were made by leaf spraying with the mineral fertilizers. The humidity of soil was kept const. at 65-80% of capacity. Best results were with 10,000 kg. manure/ha. and with 15:10:5 N-P-K (with superphosphate in the powd. form) and with leaf spraying. The yield was 54,670 kg. beets/ha. compared to 34,810 kg./ha. in the control. The best yield without leaf spraying was 52,250 kg./ha. The best yield of sugar was, with leaf spraying, 8980 kg./ha., without it 8230 kg./ha."

A-563 Il'in, S.S. 1965. Effect of fertilizing system on the accumulation of organic substances in soil and the plant crop during crop rotation. Tr., Kazan. Gos. Pedagog. Inst., No. 2: 3-124. 31 ref. (cited in Chem. Abstr., 67: Abstr. No. 10815.)
"Since 1930 plot tests were conducted on sod-medium podzolic, sod-podzolic soils, and chernozem. In the case of sod-podzolic soils, the basic soil nutrition (18 tons/ha.) was horse manure and various amts. of mineral fertilizers (superphosphate, $(NH_4)_2SO_4$, K salt 40%). Total org. and mineral fertilization of rye gave a 3-fold increase of the root system (compared with nonfertilized plots), permitting a much better utilization of mineral fertilizers. The same was true of peas, potatoes, summer wheat, and other plants. The content of N in roots increased slowly (by 50% with total fertilization). . . ."

A-564 Il'in, S.S. and A.D. Politov. 1965. Effect of fertilizing system on soil fertility and yields of peas and winter rye planted in fallow. Tr., Kazan. Gos. Pedagog. Inst., No. 2: 125-151. (cited in Chem. Abstr., 67: Abstr. No. 10816.)

"Plot tests were made on peas and winter rye with crop rotation: pea, winter rye, sugar beet, summer wheat on sod medium podzolic, clayey soil using manure and mixed fertilizers. Tests with peas showed the dynamics of nitrate formation in the soil increased 3-fold with manure, esp. with total mineral nutrition (N-P-K) (30:60:60), compared with the control without fertilizing. Although the pea soil, during the growing stage had much less nitrates than soil free of peas, at the end of that stage the pea roots caused strong nitrification processes, thus making up for the shortage. Fertilization enhanced pea growth, the highest crop yield being with 18 tons of manure/ha. and 11.25 quintals N-P-K (30:60:60)/ha. The root system was increased by the mineral fertilizers from 5.9 to 14.5 quintals/ha. During the growth of winter rye, the humidity was higher on plots free of plants. The nitrate content varied during growth and was lowest at the end of summer due to the asimilation of N by plants and lower soil moisture. The best yield of rye was obtained with 18 tons of manure/ha. and 19.4 quintals N-P-K (30:60:60) ha."

A-565 Lazurkevich, Z.V., I.G. Bukh and L.V. Stoyanova. 1967. Bacteria quantity and vitamin B_{12} content in active silt. Mikrobiol. Zh. (Kiev), 29(2): 100-105. (cited in Chem. Abstr., 67: Abstr. No. 25255.)

"The quantity of bacteria in active silts, which purify agricultural wastes (group III silts) is higher, than in silts which purify industrial wastes (silt groups I and II): 14-111 billion and 0.100-37,000 billion/g. of dry silt, resp. Vitamin B_{12} was greater in group III active silts, than in groups I and II: 540-700 and 37.5 μg./g. dry silt, resp. No correlation was established between the quantity of bacteria and of vitamin B_{12} in the active silts of any group."

A-566 Hoopes, J.A. and D.R.F. Harleman. 1967. Dispersion in radial flow from a recharge well. J. Geophys. Res., 72(14): 3595-3607. (cited in Chem. Abstr., 67: Abstr. No. 36181.)

"The recharge and disposal of treated and untreated waste waters in ground water aquifers results in a mixing of these waters with the natural ground water. The distribution and boundaries of the ensuing mixt. are detd. by the combined mechanisms of convection, dispersion, diffusion, and sorption. In this study, the mass conservation equation for a dissolved substance in 2-dimensional ground water flow is developed. An anal. soln. and a numerical soln. of this equation are obtained for the radial and temporal distribution of a conservative, dissolved substance, which is injected into a homogeneous isotropic confined aquifer, by a single recharging well. Exptl. measurements of the concn. distributions of a dil. salt H_2O + racer support the theoretical solns. For homogeneous media, the dispersed or mixed region may be $<$1% of the vol. of fluid recharged at distances of only 30-60 m. from the well. The exptl. results show that the dispersion coeff. along the streamlines is the same for both uniform and nonuniform flows at the same velocity."

A-567 Geller, I.A., K.M. Dobrotvorskaya and V.P. Karpenko. 1967. Application of antibiotics for partial inhibition of denitrification processes. Agrokhimiya, 1967(4): 111-115. (cited in Chem. Abstr., 67: Abstr. No. 41211.)

"In gray forest podzolized soils and chernozems, prepns. of streptomycin, polymyxin, or streptomycin metabolites decreased the no. and biol. activity of denitrifying bacteria which are important in the soil N cycle. Streptomycin, cycloserine, and streptomycin metabolites added to stored manure partially inactivated the bacterial processes, esp. urease activity, and the activity of the urinary tract bacteria and the denitrifying bacteria responsible for decreasing the manure N content and improving its quality."

A-568 Kramer, D. 1967. Some aspects of purification of waste waters with small amounts of contaminants with special consideration of the soil treatment method. Wasserwirt.-Wassertech., 17(6): 196-202. 48 ref. (cited in Chem. Abstr., 68: Abstr. No. 32992.)

"Soil treatment of waste waters results in a B.O.D. decrease of about 8000 kg./ha. of dispersion area, for a single operation. In East Germany, 67% of the total waste water vol., and only 13% of pollution mass, are due to domestic sewage. The main sources of pollution are (in millions of inhabitants equivs.): domestic sewage 4.6; livestock breeding 8.0; bulk storage of foods or fodders, 20; and potato cooking (for swine breeding) 2.4. For the last 3 sources of pollution, the vols. produced, the chem. characteristics, and the equiv. pollution are tabulated and discussed. The cost for waste waters soil treatment is discussed, and operating rules are given."

A-569 Appleman, M.D. 1967. Converting odors in manure and human excreta. U.S. Patent 3,345,152. (cited in Chem. Abstr., 68: Abstr. No. 48645.)

"The invention provides continuous means for converting the odor of manure from excreta to more pleasant odor by heat distn. of the manure and returning the produced gaseous effluent back into the incoming fresh manure. The distn. compartment of the app., substantially free of O, is kept at a temp. between 180 and 600°F. To assist in the odor conversion and make it more complete and permanent, gaseous products of destructive distn. of cellulose materials such as wood and plant products are led into the heated compartment. This material should be at least 40 wt. % of cellulose. Essential oils of characteristic odor may be introduced into the distn. chamber to impart distinctive odor to the product. Several modifications of the app. are discussed."

A-570 Pillorget, P. 1967. Process and apparatus for the physical and chemical transformation of agricultural and biological wastes. French Patent 1,484,673. (cited in Chem. Abstr., 68: Abstr. No. 62511.)

"The wastes were hydrolyzed with acidulated water to transform the pentosans to furfural (I) and a part of the celluloses (II) into sugars. The extn. of I is limited to prevent the carbonization of II and of lignin, and the destruction of sugars. The crushed materials to be treated were sent by an elevator to a funnel where they were humidified until satn. after which they went into the hydrolyzer under 2 or 3 atm. of vapor; and dropping at the base of the app. permitted the recycling of excess acidulated water to the funnel. A system of sluices permitted, when the balance of pressures was obtained in the top of the app., to send I-contg. vapors through filters where the furan gas and then I-contg. vapors were condensed with a refrigerant, to be later on sent to a distn. unit. When the I content was $\sim$1%, hydrolysis was stopped, the hydrolyzate drawn off, the app. charged, and a new cycle begun. The neutralized hydrolyzate was stored and its sugars (nonsterilized) slowly transformed the matter into a moist compost contg. org. matter, N, sol. or insol. phosphoric acid, humic acids, and potash. This compost can be dried and sown with Azobacter."

A-571 Gleave, C.L. 1968. Treatment of sewage and (or) polluted water. U.S. Patent 3,362,905. (cited in Chem. Abstr., 68: Abstr. No. 89750.)
"Fecal excretions of pregnant cows contain aerobic-promoting compns. suitable for the treatment of polluted waters. The fecal excrement is mixed with water and a fermentation-inducing material producing an independent aq. phase is formed. The mixt. is then treated in primary and secondary digestion zones with the water to be treated at preestabilished pH ranges for definite periods of time. Through the treatment, all of the objectionable conditions in the waters such as odor, pathogens, fats, and greases are greatly reduced. The water may be reclaimed after disposal of the waste materials. The method is economical, since the material used for the treatment may be produced from the fecal excretions of animals in dairies."

A-572 Nakano, N. 1968. Feeds producing odor-free excreta. U.S. Patent 3,370,953. (cited in Chem. Abstr., 68: Abstr. No. 94760.)
"Animals are given feed contg. at least 0.1% humic acid or salts thereof. Thus, groups of chickens are given feed contg. for (a) 0, (b) 0.3, (c) 0.2, and (d) 0.1% humic acid. Odor from the excrement at the end of 10, 30 and 40 days is for (a) bad, bad, bad; (b) substantially deodorized, none, none; (c) slight, medium, none; (d) medium, medium, none. Similar results are obtained with a dog. Humic acid increases crossing-times in mink and egg-laying in hens and promotes the beauty of hair and feathers of animals."

A-573 van't Klooster, A.T. 1967. The condition of calcium, magnesium, and other minerals in the intestinal contents and manure of ruminants in connection with their absorption. Meded. Landbouwhogesch. Wageningen, No. 5. 135 pp. 177 ref. (cited in Chem. Abstr., 69: Abstr. No. 9233.)
"Metabolic studies with milk cows indicated that ingested Ca, Mg, and P are excreted mainly in the feces ($\sim$50% of Ca and Mg occurs as phosphates), while Na and K are excreted mainly via the urine. Approx. 30% of the Ca and Mg in the feces can be absorbed on the undigested feed residues, esp. on the fibrous particles; this adsorption likely occurs in the middle of the small intestines, where the pH of the chyme is $\sim$6. In the first part of the small intestines > 70% of the Ca, Mg, and P occurred in a sol. form, and in the following parts this percentage decreased; at the end of the small intestine only 35% of the Ca, 58% of the Mg, and 31% of the P occurred in the sol. form, whereas in the feces these values had decreased to 15, 38, and 9% resp. . . ."

A-574 Tono, T., Y. Tani and K. Ono. 1968. Microbial treatment of agricultural industrial wastes. I. Adsorption of lignins and clarification of lignin-containing liquor by molds. Hakko Kogaku Zasshi, 46: 569-576. (cited in Chem. Abstr., 69: Abstr. No. 80014.)
"In microbial treatments of agricultural industrial wastes contg. lignins such as pulp waste, the clarification and the efficiency of chem. O demand removal of wastes can be elevated, if the adsorption of lignins on microorganisms is utilized for the elimination of lignins in waste. In view of

this, molds (identified as Aspergillus species and Penicillium species) which adsorb lignins efficiently were sepd. from the mycelial maps formed over kraft waste, and expts. on the clarification of lignin-contg. media were carried out by using these molds. As a result, the degree of clarification is greatly elevated and lignins in the media were almost thoroughly eliminated by these molds during shaking culture for a week under growing conditions of 30° and pH 6-8, provided sugars as a C source are added in a small amt. (<0.05%) to the media contg. 0.1% lignin. In addn., a further investigation showed that Aspergillus strains in stock cultures also adsorbed lignins and clarified the lignin-contg. media but that other molds such as rot fungus adsorbed no lignins."

A-575 Ishida, M. and T. Shirai. 1968. Fluidized incineration of chicken droppings. Kagaku Kogaku, 32: 459-464. (cited in Chem. Abstr., 70: Abstr. No. 14238.)

"This study is concerned with the incineration study of chicken droppings with sufficient water content in a fluidized-bed using mech. agitation devices. The theoretical anal. of temp. and rate of incineration in a fluidized bed was completed and the results were as follows: (1) The rate of incineration was proportional to O mole ratio between the concn. of O and inlet concn. O and to non-incinerated quantity of chicken droppings. (2) The combustion rate const. vs. bed temp. at a steady state linear. From this Arrhenius plot, the activation energy of 13 kcal./mole was obtained below 500° above which a diffusion took place and the slope of the Arrhenius plot was diverted. (3) The combustion rate const. varied with air (or O) velocity as well as with chicken droppings charged quantity. The rate const. decreased as the theoretical combustion period increased owing to the decrement of effective area as a result of mutual effect among the chicken droppings. The combustion rate const. from the gas anal. was found consistent with that obtained from the combustion curve."

A-576 Tokovoi, N.A., N.M. Maiboroda and L.N. Lapshina. 1967. Dynamics of macro and trace elements in manure. Mikroelem. Biosfere Ikh Primen. Sel. Khoz. Med. Sib. Dal'nego Vostoka, Dokl. Sib. Konf., 2nd. pp. 542-546. (cited in Chem. Abstr., 70: Abstr. No. 86673.)

"Grain-fed cattle assimilated 70-81% of the Na, 71-79% of the P, 40-50% of the Fe, and 20-25% of the Co, Cu, Mn, and Zn in their nutrients, while 90-94% of both the Pb and Ni passed into the manure. The Mg content of fresh manure soon decreases by 25 and that of Mn and Zn by 30%. Cu, Co, Mo, Pb, and Ni losses are much less; 20 tons of manure/ha. fully covers the requirements of potatoes and sugar beets for Mn, Zn, and Cu, when the crop is 20 tons/ha; amts. of Pb and Ni supplied exceed their requirements."

A-577 Ziolecka, A. and A. Rymarz. 1968. Nitrogen fractions in fresh and dried pig feces. Rocz. Nauk Roln., Ser. B, 90(3): 325-331. (cited in Chem. Abstr., 71: Abstr. No. 1322.)

"Total N, protein N, nonprotein N, and ammonia N were detd. in 16 samples of fresh and dried (60° for 24 hrs.) pig feces obtained from pigs fed a control diet supplemented with casein, gluten or soybean oil meal in amts. corresponding to 100 g. protein/day. The content of total, protein, and ammonia N was higher in fresh than in dry samples, by 0.22, 0.27, and 0.09%, on dry matter basis, resp. These losses, expressed as a percentage of the N content in fresh feces were 7.91, 10.84, and 38.06% resp. The nonprotein N content was higher in the dried than the fresh samples with the exception of the control diet, but only in the gluten-supplemented diet was the increase of any magnitude. The proportion of nonprotein N in the total N was in all cases higher in dried samples."

A-578 Koepf, H.H. 1969. Soil utilization and water quality. Mitt. Deut. Landwirt. -Ges., 84(9): 242-246. (cited in Chem. Abstr., 71: Abstr. No. 42040.)

"The effect of farm effluent on water quality is discussed. Farm effluent cannot be purified in the same way as domestic effluent since it is much too concd. Farm effluent raises the concn. of NO_3^- in water, which is harmfull to small children. NO_3^- is also leached from fields to increase the NO_3^- concn. in lakes and rivers. The prevention of NO_3^- leaching is discussed."

A-579 Rizk, S.G., F.A. Farag, M.Kh. El-Mofty and M.A. El-Fadl. 1968. Production of methane gas from organic wastes under anaerobic conditions. I. Important factors influencing formation of combustible gases. Agr. Res. Rev., 46(2): 53-66. (cited in Chem. Abstr., 71: Abstr. No. 53297.)

"As a 1st step in producing CH_4 on a com. scale, lab. expts. were carried out to ferment, under restricted O conditions rice straw, corn stalks, cotton stalks, and buffalo dung. Factors affecting gas yield viz., $CaCO_3$ and $(NH_4)_2SO_4$, variation in incubation temp., ratio between materials and aq. soln. in fermentors, and changes in pH were studied. The max. rate of CH_4 formation occurs in environments of neutral pH; there is little activity below pH 6.0. Addn. to the substrate of buffering materials such as $CaCO_3$ to neutralize the acids formed would favor CH_4 production. CH_4-producing organisms flourish at 30° thus raising the incubation temp. to 37° or 60° would depress gas yields. It appears logical that fragmentation of org. wastes in the CH_4 fermentors favors production of gas yields compared to powdering."

A-580 Gusev, S.P. 1968. Reprocessing poultry manure into mineral fertilizer. Tr., Mosk. Inst. Nar. Khoz., No. 46: 176-179. (cited in Chem. Abstr., 71: Abstr. No. 80363.)

"Poultry manure contains N 6%, P_2O_5 4%, and K 2%, but during storage it loses nearly 50% of its N. G. proposes to treat it with Cl_2 or to mix it with superphosphate in order to bind NH_3. After its treatment with superphosphate it contains N 5%, P_2O_5 7% and K 2%."

A-581 Foster, H.L. 1969. Effects of different management and fertilizer treatments on the soil and leaf nutrient status of an elephant grass ley. E. African Agr. Forest. J., 34: 468-475. (cited in Chem. Abstr., 71: Abstr. No. 90336.)

"Soil and grass analyses indicated that at Kawanda research station phosphate may limit elephant grass yields and following crops yields, if only N fertilizer was applied to the grass; and that K, and not Mg, was likely to limit both ley and crop yields, if only N and phosphate fertilizers were applied to elephant grass which was zero-grazed. N and P could be raised to the recommended level if fertilizers were applied, and Mg increased to a sufficient concn. if the grass were cut. The results for the unfertilized plots showed that grazing was the management treatment which had the most beneficial chem. effect on the soil; the return of dung and urine increased soil N and exchangeable K."

A-582 Ortega, B.C., V. Hernando and M.P.S. Conde. 1968. Differences in the effect of humic acid extracted from manure and from peat on maize plants. Isotop. Radiat. Soil Org. Matter Stud., Proc. Symp., 2nd. pp. 541-553. (cited in Chem. Abstr., 71: Abstr. No. 90344.)
"The effects of two humic acids of different origin, humic acid E extd. from manure and humic acid T extd. from peat, were studied on the development and uptake of nutrients by maize plants. Anal. of the humic acids showed that the E type had a larger content of N and carboxyl groups, while the T type had a larger amt. of phenol groups. The expt. was carried out in a hydroponic culture, with ground quartz serving as the inert support to which doses of 0, 6, 12, 24, 48, and 96 mg. of humic acid were added (in solid form) per kg. of quartz. The beneficial effect of humic acid E on the plants is obvious, since a 58.5% increase in yield was obtained with a 6-mg. dose, whereas a 96-mg. dose of humic acid T was needed to get a 4.2% increase in yield. The humic acids caused increased uptake of P and Ca by the plant and decreased uptake of K and Mg. Humic acid E caused increased uptake of N at all levels, whereas the T type did so only at the 6 and 12 mg. levels, giving rise to a decrease at the other dose levels. A hypothesis is presented to explain the differences in behavior of these acids."

A-583 Blaha, K. 1968. Effect of superphosphate on the quality of manure and on the yield indexes of crops. Agrochemia (Bratislava), 8(1): 7-11. (cited in Chem. Abstr., 71: Abstr. No. 90397.)
"Superphosphate was spread over layers of manure in the amt. 17-25%. Analyses 9 months later showed that the optimal % increase of N in the dry matter of manure corresponded with a 1.5%-2% P_2O_5 increase, resulting from 2.5-3.22% superphosphate added (by wt.). Also, 25-200 g. superphosphate was spread over 1 $m.^2$ surface of deep piles of manure. Optimal N retention was observed with 200-320 g. superphosphate/$m.^2$ surface of deep piles of manure. NH_3 production by 1 $m.^3$ piled manure, escaping in the air, was 8.14 mg. under control conditions and 4.78 mg. under exptl. conditions. Straw-free cow manure was enriched with 0-15% superphosphate (by wt.). The dependence of N losses on supplemented superphosphate is expressed by an equation. Sugar beet yields increased by 2.5% due to superphosphate added to manure. Superphosphate contributed to a higher level of imide N in the manure."

A-584 Nakayama, T. and T. Yamashita. 1967. Availability and fixation of phosphorus in soils. VI. Influence of farmyard manure and ammonium nitrohumate on fixation of phosphorus in soils, and absorption of phosphorus by tobacco plants. Hatano Tab. Shikenjo Hokoku, No. 60: 105-111. (cited in Chem. Abstr., 71: Abstr. No. 100896.)
"Tobacco plants were grown on Hatano soil. supplied with $^{32}PO_4{}^{3-}$, and with or without farm manure and $NH_4{}^+$ nitrohumate (NHA). Absorption of P derived from fertilizers was increased, and its peak was at an earlier stage, by the presence of farmyard manure and NHA. At the earlier stage of growth, P in the tobacco plant derived from fertilizers was increased by the supply of NHA. These effects developed more clearly when superphosphate was used as a P source compared with fused phosphate. Fixation of added P by soil decreased, and absorption of P by tobacco plants increased, with increased supply of farmyard manure and NHA."

A-585 Cumakov, A. 1969. Content of trace elements in manure and composts in Czechoslovakia. Agrochemia, 9(6): 171-172. (cited in Chem. Abstr., 71: Abstr. No. 123063.)

"The following levels of trace elements were found in horse, cattle, pig, and chicken manures (amts. in mg./kg. dry matter): B 24.9 (10.75-39.0), Cu 10.4 (3.00-18.30), Mn 113.2 (70.0-160.3), Mo 0.72 (0.17-1.51), and Zn 76.8 (17.3-150.0). These concns. were not sufficient to meet the needs of crops. The use of compost which contains more trace elements than manure may partially diminish the deficiency of trace elements in the soils."

A-586 Hashimoto, H., M. Ishikawa and Y. Ibihara. 1969. Relation between chemical components of farmyard manures and growth of barley. Nippon Dojo-Hiryogakü Zasshi, 40(8): 309-314. (cited in Chem. Abstr., 72: Abstr. No. 54270.)

"Farmyard manures (10) were collected from 7 farms located in different districts, including exptl. fields of prefecture stations. Amts. of N, P, or K varied in these manures, esp. N and P. Farmyard manures from high yield paddy fields had a higher concn. of these elements than those from Agricultural Expt. Station. Other elements (e.g. Ca, Mg, of Mn) showed no such relation. Expts. with humus-rich volcanic-ash soil and the farmyard manures showed a close correlation between the growth and yield of barley and the contents of elements, esp. N and P."

A-587 Bawaskar, V.S. 1968. Chemical composition of dungs and some organic waste materials. Poona Agr. Coll. Mag., 58(2/3): 97-99. (cited in Chem. Abstr., 72: Abstr. No. 65996.)

"Contents of moisture, org. C, humus, acid-insol. matter, total N, P_2O_5, Ca, and Mg are tabulated for compost, 6 animal dungs, tamarind seed powder, penicillin waste, press mud cake, and bajirao weed (<u>Flaveria contrayerba</u>). Tamarind seed powder, buffalo dung, penicillin waste, and cow dung were rich in org. C, whereas bajirao, farm compost, and press mud cake were rich in Ca. Penicillin waste, buffalo dung, and bajirao were rich in K_2O."

A-588 Tha, M.K. and A. Sen. 1969. Formation of elemental sulfur from gypsum. Indian J. Agr. Sci., 39(5): 423-425. (cited in Chem. Abstr., 72: Abstr. No. 65998.)

"Dried cow dung and dried leaves of <u>Sesbania sesban</u> and of <u>Calatropis gigantea</u> were combined with gypsum. Water was added in such amts. as to maintain anaerobic conditions. After a month, the mixt. was dried, powd., and extd. with CS_2 to obtain crude S. Decompn. of org. matter under anaerobic conditions led to the formation of free S from added gypsum, and the amt. of S formed was proportional to the loss of org. matter. The plant leaves, which were rich in N, were better sources of org. matter than cow dung for carrying out the redn. of sulfate to free S."

A-589 Susbielle, H., R. Forestier and F. Gaudin-Harding. 1969. Use of x-ray fluorescence for determination of total sulfur. Application to animal matter. Bull. Soc. Chim. Biol., 51(1): 187-190. (cited in Chem. Abstr., 72: Abstr. No. 75484.)

"The method of x-ray fluorescence is described. For the detn. of total S in a large no. of samples of biol. material it was shown to be rapid and sensitive; and nondestructive for the samples used. Blood serum, urine, and feces were analyzed."

A-590 Teslinova, N.A. 1969. Activity of urease of sierozem soil. Uzb. Biol. Zh., 13(5): 54-55. (cited in Chem. Abstr., 72: Abstr. No. 78020.)

"Soil was mixed with: (1) nothing (control), (2) N-P-K fertilizer, (3) N-P-K and manure, (4) cotton roots, (5) alfalfa roots, stems, and leaves. Fertilizers and plant residues were incorporated at 0.2 g N/kg soil. The soil was examd. after 40, 65, 120, and 160 days at 26-8° and 60% moisture. The activity of urease was detd. by the Hoffman method, and expressed in mg ammonia N/g soil in 48 hr. The effect of test (2) on the activity of urease was insignificantly greater than in (1). In test (3) the activity of urease was very high, because of the presence of microflora, urea, enzymes, and amino acids. In (5) the activity was increased 10-fold as compared with (1). The microorganisms participating in the decompn. of alfalfa were varied, but the no. of Pseudomonas mycophaga was large. This bacterium formed large amts. of urease. The urease activity may serve as an index of soil fertility."

A-591 Wachs, B. 1969. Effect of liquid manure on sewage purification plants in small communities. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 130-146. (cited in Chem. Abstr., 72: Abstr. No. 82715.)

"In the sewage purification plants of Muenchen-Grosslappen, tests were conducted in 1968 with special Schreiber trickling filters, in compact clarification plant OMS-CS with trickling filters, and with the Schmitz-Lenders clarification plant. Manure used was already considerably disintegrated because of its age of several months. With daily 5-day BOD supply of manure being 1/12th of the load, the quality of H_2O discharged from the purification plant was considerably worsened. The special trickling filter plant showed inadequate clarification particularly when manure was fed at intervals, but not while feeding was continuous. In trickling filters, when manure was fed at intervals, the water quality dropped considerably. Feeding of a double quantity of manure to the small Schmitz-Lenders purification plant caused many problems with the discharged water and nitrification did not take place. The quality of discharged, purified sewage of this compact plant was still within the degrees of purity prescribed by the Water Commission. Costs of treating manure in purification plants are prohibitive. Manure must settle for at least 6 months; it is more economical to use manure on cultivated fields."

A-592 Bernhardt, H., W. Such and A. Wilhelms. 1969. Nutrient content of water from watersheds with mainly agricultural utilization and rural population. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 60-118. (cited in Chem. Abstr., 72: Abstr. No. 82731.)

"To arrive at nutrient content of lakes, the total quantities of P and N carried annually by tributaries must be known. From these data, the nutrient content of the body of water can be calcd. Moreover, when lakes have a min. quantity of P of their own, the quantity of P continually added by influx from rivers must be taken into consideration, particularly during the 6 summer months which have a crit. influence on biol. production. Extensive knowledge of origins of P and N compds. coming into the drainage is a prerequisite to reorganizing of the drainage area. Tests at Wahnbach Dam have shown that the major quantities of incoming compds. do not stem from domestic or agricultural plant sewage, but from cultivated fields and the many manure storage areas. It is possible to remove from the inflows 40% of annual quantities of P by irrigation and treatment by mech.-biol.-chem. processes."

A-593 Scherb, K. 1969. Fermented feed preparation and its effect on drainage and sewage purification plants of small communities. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 147-168. (cited in Chem. Abstr., 72: Abstr. No. 82753.)

"Depending on type of silo, plants used, and stage of vegetation, as well as degree of freshness of the plants, different amts. of juice are produced. Nearly 75 to 80% of the total amt. are discharged 2 to 3 weeks after filling, the rest in $\sim$2 to 6 more weeks. This discharge from the silos has an extremely high content of biol. degradable compds. If silo liqs. come into other sewage, its concn. is increased many times and if it then comes to treatment plants, problems inevitably arise. With a mere 1% of silo juice present, there is a very high requirement of biol. O. Only when there was a percentage of silo juice of 0.5 in the general sewage as well as a corresponding adaptation of microorganisms did the tests become more successful. Also, oxidn. drains with not too high a load brought good results. If a treatment plant is of sufficient size, silo liqs. can be treated, however, biol. processes in the treatment are very expensive."

A-594 Scheltinga, H.M.J. 1969. Aerobic biological purification of liquid manure and other agricultural wastes. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 49-59. (cited in Chem. Abstr., 72: Abstr. No. 82754.)

"Since agriculture and animal husbandry are becoming more and more industrialized, manure has been allowed to run off into rivers and streams. This has led to widespread dying of fish because of the content of NH_3, and water has become unfit for human consumption. One soln. to this problem is to dry manure by evapn., but anaerobic decompn. of manure is more economic. For this, suitable processes are described and data given for construction of appropriate ditches and ponds."

A-595 Liebmann, H. 1969. Accumulation and removal of liquid and solid wastes in large-scale animal husbandry. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 9-23. (cited in Chem. Abstr., 72: Abstr. No. 82777.)

"Solid and liq. wastes in large-scale animal husbandry are composed of slaughtering wastes, other waste, manure accumulation from dairy farms, and human waste. Slaughtering waste not only of intestinal content but also of such unusable organs as heads, tongues, livers, etc., or even whole carcasses. Other waste accumulations are of whole bodies of still-born animals or baby animals dying very early. To remove wastes, 2 approaches are given: (1) utilizing org. matter as fertilizer or as food, and (2) removal for decompn. in anaerobic or aerobic clearing pools. The content of N, P, and K is high in wastes so that they are used as fertilizers. The simplest process for treating waste centrally is in ponds with a longer or shorter residence time, with oxidn. ponds preferred, because no pollution odor results. In operating such ponds, questions of hygiene must be considered as up to 100 diseases may be transmitted from animals to men."

A-596 Panikar, S.N. and B.T. Sajnani. 1969. Response of Jati tobacco varying levels of f.y.m. (farmyard manure), nitrogen, phosphorus, and potassium. Indian J. Agron., 14(1): 42-45. (cited in Chem. Abstr., 72: Abstr. No. 89329.)

"Effect of varying doses of f.y.m., N, P, and K on yield and quality of Jati tobacco was studied for 2 years. Twenty tons f.y.m./ha was significantly better than no f.y.m. Application of 100 kg N/ha increased yield and improved quality of tobacco significantly as compared to 50 kg N/ha; a further increase to 150 kg N/ha was harmful in an adverse season and beneficial when the season was favorable. Application of P_2O_5 at 200 kg/ha seemed to be beneficial during an adverse season; otherwise, there was no response to P_2O_5 or K_2O. (In an adverse season the rains either continue up to the end of October and thus delay transplanting or occur at the time of harvesting. Both lead to a deterioration of leaf quality.)"

A-597 Bunescu, O., E. Petrache and C. Coronea. 1967. Effect of fertilizers on yield and chemical composition of corn in an uninterrupted crop. An. Inst. Cercet. Cereale Plante Teh. -Fundulea, Inst. Cent. Cercet. Agr., Ser. B, 35: 432-440. (cited in Chem. Abstr., 72: Abstr. No. 99584.)

"The paper presents results of investigations carried out on a chestnut chernozem of Dobrogea, concerning the effect of fertilizers applied to corn grown as an uninterrupted crop. The effects of mineral and org. fertilizers on certain agrochem. characters, on yield amt. and on yield chem. compn. were investigated. N and P fertilizers applied together with moderate rates of barnyard manure enhanced corn production and increased the net income achieved per ha. Among the corn kernel components, protein registered highest increase under fertilizer effect. The results of fractional protein anal. showed the increase in protein content to be wholly related to an abs. and relative prolamin increase."

A-598 Ghiula, A., V. Matel, C. Pop, I. Vines, S. Popescu, L. Haceadur and M. Handra. 1967. Effect of fertilizers applied to corn in an uninterrupted irrigated crop on a reddish-brown forest soil. An. Inst. Cercet. Cereale Plante Teh. -Fundulea, Inst. Cent. Cercet. Agr., Ser. B, 35: 441-455. (cited in Chem. Abstr., 72: Abstr. No. 99587.)

"N and P chem. fertilizers gave corn yield increases each year (1962-7), and an addn. of 40-80 kg/ha K have yield increases only in certain years. Yield gains obtained in the first 3-4 years of uninterrupted crops were much higher than those obtained in the following years. A particular effect was recorded in organo-mineral fertilization, where yield gains were higher in all the years with uninterrupted crops and did not decrease in the 4th and 5th years as reported in treatments with chem. fertilizers. . . . When org.-mineral fertilizers were applied, a higher content of humus and a higher percolation coeff. than in the unfertilized or in the chem. fertilized plots were recorded. From this it appears that for obtaining higher yield gains, but most particularly for maintaining the phys. and chem. characteristics of an irrigated crop, on a reddish brown forest soil, barnyard manure should be applied every 2-3 years at a rate of at least 30 t/ha."

A-599 Bruin, P. 1969. Still on about chemical versus organic farming. Stikstof, No. 13: 18-28. (cited in Chem. Abstr., 72: Abstr. No. 120502.)

"A detailed review is given of many investigations, in Holland and other countries, comparing chem. and org. plant foods."

A-600 Davii, K.A. 1970. Fertilizers for saline soils. Khim. Sel. Khoz., 8(1): 18-20. (cited in Chem. Abstr., 72: Abstr. No. 120537.)

"The study is carried out with Wagner pots (24 kg soil) and saline soils (up to 0.544% chloride). Two fertilizers were applied: semiliquid manure (10-30 tons/ha) and urea-formaldehyde (UF, 150 kg/ha). The manure decreases the toxicity of Cl^- although its concn. in the soil ext. does not change, whereas the UF decreases the concn. of Cl^- in the soil ext. It is believed that Cl^- is adsorbed by UF."

A-601 Chakrabarty, R.N., A.Q. Khan and S.N. Chattopadhya. 1969. Treatment and disposal of caustic-chlorine waste. Environ. Health, India, 11(3): 239-247. (cited in Chem. Abstr., 72: Abstr. No. 124869.)

"Liq. waste from the caustic-Cl industry can become a source of stream pollution. Even exceedingly small fractions of the products in the effluent is esp. a hazard to aquatic life. Reducing agents or partially fermented cow dung were used in treating the Cl-bearing waste. Based on expts., cow dung or any other org. matter of even org. industrial waste were found to be the most suitable agents for dechlorination of the waste water."

A-602 Verma, B.P. and C.R. Prasad. 1970. Cumulative effects of manures and fertilizers on the quality of grains. I. Changes in minerals, crude proteins, crude fiber, and fat content of wheat and maize grains. J. Inst. Chem., Calcutta, 42(1): 33-37. (cited in Chem. Abstr., 72: Abstr. No. 131561.)

"Fertilizing with P combined with N, or N alone, or manure increased the percent of ash, Ca, and Mg in wheat grain. Also lime, together with fertilizer or with manure, increased the amts. of ash, Ca, and Mg in wheat and corn grains more than treatment without lime. Total P in the grain was higher after treatment with manure supplemented by P than without it. Inclusion of K further decreased the K/grain. Addn. of N greatly increased crude protein in wheat."

A-603 Liebmann, H. 1969. Practical use of waste water treatment from agriculture and from plants manufacturing agricultural products. Muenchner Beitr. Abwasser-, Fisch. -Flussbiol., 16: 394-405. (cited in Chem. Abstr., 73: Abstr. No. 6933.)

"A thorough review is given of all wastes from the agricultural and animal industrial production."

A-604 Minciuna, V., V. Georgescu and R. Daniel. 1969. Disinfection method for residual waters from industrial pig farms. Lucr. Inst. Cercet. Vet. Bioprep. Pasteur, 6: 275-283. (cited in Chem. Abstr., 73: Abstr. No. 28616.)

"The effluent can be treated with Cl obtained from lime water contg. Cl. To destroy the E(scherichia) coli and Salmonella, 2 g active Cl for 1 l. effluent is necessary. Staphylococcus aureus can be destroyed with 5 kg/m^3 water. Before using Cl, it is suggested to use a coagulant such as T.I. (which is a product from metallurgic slag extd. with H_2-SO_4), to reduce the org. substances and the amt. of Cl to be used to a min."

A-605 Miljkovic, N. and N. Plamenac. 1969. Improvement of solonetz soils in Yugoslavia. Agrokem. Talajtan, 18(Suppl.): 377-384. (cited in Chem. Abstr., 73: Abstr. No. 34208.)

"A review with 15 refs. The improvement of the solonetz soils of Vojvodina (Yugoslavia) by treatment with S and manure, tillage and draining is discussed."

A-606 Vavulo, F.P., L.A. Karyagina and T.I. Kolyada. 1969. Effect of fertilizers on the microflora and enzymic activity of sod-podzolic and peat-bog soils. Tr., Beloruss. Nauch. -Issled. Inst. Pochvoved., No. 6: 122-135. (cited in Chem. Abstr., 73: Abstr. No. 76224.)
"Changes of soil enzymes were closely related to those of the population of bacteria. During seasonal changes, when the no. of bacteria increased, the activity of the enzymes also increased. Use of farm manure on sod-podzolic soil increased the activity of the enzymes, but application of the mineral fertilizers had a depressing effect. Application of the mineral fertilizers on peat bog soils depressed bacterial population and enzymic activities. Improvement of peat bog soil decreased the activity of asparginase, catalase, and urease, but increased the activity of invertase. Enzymes activity was higher in sod-podzolic soils than on peat-bog soils."

A-607 Gladilovich, B.R. and V.A. Makarov. 1969. Copper, manganese, cobalt, and zinc levels in mineral and organic fertilizers. Zap. Leningrad. Sel'skokhoz. Inst., 128(3): 97-101. (cited in Chem. Abstr., 73: Abstr. No. 76305.)
"A survey of the contents of total and available Cu, Mn, Co, and Zn in a series of mineral and org. fertilizers (nitrophoska, NH_4NO_3, granulated and powd. superphosphate, powd. rock phosphate, KCl, K_2SO_4, manure, and various types of turf) showed that except for synthetic NH_4NO_3 all fertilizers studied contained variable amts. of trace elements. In the mineral fertilizers the greatest content of Co was found in KCl, powd. rock phosphate, and K_2SO_4. All fertilizers studied were poor with respect to Zn. Most (50-80%) of the trace elements in mineral fertilizers occurred in water-sol., available forms. Manure was the richest source of trace elements, but the availability of these elements was lower, generally not exceeding 25% of the total. The contents and availabilities of these elements in turfs varied widely according to type, origin, and age."

A-608 Floate, M.J.S. 1970. Decomposition of organic materials from hill soils and pastures. II. Comparative studies on the mineralization of carbon, nitrogen, and phosphorus from plant materials and sheep feces. Soil Biol. Biochem., 2(3): 173-185. (cited in Chem. Abstr., 73: Abstr. No. 119718.)
"Four plant materials obtained from Nardus and Agrostis-Festuca hill pastures, and the sheep feces derived from these materials, were incubated at 30° for periods up to 12 weeks. The evolution of CO_2 and the production of mineral N and P were measured: 10-20% and 30-55% of the original C was evolved as CO_2 from feces and plant materials resp. Of the total original N, up to 8% was mineralized from feces, and up to 25% from plant materials. Grass from monthly cut treatments decompd. more rapidly than annually accumulated grass, and mineralization was greater from Agrostis-Festuca than from Nardus. More than half of the N mineralized was evolved as NH_3. Throughout most of the incubation period plant materials immobilized P while 3-4% of the total P in feces was mineralized. The results are discussed in relation to the role of sheep in the soil-plant-animal nutrient cycle."

A-609 Floate, M.J.S. 1970. Decomposition of organic materials from hill soils and pastures. III. Effect of temperature on the mineralization of carbon, nitrogen, and phosphorus from plant materials and sheep feces. Soil Biol. Biochem., 2(3): 187-196. (cited in Chem. Abstr.,

73: Abstr. No. 119719.)
"Plant materials obtained from Nardus and Agrostis-Festuca hill pastures, and the sheep feces derived from these materials, were incubated for periods up to 12 weeks at 30, 10 and 5°. The amts. of CO_2 evolved from plant materials were reduced from an av. of 40% of the original C content at 30° to 25% at 10°, and 12% at 5°C. For feces the corresponding amts. were 16 (at 30°), 4 (at 10°), and 2% (at 5°). Of the original total N in plant materials, the mean amt. of 5.4% was mineralized at 30° while at 10 and 5° only 0.9% and -0.3%, resp. were mineralized. The largest amts. of mineral N (up to 10%) were produced from feces at 10°. P mineralization was reduced from a mean value of 0.2% of the original total P in plant materials at 30° to -27% at 10° and -41% at 5°. For feces the corresponding values were 10 at 30°, 2.5 at 10°, and -12% at 5°. The results are discussed in relation to nutrient recirculation and the annual cycle of hill soil temps."

A-610 Kudzin, Y.K. and V.A. Gubenko. 1970. Effect of the systematic use of fertilizers for fifty-five years on the reserves and forms of organophosphorus compounds in chernozem soil. Agrokhimiya, 9: 3-10. (cited in Chem. Abstr., 73: Abstr. No. 119729.)
"The title treatment of thick layers of weakly leached chernozem resulted in but little change in the total content of organophosphorus compds. (I), but with a variant with a max. manure content the total I content was somewhat raised, extending down to 1 m depth by migration processes. The title effect consisted of an increase in the $C:P_{org}$ ratio by withdrawal of P from the humic acid fraction, together with a decrease in the $C:P_{total}$ ratio due to fertilization. The mineral P content was enriched, accumulation of mobile forms of RNA enhanced, and the difference between DNA and RNA contents diminished."

A-611 Patruno, A., L. Cavazza and A. De Caro. 1969. Possibility of improving magnesium-rich saline soil. Riv. Agron., 3(4): 143-160. (cited in Chem. Abstr., 74: Abstr. No. 12165.)
"The stability index of a saline, Mg-rich soil was increased from 30.1 to 31.7 by treatment with 0.5 or 1.0% of $FeSO_4 \cdot 7H_2O$, to 31.6 with 0.5% stall manure, and to 34.2 with 0.25% glucose and 0.01% N as $(NH_4)_2$-SO_4. The differences are significant and show the improvement of soil by supplying org. matter readily available to microorganisms. Permeability of the soil was increased. Reaction of $FeSO_4$ and $CaCO_3$ resulted in increased salinity of the soil. A 1.0% dose of manure caused an increase in soil pH and in K. In general, the treatments had little effect on soil properties."

A-612 Panak, H. 1970. Fermentation of manure with addition of sodium sulfate labeled with sulfur-35. Zesz. Nauk. Wyzsz. Szk. Roln. Olsztynie, Ser. A, Suppl. 4: 3-105. (cited in Chem. Abstr., 74: Abstr. No. 12186.)
"Fermentation of manure was carried out at room temp. and at 30° without and with addn. of 0.1% and 0.2% S in the form of $Na_2{}^{35}SO_4$. The fermentation products were extd. with H_2O and with 0.1N NaOH and various S fractions in the decompn. products were detd. Greenhouse and lab. expts. with spring and winter rape were performed to det. the availability of the fermented sulfates to the plants. Of the total S introduced, 52-67% was fixed in the manure as H_2O-insol. compds., and 68-84% was bound in org. humification products. In extn. with NaOH 55% of the total S added was leached, and 40% was combined with fulvic acids. Aeration of manure during

fermentation had no distinct effect on the amt. of sulfates bound by the humic and fulvic acid fractions. Manure fermented with addn. of sulfates was characterized by higher pH; its H_2O exts. contained more sol. C. The sorption of S compds. from H_2O exts. of manure by light soils was 3-13 times that from aq. Na_2SO_4 of similar concn. The availability of S for plants was similar for manure fermented with Na_2SO_4 and for nonfermented manure."

A-613 Zaderii, I.I., M.I. Matsenko and I.T. Voit. 1968. Dynamics of ammonia nitrogen in the alimentary canal of animals fattened on urea. Nauch. Tr., Kamenets-Podol'sk. Sel'skokhoz. Inst., 10: 29-37. (cited in Chem. Abstr., 74: Abstr. No. 39892.)
"Feeding cattle with urea increased the NH_4^+ concn. in ruminal chyme 12-fold and in duodenal juice 9-fold. Addn. of Na_2SO_4 or KI weakened the effect of urea and the NH_4^+ concn. in ruminal chyme was increased only 6-8 fold. Starch present in rations considerably compensated the effect of urea of the NH_4^+ concn. in the chyme; pectin was less and sugar least effective. Urea decreased excretion of N as fecal NH_4^+ by 50%, probably due to a pH increase in the feces by 0.12-0.18 units."

A-614 Sugimoto, M., H. Sugimoto and T. Okawa. 1970. Granular organic soil-improving agents. Japenese Patent 70 19,604. (cited in Chem. Abstr., 74: Abstr. No. 41494.)
"Org. substances such as peats, tobacco wastes, chicken dungs, etc. are mixed with perphosphoric acid, piled for a long time to reach a humus state, mixed with $(NH_4)_2SO_4$ of NH_4Cl and KCl, sprayed with H_2O-sol. polymers (as binders) such as polyacrylamide or poly (vinylpyrrolidinone), and granulated."

A-615 Ptashkin, A.A. and V.G. Volik. 1969. Determination of endogenous phosphorus in sheep during single and multiple administration of phosphorus-32. Tr. Vses. Nauch.-Issled. Inst. Fiziol. Biokhim. Sel'skokhoz. Zhivotn., 6: 283-288. (cited in Chem. Abstr., 74: Abstr. No. 84992.)
"The total amt. of P found in the feces consists of the P contained in the unabsorbed food and of the P secreted by the digestive tract. The proportion of P in the feces which is due to the secretion from endogenous sources can be measured after the animals are injected with ^{32}P. The measurement is based on the comparison of sp. radioactivities of P in the blood and in the feces. In expts. on adult sheep, similar results were obtained using either the method of repeated injections of ^{32}P or the method of a single injection of ^{32}P; the latter method is preferred because of its simplicity. Daily assimilation of P was 1.15-1.58 g and daily secretion of P from the endogenous sources via the digestive tract was 0.42-1.5 g."

A-616 Prugar, J. and A. Sasek. 1970. Influence of organic and mineral fertilizers on the representation of protein fractions in wheat kernels. Getreide Mehl, 20(4): 27-29. (cited in Chem. Abstr., 74: Abstr. No. 86905.)
"The kernel protein of winter wheat samples of the Fanal variety from a fertilizer expt. was analyzed according to Lund-Sandstroem's method. The effects of org. (manure, compost, and half-decompd. compost) and mineral ($N_1P_1K_1$, $N_2P_2K_2$, $N_3P_1K_1$, and $N_4P_2K_2$, where N_1, N_2, N_3, and N_4 correspond to 40, 55, 80, and 95 kg N/ha; P_0, P_1, and P_2 to 0, 48, and 60 kg P_2O_5/ha;

and K_0, K_1, and K_2 to 0, 96, and 120 kg K_2O/ha, resp.) fertilizers were tested. A total N increase was obsd. with compost mainly due to increased albumin, prolamine, and glutelin fractions. All protein fractions, total N, and gluten were always reduced when org. fertilizer was not used. For mineral fertilizers, high N rates assocd. with P_2O_5 and K_2O ($N_3P_1K_1$ and $N_4P_2K_2$) increased the albumin content of gluten. $N_1P_0K_0$ caused an increase in albumin content mainly in the prolamine fraction, and the ratio glutelin: prolamine was comparatively reduced."

A-617 Kapitonov, A.A. 1969. Effect of mineral fertilizers on the winter hardiness and yield of perennial leguminous grasses. In Y.I. Solov'ev. (ed.) Vop. Genezisa Ratsion. Ispol'z. Pochv, Kazan. Univ., Kazan, U.S.S.R. pp. 38-47. (cited in Chem. Abstr., 74: Abstr. No. 86942.)

"Addn. of 25 tons/ha manure, lime, 60 kg/ha granular superphosphate and KCl each increases the total of absorbed bases from 8.57 to 12.46 mequiv/100 g soil and increases available P from 2.5 to 15.0 mg/100 g soil, Al decreases to 0.03 and Mn to 6.5 mg/100 g of soil. Because of a high concn. of Fe in these soils (18.6-97.0 mg/100 g soil), addn. of lime lowers the soil acidity, increases available P_2O_5, and decreases its absorption by the soil. A simultaneous application of manure, P, and K fertilizers increases the winter survival of lucerne to 88.5, and of clover to 48.9%; the yield of lucerne increases from 2560 to 7610 kg/ha at the same time."

A-618 Marty, F. 1970. Complex industrial treatment of manure by methane production. French Patent Addn. 95,316. (cited in Chem. Abstr., 74: Abstr. No. 90974.)

"Improvements permit more efficient conversion of solid manure into CH_4 and liq. waste products. The app. is both water and air tight, has many valves and gages, and depends on biol. degradation. The capacity of the app. is a function of climate, quantity of CH_4 wanted, degree of liquification needed, time in the app., quantity of manure, and contents of the manure."

A-619 Floate, M.J.S. 1970. Decomposition of organic materials from hill soils and pastures. IV. Effects of moisture content on the mineralization of carbon, nitrogen, and phosphorus from plant materials and sheep feces. Soil Biol. Biochem., 2(4): 275-283. (cited in Chem. Abstr., 74: Abstr. No. 98988.)

"Variation in moisture content resulted in minor changes in the evolution of CO_2 during the incubation of plant materials and sheep feces from Agrostis-Festuca-Nardus hill pastures. After 12 weeks less CO_2 was produced at 25% moisture-holding capacity (MHC) than at 50 or 100% MHC. Mineral-N production from plant materials was little affected by moisture but with sheep feces, the accumulation of NH_4, and the evolution of gaseous NH_4 were greatest at 100% MHC. At 25% MHC the production of mineral-N from feces was almost completely inhibited. The immobilization of P by plant materials was reduced at 25% MHC and mineral-P production from sheep feces was slightly enhanced. The possible influence of moisture upon the mineralization of plant nutrients under field conditions is discussed."

A-620 Salo, M.L., U. Peltola and K. Kotilainen. 1970. Diurnal and daily variations in the composition of cow feces. Maataloustieteelinen Aikak., 42(4): 238-249. (cited in Chem. Abstr., 74: Abstr. No. 108944.)

"Large variations occurred in the cellulose, crude protein, and ash of cow feces; diurnal regularity was not noted."

A-621 Meelu, O.P. and N.S. Randhawa. 1970. Comparative efficiency of zinc from various sources for corn (Zea mays). Indian J. Agr. Sci., 40(7): 637-644. (cited in Chem. Abstr., 74: Abstr. No. 111076.)
"On a sierozem soil which was low in available Zn, the responses of corn to 5 sourses of Zn were studied in the presence or absence of farmyard manure. Highly significant increases in the yield, in the Zn content of plants, and in the total uptake of Zn were recorded irresp. of the source of Zn applied, except spartin (a Zn source). With all Zn sources, except spartin, high levels of farmyard manure depressed the yield and Zn uptake by maize. . . ."

A-622 White, W.A. and M.K. Kyriazis. 1970. Effects of waste effluents on the plasticity of earth materials. Environ. Geol. Notes, No. 23. 23 pp. (cited in Chem. Abstr., 74: Abstr. No. 115618.)
"Chems. in effluents from septic tanks, land fills, or disposal ponds pollute earth's surface materials. Clay minerals exchange one cation for another in the same way compds. react in H_2O softeners. Stability of clay materials depends on the plasticity index, normal 1, if this index is increased due to pollution by chems. (detergents, etc.), its plasticity increases. Increase in plasticity changes normal clay to "quick" clay which is stable until disturbed, it then becomes fluid and flows as a viscous liq.; movement may be imperceptible or it could reach the dimensions of a landslide."

A-623 Kortleven, J. 1970. Changes in the humus content of an uncultivated sandy clay soil during a sixty-year period. Inst. Bodemvruchtbaarheid, Rapp., No. 9. 27 pp. (cited in Chem. Abstr., 74: Abstr. No. 124119.)
"To provide soil productivity characteristics of the 3 northern provinces of the Netherlands, a plot was excavated to 1.10 m, drainage was installed, and the plot refilled successively with 50 cm fill soil, and 30 cm each of subsoil and topsoil from a farm in Groningen. The plot was allowed to remain fallow from 1911 to 1951. During this period, humus and $CaCO_3$ decreased. After 1951, application of 15 tons/year of farmyard manure to half of the plot resulted in increases of humus, total N, and Mg, K, and P. In quarters of the plot which were subsequently cultivated, farmyard manure alone increased the yields of potatoes and beets by 8% and those of oats by 13%. The high yield increase of oats was correlated with an increased uptake of N, P, K, Ca, and Mg from the soil."

A-624 Pavlikhina, A.V. and N.N. Poddubnyi. 1970. Level of available and isotopic-exchange phosphates in sod-podzolic soils of varying degree of cultivation. Dokl. TSKHA (Timiryazev. Sel'skokhoz. Akad), No. 160. pp. 56-62. (cited in Chem. Abstr., 74: Abstr. No. 124125.)
"Available and isotopic-exchangeable phosphate in soils are directly related to the degree of soil cultivation. The smallest amt. of these P forms was found in virgin soils (20.7 mg% P_2O_5) and the greatest one in an arable sod podzolic soil (28.6 mg%). Pastures had an intermediate level of exchangeable phosphates (24.8 mg%). Liming did not change and manuring increased the phosphate level in the upper soil horizon. In a manured soil, less P appeared in the fraction of isotopic-exchangeable phosphate; this observation is explained by the competitive interaction of org. material with P binding sites on soil mineral particles."

A-625 Lubbers, J. 1970. Mineral balance during a 3-year agricultural study on sandy soil with breeder pigs and hens. Inst. Bodemvruchtbaarheid, Rapp., No. 7. 18 pp. (cited in Chem. Abstr., 74: Abstr. No. 124180.)

"In a 3-year study of mineral balance in the soil of an independent farm with 55 brood sows and 3000 laying hens, it was shown that chicken and pig manure applied to the soil accounted for 7065 kg N, 9780 kg P_2O_5, 4037 kg K_2O, 17,947 kg CaO, 1883 kg MgO, and 1039 kg Na_2O. These amts. exceeded the soil requirements by 7650 kg P_2O_5 and 2905 kg K_2O. MgO and CaO were deficient by 380 and 5613 kg, resp., based on agricultural recommendations. The excessive fertilization resulted from the introduction of minerals in feed concs. On an annual basis, the difference between mineral income and outgo was P_2O_5, 263; K_2O, 73, MgO, 58; CaO, 429; and Na_2O, 25 kg/ha."

A-626 Vekhov, P.A. 1971. Effectiveness of repeated liming against a background of lime combined with manure. Agrokhimiya, 2: 102-105. (cited in Chem. Abstr., 74: Abstr. No. 124187.)

"Repeated liming of podzolic soils after 12, 15, and 19 years increased the yields of perennial crops (clover-timothy mixts.) and oats, considerably when no farmyard manure was applied in the rotation, and only slightly, then farmyard manure was given. Repeated liming did not increase the yields of potatoes, rye, and flax."

A-627 Prasad, C.R., K.C. Gulati and M.A. Idnani. 1970. Changes in biochemical constituent of some organic waste materials under anaerobic methane fermentation. Indian J. Agr. Sci., 40(10): 921-924. (cited in Chem. Abstr., 74: Abstr. No. 130140.)

"Changes in the percent compn. of holocellulose, cellulose, hemicellulose, lignin, pentosans, and methoxyl contents of org. materials after fermentation of various systems such as cow dung alone, cow dung-gum arabic, cow dung-wheat straw, cow dung-peanut shells and cow dung-sugarcane bagasse by methane organisms indicated that the systems which had holocellulose:lignin in a ratio of 3:1 or less before fermentation showed a greater decrease of hemicellulose fraction than of cellulose fraction, whereas above this ratio the cellulose decompd. with ease by mixed species of methane-formers, so that at a ratio of 3.5:1 there was almost an equal decrease of both the fractions, e.g. cow dung-sugarcane bagasse, and wheat straw. In the presence of lignin the lignocellulose complex is more resistant to decompn. than lignohemicellulose complex. The percent of lignin and pentosans increased in every system after fermentation, except in cow dung-gum arabic, which showed a decrease of pentosans content. The methoxyl contents also decreased after fermentation, indicating a pos. role of the methyl group of methoxyls in the formation of methane by methane-formers."

A-628 Hirte, W.F. 1970. Reciprocal effect between soil reaction and microorganisms. I. Change of the soil reaction by microflora of the soil. Zentralbl. Bakteriol., Parasitenk., Infektionskr. Hyg., Abt. 2, 125(5): 458-470. (cited in Chem. Abstr., 74: Abstr. No. 140192.)

"During the deamination of the proteins of org. fertilizers (manure) by microorganisms, the soil pH was, initially, increased by the evolving NH_3, and then decreased by the resulting org. acids. Org. substances poor in protein but rich in carbohydrates did not show this wide variation in soil pH, but when sufficient inorg. N was present for the development of heterotrophic microflora, the pH did drop."

A-629 Krishnamoorthi, T. and M.S. Rao. 1970. Method of application of superphosphate to cigar tobacco (Nicotiana tabacum). Indian J. Agr. Sci., 40(10): 864-866. (cited in Chem. Abstr., 74: Abstr. No. 140196.)
"Significant increases were obtained with N and P but K did not appear to have any effect on tobacco yields. Significant increases were obsd. in N + P and N + P + K treatments but the P + K treatment never significantly differed from that of P alone. The response in yield to P application was very high and significant, and in the presence of N, the yield was increased further. Mixing superphosphate with farmyard manure is an effective method for increasing the availability of P in calcareous soil with a high pH $\sim$8.5, when the usual methods of broadcast application or placement of superphosphate alone fail."

A-630 Novak, B. 1971. Microbial formation of humus. 4. Anaerobic and aerobic processes in humification of farmyard-manure in model experiments. Zentralbl. Bakteriol., Parasitenk., Infektionskr. Hyg., Abt. 2, 126(1): 48-62. (cited in Chem. Abstr., 75: Abstr. No. 4691.)
"Theoretical aspects of humus formation under aerobic and anaerobic conditions are discussed in view of energy release. The effects of aerobic and anaerobic incubation of farmyard manure and of a mixt. of farmyard manure with 10% soil was examd. in model conditions. Humification was more extensive under aerobic than under anaerobic conditions. Mixing of manure with soil caused a decrease in substrate mineralization and a rise in productivity of humus formation."

A-631 Mongia, A.D., N.S. Randhawa and G. Dev. 1970. Solubility of phosphorus in phosphatic sources and its availability to wheat plants. Technology, 7(2): 36-39. (cited in Chem. Abstr., 75: Abstr. No. 4818.)
"A greenhouse pot culture expt. was conducted on wheat to compare the relative performances of water-sol. superphosphate and citric acid-sol. di-Ca phosphate in the presence or absence of organic matter with an org. P source (humophos) in a P deficient calcareous soil. Humophos was prepd. by mixing superphosphate with partially decomposed farmyard manure in a ratio 1:20 and decomposed over a period of 90 days, moisture holding content 40% of satn. . . . Addn. of org. matter with either superphosphate or di-Ca phosphate improved the P content but depressed the yield of both grain and straw. The relative efficiencies of the sources for grain production were: superphosphate > superphosphate + org. matter > di-Ca phosphate > di-Ca phosphate + org. matter > humophos."

A-632 Lyon, L.B. and P.A. Little. 1970. Nutritional compositions from agricultural waste materials. S. African Patent 70 00,421. (cited in Chem. Abstr., 75: Abstr. No. 9709.)
"The nutrients are produced from agricultural waste materials by treating the waste in a reaction zone with NH_3 at a temp. sufficient to maintain an ammoniation reaction and at a pressure sufficient to retain the NH_3 in the system until the pH of the waste material is adjusted to a value > 7. The waste material is subsequently digested in the presence of mineral acid, such as phosphoric or sulfuric acid, to produce an org. complexing agent, including modified polysaccharides carrying functional O and N groups capable of form-complexes with inorg. constituents. The digested material may then be treated with one or more sources of inorg. nutrients to form nutritional complexes

of the inorg. nutrients with the modified polysaccharides. A nutritional complex contg. as much as 75% or more by wt. of nonorg. nutrients results. A particularly desirable feature of the nutritional compns. is that the inorg. nutrient materials are produced in complexed forms with digestable polysaccharide materials and, in some instances, with digestable proteinaceous, tannin, lignin, and (or) other org. materials. Thus, plants or animals ingesting the products may receive, in nontoxic but available form, normally toxic dosages of inorg. nutrients."

A-633 Getmanets, A.Y. 1971. Carbon/nitrogen ratio of Ukrainian chernozems as affected by fertilizer application. Pochvovedenie, 4: 35-41. (cited in Chem. Abstr., 75: Abstr. No. 19254.)
"Systematic application of mineral fertilizers and manure to chernozems for 50 years did not change significantly the C/N ratio in them. It varied from 8.70 to 9.39 in the 0-20 cm of soil, when fertilizer were applied (control 9.58) and it decreased gradually with depth. In the 80-100 cm layer it varied from 6.69 to 8.34 (control 6.52). Continuous cultivation of winter wheat for 40 years increased the C/N ratio to 10.35 and 10.19 for manure and mineral fertilizers, resp. (control 10.33); for continuous sugar beets it was 9.61 and 9.56, resp. (control 9.51); and for continuous corn, 9.80 and 9.62, resp. (control 9.92). The C/N ratio in the soil under crops cultivated in a rotation, was higher than in that from under monocultures, and the use of 250 tons/ha manure + 5000 kg/ha superphosphate for the 50-year period increased the C/N ratio to 11.15, 11.34, 10.55, 9.87, and 7.49 in 0-20, 20-40, 40-60, 60-80, and 80-100 cm layer of the soil resp., 10 years after the application of fertilizers. The C/N ratio in control photo resp. soil layers was 12.15, 12.98, 11.10, 8.72, and 7.55."

A-634 Poopel, F. and O. Tabasaran. 1971. Purification capacity of a prefabricated clarifying installation for 50 inhabitants with and without liquid manure load. Gesundh.-Ing., 92(4): 120-123. (cited in Chem. Abstr., 75: Abstr. No. 40075.)
"The plant is a low load activated sludge system with partial sludge stabilization without preclarification. A gyroscopic system is used for mixing and aeration. Expts. with varying loads of domestic sewage showed an av. decompn. of 97%. Addn. of liq. manure reduced the decompn. considerably, and 3 days was necessary to restore plant performance. The av. energy input was 5 kWhr/kg 5-day BOD. The gyroscopic aerator assured a high O load, but its mixing effect was not satisfactory. The floating sludge had to be removed manually every week."

A-635 Banerjee, S.C. 1970. Detoxification of pond water treated with endrin. Indian J. Appl. Chem., 33: 285-290. (cited in Chem. Abstr., 75: Abstr. No. 47832.)
"Within 7-8 days either $KMnO_4$ at 5 ppm, wood charcoal at 50 ppm, or manure at 2000 ppm (20,000 kg/ha) removed residual toxicity of endrin which was used as a pesticide to clear fishponds before restocking with fingerlings."

A-636 Oke, O.L. 1969. Nigerian manures. II. Fractionation and mineralization of manure nitrogen. W. African J. Biol. Appl. Chem., 12(1): 22-27. (cited in Chem. Abstr., 75: Abstr. No. 47935.)
"Animal and bird feces were analyzed for total, nitrate, and ammonium N. N availability was tested with guinea grass. Chicken manures contained the most total N and H_2O-sol. N (32 and 11 mg/g , resp.), and gave best yields

and highest N absorption. Plant yield was highly correlated with sol. and total N, and N uptake with sol. and nitrate N. Nitrification rates of the manures with and without $CaCO_3$ showed that chicken manures accumulated the most nitrate N (500 ppm) and cow manure the least (100 ppm). More nitrate N accumulated in the presence of $CaCO_3$."

A-637 Greilich, J. 1971. Control of mineralization and humification of organic substances by iron sulfate. Arch. Bodenfruchtbarkeit Pflanzenproduktion, 15: 249-256. (cited in Chem. Abstr., 75: Abstr. No. 97701.)
"Farmyard manure, rye and pea straw was soaked in a 5% $FeSO_4$ soln., dried, ground, and mixed in a 1:10 proportion with sand. During 33 months the mineralization and humification were measured. Mineralization was inhibited by $\sim$20% during the whole expt. The humification index, (humic acid/org. matter ratio) was always lower in the $FeSO_4$ treated samples than in the untreated. The new formed humic substances contained 50% more Fe and were resistant to microbiol. decompn. than those from untreated samples."

A-638 Singeald, A. and A. Effmert. 1971. Processing semiliquid excrement, especially chicken manure. German Patent Offen. 1,963,177. (cited in Chem. Abstr., 75: Abstr. No. 97846.)
"The manure was mixed with powd. calcined kieserite and a small amt. of Br^- or Cl^-. Peat could be substituted for part of the kieserite. Thus chicken manure (81% H_2O) was mixed with about 80% wt. calcined kieserite, mixed for 5 minutes and treated with a little Br^-. This resulted in a crumbly, odorless matter, which after a few hr was dry and free-flowing. Only about 1% of total N was lost during treatment."

A-639 Feher, G., A. Horvath, M. Gregacs and L. Ormai. 1971. Natural model experiment to study the soil-polluting effect of solid organic waste matter. Egeszsegtudomany, 15(2): 145-151. (cited in Chem. Abstr., 75: Abstr. No. 132734.)
"Chem. lab. and bacteriol. tests were carried out on soil samples to det. the content of NH_4^+, NO_2^-, NO_3^-, total N, total org. matter content, and the amt. of Cl^-. Chlorides are the best indicator for the pollution of soil by org. substances. The Cl content of manured soil increases and reaches the level of Cl in feces. NH_4^+ increase can be ascertained only in the upper soil layers and in the vicinity of feces. The amt. of coli decreases during the 1st year from 10^5 to 10^2. Ground water tests showed that the Cl content reached 1 year after manuring 300 mg/l, NH_4^- could not be detd. Bacteriol. tests on ground water showed that a double amt. of bacteria were found 1 month after pollution, the coli amt. increased to 10^3. There were characteristic differences between the pollution of soil and ground water depending on the kind of waste used. Domestic waste is less dangerous, but degradable matter reaches ground water, because 1 m soil filter is not sufficient to keep bacteria."

A-640 Kinugasa, Y., T. Kawasugi and H. Hamano. 1968. Anaerobic digestion of feces waste by addition of enzyme preparation. Suido Kenkyusho Hokoku, 5(1): 68-72. (cited in Chem. Abstr., 75: Abstr. No. 143748.)
"Com. enzyme prepns. (0-0.1%) were added to digestion sludge and feces waste, then anaerobic processes were carried for 30 days. Gas production during 10-20 days increased 10-20% by addn. of enzyme prepns. Residual BOD, COD, and org. acids increased."

A-641 Babarina, E.A. 1971. Effect of the systematic use of manure and mineral fertilizers on the level of various phosphorus compounds in soil. Khim. Sel. Khoz., 9: 654-656. (cited in Chem. Abstr., 75: Abstr. No. 150728.)

"By systematic application of manure, with or without addn. of superphosphate, the total content of P_2O_5 in the soil top layer, esp. after addn. of mineral phosphates, increased considerably. P_2O_5 accumulation in the soil depended on the application time, on the amt. of fertilizers used, and on the cultivated plants. No significant difference between manure and superphosphates was obsd. with regard to the formation of mineral phosphates in the soil. P_2O_5 from both sources accumulated in the soil as Al-phosphate, and to a lesser degree as Fe-, and Ca-phosphates. Some higher content of sesquioxide phosphates in soils fertilized with mineral fertilizers than in soils fertilized with manure, was probably related to the higher oxidative activity in the latter."

SECTION B

References listed in this second section were located in scientific and technical journals. In cases where an abstract or summary accompanied the original article or paper, this was reproduced as it appeared in the publication. Occasionally an original abstract or summary was abbreviated to include only that portion regarded as pertinent to the farm animal waste field. The large majority of these references, however, were abstracted for this bibliography.

B-001 Jedele, D.G. 1959. Liquid manure for Midwest swine production. Trans. Amer. Soc. Agr. Eng., 2: 9. 6 fig.
The requirements for systems where liquid manure is collected, pumped into tank wagons, and distributed onto cropland are discussed. Alternative methods are indicated, including (1) chopping of solid manure, mixing with liquid and field spreading, (2) liquid manure spreading through irrigation equipment, (3) septic system with underground disposal fields, (4) lagoons, and (5) manure digestion in which methane gas is produced and collected for farm use.

B-002 Hart, S.A. 1960. Management of livestock manures. Trans. Amer. Soc. Agr. Eng., 3: 78-80. 13 ref. 4 fig. 1 tab.
A systems approach is applied to the management of livestock manure. The system studied consisted of gathering, processing and/or storing, and finally utilizing or disposing of the manure. Manure production rates are given in tabular form.

B-003 Hart, S.A. 1964. Thin spreading of slurried manures. Trans. Amer. Soc. Agr. Eng., 7: 22-25, 28. 21 ref. 3 tab. 9 fig.
This report discusses the technique of minimal fluidization, followed by thin spreading and drying of manure for processing prior to utilization. Odors are minimized by very thin layering of fresh manure, complete drying, or by the use of chemicals.

B-004 Taiganides, E.P. and T.E. Hazen. 1964. Properties and pumping characteristics of hog wastes. Trans. Amer. Soc. Agr. Eng., 7: 123-124, 127, 129. 3 fig. 1 tab.
This paper reports the findings to date (1963) of a study of hog manure properties and the pumping characteristics of untreated hog manure when handled by a diaphragm pump and an auger. Pump performance curves are given.

B-005 Ostrander, C.E. 1965. Poultry manure disposal. Trans. Amer. Soc. Agr. Eng., 8: 105-106.
General paper describing some of the methods used to collect and dispose of poultry manure throughout the U.S.A. Methods discussed included daily clean out, flushing or pumping into lagoons, hydraulic manure removal into holding tanks, composting, and dehydration. The author foresees no future for aerobic lagoons to treat poultry manure because of the large area requirements. No one system can be considered best for all situations.

B-006 Wolf, D.C. 1965. Developments in hog-manure disposal. Trans. Amer. Soc. Agr. Eng., 8: 107-109.
Technology to date on hog manure disposal is reviewed. Three types of pens are discussed as well as the effects of pen arrangements, size and shape of pens, number of pigs per pen, method of feeding, and temperature control on the social behavior of pigs. Methods of disposal of manure are discussed with reference to both the U.S.A. and U.K. Some on-paper costing figures are given.

B-007 Johnson, C.A. 1965. Disposal of dairy manure. Trans. Amer. Soc. Agr. Eng., 8: 110-112. 11 ref. 3 fig.
Report on experimental work in progress at the University of Massachusetts directed toward speedy removal of manure from dairy barns. Criteria to be used in judging the adequacy of manure handling systems are economics, aesthetics, effectiveness, efficiency and ease. Methods of disposal are

discussed and the need for further research indicated. The septic tank process is deemed to be the most promising method for disposal of bovine wastes.

B-008 Jeffrey, E.A., W.C. Blackman and R. Ricketts. 1965. Treatment of livestock waste - a laboratory study. Trans. Amer. Soc. Agr. Eng., 8: 113-117, 126. 17 ref. 5 tab. 6 fig.
Report on recent studies conducted in Missouri on the aerobic and anaerobic digestion characteristics of hog, cow, and sheep wastes. Experimental procedures are discussed, and the results obtained are used in design calculations for hog waste lagoons, heated and unheated anaerobic digestors, and aerators. It was concluded that the use of aerobic lagoons for the treatment of hog wastes is not practical because of the large land and water requirements, whereas the use of anaerobic lagoons appears to be feasible.

B-009 Day, D.L., E.L. Hansen and S. Anderson. 1965. Gases and odors in confinement swine buildings. Trans. Amer. Soc. Agr. Eng., 8: 118-121. 11 ref. 3 tab. 11 fig.
This paper reports on the exploratory phase of research to identify atmospheric contaminants produced in confinement swine buildings. Ammonia was found in a solid floor building. An attempt was made to identify the odoriferous components of the gas from the building. Carbon dioxide, hydrogen sulphide, methane and ammonia were detected in the slotted floor building with underfloor pits.

B-010 Hart, S.A. and C.G. Golueke. 1965. Producing algae in lagoons. Trans. Amer. Soc. Agr. Eng., 8: 122-123. 6 ref. 3 fig.
Report on the production of algae (up to 400 mg/l) in an aerobic lagoon at the University of California. Problems encountered and the need for more research are indicated.

B-011 Johnson, C.A. 1965. Liquid handling of poultry manure. Trans. Amer. Soc. Agr. Eng., 8: 124-126. 6 ref. 1 tab. 2 fig.
Report on a hydraulic cleaning device and a heated septic tank constructed on a Massachusetts poultry farm in 1962. The system provides easy manure handling, few moving parts, little ammonia odor, low water usage, simple manure disposal and low-cost pit cleaning. Problems encountered with the system were also discussed.

B-012 Grub, W., C.A. Rollo and J.R. Howes. 1965. Dust problems in poultry environments. Trans. Amer. Soc. Agr. Eng., 8: 338-339, 352. 3 ref. 9 fig.
Report on studies to determine the composition and source of poultry dust and the effects of temperature and humidity on the quantity and kind of dust produced. Poultry dust originated from feather and skin debris, feed and litter. Relationships between quantity and kind of dust produced and several environmental factors are discussed.

B-013 Notestine, J.C. and D.L. Pfost. 1965. Dust problems in livestock environments. Trans. Amer. Soc. Agr. Eng., 8: 340-341, 352. 1 tab.
Emphasis in this paper is placed on the problems encountered in attempting to operate commercial cooling equipment in severely dust-laden atmospheres as found in livestock housing structures. Three specific types of equipment trouble experienced in a pilot dairy-housing study are discussed.

B-014 Witzel, S.A., E. McCoy and R. Lehner. 1965. Chemical and biological reactions from lagoons used for cattle. Trans. Amer. Soc. Agr. Eng., 8: 449-451. 16 ref. 1 tab. 1 fig.
Results of tests made on the wastes treated in an experimental circular lagoon, 5 ft. deep and 50 ft. nominal diameter, at the University of Wisconsin. BOD reduction, solids reduction, ammonia-nitrogen, pH values, and temperature were measured for the lagoon wastes. No odor problems were observed. A bacteriological study indicated a high population of proteolytic type bacteria. The bacterial population in general was very high and diversified, but well balanced.

B-015 Herum, F.L., G.W. Isaacs and R.M. Peart. 1966. Flow properties of highly viscous organic pastes and slurries. Trans. Amer. Soc. Agr. Eng., 9: 45-47. 3 ref. 2 tab. 8 fig.
Although this paper deals specifically with slurry-conveyance of livestock feeds, principles of fluid flow derived for the slurries under consideration may have application to conveyance of manure slurries. No simple relations exist between the individual and combinations of parameters studied. Indication of the need for further research is made.

B-016 Taiganides, E.P. and T.E. Hazen. 1966. Properties of farm animal excreta. Trans. Amer. Soc. Agr. Eng., 9: 374-376. 13 ref. 6 tab.
Review of available data on the properties of animal manures and how these properties affect the selection of methods of manure handling, treatment, and disposal. The complete lack of information on the composition of the gases and the control of odors produced as a result of the uncontrolled biological degradation of manures is noted. When antibiotics are included in animal rations, sufficient amounts of them may accumulate in the excreted wastes and can seriously inhibit biological decomposition of those wastes.

B-017 Cross, O.E. and J.S. Boyd. 1966. Electro-osmotic moisture migration in poultry excrement. Trans. Amer. Soc. Agr. Eng., 9: 626-628. 5 ref. 7 fig.
Report on an investigation to determine the effectiveness of expelling water from poultry excrement by electro-osmosis. The quantity of water expelled increased with increasing current flow and increasing days of operation; the final moisture content decreased as the sample length decreased.

B-018 Kaminski, T.L. and S. Persson. 1966. Distribution of a viscous liquid by a rotating disk. Trans. Amer. Soc. Agr. Eng., 9: 875-879. 3 ref. 3 tab. 14 fig.
Report on an investigation to study the factors affecting the flow of liquid on a rotating disk using theoretical considerations and to present a hypothesis for producing a specific form of spray pattern with a rotating disk. The Navier-Stokes equations successfully predicted laminar flow of Newtonian fluids on a rotating disk. When compared with the theoretical results, the experimental results indicated that flow rate had less effect than expected, whereas viscosity and rotational speed had the expected effects.

B-019 Schacht, C.J. 1967. Development of liquid-manure handling equipment. Trans. Amer. Soc. Agr. Eng., 10: 161-163. 5 fig.
Report on an attempt to define the functions of a liquid-manure system, outline the types of systems being developed, and clarify some aspects of the

components of such systems, with emphasis on how these components have affected the development of liquid-manure handling equipment.

B-020 Converse, J.C., G.L. Pratt, R.L. Witz, R.G. Butler and J.L. Parsons. 1967. Effect of low-volume and high-volume aeration on a hog lagoon. Trans. Amer. Soc. Agr. Eng., 10: 475-477, 482. 5 ref. 3 tab. 4 fig.
Report on trials. Two levels of aeration were tested in lagoons receiving wastes from a hog barn. Low levels of aeration (3.6 - 3.8 cfm) did not have any effect on the lagoon. During high-volume aeration, an average of 2.28 mg/l of dissolved oxygen was maintained, which was sufficient to maintain aerobic conditions. Differences in treatment effectiveness for aerobic and anaerobic conditions are reported.

B-021 Miner, J.R., R.I. Lipper and L.E. Erickson. 1967. Modeling feedlot runoff pollution. Trans. Amer. Soc. Agr. Eng., 10: 497-501. 7 ref. 5 tab. 8 fig.
Several models were developed and compared for usefulness as aids in studying the mechanism by which rain falls on a manure-covered surface, becomes laden with the various manure components, and runs off. These models had to be simplified due to mathematical complexities; as such, they are basically concentration models and must be combined with flow-rate models to obtain a model which will accurately predict overall water pollution from a single feedlot.

B-022 Dale, A.C. and D.L. Day. 1967. Some aerobic decomposition properties of dairy-cattle manure. Trans. Amer. Soc. Agr. Eng., 10: 546-548. 6 tab. 11 fig.
Results of tests run for 77 days using loading rates of 4, 3, 2, 1 and ½% wastes by volume, to determine BOD reduction and reduction of volatile solids by aeration. A 90% reduction in 5-day BOD may be obtained by aeration, approximately 50% of volatile solids will be decomposed in a retention time of 18½ weeks when the daily added wastes amount to ½% of the volume and salts may be concentrated to some extent, although this was not considered serious.

B-023 Bell, E.S., M. Marshall, J.M. Stanley and H.R. Thomas. 1967. Studies of slotted-floor swine housing in controlled, semicontrolled and uncontrolled environments. Trans. Amer. Soc. Agr. Eng., 10: 561-563. 8 ref. 1 tab. 4 fig.
The effect of floor type on swine performance was studied. The data indicate that the various floors studied (solid concrete, 25% slotted, 50% slotted, fully slotted) did not affect rate of gain for hogs. Cleanliness of animals and pens was affected by floor type; generally, cleanliness improved with increasing percentages of slotted floor. The use of fully slotted floors in double-decker units was also discussed, and it was noted that swine in the lower deck of such units remained as clean as those above.

B-024 McCoy, E. 1967. Lagooning of liquid manure (bovine): bacteriological aspects. Trans. Amer. Soc. Agr. Eng., 10: 784-785. 3 ref. 5 tab.
Bacteriological studies at the University of Wisconsin indicated that the highly fermentative bacterial flora of the rumen and bovine feces changes to a dominantly proteolytic flora in a manure lagoon. The population in lagoon water was well balanced. Pollution types of bacteria, such as coliform and enterococci, died off rapidly in the lagoon and soil, indicating that the pollution hazard from lagoon treatment of liquid manure is small.

B-025 Pratt, G.L. and G.L. Nelson. 1968. Structural analysis of floor grids for confinement cattle feeding systems. Trans. Amer. Soc. Agr. Eng., 11: 50-53, 56. 21 ref. 5 tab. 6 fig.
The design and performance of gridwork floor systems for cattle are evaluated in this report. A Guyon-Massonnet design procedure is considered.

B-026 Loehr, R.C. 1968. Anaerobic lagoons: considerations in design and application. Trans. Amer. Soc. Agr. Eng., 11: 320-322, 330. 14 ref. 4 tab. 2 fig.
General discussion on the anaerobic lagoon as a biological system distinct from the aerobic lagoon. The purpose of anaerobic lagoons is the destruction and stabilization of organic matter, not water purification. Anaerobic lagoons can be practical when used prior to further treatment and disposal.

B-027 Funk, W.E. and I.H. Lehman. 1968. Slurry fertilizer: equipment and application costs. Trans. Amer. Soc. Agr. Eng., 11: 419-421. 5 fig.
Three types of machines in use in Indiana as slurry spreaders are discussed and compared, these being (1) truck-mounted slinger, (2) tractor pull-type slinger, and (3) machine for "knifing in" slurries. A model slurry fertilizer plant is illustrated, in which ingredients can be added to slurry prior to field disposal to increase its fertilizer value.

B-028 Wolfe, R.R., D.P. Anderson, F.L. Cherms and W.E. Roper. 1968. Effect of dust and ammonia air contamination on turkey response. Trans. Amer. Soc. Agr. Eng., 11: 515-518, 522. 10 ref. 3 tab. 15 fig.
Results of trials conducted in Wisconsin to evaluate the effects of dust and ammonia air contamination on turkeys. The main effects of dust and ammonia were studied separately; consideration was also given to interactions between these two contaminants. The incidence of airsacculitis was affected by dust in the air. No effect of ammonia on airsacculitis was found. Mortality rates and feed conversion were not significantly affected by dust and ammonia treatments.

B-029 Longhouse, A.D., H. Ota, R.E. Emerson and J.O. Heishman. 1968. Heat and moisture design data for broiler houses. Trans. Amer. Soc. Agr. Eng., 11: 694-700. 28 ref. 5 tab. 8 fig.
One part of this report was concerned with current (1968) information on undesirable gases and dust in poultry environments. Measured concentrations and distribution of, and harmful effects attributed to, such gases and dust were considered. Gases mentioned were ammonia, carbon dioxide, carbon monoxide and acrolein.

B-030 Jones, D.D., B.A. Jones, Jr. and D.L. Day. 1968. Aerobic digestion of cattle wastes. Trans. Amer. Soc. Agr. Eng., 11: 757-761. 4 ref. 1 tab. 18 fig.
Report on laboratory studies of aerobic digestion of waste from beef and dairy cattle, fed high-concentrate rations, in an attempt to determine aerobic digestion characteristics of the two wastes. A summary of the aerobic digestion process is included. On the basis of the studies, BOD is a better indicator of micro-organismic activity than COD, volatile solids or fixed solids. Significant reductions in biodegradable organic concentrations were observed.

B-031 Mills, K.C., B.F. Parker and I.J. Ross. 1969. Effects of feed consumption on biochemical oxygen demand of steer excreta. Trans. Amer. Soc. Agr. Eng., 12: 133. 2 ref.
Report on study conducted at the University of Kentucky to determine some of the effects of animal feed composition on the rate of aerobic breakdown of animal waste. Excreta produced from all-grain rations had a faster rate of oxidation than the excreta produced by steers on roughage or part roughage rations; thus, the composition of the animal feed will be expected to change the biochemical oxygen demand of animal excreta.

B-032 Merkel, J.A., T.E. Hazen and J.R. Miner. 1969. Identification of gases in a confinement swine building atmosphere. Trans. Amer. Soc. Agr. Eng., 12: 310-313, 315. 11 ref. 1 tab. 5 fig.
Recent damage suits involving production of animals have been largely related to odor control or lack of it. This study was initiated to determine the constituents of the gaseous atmosphere within a swine house, with special emphasis on those gases of importance in explaining odor and toxic conditions. Work to date has indicated that major odor constituents are from the amine and sulfide groups.

B-033 Hermanson, R.E., T.E. Hazen and H.P. Johnson. 1969. Bio-oxidation of swine waste by the activated-sludge process. Trans. Amer. Soc. Agr. Eng., 12: 342-348. 19 ref. 1 tab. 5 fig.
Report on research conducted in Iowa to investigate the extended-aeration activate-sludge process for swine waste treatment. A mathematical model for the BOD reduction efficiency of the system was developed and gave good results when applied to laboratory-scale physical models. Effluent from an anaerobic lagoon is sufficiently constant to be a practical influent substrate for model studies.

B-034 Robbins, J.W.D. and G.J. Kriz. 1969. Relation of agriculture to groundwater pollution: a review. Trans. Amer. Soc. Agr. Eng., 12: 397-403. 97 ref.
Review of recent literature designed to orient agricultural engineers in three general areas of agricultural pollution: (1) evaluation of groundwater as a sink for wastes; (2) characterization of the sources of agricultural groundwater pollutants; and (3) delineation of solutions to agricultural groundwater quality problems.

B-035 Pratt, G.L., R.E. Harkness, R.G. Butler, J.L. Parsons and M.L. Buchanan. 1969. Treatment of beef-cattle waste water for possible reuse. Trans. Amer. Soc. Agr. Eng., 12: 471-473. 19 ref. 3 tab. 2 fig.
Report on attempts at the North Dakota Experimental Station to remove solid materials from animal wastewaters. Settling tanks used in conjunction with aerators and chemical coagulation were tested and compared to settling tanks used alone. Other treatments are necessary for odor control.

B-036 Grub, W., R.C. Albin, D.M. Wells and R.Z. Wheaton. 1969. Engineering analyses of cattle feedlots to reduce water pollution. Trans. Amer. Soc. Agr. Eng., 12: 490-492, 495. 3 ref. 2 tab. 5 fig.
Incorporating both engineering and biological aspects, this report contains an analysis of data and suggests management and design practices that could materially reduce the pollution contributed by the confined land area where feeder cattle are maintained.

B-037 Miller, L. 1969. Dairy installations design in Mississippi. Trans. Amer. Soc. Agr. Eng., 12: 496-498. 8 ref. 2 fig.
Waste disposal, including wastes from silos, fecal material and bedding, is considered as part of the overall dairy production system. In making recommendations, existing conditions and the resources of the dairyman must be projected into the future when changes will need to be made. A lack of knowledge in some areas of waste management is recognized.

B-038 Willis, G.H., J.M. Laflen and C.E. Carter. 1969. A system for measuring and sampling runoff containing sediment and agricultural chemicals from nearly level lands. Trans. Amer. Soc. Agr. Eng., 12: 584-587. 7 ref. 4 tab. 1 fig.
Report on design and performance of a runoff measuring and sampling system that requires very little head room and thus can be used on nearly flat lands. The system, consisting of a Parshall flume, Geib multislot divisor, sump pump and storage tanks, appropriately arranged, measured runoff with reasonable accuracy and collected representative samples of the runoff.

B-039 Mahoney, G.W.A., G.L. Nelson and S.A. Ewing. 1969. Performance of experimental close-confinement (caged) cattle feeding systems. Trans. Amer. Soc. Agr. Eng., 12: 631-633, 637. 5 tab. 5 fig.
Report on study conducted in Oklahoma to determine the performance of cattle in crowded housing and to develop design parameters for confined housing facilities. Sections of the report dealt specifically with rates of accumulation of animal waste, nature of the waste, and removal problems in pens open to air movement.

B-040 Miner, J.R. and T.E. Hazen. 1969. Ammonia and amines: components of the swine building odor. Trans. Amer. Soc. Agr. Eng., 12: 772-774. 6 ref. 7 tab. 5 fig.
Report on research. Ammonia concentrations in hog barns were measured and were below threshold-odor levels, yet a distinctive hog-house odor was present. Indications were that ammonia was not the only contributor to odor. Methylamine, ethylamine, and triethylamine were detected and must be considered as part of the hog-house odor complex.

B-041 Witz, R.L., G.L. Pratt and J.L. Sell. 1969. Reuse of wash water for cleaning caged layer houses. Trans. Amer. Soc. Agr. Eng., 12: 807, 812. 7 fig.
A system of waste treatment utilizing recirculation of wash waters has been used at the North Dakota State University since 1967. Some operational features of the system are reported. The major problem has been odor control.

B-042 Vanderholm, D.H. and C.E. Beer. 1970. Use of soil to treat anaerobic lagoon effluent: design and operation of a field disposal system. Trans. Amer. Soc. Agr. Eng., 13: 562-564. 17 ref. 1 tab. 2 fig.
Report on field studies to investigate the pertinent variables involved (application rate and frequency of application) and the performance of waste renovation systems involving the soil. Four rates and frequencies of applications were tested. The best treatment, comprised of frequent but light applications, reduced the COD, total nitrogen, chlorine, phosphate and pH of the applied effluent by 98%, 83%, 31%, > 99% and 8%, respectively. Recommendations on design criteria of land disposal-irrigation systems were given.

B-043 Hensler, R.F., R.J. Olsen, S.A. Witzel, O.J. Attoe, W.H. Paulson and R.F. Johannes. 1970. Effect of method of manure handling on crop yields, nutrient recovery and runoff losses. Trans. Amer. Soc. Agr. Eng., 13: 726-731. 26 ref. 10 tab.
Results of greenhouse and field studies conducted on three Wisconsin soils to determine the effect of handling dairy-cattle and steer manures in fresh, fermented, aerobic liquid, and anaerobic liquid forms on crop yields, nutrient recovery, soil fertility levels and runoff losses. Fresh, fermented, and anaerobic liquid manures generally gave superior increases in yield of corn and % recovery of N and P compared to those for liquid aerobic manure. Allowing manure to dry for a week before spreading reduced its fertilizer value. Winter-applied manure gave the highest runoff losses. Exchangeable K, available P, and organic matter content in the soil were increased by all manure treatments. Summer applications of manure on alfalfa-grass meadows increased the grass and weed species over legume species.

B-044 Burnett, W.E. and N.C. Dondero. 1970. Control of odors from animal wastes. Trans. Amer. Soc. Agr. Eng., 13: 221-225, 231. 15 ref. 5 tab. 3 fig.
Report on study conducted at Cornell University, New York State, to find ways to eliminate or modify animal waste odors by chemical means. The matching standards technique for characterizing odor qualities was employed to evaluate the performance of several commercial odor-control chemicals. It was concluded that there are odor-control chemicals available which will control odors from animal wastes when added directly to the waste before disposal. Masking agents and counteractants, deodorants, and digestive deodorants were ranked in that order on the basis of effectiveness. A list of 17 manufacturers of odor-control products is appended.

B-045 Cross, O.E. and A. Duran. 1970. Anaerobic decomposition of swine excrement. Trans. Amer. Soc. Agr. Eng., 13: 320-322, 325. 7 ref. 11 fig.
Results of a laboratory analysis of anaerobic digestion of swine excrement as affected by temperature and loading rate. The tendency of the system to approach equilibrium or to approach failure was evaluated on the basis of the difference in theoretical and actual percentage of volatile solids content in the digestor. An increase in temperature was shown to improve digestion.

B-046 Law, J.P. and H. Bernard. 1970. Impact of agricultural pollutants on water uses. Trans. Amer. Soc. Agr. Eng., 13: 474-478. 23 ref. 3 tab.
This general article considers various sources of agricultural pollutants, including animal wastes, and assesses the effect of such pollutants on subsequent water users. Water quality legislation, standards and criteria and agriculture's responsibility with regard to water pollution are discussed.

B-047 Koelliker, J.K. and J.R. Miner. 1970. Use of soil to treat anaerobic lagoon effluent - renovation as a function of depth and application rate. Trans. Amer. Soc. Agr. Eng., 13: 496-499. 19 ref. 4 tab. 3 fig.
Report on research conducted to study the renovation of anaerobic lagoon effluent at various depths and application rates as it percolated through a tile-drained, 4 ft. soil profile. The active soil profile reduced COD, P, and N concentrations by 95, 99, and 80%, respectively, in 3 months of summer

operation. COD removal was attributed to biological activity and physical filtration; P reduction resulted from chemical activity of the clay fraction of the soil profile; and nitrogen reduction was primarily due to denitrification in the soil profile.

B-048 Kang, S.F., L.T. Fan, E.S. Lee and L.E. Erickson. 1970. Modeling feedlot runoff pollution. I: Analog simulation. Trans. Amer. Soc. Agr. Eng., 13: 859-863. 8 ref. 1 tab. 9 fig.
Report on an investigation at Kansas State University of a dynamic mathematical model, represented by a set of non-linear differential equations simulated on an analog computer, to realistically represent the water pollution potential of cattle feedlot runoff. Two differential equations were used to relate the original parameters of the system to the groups of dimensionless parameters used in the model. The unknown flow rate and COD concentration of runoff could then be predicted. The injection rate to streams was found to have an approximately linear relationship with rainfall intensity despite different surface conditions.

B-049 Kang, S.F., L.T. Fan, E.S. Lee and L.E. Erickson. 1970. Modeling feedlot runoff pollution. II: Quasilinearization. Trans. Amer. Soc. Agr. Eng., 13: 864-869. 18 ref. 2 tab. 2 fig.
Second report on an investigation of a dynamic mathematical model to represent the water pollution potential of cattle feedlot runoff. The quasilinearization technique was used to estimate the unknown parameters of a feedlot runoff system where more than three parameters are unknown. Problems encountered, including a convergence problem, were described. The advantage of the quasilinearization technique is that, if the process converges, it converges quadratically.

B-050 Gramms, L.C., L.B. Polkowski and S.A. Witzel. 1971. Anaerobic digestion of farm animal wastes (dairy bull, swine and poultry). Trans. Amer. Soc. Agr. Eng., 14: 7-11, 13. 7 ref. 4 tab. 10 fig.
Report on trials, conducted in Wisconsin, with high-rate, temperature-controlled anaerobic digestors to determine optimum loading rates, the resulting reduction in volatile solids and COD and the settleability and drainability of digested sludge residues. Results of these laboratory trials are presented in detail, including recommendations useful in the design and operation of anaerobic digestors for animal wastes. Comparisons are drawn between anaerobic digestion of animal waste and domestic sewage.

B-051 Nye, J.C., A.C. Dale and D.E. Bloodgood. 1971. Effect of temperature on aerobic decomposition of dairy cattle manure. Trans. Amer. Soc. Agr. Eng., 14: 545-548. 7 ref. 3 tab. 8 fig.
Report on studies conducted in Indiana utilizing semi-continuous feed and batch feed techniques in laboratory aerobic digestion chambers. Reductions in volatile solids of 70% and 45% were obtained at 65°F and 48°F, respectively. Lower solids concentrations in the supernatant liquid may be expected at higher operating temperatures. The effect of aeration on the NPK value of manure was shown.

B-052 Choi, S.K., L.T. Fan, L.E. Erickson and R.I. Lipper. 1971. Transport rate of COD through a wet porous stratum - measurement of diffusivity of cattle manure solution. Trans. Amer. Soc. Agr. Eng., 14: 720-726.

16 ref. 1 tab. 10 fig.
Results of research to investigate the rate of transport, by diffusion, of COD through a saturated, porous stratum (such as the soil-manure surface in a feedlot) under simulated conditions. A mathematical model was presented of a system consisting of a soil-manure packed bed, saturated by water, and of a well mixed pool of homogeneous solution on top of the bed. By measuring the COD (concentration of manure) in the pool on top of the bed, a value of 7.10×10^{-6} sq. cm. per sec (at 25±2°C) was determined for the diffusion coefficient of a cattle manure solution. For a system with a known diffusivity, the analytical expressions presented can be used to predict the rates that feedlot wastes will contaminate surface or groundwater.

B-053 Ludington, D.C., A.T. Sobel and B. Gormel. 1971. Control of odors through manure management. Trans. Amer. Soc. Agr. Eng., 14: 771-774, 780. 2 ref. 8 tab. 12 fig.
Report on attempts to control air pollution from poultry manure by inhibiting odor production. Both daily manure removal and moisture removal were successful in reducing the odor offensiveness of poultry operations. Diluted manure was judged more offensive than undiluted manure in all cases; 25% moisture content was considered optimum.

B-054 Jones, D.D., D.L. Day and U.S. Garrigus. 1971. Oxidation ditch in a confinement beef building. Trans. Amer. Soc. Agr. Eng., 14: 825-827. 1 ref. 2 tab. 6 fig.
Report on trials at the University of Illinois Beef Farm with in-the-building oxidation ditches. Results were promising. Loading rates of 55 cu. ft. per 800-lb fattening calf and 80 cu. ft. per cow-calf unit were recommended. Costs of aerating beef wastes were estimated at 1 cent per pound of gain per day per animal.

B-055 Frus, J.D., T.E. Hazen and J.R. Miner. 1971. Chemical oxygen demand of gaseous air contaminants. Trans. Amer. Soc. Agr. Eng., 14: 837-840. 8 ref. 6 tab. 5 fig.
The authors proposed a modified COD technique for measuring odor intensity, and tested the technique on swine-building odors. Problems encountered in the practical field application of the technique, as well as its merits, were discussed.

B-056 Ludington, D.C., A.T. Sobel and A.G. Hashimoto. 1971. Odors and gases liberated from diluted and undiluted chicken manure. Trans. Amer. Soc. Agr. Eng., 14: 855-859. 8 ref. 1 tab. 12 fig.
Results of an investigation comparing the release of gases and odors from diluted and undiluted chicken manure. Undiluted manure released more ammonia and carbon dioxide and less hydrogen sulfide than diluted manure. Odors arising from diluted systems have the same odor strength as those from undiluted systems, but the quality of the odor from liquid manure was judged very offensive compared to the predominantly ammonia odor from undiluted manure. Upon agitation, the difference in odor quality was intensified.

B-057 Gilbertson, C.B., T.M. McCalla, J.R. Ellis and W.R. Woods. 1971. Methods of removing settleable solids from outdoor beef cattle feedlot runoff. Trans. Amer. Soc. Agr. Eng., 14: 899-905. 11 ref. 19 fig. 2 tab.
Results of trials with two experimental systems designed to remove settleable

solids from feedlot runoff, based on the hydrologic principle of reducing velocity of flow to allow heavier particles to settle. One method, the "batch" system, consisted of a primary settling basin and a secondary basin, while the other method, termed the "continuous flow" system, consisted of a series of porous dams of variable porosity. The batch system was efficient in removing settleable solids but had considerable maintenance disadvantages. Cold weather problems were mentioned. The authors suggested that the "continuous flow" concept might be adapted to many feedlots experiencing runoff pollution problems.

B-058 Elliott, L.F., T.M. McCalla, N.P. Swanson and F.G. Viets, Jr. 1971. Use of caissons for sampling chemical and biological conditions beneath a beef feedlot. Trans. Amer. Soc. Agr. Eng., 14: 1018-1019. 2 ref. 2 tab. 4 fig.
"The caisson installation allows soil gas and soil solution samples to be taken from the same sites, in the feedlot soil profile, over extended periods of time. These samples provide a measure of the chemistry and biological activity under a feedlot which would be extremely difficult without the benefit of the caisson installation. Values obtained indicate the system will permit the measurement of the effect of feedlot management on the downward movement of pollutants."

B-059 Bell, R.G. and J. Pos. 1971. Design and operation of a pilot plant for composting poultry manure. Trans. Amer. Soc. Agr. Eng., 14: 1020-1023. 6 ref. 6 fig.
Composting reduces the pollution potential of poultry manure so that it may be stored for prolonged periods in the composted state without danger to the environment. A pilot scale composting unit, designed and operated in Ontario, was illustrated, some operational features and difficulties are explained, and some data are presented for several operational parameters.

B-060 Smith, R.E. and J.D. Jenkins. 1971. Salts concentrations in a recycling aerobic waste disposal system. Trans. Amer. Soc. Agr. Eng., 14: 1076-1079. 14 ref. 3 tab. 3 fig.
Report on studies to investigate the effects of salts concentrations on the biodegradation of poultry wastes. Salts concentrations in the effluent of aerobic digestors after 1 year of operation were measured. The results indicated that salt buildup in recycling aerobic digestors for poultry wastes has little effect on biodegradation efficiency up to a concentration of soluble nonvolatile salts of 20,000 mg/l of solution. A concentration of 250,000 mg/l impairs BOD and volatile solids reduction rates for the naturally occurring microbial populations used in this study; however, harmful concentrations such as this are unrealistic in properly operated aerobic digestors. The possibility of acclimatization of the microbial population was noted.

B-061 Fitzgerald, G.P. and G.A. Rohlich. 1958. An evaluation of stabilization pond literature. J. Water Pollut. Contr. Fed., 30: 1213-1224. 79 ref. 4 tab.
Literature review covering the history of stabilization ponds, their effectiveness in lowering BOD, bacterial counts and nutrient concentrations, the growth of algae in ponds, and the economics of oxidation ponds.

B-062 Geldreich, E.E., R.H. Bordner, C.B. Huff, H.F. Clark and P.W. Kabler. 1962. Type distribution of coliform bacteria in feces of warm-blooded animals. J. Water Pollut. Contr. Fed., 34: 295-301. 24 ref. 4 tab. Report on a comparative study of fecal coliforms from the feces of human, cow, pig, sheep, turkey, chicken and duck samples as to their classification and distribution. The membrane filter technique was used to separate strains of each coliform type as they were isolated from fecal samples. The reactions of 4,512 human, 2,339 livestock, and 1,896 poultry coliform strains have been investigated. An evaluation of testing procedures was given.

B-063 Scott, R.A. 1962. Disposal of high organic content wastes on land. J. Water Pollut. Contr. Fed., 34: 932-950. 10 ref. 12 tab. 12 fig. Review of information on the practical aspects of strong organic waste application to land and on general experience gained from the practice in Wisconsin. The three wastes considered, digested sewage sludge, whey from cheese manufacturing and spent sulfite liquor from the sulfite pumping plants, were discussed as to their material values. Care must be taken in land spreading to avoid erosion, nuisance conditions, and ground water pollution. Land disposal appeared to be a suitable method for the wastes discussed.

B-064 Mackenthun, K.M. 1962. A review of algae, lake weeds, and nutrients. J. Water Pollut. Contr. Fed., 34: 1077-1085. 24 ref. 4 tab. 1 fig. Report on measurements of algal growths and growth factors. The natural cycles of phosphorus and nitrogen, basic suppliers of these two nutrients and some facts on nutrient loadings and utilization were presented. Temporary nuisance control is considered.

B-065 Hart, S.A. 1963. Digestion tests of livestock wastes. J. Water Pollut. Contr. Fed., 35: 748-757. 11 ref. 2 tab. 7 fig. Results of laboratory tests on the digestion of chicken and dairy cattle manures indicating: (1) the feasibility of high rate digestors for treatment of livestock manures; (2) that dairy manure is least potent of all manures; (3) the destruction of volatile matter from digesting chicken manure closely resembles that of municipal sludge digestion; (4) operational parameters of digestion follow those of municipal sludge digestion; (5) nitrogen in chicken manure is concentrated by digestion and is changed from organic to ammoniacal form; (6) COD on a mg O_2 per mg VS basis increases upon digestion; (7) expressed as mg O_2 per mg VS, BOD of chicken manure was not reduced; and (8) digestion does not destroy the waste so final disposal must be given further consideration.

B-066 Gates, C.D. 1963. Treatment of Long Island duck farm waste. J. Water Pollut. Contr. Fed., 35: 1569-1579. 16 ref. 2 tab. 7 fig. Report on laboratory investigations of the chlorination characteristics of the effluent from Long Island duck farm lagoons. The study showed that the chlorination characteristics of duck farm lagoon effluent are similar to those of effluents from municipal waste treatment plants. "Dry farming" did not result in greater coliform densities or in greater chlorine demands. Successful disinfection of the duck farm lagoon effluents by chlorination would require some changes in normal management, some of which are outlined.

B-067 Engelbrecht, R.S., B.B. Ewing and R.L. Hoover. 1964. Soybean and mixed-feed plant processing wastes. J. Water Pollut. Contr. Fed., 36: 434-442. 1 ref. 1 tab. 4 fig. Report on studies made at a feed processing plant in Illinois to determine the sources and character of wastes and existing pollution control measures being used. Wastes from normal operations carry only nominal organic loads to receiving streams. Accidental spills of feed additives such as molasses (BOD of 650,000 mg/l) can impose large shock loadings which can be controlled by the use of detention ponds. Inorganic sludge discharges from boiler water treatment and ash handling can pose serious stream pollution problems but can be settled out in settling ponds and the clarified water reused.

B-068 Hart, S.A. and M.E. Turner. 1965. Lagoons for livestock manure. J. Water Pollut. Contr. Fed., 37: 1578-1596. 9 ref. 5 tab. 6 fig.
Report on study on the use of anaerobic lagoons for treatment of livestock wastes. Odor was a definite problem but fly problems were not encountered except for some breeding of Tubifera tenax which are not considered a public health hazard. All except one of the eight experimental lagoons had disagreeable appearances. Differences in appearance, odor, fly problems, organic matter destruction and infiltration loss were noted for swine, dairy and poultry manure. All lagoons except one removed more than 2/3 of applied solids and BOD reductions were about 89%. Water loss by infiltration was considerable and was regarded as serious. Lagoons of this type do have a definite place in the management of livestock manures.

B-069 Miner, J.R., R.I. Lipper, L.R. Fina and J.W. Funk. 1966. Cattle feedlot runoff - its nature and variation. J. Water Pollut. Contr. Fed., 38: 1582-1591. 12 ref. 11 tab. 8 fig.
Report on studies to determine the nature of cattle feedlot runoff and to evaluate factors that influence runoff and various techniques to minimize pollutional effects of such runoff. The greatest pollutant concentrations were obtained during warm weather, during periods of low rainfall intensity and when the manure was soaked with antecedent moisture. Runoff from concrete-surfaced lots was more polluted than that from unsurfaced lots.

B-070 Loehr, R.C. 1967. Effluent quality from anaerobic lagoons treating feedlot wastes. J. Water Pollut. Contr. Fed., 39: 384-391. 12 ref. 6 tab.
Report on laboratory and field data on the quality of effluent that can be expected from anaerobic lagoons treating livestock feedlot wastes. The effluent is high in oxygen-demanding material, solids, and nitrogen. Subsequent treatment of the lagoon effluent is advisable before release to receiving water. The quality of settled solids from lagoons treating dairy and beef cattle wastes was also discussed.

B-071 Loehr, R.C. and J.A. Ruf. 1968. Anaerobic lagoon treatment of milking-parlour wastes. J. Water Pollut. Contr. Fed., 40: 83-94. 14 ref. 4 tab. 5 fig.
Results of a field study of an 80-cow milking-parlour and its waste treatment facilities. The average flow and BOD_5 of the milking-parlour waste were 760 gpd and 1030 mg/l, respectively. Summer reduction of BOD_5 was 85% whereas winter reduction was only 20%. Coliform reductions exceeded 99%. Removal of solids during cold weather adversely affected the performance of the lagoons.

B-072 Preul, H.C. 1968. Contaminants in groundwaters near waste stabilization ponds. J. Water Pollut. Contr. Fed., 40: 659-669. 13 ref. 2 tab. 7 fig.
Tabulated and graphical results of studies on the travel of pollutants in

groundwater in the vicinity of 10 crude sewage lagoons in Minnesota. Nitrogen in the lagoon percolation waters was mainly in the form of ammonia, this being attributed to the lack of oxygen in the unsaturated zone below the lagoon and thereby preventing nitrification. These results are in contrast to those for septic tank percolation fields. The author concluded that the risk of nitrate or phosphate contamination of shallow groundwater from sewage lagoon percolation was not serious. Significant concentrations of alkyl benzene sulfonate were found in groundwater as far as 20 ft. from lagoons. An example is given of the calculation of the effect of soil adsorption on the travel of ammonia-nitrogen.

B-073 Dawson, R.N. and J.W. Grainge. 1969. Proposed design criteria for wastewater lagoons in arctic and subarctic regions. J. Water Pollut. Contr. Fed., 41: 237-246. 6 ref. 8 fig.
Report on four types of lagoons suitable for arctic and subarctic regions: (1) single cell, long retention; (2) primary, short retention; (3) secondary, long retention; and (4) aerated. Evaluation of each type is given and parameters of each are evaluated for use under the existing cold temperatures.

B-074 Weidner, R.B., A.G. Christianson, S.R. Weibel and G.G. Robeck. 1969. Rural runoff as a factor in stream pollution. J. Water Pollut. Contr. Fed., 41: 377-384. 3 ref. 10 tab. 6 fig.
Results of study showing that, despite an increased amount of fertilizers and manure being used, there was a marked decrease in the pollutional load coming from such heavily fertilized watersheds as compared to the load from watersheds where such practices have not been adopted. It was concluded that, despite the fact that rural runoff is a factor in stream pollution, there are means available for reducing the pollutional load from agriculture.

B-075 Bhagat, S.K. and D.E. Proctor. 1969. Treatment of dairy manure by lagooning. J. Water Pollut. Contr. Fed., 41: 785-795. 6 ref. 7 tab. 9 fig.
Report on an investigation to determine and evaluate the performance of the dairy lagoons operated at Washington State University for stabilization of dairy wastes. Primary waste treatment by anaerobic lagooning is satisfactory because of the high solids content of dairy manure. Secondary treatment may be accomplished by aerobic lagooning or by oxidation ditch treatment.

B-076 Research Committee. 1969. A review of the literature of 1968 on waste water and water pollution control. J. Water Pollut. Contr. Fed., 41: 873-1251.
Sections of this review of the 1968 literature on waste treatment and management refer directly to livestock wastes; several other sections include information pertinent to animal waste management.

B-077 Geldriech, E.E. and B.A. Kenner. 1969. Concepts of fecal streptococci in stream pollution. J. Water Pollut. Contr. Fed., 41: R336-R352. 35 ref. 6 tab. 3 fig.
Results of an intensive study on the occurrence and strain distribution for 12,536 fecal streptococcus strains found in warm-blooded animals' feces and numerous water sources from a wide geographical area. Several factors that must be understood for a proper interpretation of the sanitary significance of this bacterial group in water pollution studies were presented. The detection of S. bovis and S. eginus subgroup may be considered a specific indicator of non-human animal pollution.

B-078 Nemerow, N.L. 1969. Baffled biological basins for treating poultry plant wastes. J. Water Pollut. Contr. Fed., 41: 1602-1612. 9 tab. 8 fig.
"A Millsboro, Delaware poultry plant processes 10,000 chickens/hr with a wastewater of 40,000 gph and an effluent of 2,500 lb 5-day BOD/day at an average BOD of 630 mg/l. Because the area is recreationally and commercially of great value, a program was initiated to reduce the wastewater concentration at a maximum cost of $100,000. A two-stage oxidation pond was selected. The first stage consists of a baffled, high-rate, deep pond. The second stage is a shallow, photosynthetic basin. Cost was $90,000. Loadings of over 200 lb/day/acre have resulted in organic reduction of 85 to 90 percent and coliform counts of less than 10/100 ml."

B-079 Gillham, R.W. and L.R. Webber. 1969. Nitrogen contamination of groundwater by barnyard leachates. J. Water Pollut. Contr. Fed., 41: 1752-1762. 13 ref. 2 tab. 10 fig.
Results of a comprehensive study of a zone of nitrogen-contaminated groundwater associated with a barnyard in Ontario. An increase from 2 to 15 mg/l of inorganic nitrogen occurred in the groundwater beneath the barnyard during the 5-month study period. The surface topography proved to be a poor indication of the direction of groundwater flow.

B-080 El-Sharkawi, F.M. and S.K. Moawad. 1970. Stabilization of dairy wastes by algal-bacterial symbiosis in oxidation ponds. J. Water Pollut. Contr. Fed., 42: 115-125. 17 ref. 5 tab. 4 fig.
Results of a study on the treatment of milk wastes in a pilot-scale oxidation pond. An algal-bacterial symbiotic system for treatment of dairy wastes was shown to be feasible, being both economical and efficient. BOD reductions of 80 to 90% were obtained over a detention period of 10 days. A depth of 75 cm was considered optimum. The micro-flora showed a remarkable ability to respond to the prevailing climatological conditions. Diurnal variations were noted.

B-081 Townshend, A.R., S.A. Black and J.F. Janse. 1970. Beef feedlot operations in Ontario. J. Water Pollut. Contr. Fed., 42: 195-208. 10 ref. 10 tab. 3 fig.
Report on feedlot operations in Ontario. The waste handling problem is summarized, and guidelines are presented on satisfactory management of feedlot wastes. Pollution from feedlots arises from three sources; feed storage seepage, feedlot runoff and land disposal runoff. Examples of pollution arising from the three sources are given, as well as recommendations for prevention of such pollution.

B-082 Miner, J.R., E.R. Baumann, T.L. Willrich and T.E. Hazen. 1970. Pollution control - feedlot operations. J. Water Pollut. Contr. Fed., 42: 391-398. 6 ref. 1 tab.
General review of feedlot pollution control. Extreme variations in physical factors and management techniques necessitates flexible pollution control regulations. Changes in livestock production techniques and changes in public opinion are causing agriculture to be subject to environmental quality restrictions that it was not subject to before. The challenge is to devise and operate systems that economically produce livestock within a complex, pollution conscious community.

B-083 Research Committee. 1970. A review of the 1969 literature on wastewater and water pollution control. J. Water Pollut. Contr. Fed., 42: 861-1268.
Sections of this review of the 1969 literature on waste treatment and management refer directly to livestock wastes; several other sections include information pertinent to animal waste management.

B-084 Gilbertson, C.B., T.M. McCalla, J.R. Ellis, O.E. Cross and W.R. Woods. 1971. Runoff, solid wastes, and nitrate movement on beef feedlots. J. Water Pollut. Contr. Fed., 43: 483-493. 18 ref. 6 tab. 2 fig.
"A study of the effects of feedlot slope and cattle densities on the quantity and quality of runoff resulting from rainstorms and snowmelt, the downward movement of pollutants into the soil profile on unpaved feedlots, and the amount of solids accumulation on the feedlot surface revealed that feedlots with 18.58 sq m/head yielded 5.6 metric tons/day/ha, whereas those with 9.29 sq m/head yielded 7.6 metric tons/day/ha. Feedlot slope had little effect. About 30% of the solids were volatile. Runoff quantity and quality depended more on rainfall than slope or cattle density, but high-density lots yielded 130 to 170 percent more winter runoff than low-density lots. Winter runoff averaged 6.2 to 17.6 metric tons/ha-cm, with about 50 percent volatile. Nitrate movement in soil after 1 yr. was minimal."

B-085 Research Committee. 1971. A review of the 1970 literature on wastewater and water pollution control. J. Water Pollut. Contr. Fed., 43: 931-1419.
Sections of this review of the 1970 literature on waste treatment and management refer directly to livestock wastes; several other sections include information pertinent to animal waste management.

B-086 Fritschi, E.W. and F.W. Macdonald. 1971. Wastewater from simian primate facilities. J. Water Pollut. Contr. Fed., 43: 883-889. 8 ref. 8 tab. 1 fig.
Report on investigation of the amount and nature of wastewater effluents from a primate research center in an attempt to determine the expected hydraulic and biochemical oxygen demand loadings for a proposed treatment plant. Bacteriological and parasitological aspects were also considered.

B-087 Loehr, R.C. 1971. Alternatives for the treatment and disposal of animal wastes. J. Water Pollut. Contr. Fed., 43: 668-678. 10 ref. 2 tab. 2 fig.
Review of the problems presented by animal wastes as a result of the increased efficiency of agricultural production. No one treatment process is best for all situations, but several alternatives are available; aerobic and anaerobic processes, oxidation ditches, land disposal, drying, incineration and composting represent some of the alternatives available with today's technology. Ammonia release, controlled nitrification and denitrification, and crop management appear to be feasible methods for reducing the nutrient losses from animal wastes to surface and ground water.

B-088 Kampelmacher, E.H. and L.M. van Noorle Jansen. 1971. Reduction of Salmonella in compost in a hog-fattening farm oxidation vat. J. Water Pollut. Contr. Fed., 43: 1541-1545. 3 ref. 3 tab. 4 fig.
"The reduction of Salmonella in compost in an experimental oxidation vat on a

hog-fattening farm was shown to be approximately 100 fold. As long as excretion of Salmonella in the hog feces remains low, only small numbers will be sluiced out with the effluent, and the possibility of human or animal infection in surface water will be very slight. However, if the loading is increased or the numbers of excreted bacteria increase, plant effluent chlorination should be considered."

B-089 Henderson, J.M. 1962. Agricultural land drainage and stream pollution. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 88(SA6): 61-74. 14 ref. 4 tab.

Characteristics of organic pollution contributed to agricultural land drainage by farm animals were investigated. This contribution was shown to be a significant problem in stream pollution by use of a case study in the Potomac River drainage shed. The nature of abatement measures was outlined, and human disease hazards were reviewed. Limited data are cited concerning the actual BOD contribution of agricultural land drainage to a stream under flushing-flow conditions.

B-090 Clark, C.E. 1965. Hog waste disposal by lagooning. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 91(SA6): 27-42. 9 ref. 5 tab. 1 fig.

"A two-year field investigation and laboratory testing program has proven that a modified anaerobic lagoon can be used successfully for the disposal of confinement-fed hog waste. A loading rate of 275 feeder hogs per acre at an average depth of 5 ft provides for odor-free operation with a minimum of maintenance and a long operational life. The total containment design without an overflow or discharge eliminates the necessity for a receiving stream or secondary treatment but may require a special make-up water source. The system uses single stage anaerobic digestion combined with a massive heterotrophic growth of algae. A by-product, harvested algae for use as a feed additive, is an indicated possibility. Other included design factors are the chemical constituents and fertilizer values of hog waste. An interesting side-effect is the measurable antibiotic action of the waste caused by a carry-over of antibiotics from the feed. This was found to completely prevent digestion of undiluted waste and caused complete failure of the 5-day BOD test."

B-091 Loehr, R.C. and R.W. Agnew. 1967. Cattle wastes - pollution and potential treatment. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 93(SA4): 55-72. 31 ref. 9 tab. 2 fig.

Feedlot runoff is a significant problem. Treatment facilities must be able to handle slug loads without causing stream pollution. Because of the quantity and quality of the waste produced, a combination aerobic-anaerobic lagoon appears to be the most promising treatment system.

B-092 Loehr, R.C. 1969. Animal wastes - a national problem. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 95(SA2): 189-221. 86 ref. 9 tab. 4 fig.

A state of the art summary on the control and management of animal wastes as of August, 1967. Items discussed included the magnitude of the problem, pollution that has been caused by animal wastes, feasible treatment processes, major problem areas, and areas for future research activity.

B-093 Minshall, N.E., S.A. Witzel and M.S. Nichols. 1970. Stream enrichment

from farm operations. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 96(SA2): 513-524. 4 ref. 5 tab. 2 fig.
This study on the effect of time of application of manure to the land concluded that up to 20%, 13% and 33% of the nitrogen, phosphorus and potassium nutrient contents, respectively, of winter spread manure may be lost in early spring runoff. Nutrient losses from summer applications were lower than losses from check plots receiving no manure. Manure should be spread only on unfrozen ground and incorporated into the soil soon thereafter. Indication was made of the need for well designed storage structures, and for more research in this area of waste management.

B-094 Loehr, R.C. 1970. Drainage and pollution from beef cattle feedlots. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 96(SA6): 1295-1309. 26 ref. 1 tab. 4 fig.
Changes in beef feeding operations and water contamination from beef feedlots are documented. Data on the quality and quantity of runoff from feedlots were presented, and indicated that the runoff contained high concentrations of pollutants and occurred as a slug load on the resources of a stream. Minimum control may be possible using retention ponds. Possibilities of groundwater pollution were explored.

B-095 Webb, H.J. 1962. Water pollution resulting from agricultural activities. J. Amer. Water Works Assoc., 54: 83-87. 10 ref.
Discussion of fertilizers, animal wastes, and pesticides as sources of water pollution. A case of litigation against a cattle feedlot operator was cited, the operator being fined $500 for allowing 75 cu. yds. of manure to be scraped into the Napa River, causing the deaths of about 1,000 fish 3 miles downstream. It was suggested that increased attention must be paid to pollution of water by agricultural practices.

B-096 LeGrand, H.E. 1964. A system for evaluating the contamination potential of some waste sites. J. Amer. Water Works Assoc., 56: 959-974. 4 ref. 1 tab. 6 fig.
A relatively simple system for evaluating the contamination potential of waste disposal sites is discussed. The probable effects of five environmental factors - water table, sorption, permeability, water table gradient and distance to point of use - are appraised and a problem site is characterized. No claim for precision was made.

B-097 Nichols, M.S. 1965. Nitrates in the environment. J. Amer. Water Works Assoc., 57: 1319-1327. 25 ref.
The various sources of nitrogen fertilizers include nitrogen from the atmosphere, nitrogenous organic wastes, niter beds as nitrate-containing salts, and electrical discharges during thunderstorms. Nitrogen fixation may be the result of man using scientific methods or may be accomplished by non-symbiotic or symbiotic microorganisms. Nitrogen also becomes concentrated as a result of organic mineralization. Excessive concentrations of nitrates can account for large aquatic growths, methemoglobinemia in infants, cyanosis and livestock poisoning by silage gas. Sources of nitrogen from waste treatment facilities are discussed.

B-098 Deaner, D.G. and K.D. Kerri. 1969. Regrowth of fecal coliforms. J. Amer. Water Works Assoc., 61: 465-468. 6 ref. 3 fig.

Nonfecal coliforms often undergo regrowth after discharge into a stream. A California team investigated whether or not fecal coliforms would do likewise. Samples taken below the outfall of a highly treated wastewater discharge indicated that no such regrowth of fecal coliforms occurred. Several factors which may have inhibited regrowth were discussed. Results require verification by further research.

B-099 Ammerman, C.B., P.W. Waldroup, L.R. Arrington, R.L. Shirley and R.H. Harms. 1966. Nutrient digestibility by ruminants of poultry litter containing dried citrus pulp. J. Agr. Food Chem., 14: 279-281. 9 ref. 4 tab.
"Dried citrus pulp was used as the absorbent material for the droppings of broiler chicks and the digestibility of the nutrients in the resulting litter was determined with lambs. Both the nutrient digestibility and composition of the poultry litter were compared with those of the citrus pulp. On a per cent composition basis, nitrogen and ash of the combined droppings and citrus pulp were greater than in the original pulp. When compared with the citrus pulp diet, the poultry litter diet had a higher ($P<0.01$) apparent digestion coefficient for crude protein and a lower ($P<0.05$) digestibility of ether extract. Other nutrients were of similar digestibility for the two diets. The results suggest that dried citrus pulp and perhaps certain other feeds can be used as poultry litter and subsequently fed to ruminants."

B-100 Holt, R.F., D.R. Timmons and J.J. Latterell. 1970. Accumulation of phosphates in water. J. Agr. Food Chem., 18: 781-784. 37 ref. 1 tab.
Agricultural sources of phosphorus to surface water include animal wastes, fertilizers and land runoff. While the contribution from these is quite low, only very small quantities are required to support profuse algal blooms. Methods for decreasing phosphate contamination of surface water were presented.

B-101 Morrison, J.L. 1969. Distribution of arsenic from poultry litter in broiler chickens, soil, and crops. J. Agr. Food Chem., 17: 1288-1290. 27 ref. 5 tab.
"The effect of the presence of organoarsenicals from feed additives in poultry house litter was investigated with respect to the distribution of arsenic in chickens raised on this litter, to the distribution of arsenic in soil fertilized with this litter, and to the distribution of arsenic in crops raised on soil fertilized with this type litter. Although measurable amounts of arsenic (15-30 ppm) were found in litter, the arsenic content of soil and crops was unaffected by the use of poultry litter as fertilizer. Similarly, the arsenic content of birds was unaffected when raised on this type litter."

B-102 Soltero, R.A. 1969. Chemical, physical findings from pollution studies on the East Gallatin River and its tributaries. Water Res., 3: 687-706. 20 ref. 4 tab. 15 fig.
During a twelve-week survey, several chemical-physical analyses were conducted on samples of water from a section of the East Gallatin River. Possible sources of pollution included the Bozeman City sewage treatment plant, a slaughterhouse, and a stockyard. Results of 24-hr. sampling indicated that the city sewage effluent was the major source of pollution.

B-103 Forsyth, R.J. 1965. The collection of manure from housed livestock. J. Proc. Inst. Agr. Eng., 21: 129-133.

Discussion of various collection devices for livestock manure currently being used or tried in Scotland. These methods include mechanical scrapers, sluice gates at the lower end of sloping gutters, and slatted or partially slatted floors over tanks, channels or oxidation ditches. Some costing figures were presented.

B-104 Rundle, W.T.A. 1965. Effluent disposal - still a problem. J. Proc. Inst. Agr. Eng., 21: 134-138. 5 tab. 5 fig.
Methods of handling slurry in Scotland, and equipment used for collection and transport of slurry were discussed. Treatment and/or disposal of slurry by anaerobic digestion and field spreading were considered as two alternatives to the waste disposal problem. Some references were made to maximum application rates to cropland, labor requirements of various handling methods, and equipment costs.

B-105 Taiganides, E.P., E.R. Baumann, E.P. Johnson and T.E. Hazen. 1963. Anaerobic digestion of hog wastes. J. Agr. Eng. Res., 8: 327-333. 9 ref. 5 fig.
Results of some laboratory investigations of anaerobic digestion of swine wastes were reported. At 95^{o}F with once-a-day feeding and continuous mixing, satisfactory digestion was achieved at a loading rate of 0.20 lb of volatile solids per day per cu. ft. of digestor capacity in a detention period of 10 days or less. Average gas yields per day per pound of volatile solids amounted to 7.8 to 10.3 cu. ft. Gas was 59% methane and 40% carbon-dioxide with a heating value of 3,600 Btu per day from the daily waste of one pig. The digested sludge was free of offensive odors and did not attract flies. The fertilizer value of the digested sludge was greater than that of the undigested wastes. BOD reductions of 60 - 70% were experienced. Considerations for the design of digestors and recommendations on their use were given.

B-106 Irgens, R.L. and D.L. Day. 1966. Laboratory studies of aerobic stabilization of swine waste. J. Agr. Eng. Res., 11: 1-10. 11 ref. 7 tab. 6 fig.
"Pig waste was allowed to accumulate in a pit beneath a slatted-floor swine finishing building for one week or one month. Samples of this waste were brought to the laboratory for analysis and aerobic stabilization. It was concluded that adding the raw waste continuously to the aeration unit gave the best results. The treated effluent had a BOD of 10 to 15 ppm and contained only a trace of ammonia. Treatment by the aerobic process made the swine waste virtually odourless and stable. About 6 ft^3 of liquid was required to dilute the waste from a 150 lb pig at the beginning of the aerobic process and 2,500 ft^3 of air was needed per pound of BOD. However, the more efficient oxygenation obtained with an aeration rotor in an oxidation ditch might reduce the latter value considerably. It was estimated that 36 kWh might be required per pig per year for operation of the aeration rotor of an oxidation ditch. Chlorination of diluted swine waste eliminated a certain degree of odour and improved flocculation and dewatering of the solids. The COD of the chlorinated and filtered waste was reduced 72%. Chlorinated compounds of various types may have similar effects."

B-107 Bell, R.G. 1970. The influence of aeration on the composting of poultry manure-ground corncob mixtures. J. Agr. Eng. Res., 15: 11-16. 8 ref. 2 tab. 5 fig.

"The influence on the rate of aeration on 1.5 meter columns of composting mixtures of 2 parts poultry manure and 1 part ground corncob was investigated. The results indicated that the optimum aeration rate for the production of a stable sanitary compost was 4 liters of air/m^2/min. for every 10 cm. of composting material up to a maximum depth of 2.4 meters."

B-108 Stewart, B.A., F.G. Viets, Jr., G.L. Hutchinson and W.D. Kemper. 1967. Nitrate and other water pollutants under fields and feedlots. Environ. Sci. Technol., 1: 736-739. 1 ref. 1 tab. 2 fig.
"Agriculture's effect on nitrate pollution of ground water was investigated in the South Platte valley of Colorado. The valley is intensively farmed and contains many concentrated livestock feeding operations. A water table, generally between 3 and 20 meters below the surface, underlies much of the area. The average total nitrate-nitrogen to a depth of 6.7 meters in the profiles for the various kinds of land use was: alfalfa (13 cores), 70: native grassland (17 cores), 81; cultivated dryland (21 cores), 233; irrigated fields not in alfalfa (28 cores), 452; and feedlots (47 cores), 1282 kg. per hectare. Ground water samples often contained high concentrations of nitrate, and those obtained beneath feedlots contained ammonium-nitrogen and organic carbon."

B-109 Burnett, W.E. 1969. Air pollution from animal wastes. Determination of malodors by gas chromatographic and organoleptic techniques. Environ. Sci. Technol., 3: 744-749. 21 ref. 2 tab. 6 fig.
"A combination of gas chromatographic and organoleptic techniques was used to determine the chemical compounds responsible for the offensive odor of accumulated liquid poultry manure. The volatile odorous substances were trapped and concentrated in short sections of gas chromatographic columns held at -78°C, separated by gas chromatography and identified by the correspondence between relative retention time and the odors of the peaks for the unknowns and authentic compounds. Mercaptans, sulfides, and diketones were identified. Volatile organic acids and the nitrogen heterocycles, indole and skatole, were also identified, using direct injections of liquid manure supernatant and standard gas chromatographic techniques. The sulfur compounds, organic acids, and skatole were implicated as important malodorous components involved in air pollution. The prevention of the formation of the malodorous substances was suggested as the best means of control of air pollution from animal wastes."

B-110 Stewart, B.A. 1970. Volatilization and nitrification of nitrogen from urine under simulated feedlot conditions. Environ. Sci. Technol., 4: 579-582. 7 ref. 6 tab.
"Animals fed for slaughter are being concentrated in large feedlots, and, in some cases, contamination of ground and surface water supplies has resulted. In laboratory model studies, the amounts of ammonia volatilization and nitrate accumulation under simulated feedlot conditions depended on the moisture content of the soil. When urine was added every 2 days to an initially wet soil at the rate of 5 ml. per 21 cm^2, less than 25% of the added N was lost as ammonia and about 65% was converted to nitrate. When urine was added every 4 days to initially dry soil, essentially all the water evaporated between urine additions and 90% of the added N was lost as ammonia. These findings suggest that the stocking rate and other management factors should be considered in pollution abatement."

B-111 Knapp, C.E. 1970. Agriculture poses waste problems. Environ. Sci.

Technol., 4: 1098-1100. 2 fig.
Primary sources of agricultural pollution are animal wastes, agricultural processing wastes, domestic pollutants, sediment from land, plant nutrients from fertilizers, pesticides, and particulate and gaseous substances derived from the combustion of wastes. A large poultry operation in Pennsylvania is converting to a manure drying process to reduce odor, bulk and weight. Sub-sod injection and the plow-furrow-cover method of land disposal were also mentioned. Shredding and composting also are being used to utilize poultry and livestock wastes.

B-112 Elmund, G.K., S.M. Morrison, D.W. Grant and M.P. Nevins. 1971. Role of excreted chlorotetracycline in modifying the decomposition process in feedlot waste. Bull. Environ. Contamination Toxicol., 6: 129-132. 9 ref.
Report on trials with yearling steers receiving a high concentrate ration supplemented with 70 mg/head/day chlorotetracycline. Quantitative bioassays of manure from those animals receiving the drug revealed that 75% of the dietary chlorotetracycline was excreted. It was also demonstrated that the effect of ingested chlorotetracycline in modifying the subsequent biodegradation of excreted wastes is twofold: (1) the ingested antibiotic selects for a microbial population which is relatively inefficient in the stabilization process, and (2) the antibiotic alters the digestive processes in the animal resulting in manure which is less biodegradable than normal. The significance of these findings to the pollution potential of feedlots was evaluated.

B-113 Boyd, J.C. 1971. Field study of a chlordane residue problem: soil and plant relationships. Bull. Environ. Contamination Toxicol., 6: 177-182. 10 ref. 4 tab.
The highest chlordane residue was found in organic trash lying on top of the ground in alfalfa fields with the next highest concentration in the top ¼ in. of soil. Disposal of milk and manure from a contaminated herd by spreading on a field apparently raised the residue level in the surface trash.

B-114 Hendrickson, D.A. and D.W. Grant. 1971. Aflatoxin formation in sterilized feedlot manure and fate during simulated water treatment procedures. Bull. Environ. Contamination Toxicol., 6: 525-531. 7 ref.
Report on studies to evaluate feedlot manure in various stages of decomposition as a substrate for aflatoxin formation. The fate of aflatoxin during simulated water treatment procedures was reported and the probable human exposure following contamination of surface and groundwater supplies was assessed. The fungus used in the experiments was _Aspergillus flavus_ which has been isolated from stockpiled feedlot manure by other researchers.

B-115 Smith, H.W. 1970. The incidence of transmissible antibiotic resistance amongst salmonellae isolated from poultry in England and Wales. J. Med. Microbiol., 3: 181-182. 5 ref.
"Of 167 strains of salmonellae isolated from poultry in England and Wales in 1968, 7 (4.2%) were resistant to antibiotics; 3 strains were resistant to tetracyclines, streptomycin and sulphonamides, 2 to streptomycin and sulphonamides, and 2 to tetracyclines; they were all sensitive to ampicillin, neomycin, chloramphenicol, furazolidone and nalidixic acid. The incidence of resistance amongst the _Salmonella typhimurium_ strains examined was 10.9 per

cent. and 0.9 per cent. amongst the other strains. All the resistance was of the transmissible type."

B-116 Addanki, S., J.W. Hibbs and H.R. Conrad. 1968. Antithyrotoxic factor content of various roughages and cow feces based on repression of induced liver malic enzyme in thyrotoxic rats. J. Nutr., 94: 125-128. 16 ref. 1 tab.
"The repression of liver malic enzyme induced by adding 0.025% iodinated casein (1% thyroxine (T_4) equivalent) to the basal diet was used to measure the antithyrotoxic factor (ATF) content of several roughages (flaked soybean hulls, alfalfa hay, corn silage and alfalfa-grass silages) and dried cow feces fed at the level of 15% in the diet of rats. Relative ATF units (100 units equivalent to the effect of adding 10% hemoglobin standard to the thyrotoxic diet) ranged from 77.6 to 116.3 in the roughages, soybean hulls being lowest and alfalfa-grass silage highest. The ATF content of the dried feces from cows fed alfalfa-grass silages was higher than that of the silages, ranging from 125.3 to 134.9 units."

B-117 Gillham, R.W. and L.R. Webber. 1968. Groundwater contamination. Water Pollut. Contr., 106(5): 54-57. 11 ref. 1 tab. 5 fig.
A network of piezometers and water table observation wells was installed radially about a barnyard. From piezometric potential and hydraulic conductivity measurements, quantitative flow nets were drawn permitting the calculation of the discharge of groundwater from the barnyard. Analysis of water samples indicated that the concentration of nitrogen in the groundwater increased significantly as the water passed beneath the barnyard. The reliability of the results obtained would depend primarily upon the confidence in the measurements of hydraulic conductivity and the distribution of the hydraulic potential. It was concluded that the barnyard contributed to the nutrient enrichment of the groundwater.

B-118 Starr, G.H. and C.J. Kercher. 1969. Passage of Pseudomonas phaseolicola in bean plants through sheep. Phytopathol., 59: 1976.
Report on studies. Fresh sheep manure may contain halo-blight-producing bacteria but manure exposed to the weather for as much as 9 months probably will not carry viable blight bacteria.

B-119 Day, D.L. 1968. Oxidation ditches for waste disposal. International J. Farm Bldg. Res., 3: 1-7. 9 ref. 9 fig.
Report on previous research in North America and Europe on the use of oxidation ditches for waste disposal. The design of oxidation ditches, operational considerations and problems and the design and operation of associated mechanical equipment were discussed. The oxidation ditch system for treatment of piggery wastes appears promising.

B-120 Bartley, C.H. and L.W. Slanetz. 1960. Types and sanitary significance of fecal streptococci isolated from feces, sewage, and water. Amer. J. Public Health, 50: 1545-1552. 12 ref. 4 tab.
Report on studies to obtain additional information on the species or types of fecal streptococci that are present in the feces of humans and domestic animals, in sewage, and in contaminated water. The types and characteristics of streptococci isolated from bovine, sheep, swine, poultry and horse feces were reported. Discussion was included on the viability of fecal streptococci

in water, on differentiation between human and animal sources of pollution, and on techniques used for isolation and differentiation of fecal streptococci. The presence of S. faecalis may be considered as an indication of pollution of human origin; presence of S. bovis would indicate bovine or ovine pollution.

B-121 Kenner, B.A., H.F. Clark and P.W. Kabler. 1960. Fecal streptococci. II. Quantification of streptococci in feces. Amer. J. Public Health, 50: 1553-1559. 6 ref. 3 tab.
Report on a quantitative examination of fecal streptococci in the feces of humans, cattle, swine, sheep and fowl. The mean density of streptococci (in millions per gm of moist feces) was 1.3 for cows, 3.0 for humans, 3.4 for fowl, 38.0 for sheep and 84.0 for swine, whereas enterococci densities were 0.16, 2.29, 2.10, 9.42 and 8.40 millions per gm, respectively. The average number of streptococci discharged in a 24-hr period increased in the order of human, fowl, cow, sheep, and pig. Differences in the types of streptococci present in the feces of the various animals were discussed with reference to the use of fecal streptococci as pollution indicator organisms.

B-122 Gillespie, W.H. and J. Ryno. 1963. Epidemiology of leptospirosis. Amer. J. Public Health, 53: 950-955. 12 ref. 2 tab.
"Observations are presented on the contamination of surface water by cattle infected with Leptospira pomona. Water may remain infective for several weeks even though the cattle responsible have been vaccinated. Evidence of downstream dissemination is given and critically evaluated. Some evidence of the degree of infectivity of the water is given."

B-123 MacLeod, L.B., R.F. Bishop, L.P. Jackson, C.R. MacEachern and E.T. Goring. 1960. A long-term field experiment with commercial fertilizers and manure. I. Fertility levels and crop yields in a rotation of swedes, oats and hay. Can. J. Soil Sci., 40: 136-145. 7 ref. 8 tab.
Report on field experiments conducted in Nova Scotia from 1936 to 1957 to determine the effects of commercial fertilizers and FYM on soil fertility and crop yields. The original levels of organic matter, total nitrogen, and exchangeable K in the soil were not maintained by the application of 20 tons per acre of FYM every 3 years, or by the fertilizer treatments. P status of the soil was maintained by application of 20 tons of manure per acre every 3 years. Manure had a considerable residual effect.

B-124 Bishop, R.F., L.B. MacLeod, L.P. Jackson, C.R. MacEachern and E.T. Goring. 1962. A long-term field experiment with commercial fertilizers and manure. II. Fertility levels and crop yields in a rotation of potatoes, oats and hay. Can. J. Soil Sci., 42: 49-60. 12 ref. 7 tab. 1 fig.
"... Application of manure at 30 tons per acre every third year practically maintained initial levels of total nitrogen and soil organic matter. Marked decreases occurred with lower rates of manure and various commercial fertilizers applied at 1 ton per acre. Increases and decreases in adsorbed and easily acid-soluble phosphorus were directly related to the amounts of phosphatic fertilizer applied. Although the situation with respect to exchangeable potassium was not comparable, there was some evidence that final values were influenced by the amounts of potassium applied ... (residual effects) were much more marked from manure and where commercial fertilizer was applied at a ton per acre ...."

B-125 Ridley, A.O. and R.A. Hedlin. 1962. Effect of mineral fertilizers and manures on the phosphorus content of a clay soil and on crop yields and quality in a long-term crop rotation. Can. J. Soil Sci., 42: 137-149. 15 ref. 4 tab. 8 fig.

"Investigations of a long-term rotation experiment, to which mineral fertilizers and manures have been added for 38 years, show that the total inorganic and extractable phosphorus content of the soil has been increased by phosphate fertilizers. The organic phosphorus fraction was not affected. The extractable phosphorus content of the phosphate-treated plots was found to be inversely related to the soil inorganic carbon content. Moving 12-year average yields of wheat first crop and barley third crop in the rotation showed the response to phosphorus is apparent only in the first year, with no residual effect on crops due to the increased soil phosphorus content. Mineral fertilizer nitrogen had no effect on the yield of the first crop, but a residual effect was apparent on the third crop. Barn manure increased yields of both crops, presumably due to the effect of phosphorus in barn manure on the first crop and the nitrogen on the third crop ...."

B-126 Bishop, R.F., L.P. Jackson, C.R. MacEachern and L.B. MacLeod. 1964. A long-term experiment with commercial fertilizers and manure. III. Fertility levels, crop yields, and nutrient levels in corn, oats and clover. Can. J. Soil Sci., 44: 56-65. 33 ref. 6 tab. 3 fig.

"... All treatments were applied in the corn year and the phosphorus content of fertilizers was reflected in the per cent total phosphorus in tissue samples of corn and the succeeding oat and clover crops. Application of fertilizers containing increasing percentages of potassium consistently increased the per cent total potassium in corn and oats but not in clover. However, application rates of manure were invariably reflected in the percentages of total phosphorus and potassium in all crops. With 20 tons of manure, corn, oats and clover contained 0.33, 0.28, and 0.27% phosphorus and 2.51, 1.92 and 1.42% potassium... All crop yields were significantly higher with 20 tons of manure than with 1,000 lb of 4-8-8 fertilizer. With this rate of manure corn produced 3.18 tons of dry matter, oats approximately 52 bu, and hay 2 tons of dry matter per acre."

B-127 Sowden, F.J. and H.J. Atkinson. 1968. Effect of long-term annual additions of various organic amendments on the organic matter of a clay and a sand. Can. J. Soil Sci., 48: 323-330. 15 ref. 5 tab. 1 fig.

Annual additions of green rye, straw, alfalfa, peat, muck and manure to an Uplands sand and a Rideau clay soil under field conditions were made for a 20-year period. With the clay soil, additions of straw, alfalfa, leaves and manure maintained the carbon level, but only the peat and muck treatments increased the organic matter content. With the sandy soil, carbon content decreased on the control, but was increased by all other treatments. Peat and muck had the largest effect, but manure, leaves, and straw also gave significant increases in organic matter. The organic matter level was better maintained on the control plots and increased more by the addition of the various amendments on the sand than on the clay.

B-128 Sowden, F.J. 1968. Effect of long-term annual additions of various organic amendments on the nitrogenous components of a clay and a sand. Can. J. Soil Sci., 48: 331-339. 18 ref. 5 tab.

The percentages of the total soil nitrogen represented by the acid-soluble-N, amino acid-N, ammonia-N and amino sugar-N were similar in both soils and were only slightly, if at all, affected by the addition of the amendments, despite the large differences in nitrogen composition of the various amendments. Although the amendments added differed both in the total amount of amino acid and in their molar ratios, the soil material was quite uniform in its amino acid content. The muck-treated plots were an exception, but the muck was already decomposed when it was added to the soil, its amino acid content and composition being fairly characteristic of the soil to which it was added. Thus it was emphasized that one should use "brown manuring" rather than "green manuring" to get persistent effects.

B-129 Halstead, R.L. and F.J. Sowden. 1968. Effect of long-term additions of organic matter on crop yields and soil properties. Can. J. Soil Sci., 48: 341-348. 15 ref. 4 tab.
"Annual additions of green rye, straw, alfalfa, leaves, peat, muck and manure to a sand and a clay soil for 20 years tended to increase the mean yields of the crops grown in the field. This positive effect of the organic amendments on yield was confirmed in a greenhouse experiment with oats, which were grown in samples obtained at the end of the experimental period. Additions of straw, alfalfa, leaves and manure had the greatest effect on yield and on uptake of N and P by the oats. A comparison of the amended and untreated samples at the end of the experiment showed that the amendments usually increased the total C and N slightly, nitrate production capacity, exchange capacity, exchangeable and water-soluble Ca, Mg and K, and phosphatase enzyme activity of the soils, whereas their effect on soil P was less consistent. In most instances, the amendments increased the aggregate stability of the clay soil...."

B-130 Nuttall, W.F. 1970. Effect of organic amendments on some physical properties of Luvisolic soils in relation to emergence of rapeseed in a growth chamber. Can. J. Soil Sci., 50: 397-402. 9 ref. 4 tab.
"Organic amendments (including manure) at 2.5% of soil weight were applied to three Luvisolic soils in the greenhouse. After five successive crops, soil crust strength as indicated by modulus of rupture measurements was reduced by the amendments. Modulus of rupture values were highly related ($R^2 = 85.4\%$) to plant counts of Target rape in the growth chamber. Modulus of rupture determinations were made independently on oven dried samples and showed that the effect of soil moisture on crust strength among treatments was negligible. Plant emergence was increased as much as threefold by the amendments. Treatments increased field and available moisture capacities of soils but had little effect on moisture retained at 0.35 and 15.8 bar tensions."

B-131 Hedlin, R.A. 1971. Nitrate contamination of ground water in the Neepawa-Langruth area of Manitoba. Can. J. Soil Sci. 51: 75-84. 13 ref. 2 tab. 2 fig.
An investigation of the cause and distribution of high nitrate levels in the soil and groundwater is reported. Results indicate that toxic levels of nitrates occur most commonly in areas where shallow layers of sandy materials overlay less permeable soil material. Groundwater upgrade from farmsteads investigated was free of toxic levels of nitrates, whereas high levels of nitrate were observed downgrade from farmsteads. Within about 100 meters of the farmstead source of nitrates, less than 10 ppm of nitrate were observed in the groundwater; this dilution may be associated with lateral movement of groundwater or may be the result of nitrate reduction by microorganisms.

Energy for such reduction may come from carbon deposits in the soil profile.

B-132 Salter, P.J. and F. Haworth. 1961. The available-water capacity of a sandy loam soil. II. The effects of farmyard manure and different primary cultivations. J. Soil Sci., 12(2): 335-342. 20 ref. 5 tab. 1 fig.
"The effects of annual application of farmyard manure and of different cultivation treatments for a 6-year period on the available-water capacity of a sandy loam soil have been measured. It has been shown that the farmyard manure applications have led to a significant increase in the available-water capacity of the soil. The cultivation treatments influenced the available-water capacity to a lesser extent...."

B-133 Salter, P.J. and J.B. Williams. 1963. The effect of farmyard manure on the moisture characteristics of a sandy loam soil. J. Soil Sci., 14(1): 73-81. 24 ref. 2 tab. 2 fig.
"Annual applications of farmyard manure for 7 or 8 years have led to a significant increase in the available-water capacity of a sandy loam soil and in the volüme of water released at low tensions. The available-water capacity increased, and the moisture characteristics altered, as the soil became more compacted during crop growth in both 1960 and 1961, and the differences in moisture characteristics between the manured and unmanured soil were greatest at the harvest time of the crop."

B-134 Salter, P.J., G. Berry and J.B. Williams. 1967. The effect of farmyard manure on matric suctions prevailing in a sandy loam soil. J. Soil Sci., 18(2): 318-328. 25 ref. 2 tab. 3 fig.
"Soil matric suctions under a crop of ryegrass on farmyard manure-treated and untreated plots were determined over a total period of 24 weeks from March to November.... Although differences between available-water capacity of the manured and unmanured plots were small throughout the 6-month period of sampling, the soil matric suctions of the manured plots were almost always lower than those of the unmanured plots. The lower suctions prevailing in the manured soil could be a factor contribution to the higher yields of ryegrass obtained from the manured plots as compared with those obtained from the unmanured plots."

B-135 Chater, M. and J.K.R. Gasser. 1970. Effects of green manuring, farmyard manure, and straw on the organic matter of soil and of green manuring on available nitrogen. J. Soil Sci., 21(1): 127-137. 13 ref. 9 tab.
"In an experiment on green manuring started at Woburn in 1936, farmyard manure (FYM) was applied in alternate years until 1954 and straw similarly from then until 1963. Various green manures were grown from 1936 to 1953. From 1954 to 1963 ryegrass and trefoil were grown either each year or in alternate years; in 1964 and 1965 they were grown each year. After annual cropping without organic manuring, the organic-C and total-N decreased from 0.86 per cent and 0.91 per cent respectively in 1936 to 0.76 per cent and 0.82 per cent in 1966. Ploughing in straw alone approximately halved the loss. FYM and green manures both maintained the original percentages of soil C and N. The effect of FYM and straw applied together was approximately the sum of the effects of FYM and straw applied separately...."

B-136 Russell, E.W. 1971. Soil structure: its maintenance and environment. J. Soil Sci., 22: 137-151. 45 ref.
Review of soil structure and factors affecting it. The role of earthworms was pointed out, and the effect of manure on the earthworm population of soil was noted. Other effects of organic matter and manure on soil stability were discussed briefly.

B-137 Digar, S. 1960. Manurial requirement of paddy in a lateritic soil. Indian Soc. Soil Sci. J., 8: 23-33. 5 ref. 8 tab.
Report on a manurial experiment on Aman paddy, West Bengal, with ammonium sulfate at the rate of 0, 30 and 60 lb N per acre, superphosphate at the rate of 0, 30 and 60 lb P_2O_5 per acre and FYM at the rate of 0 and 100 md. per acre in all possible combinations with a view to find out a suitable manurial schedule for the area. Slight, but insignificant, residual effects on yield were noted for superphosphate and FYM. In FYM treated plots, increases in the carbon and nitrogen contents of the soil were observed. The straw to grain ratio was increased by increasing doses of ammonium sulfate and FYM, but decreased by the application of superphosphate. All treatments gave some yield response.

B-138 Sen, S. 1961. Comparative value of farmyard manure prepared by different methods. Indian Soc. Soil Sci. J., 9: 179-185. 1 ref. 7 tab.
"Field experiments conducted with FYM prepared by composting cattle dung and litter in (i) plastered trench, (ii) over-ground heap and (iii) exposed pit on maize and residual effect on the succeeding crop of wheat for three years, showed that there is no significant difference among these three types of manure, when applied on equal nitrogen basis... The response to the application of ammonium sulphate was significant on maize and wheat; it was better than the direct effect of FYM on maize and significant over the residual effect of FYM in the case of wheat. The economic response to ammonium sulphate was better than that of FYM. Among the different systems of composting, FYM prepared in plastered trench showed the highest profit."

B-139 Sinha, S.B. and H.G. Sharma. 1961. Mineralisation of nitrogen in organic manures in Gwalior soil. Indian Soc. Soil Sci. J., 9: 201-204. 6 ref. 2 tab.
"Among the different organic materials, farm yard manure was found to have a low rate of ammonification and nitrification. In the case of green manure, mineralisation of nitrogen was not found to proceed at a fixed rate, at least during the period of twelve weeks, but amounts of ammoniacal and nitrate nitrogen after six weeks were quite considerable. Compost showed a higher rate of mineralisation of its nitrogen than farm yard manure. In the case of groundnut cake, the rate of nitrate formation was highest though the formation of ammoniacal nitrogen or mineralisation in general was not found to occur at a fixed rate. For a rapid supply of available nitrogen to the soil, groundnut cake was observed to be the most suitable manure next in order was either compost or green manure, while farm yard manure was least suitable."

B-140 Sen, S. and W.C. Bonde. 1962. Effect of time of application of farmyard manure at different levels on wheat. Indian Soc. Soil Sci. J., 10: 61-66. 8 ref. 2 tab.
"Field experiments were conducted on the I.A.R.I. Farm, New Delhi to study the effect of stored FYM applied at different intervals and at different levels in

conjunction with a small dose of ammonium sulphate on the yield of wheat for six years. Chemical analysis of the surface soil, representing the treatments, in respect of total nitrogen, organic carbon, nitrate nitrogen and pH were determined in 1955-56 at three stages, namely, before sowing wheat, grand period of growth and after harvesting wheat..."

B-141 Kanwar, J.S. and S.S. Prihar. 1962. Effect of continuous application of farmyard manure and inorganic fertilizers on crop yields and properties of soil. I. Chemical properties. Indian Soc. Soil Sci. J., 10: 109-120. 15 ref. 6 tab. 4 fig.
"Surface (six inch) soil samples collected from various treatments of the permanent wheat-fallow-wheat plots at Ambala, Hansi and Jullundur (started 1946-47) and cotton-fallow-cotton plots at Hansi (started 1951-52) during May, 1959 and December, 1959 respectively were analysed for various nutrients. The treatments under trial were farmyard manure, ammonium phosphate, ammonium sulphate and control (no manure)..."

B-142 Kanwar, J.S. and S.S. Prihar. 1962. Effect of continuous application of manures and fertilizers on some physical properties of Punjab soils. Indian Soc. Soil Sci. J., 10: 243-247. 9 ref. 3 fig. 1 tab.
"The observations on aggregation, water holding capacity, hydraulic conductivity and water infiltration rates were made in the permanent manurial trials plots where farmyard manure and fertilizers are applied continuously. The results show that the farmyard manure in the doses used in these experiments did not prove in any way superior over fertilizers especially over ammonium phosphate in improving the physical condition of the soil."

B-143 Datta, N.P. and N.N. Goswami. 1962. Effect of organic matter and moisture levels on the uptake and utilization of soil and fertilizer phosphorus by wheat. Indian Soc. Soil Sci. J., 10: 263-276. 34 ref. 5 tab.
"Effect of three levels of organic matter (0, 10 and 20 tons of FYM per acre) and four levels of moisture (50, 75, 100 and 125 per cent moisture equivalent of the soils) on the availability and uptake of soil and fertilizer phosphorus by wheat was studied on four Indian soils having quite different physical and chemical properties in pot culture and laboratory experiments by radiotracer technique..."

B-144 Sen Gupta, M.B. 1964. Effect of manuring on clay-humus complex and its influence on crop yield and phosphate status in calcareous soil. Indian Soc. Soil Sci. J., 12: 165-167. 6 ref. 2 tab.
"Tiulin's group-I colloids were found to be in significantly greater amounts in the plots which received farmyard manure twice a year than in those receiving sulphate of ammonia and superphosphate together. This difference was also reflected in the yield of maize. In soils treated with FYM alone, the sodium bicarbonate soluble phosphate decreased considerably with the removal of group-I colloids, whereas it did not show any such decrease in soils receiving artificial fertilizers only."

B-145 Mandal, L.N. and A.K. Pain. 1965. Effect of continuous application of organic manures and ammonium sulphate in mulberry field on some soil properties. Indian Soc. Soil Sci. J., 13: 37-42. 9 ref. 4 tab.

"The effect of continuous application of organic manures and ammonium sulphate for 15 years on some physical, chemical and physico-chemical properties of soils growing mulberry was evaluated. Use of ammonium sulphate and cow dung resulted in a decrease in pH, total exchangeable bases and exchangeable calcium but the latter two were increased under compost and mustard cake treatments. Compost, cow dung and mustard cake or their combination with ammonium sulphate raised the C.E.C. of the soils but ammonium sulphate alone did not bring about any such change. Organic carbon and total and available nitrogen in the soils increased with compost and cow dung application but not under oilcake or ammonium sulphate. Organic manures brought about a significant increase in water holding capacity of the soils over control."

B-146 Sen Gupta, M.B. 1965. Influence of treatments and crops on the nutrient status in calcareous soil. Indian Soc. Soil Sci. J., 13: 199-203. 10 ref. 2 tab.
"Levels of organic carbon and nitrogen in the soil were improved by growing maize crop and also by the application of organic matter (farmyard manure) whereas no such enrichment was observed either by growing wheat or by the use of fertilizers. Growing of maize produced beneficial effect on the yield of succeeding wheat crop, but the latter did not show any such effect on the succeeding maize crop in a two year rotation. No significant effect on the available phosphate in the subsoil was observed."

B-147 Dayal, R., G. Sing and S.N. Bhola. 1965. Investigations on the manuring of sorghum under rainfed conditions in medium black soil. Indian Soc. Soil Sci. J., 13: 257-263. 9 ref. 6 tab.
"Application of nitrogen through farmyard manure to jowar (Sorghum vulgare) crop under rainfed conditions increased the yield of grain and karbi significantly. A mean response of 68.05, 112.46 and 160.55 Kg/acre over control were obtained with 20, 40 and 80 lb N/acre (as FYM). The linear response for grain and karbi was found to be significant. Continuous application of FYM increased the total nitrogen content but had no effect on physical properties of the soil under the conditions of experiment."

B-148 Sahu, B.N. 1968. Bronzing disease of rice in Orissa as influenced by soil types and manuring and its control. Indian Soc. Soil Sci. J., 16: 41-54. 31 ref. 6 tab.
"The effect of farm yard manure applied in three levels in conjunction with three levels of each of nitrogen and phosphate in low-land loamy sand latosol and swampy (Dahal) soil of Bhubaneswar, Orissa on the incidence of 'bronzing disease' of rice has been studied. The disease was also studied in the Bahal land of the Hirakud Dam irrigated area, Sambalpur. The control measures were investigated in latosol soil of Bhubaneswar. Iron toxicity in loamy sand latosol, sulphide injury in swampy (Dahal) soil and manganese toxicity in Bahal land appear to be the main causes of 'bronzing'. Drainage of the field, liming the soil to bring the reaction to neutrality, a combined application of phosphate and potash and spraying of urea at active tillering phase reduced the incidence of attack."

B-149 Naik, B.N. and D.K. Ballal. 1968. Effect of the association of organic matter with nitrogenous fertilizer on availability and uptake of plant nutrients and the growth of plant. I. Availability of plant nutrients. Indian Soc. Soil Sci. J., 16: 155-160. 8 ref. 4 tab.

"Availability of plant nutrients in the medium black soil was studied in laboratory by use of various doses of organic matter (FYM) and nitrogen as ammonium sulphate alone and in combination. These studies have shown that availability of nitrogen is increased at 0.5 and 1 per cent levels and that of P at 1 and 2 per cent levels of organic matter. In case of potassium, calcium and magnesium, it is increased at all the levels of organic matter. The availability as seen by Neubaur's values indicates that association of mineral nitrogen with organic matter affects adversely the nitrogen uptake but increases the uptake of other nutrients viz., P, K, Ca and Mg appreciably at 1 and 2 per cent levels of organic matter."

B-150 Naik, B.N. and D.K. Ballal. 1968. Effect of the association of organic matter with nitrogenous fertilizer on availability and uptake of plant nutrients and the growth of plant. II. Uptake of nutrients and the growth of the plant. Indian Soc. Soil Sci. J., 16: 392-397. 10 ref. 4 tab.

"A field experiment with wheat crop was conducted to study the effect of various doses of organic matter (FYM) and nitrogen (ammonium sulphate) singly and in combination, on the growth and uptake of nutrients. It is seen that except for nitrogen the uptake of other nutrients was not very much improved by the application of manure or fertilizer. The use of nitrogenous fertilizer along with FYM has given higher yields, both of the straw and the grain."

B-151 Singh, M. and J. Prakash. 1968. Effect of fertilizers on mineralisation of nitrogen and phosphorus in manures. Indian Soc. Soil Sci. J., 16: 405-413. 11 ref. 1 tab.

Report on investigations to study the effects of fertilizers on mineralization of nitrogen and phosphorus in FYM, sewage sludge, compost and dhaincha. Nutrient availability was greater with organic than inorganic fertilizers. Organic manures undergo slow oxidation producing acids which lower the soil pH and increase the availability of phosphate. Furthermore, there is an enhanced nitrogen fixation as well as nitrate formation with organic fertilizers.

B-152 Havanagi, G.V. and H.S. Mann. 1970. Effect of rotations and continuous application of manures and fertilisers on soil properties under dry farming conditions. Indian Soc. Soil Sci. J., 18: 45-50. 6 ref. 2 tab.

"Long-term effect of four rotations and application of FYM and fertilisers on chemical and physical properties of soil have been reported. The rotation which included a greenmanure crop and a legume crop increased the organic carbon and the total nitrogen of the soil. FYM application increased the organic carbon and the available P_2O_5 content of the soil but not the total nitrogen. Application of NP fertilisers also increased the available P_2O_5 content of the soil. Application of FYM and use of greenmanure decreased the bulk density of the soil and increased the water stable aggregates. These treatments had no appreciable effect on water retention at 0.33 atmosphere and the maximum water holding capacity of the soil."

B-153 Biswas, T.D., M.R. Roy and B.N. Sahu. 1970. Effect of different sources of organic manures on the physical properties of the soil growing rice. Indian Soc. Soil Sci. J., 18: 233-242. 15 ref. 7 tab.

"A study was made on the effect of long-term application of bulky organic manures (greenmanure, ground-nut cake, and farmyard manure), alone and in combination with ammonium sulphate, on the physical properties of alluvial soil growing rice. The overall effect of these organic manures was manifest in the improvement of the soil physical properties, viz., water stable aggregate status, hydraulic conductivity, and water retention characteristics. Of the three sources of organic manures, greenmanure had the most beneficial effect in this respect; farmyard manure and ground-nut cake were almost similar in their effects. The aggregation status, hydraulic conductivity, water retention at 1/3-atmosphere tension, and available water were highest in the soils receiving greenmanure. Top-dressing with nitrogenous fertilizer (ammonium sulphate) enhanced the beneficial effect of the organic manures."

B-154 Williams, R.J.B. and G.W. Cooke. 1961. Some effects of farmyard manure and of grass residues on soil structure. Soil Sci., 92: 30-39. 16 ref. 5 tab. 1 fig.
Report on investigations of soil structure in samples collected from (1) arable land where only residues of cereals have been returned to the soil, (2) arable land receiving annual dressings of FYM and (3) grassland. Soil structure was evaluated on the basis of stability and permeability, and pore size. Results indicated that, where extra organic matter is required on soils that are unstable and poorly permeable, extra organic matter is better provided by a period under grass than by occasional dressings of FYM.

B-155 Joffe, A.Z. 1963. Effects of manuring and fertilizing on the mycoflora of heavy soil in a crop rotation trial in Israel. Soil Sci., 95: 353-355. 2 ref. 1 tab.
Report on study of the long-range effects of manure and fertilizer application on the soil mycoflora. The fungal population was much greater in fertilized and manured plots than in unfertilized plots. The plots receiving NPK fertilizer out-yielded manured plots; however, the number of fungal isolates tended to be higher in the manured plots. It was concluded that, while quantitative mycoflora determinations may be used to determine gross differences in soil fertility, they cannot be relied upon to indicate smaller differences in the fertility of soils.

B-156 Jaiyebo, E.O. and D.R. Bouldin. 1967. Influence of fertilizer and manure additions and crop rotations on nonexchangeable ammonium content of two soils. Soil Sci., 103: 16-22. 21 ref. 4 tab.
Report on field plot trials to study the levels of soil organic matter, N, and nonexchangeable ammonium in plow-layer samples of soil from plots subjected to differential fertilizer, manure and cropping systems for 10 years. Without manure, large amounts of N, P and K failed to prevent a decrease in soil organic matter under continuous corn. The amount of N added as fertilizer, manure and crop residues that was fixed as nonexchangeable ammonium was small and of questionable practical significance.

B-157 Joffe, A.Z., Y. Yaffe and J. Palti. 1967. Yield levels and mycoflora of the soil in Shamouti orange plots given various nutrient treatments. Soil Sci., 104: 263-267. 10 ref. 3 tab.
Results of mycoflora determinations and yield measurements. The absence of all nutrients reduced yields (as compared to NPK plots) by at least 40 - 50%, absence of K by 30 - 50% and replacement of part of the fertilizer by manure by 20%. The potential effects of soil fungi on crop yields were discussed. It was suggested that the combined effect of the large numbers of F. solani found in manured plots, and the grove's slight infestation with nematodes, may partly explain the reduction in yield on plots receiving manure.

B-158 Huddleston, J.H. and G.W. Olson. 1967. Soil survey interpretation for subsurface sewage disposal. Soil Sci., 104: 401-409. 17 ref. 3 tab. 2 fig.
"Inadequacy of existing qualitative soil classifications for subsurface sewage disposal prompted a study to relate quantitative data to map units of a detailed soil survey to give specific recommendations for subsurface sewage disposal. Soil permeability and free water conditions were measured directly by field tests. Data regarding depth to bedrock, soil slope, and topographic position were taken from the soil survey of the area. A survey of 101 randomly selected hpmeowners provided information on the behavior of currently used subsurface sewage disposal systems in eight soils of the area..."

B-159 Abbott, J.L. and J.C. Lingle. 1968. Effect of soil temperature on the availability of phosphorus in animal manures. Soil Sci., 105: 145-152. 14 ref. 3 tab. 5 fig.
Report on greenhouse trials to evaluate the ability of common animal manures to supply available P to plants. On an equal dry-weight basis, the overall effectiveness of manures in supplying available P depended on their respective total P contents: poultry>sheep>steer = dairy. Soil temperature had no measurable effect on the availability of manurial P to tomatoes. At all soil temperatures, P-solubilizing processes contributed to the P absorbed by plants. The yield of P from manure was not the same on the two soils tested, being lower in soil with poorer drainage and higher clay content. It was shown that the HOAc-soluble:non-soluble P ratio of manure does not influence the availability of manurial P to plants.

B-160 Barratt, B.C. 1967. Differences in humus forms and their microfabrics induced by long-term topdressings in hayfields. Geoderma (Netherlands), 1: 209-227. 22 ref. 6 tab. 1 fig.
Differences in humus forms and microfabrics of soils in New Zealand hayfields were described in relation to long-term topdressings of manure and fertilizers. In plots which have received annual topdressings of FYM alone or in combination with inorganic fertilizers since 1856, the humus form that has developed is a fine over granular mull. The unincorporated dung and surface soil horizon contain mull-like moder microfabrics indicating that mesofauna are very active. They are underlain by A_{12} horizons having strong mull humus microfabrics indicating the incorporation of abundant organic matter by earthworms. The effects of other topdressings, including lime, sodium nitrate, basic slag, ammonium sulfate and potassium fertilizer, were reported as well.

B-161 Khan, S.U. 1969. Humic acid fraction of a gray wooded soil as influenced by cropping systems and fertilizers. Geoderma (Netherlands), 3: 247-254. 16 ref. 2 tab. 1 fig.
Report on a study to determine the long-term effect of two cropping systems and various fertilizer treatments on the humic acid fraction of Breton plot soils (Alberta). Continued use of manure on Breton soils resulted in a significant increase of both organic matter and humic acid content. Prolonged application of manure resulted in a significant increase of total soil nitrogen; however, the proportion of total soil nitrogen present as humic acid was found to be somewhat reduced compared to the other treatments. The NPKS and NS treatments resulted in a significant increase of humic acid-C/fulvic-C ratio, whereas manure had no effect.

B-162 El-Malek, Y.A., M. Monib, A.A. Salam and T.T. El-Hadidy. 1961. Bacteriological and chemical changes resulting from addition of certain organic materials to calcareous soils of the Mediterranean Coastal Region. Part I. Trends of chemical and bacteriological changes. United Arab Republic J. Soil Sci., 1: 23-39. 10 ref. 2 tab. 7 fig.

Various organic amendments, including fresh sheep dung and sheep manure, were applied to calcareous loamy soil from Fuka area, Alexandria, to test the effect of organic matter on microbial populations and the ensuing changes in carbon and nitrogen content. Fresh dung raised the C/N ratio of the soil whereas sheep manure (excrement plus straw) decreased the soil C/N ratio. Addition of all forms of organic matter increased total bacterial counts and the counts of nitrifiers, aerobic cellulose decomposers, and particularly the nitrogen-fixing bacteria, Azotobacter and clostridia. Factors affecting the use of organic amendments were evaluated.

B-163 El-Damaty, A.H., F.A. Hafez and F. Violet. 1963. Changes in organic matter and fractions of nitrogen in a soil treated with different organic materials upon decomposition. United Arab Republic J. Soil Sci., 3: 175-215. 34 ref. 14 tab. 13 fig.

"The present work presents an attempt to study the rate and the resultant of decomposition of different sources of organic materials namely, stable manure, compost, cottonseed cake, wheat straw, and clover straw. These different materials were added to the soil under controlled conditions in an incubator at 28 $\pm$ 2°C for 75 days. These experiments necessitated the application of various analytical procedures dealing with the nitrogen fractions to elucidate clearly the various forms and quantities of nitrogen during the decomposition period. New methods were tested to examine their validity and importance when applied to the soil under the environmental conditions prevailing in Egypt."

B-164 Shawarbi, M.Y. and R. Hamissa. 1964. The fertilizing value of some organic manures. United Arab Republic J. Soil Sci., 4: 141-150. 13 ref. 5 tab.

"The investigation of the relative merits of some organic nitrogenous sources for various crops on two different soil conditions was carried out in greenhouse pot tests using rice, corn, wheat and cotton. The results indicated consistent differences in the relative effectiveness of equivalent amounts of nitrogen in various forms. It was found that the manuring value of all organics on the clay loamy soil was, in most cases, inferior to that of ammonium sulphate, while the reverse was true as far as the sandy soil was concerned. Both farmyard manure and green manure were the least effective sources on the clay loamy soil, while on the sandy soil green manure proved to be a satisfactory manure."

B-165 Atanasiu, N. and H. Hamdi. 1964. A comparative study of the effect of organic and mineral fertilizers on the yield and nitrogen uptake of oats. United Arab Republic J. Soil Sci., 4: 198-203. 1 ref. 6 tab. 3 fig.

"The influence of Guano like product (pigeon-excrements) from Egypt, $Ca(NO_3)_2$ and $(NH_4)_2SO_4$ was examined in a pot experiment with oats. The investigation dealt with yield and N-uptake. By equal amounts of Nitrogen in the form of $Ca(NO_3)_2$ and $(NH_4)_2SO_4$ higher yields than Pigeon guano were obtained. N-uptake from the three fertilizers gave the same results. Oats uptake 70% of the applied mineral-N while only 50% of the organic-N were utilized. The

Mitscherlich equation which represents the yield curves indicates that the yield efficiency of organic-N shows only half the coefficient value of that of the mineral-N. Special effects of the guano product on the oats yield could not be detected."

B-166 Abdou, F.M. and S.Y. Metwally. 1967. The effect of organic matter, chemical fertilization and rotation on soil aggregation. United Arab Republic J. Soil Sci., 7: 51-59. 11 ref. 3 tab.
Report on long-term experiments conducted at Bahtim to study the effects of FYM, fertilizers and crop rotations on soil aggregation. Neither manuring nor fertilizing had a statistically significant effect on either the percentage of soil stable aggregates or the aggregation index. The failure of continuous annual applications of 15 tons FYM/acre for 45 years to produce an appreciable increase in the soil aggregates was due to the very rapid decomposition of organic matter under the prevailing conditions which accelerate microbial activity. Crop rotations did affect the aggregation index.

B-167 Abd-el-Malek, Y., M. Monib and A.A.M. Makawi. 1969. Effect of various beddings on the quality of farmyard manure. I. Farmyard manure from earth litter. United Arab Republic J. Soil Sci., 9: 1-12. 11 ref. 4 tab. 1 fig.
Report on studies of the microbiological and chemical changes in FYM prepared from "shirb" bedding in two experimental heaps. There was a continual narrowing of the C/N ratio of the material but the five-month storage period was not sufficient to completely ripen the manure. The composition of Egyptian manures and management factors necessary to keep nutrient losses to a minimum were discussed. It was concluded that "Sebakh baladi" (the local name for FYM prepared from earth litter), made under local conditions, suffers marked losses in nitrogen during formation.

B-168 Hamdi, H., S.Y. Metwally, F.A. Abdou and M. ElFouli. 1969. The effect of different sources of organic manures on nitrogen mineralization and organic matter content in sandy soils. United Arab Republic J. Soil Sci., 9: 35-49. 6 ref. 5 tab. 10 fig.
Report on laboratory experiments to determine the effect of various organic manures (viz., FYM, compost, town refuse manure, clover straw and wheat straw) on the organic matter content and nitrogen mineralization in sandy loam and loamy sand soils. The rate of decomposition of organic manure was generally higher in loamy sand than in sandy loam soil. The effects of each organic amendment on the C/N ratio of the soil, nitrate and ammoniacal nitrogen and total nitrogen were reported.

B-169 Abd-el-Malek, Y., M. Monib and A.A.M. Makawi. 1969. Effect of various beddings on the quality of farmyard manure. II. Farmyard manure from rice straw litter. United Arab Republic J. Soil Sci., 9: 67-84. 3 ref. 5 tab. 6 fig.
Report on trials to determine the effect of rice straw bedding on the quality of manure produced from buffalo excrement. Two sets of manure heaps were made, one in the summer and the other in the spring. One heap within each set was tamped immediately whereas the other was not tamped for 5 days. The process of decomposition was followed by microbiological and chemical analysis. The end product was not significantly affected by method of preparation or season. The manure attained maturity after 2 to 3 months at which time an increase in

total nitrogen and in humus were recorded, as compared to the starting materials. The rate of decomposition was mainly dependent upon the concentration of urine.

B-170 Abdou, F.M., S.Y. Metwally, H. Hamdi and M. El Fouli. 1969. The effect of manuring on soil properties and yield of corn. United Arab Republic J. Soil Sci., 9: 121-131. 13 ref. 6 tab.
Report on field experiments on sandy loam and loamy sand soils to study the effect of FYM and town refuse manure on soil properties and corn yields. Both manures increased the organic matter content in both soils, the increase being greater in the surface layers as compared to the subsurface layers. Soil organic matter was increased more by town refuse than by FYM when the manures were added on an equal nitrogen basis. Both manures increased the available water supply and improved soil structure, town refuse affecting mostly the surface layers, and FYM the subsurface layers. FYM increased corn yields more than town refuse manure when applied to supply equivalent nitrogen.

B-171 Carlson, C.W., D.L. Grunes, J. Alessi and G.A. Reichman. 1961. Corn growth on Gardena surface and subsoil as affected by applications of fertilizer and manure. Soil Sci. Soc. Amer., Proc., 25: 44-47. 10 ref. 3 tab.
"A study was conducted in the field to evaluate the fertility requirements of a Gardena fine sandy loam subsoil as compared to an undisturbed soil. Corn was grown on both areas the first and third years after land leveling. Manure applied the first year after leveling increased corn yields that year, and supplied residual P and Zn 2 years later. However, the yields on manured plots were not as high as those obtained with application of N, P and Zn. Where the topsoil had been removed, the most deficient element was N, followed by P and then Zn. Zn increased corn grain yields both the year it was applied and 2 years later. Applications of N and P increased yields slightly on the undisturbed area. It was necessary to apply N, P, Zn and manure to make yields on the subsoil equal those on the surface soil."

B-172 Haas, H.J., D.L. Grunes and G.A. Reichman. 1961. Phosphorus changes in Great Plains soils as influenced by cropping and manure applications. Soil Sci. Soc. Amer., Proc., 25: 214-218. 18 ref. 6 tab. 2 fig.
"Soil samples from 15 dryland experiment stations in the U.S. Great Plains and 21 farms in North Dakota were analyzed to determine the effect of cropping and manure on total, inorganic, organic, and $NaHCO_3$-soluble P content. In general, total P in the surface 6 inches of soil increased from south to north. Total P in soils from the experiment stations was reduced an average of 8% by cropping without manure, but was increased an average of 14% above virgin sod where manure had been applied. Inorganic P was not influenced by cropping to a rotation without manure, but organic P was reduced an average of 35% as compared to virgin sod. Manure applied in the rotation increased inorganic P considerably, but had no effect on reducing the loss of organic P. Cropping without manure increased $NaHCO_3$-soluble P in the soil at the majority of the stations, with the greatest increase occurring in the south. When manure was applied in the rotation, $NaHCO_3$-soluble P averaged nearly five times that of virgin sod...."

B-173 Herron, G.M. and A.B. Erhart. 1965. Value of manure on irrigated calcareous soil. Soil Sci. Soc. Amer., Proc., 29: 278-281. 17 ref.

3 tab. 7 fig.
"Each ton of high quality manure was equivalent to 22 lb. of nitrogen from ammonium nitrate as measured by equivalent grain sorghum yields over a 4-year period. Phosphorus level of the soil by the Bray and Kurtz no. I procedure was increased by 1 ppm for each ton of applied manure. Commercial phosphorus fertilizer did not increase grain yields. Total nitrogen content of the surface soil was increased by all manure applications. Nitrogen uptake by grain was correlated with relative yield of grain. The forage portion of sorghum appeared to take up nitrogen in excess of needs for maximum grain yield."

B-174 Thomas, R.E., W.A. Schwartz and T.W. Bendixen. 1966. Soil chemical changes and infiltration rate reduction under sewage spreading. Soil Sci. Soc. Amer., Proc., 30: 641-646. 18 ref. 3 tab. 11 fig.
"Laboratory and field lysimeters were used to investigate the site and nature of soil-pore clogging under sewage spreading. The site of clogging was located by determining with a seepage meter the impedance profile at 0.5-cm depth intervals. Soil samples were analyzed for sulfide, iron, phosphate, total organic matter, polysaccharide, and polyuronide to evaluate possible causative relationships. The infiltration rate loss exhibited three phases: phase I, a slow reduction under aerobic conditions; phase II, a rapid reduction under anaerobic conditions; and phase III, a further gradual decline under anaerobic conditions. The primary site of clogging was the 0- to 1-cm depth of soil. Although sulfide was an indicator of anaerobic conditions, it was not a primary cause of clogging. Accumulations of the other five measured constituents may contribute to clogging in both phase I and phase II. Organic matter was the only probable clogging agent to decline as the infiltration rate was partially recovered in a rest cycle."

B-175 Olsen, R.J., R.F. Hensler and O.J. Attoe. 1970. Effect of manure application, aeration, and soil pH on soil nitrogen transformations and on certain soil test values. Soil Sci. Soc. Amer., Proc., 34: 222-225. 10 ref. 2 tab. 2 fig.
"Nitrate production under aerobic conditions was directly related to rate of manure application, period of incubation, and soil pH but was stopped under anaerobic conditions. Average recovery by chemical analysis of N applied as manure to a Plainfield sand at relatively high rates and incubated for 37 weeks was 77% for aerobic conditions and 24% for anaerobic conditions. The addition of manure tended to increase soil pH and the contents of organic N, available P and exchangeable K, Ca, and Mg, particularly at higher rates. They also increased the field moisture capacity of a Plainfield sand. However, on an acid Ella loamy sand the two highest rates of manure caused a reduction of the values for field moisture capacity, apparently the result of formation of a waxy material that tended to repel water absorption."

B-176 Travis, D.O., W.L. Powers, L.S. Murphy and R.I. Lipper. 1971. Effect of feedlot lagoon water on some physical and chemical properties of soils. Soil Sci. Soc. Amer., Proc., 35: 122-126. 12 ref.
"Lagoon water from cattle feedlot runoff was added to undisturbed soil columns 42 cm long and 6.7 cm in diameter. The infiltration rate of the lagoon water into the columns was measured and recorded. After each run, the soil columns were sectioned into 3-cm increments and analyzed for Ca, Mg, Na, K, and NH_4 ions. Also the electrical conductivity of a saturation extract from the top 15

cm of each column was determined. Water flow in the soil columns stopped for all soils before two pore volumes of filtrate could be collected. Analyses for Ca, Mg, Na, K, and NH_4 showed that the percentages of Na, K, and NH_4 ions increased in the surface increments of the soil columns. The electrical conductivity of the saturation extracts for all soils was increased by more than 200% by adding the lagoon water to the soil. The saturation extract of the treated soils had electrical conductivity values of between 2.80 and 5.05 mmhos/cm."

B-177 Tan, K.H., R.A. Leonard, A.R. Bertrand and S.R. Wilkinson. 1971. The metal complexing capacity and the nature of the chelating ligands of water extract of poultry litter. Soil Sci. Soc. Amer., Proc., 35: 265-269. 23 ref. 1 tab. 3 fig.
"The metal complexing capacity and the nature of the chelating ligands of organic matter extracted from broiler house litter were studied by ion-exchange equilibrium and dissolution methods and infrared spectroscopy. The water extract of broiler house litter appeared to exhibit a significant chelating effect on the cations Cu^{2+}, Zn^{2+}, Mg^{2+}, and Al^{3+}. The amount of organic matter complexed by one mole of metal and the stability of metal complexes increased with increasing pH in the cases of Cu-, Mg-, and Al-complexes, but were unaffected by changes in pH in the case of Zn-complexes. With respect to the divalent ions, the amount of organic matter chelated and the stability of the divalent metal-complexes decreased in the order Cu>Zn>Mg..."

B-178 Elliott, L.F., G.E. Schuman and F.G. Viets, Jr. 1971. Volatilization of nitrogen-containing compounds from beef cattle areas. Soil Sci. Soc. Amer., Proc., 35: 752-755. 10 ref. 2 tab. 4 fig.
"The release of NH_3 plus steam-distillable organic N compounds to the atmosphere from a small beef feedlot and a pasture was measured. Acid traps placed next to the feedlot and 0.8 km from the feedlot averaged 148 and 16 kg/ha per yr NH_3 plus steam-distillable organic N compounds, respectively. The same traps averaged 21 and 3.3 kg/ha per yr, respectively, of organic N compounds that were not recovered by the 3-min steam distillation procedure. Feedlot disturbances, such as manure mounding, increased volatilization of N compounds. Ammonia plus steam-distillable organic N compounds trapped near a cattle pasture and cropland averaged 15 and 11 kg/ha per yr, respectively. Organic N compounds not recoverable by the 3-min steam distillation were very low in the areas..."

B-179 Adriano, D.C., P.F. Pratt and S.E. Bishop. 1971. Nitrate and salt in soils and ground waters from land disposal of dairy manure. Soil Sci. Soc. Amer., Proc., 35: 759-762. 14 ref. 3 tab. 3 fig.
"The NO_3^- contents of soils and ground waters underneath lands used for disposal of manures from dairies in the Chino-Corona Basin were determined. Soil and water samples were taken from 15 holes drilled to the top of water table in sites representing corrals, irrigated croplands, and pastures used as disposal areas. Considerable amounts of NO_3^- and salt were found in soil profiles underneath the disposal areas, although the magnitude was not as high as in profiles under corrals. Average NO_3-N concentrations in waters sampled from water tables were 26, 57, 45, and 74 ppm for control (undisturbed), corral, cropland, and pasture sites, respectively, exceeding the PHS recommended limit of 10 ppm NO_3-N for safe drinking water. Domestic well waters pumped from deeper aquifers averaged 6 ppm of NO_3-N. Contributions of NO_3-N to ground waters, as indicated by deep soil samples, on a per unit area basis, tended to

be: corral>pasture>cropland. Existing conditions in the study area need some modifications if acceptable quality of the groundwaters is to be maintained."

B-180 Free, G.R. 1949. Efficient use of farm manure for erosion control. J. Soil Water Conserv., 4: 117-118. 2 ref.
This paper reports the results of an experiment in New York State to determine the effects of different rates and methods of applying manure to soil on soil erosion and surface runoff. Top dressings gave the best control against runoff and erosion; 7 tons/acre of top dressing was more effective than 20 tons/acre turned under.

B-181 Elrick, D.E., J.W. Biggar and L.R. Webber. 1966. Soil pollutants: their origin and behaviour. J. Soil Water Conserv., 21: 7-11. 26 ref. 3 fig.
This article discusses certain sources of soil contaminants and outlines a few of the research techniques being used to attempt an understanding of their behavior in soils. Agricultural chemicals, waste disposal, biological and radioactive contamination, and other air pollutants such as sulfur dioxide represent the sources considered.

B-182 Stewart, B.A., F.G. Viets, Jr. and G.L. Hutchinson. 1968. Agriculture's effect on nitrate pollution of groundwater. J. Soil Water Conserv., 23: 13-15. 8 ref. 1 tab. 1 fig.
A review of the sources and effects of nitrates on groundwater. More study is needed on the effects of livestock feeding operations on groundwater pollution. Data are presented on nitrate contents in water samples from beneath feedlots.

B-183 Bouwer, H. 1968. Returning wastes to the land, a new role for agriculture. J. Soil Water Conserv., 23: 164-168. 22 ref. 1 tab.
Cleaner streams and lakes, more efficient use of our water resources and partial restoration of the nutrient cycle would result if wastes were applied to the land in a controlled manner. Agriculture may play an increased role in the field of ultimate waste disposal in the future. Figures are presented for the normal range of mineral increase in water by one cycle of domestic use.

B-184 Abrahams, J.H., Jr. 1969. Managing solid wastes. J. Soil Water Conserv., 24: 48-51. 24 ref. 3 tab. 1 fig.
Review of the problem presented by the growing volume of solid wastes, including 1.3 billion tons of agricultural manure produced each year in the U.S.A. A proposed disposal scheme involving classification and separation of various forms of solid wastes for different treatments is outlined.

B-185 Born, S.M. and D.A. Stephenson. 1969. Hydrogeolic considerations in waste disposal. J. Soil Water Conserv., 24: 52-55. 7 ref. 2 fig.
This paper refers specifically to disposal of industrial effluents by irrigation on sewage farms. Determination of flow systems is considered with reference to infiltration and movement of effluent in the soil. Preliminary site investigation is recommended prior to effluent disposal to evaluate geologic and hydrogeologic factors, thus minimizing the pollution potential.

B-186 Taylor, A.W. 1967. Phosphorus and water pollution. J. Soil Water Conserv., 22: 228-231. 26 ref. 4 tab. 2 fig.
Phosphorus pollution of lakes and streams is discussed, including sections on

movement of phosphorus via drainage water and eroding topsoil, forms and transformations of phosphorus in water and the sources of phosphorus in contaminated bodies of water. The phosphorus content of animal manures, both organic and inorganic, is presented, as well as values for the total annual excretion of phosphorus by various classes of livestock. The control of phosphorus in the environment is discussed.

B-187 Campbell, F.R. and L.R. Webber. 1969. Agriculture's contribution to the fertilization of Canal Lake. J. Soil Water Conserv., 24: 139-141. 9 ref. 3 tab. 2 fig.
Report of an investigation to quantify the various sources of plant nutrients responsible for an infestation of Myriophyllum spicatum in Canal Lake, Ontario. The contributions by agriculture, including barnyard and silo effluents and runoff from land receiving winter-spread manure, were small compared to the contributions made by precipitation, plant growth in upsteam lakes, groundwater and recycling within the lake.

B-188 Martin, W.P. 1970. Soil as an animal waste disposal medium. J. Soil Water Conserv., 25: 43-45. 18 ref.
This paper discusses the influence on pollution of soil properties such as horizon characteristics, texture, structure, porosity, pH, relief, drainage characteristics, engineering properties and soil-plant interrelationships. A survey to evaluate these characteristics should precede siting of any barnyard feedlot or treatment facility. Figures are given for the NPK content of various manures. The chemistry of nitrogen, phosphorus and potash are discussed as they relate to manure disposal. Attention is given to erosion and sedimentation as well as runoff and seepage as sources of pollution from livestock wastes.

B-189 Webber, L.R. 1971. A primer on agricultural pollution - animal wastes. J. Soil Water Conserv., 26: 47-50. 21 ref.
General review of the animal waste management problem, with particular reference to the additional restrictions imposed on livestock operations by a cold climate. The chemical, physical and biological aspects of anaerobic digestion, aerobic stabilization and land disposal were discussed, and the implications of inadequate management of wastes were assessed. Research needs were outlined. It was suggested that land use planning and zoning for livestock production could help alleviate some of the problems of odor and nuisance now being experienced.

B-190 Hedlin, R.A. and A.O. Ridley. 1964. Effect of crop sequence and manure and fertilizer treatments on crop yields and soil fertility. Agron. J., 56: 425-427. 9 ref. 4 tab.
"Highest yields of wheat were obtained on fallow land. The next best place to grow wheat in the sequence was following either flax or corn. Lowest yields of wheat were obtained when it was grown following oats, barley or rye. Manure increased yields of all crops in the year applied and produced a residual effect on yield and on the level of easily extractable phosphorus."

B-191 Lotero, J., W.W. Woodhouse, Jr. and R.G. Petersen. 1966. Local effect on fertility of urine voided by grazing cattle. Agron. J., 58: 262-265. 8 ref. 6 tab.
Report on trials to determine the local effect of urine deposited by grazing

cattle on the fertility of the affected sward. It was shown that a single urination affected a roughly circular area whose radius varied between 21 and 25 inches. The duration of the effect was at most 10 months. Because the effect is very localized and decreases quite rapidly with time after deposition, it was concluded that, under the conditions of the experiment, urine deposited by grazing cattle contributes little to the fertility of the pasture as a whole.

B-192 Cuykendall, C.H. and G.C. Marten. 1968. Defoliation by sheep-grazing versus mower-clipping for evaluation of pasture. Agron. J., 60: 404-408. 27 ref. 7 tab.
"Yields within three grass species and two alfalfa varieties defoliated by sheep-grazing or machine-clipping were nearly identical in a year of limited moisture. With adequate moisture, grazing caused higher yields of all forages, until extremely high levels of N and K were applied to both treatments. Sheep excreta significantly increased K levels of soil and plant tissue. Comparable heights of defoliation by the two methods left twice as much residual leaf and stem tissue after grazing, but this did not increase subsequent forage yields. Significantly more weeds invaded clipped plots in late summer. Regrowth of sod cores in darkness at the end of each season indicated more total reserves per unit area under grazing due to more tillers and roots per unit area. However, no differences in grams of top growth per gram of stubble and root appeared under the two methods of defoliation."

B-193 Parker, M.B., H.B. Harris, H.D. Morris and H.F. Perkins. 1969. Manganese toxicity of soybeans as related to soil and fertility treatments. Agron. J., 61: 515-518. 10 ref. 2 tab. 5 fig.
Report on greenhouse and field trials to study the conditions under which manganese toxicity exists. An abnormal leaf characteristic, described as crinkle leaf, was associated with high levels of water-soluble soil and leaf Mn. Heavy applications of commercial fertilizer resulted in increased soil pH which, in turn, resulted in increased levels of water-soluble Mn and caused the crinkle leaf condition. However, high rates of fertilizer nutrients from chicken manure could be applied to the soil without affecting the soil pH or the water-soluble Mn content of the soil.

B-194 Frink, C.R. 1969. Water pollution potential estimated from farm nutrient budgets. Agron. J., 61: 550-553. 15 ref. 3 tab. 3 fig.
"Estimates of the yield of nutrients to waterways from wooded and cultivated land vary considerably. Some of this variability can be attributed to the large variability in the N and P content of runoff water, to analytic uncertainties, and to the difficulties of obtaining accurate flow measurements. As an alternative assessment of agricultural eutrophication, nutrient budgets were derived for the highly specialized dairy farms in the Northeast. This analysis showed that under certain conditions these dairy farms could contribute significant amounts of nutrients, particularly nitrate, to ground water. However, this loss of nutrients can be minimized by providing adequate cropland per cow, by selecting crops and animals that are efficient users of N, and by applying both manure and commercial fertilizers during the growing season."

B-195 Rothwell, D.F. and C.C. Hortenstine. 1969. Composted municipal refuse: its effects on carbon dioxide, nitrate, fungi and bacteria in Arredondo

fine sand. Agron. J., 61: 837-840. 11 ref. 7 fig.
"Effects of high levels of garbage compost, chicken manure, cow manure, and sewage sludge on microbial activity in Arredondo fine sand were evaluated by determination of relative numbers of bacteria and fungi, CO_2 evolution, and nitrification. With each increase in garbage compost, relative fungal numbers increased at each measurementperiod; bacterial numbers increased, then decreased rapidly by the 4th or 6th day. The amount of cumulative CO_2-C evolved by these materials when mixed with soil was: cow manure< garbage compost< chicken manure< sewage sludge. Similar relationships were obtained when garbage compost was mixed with cow manure, chicken manure, or sewage sludge and added to soil. Nitrification decreased with increased levels of both sewage sludge and chicken manure and increased with increased levels of cow manure. However, little nitrification occurred when cow manure was mixed with equal quantities of garbage compost. Only slight nitrification occurred when the soil was amended with garbage compost."

B-196 Hensler, R.F., R.J. Olsen and O.J. Attoe. 1970. Effect of soil pH and application rate of dairy cattle manure on yield and recovery of twelve plant nutrients by corn. Agron. J., 62: 828-830. 16 ref. 2 tab.
"Addition of increasing amounts of manure (0 to 613 m tons/ha) to both unlimed (pH 4.5) and limed (pH 7.3) Ella loamy sand gave increasing total dry matter yields of corn in all cases. The yields were significantly higher for the medium rates of application (68 and 204 m tons/ha) on the unlimed soil than on the limed soil. Concentrations of Ca, Mg, P, S, Fe, and Mo in the plant tissue were usually higher for the limed soil than the unlimed soil, but the reverse was true for Zn and Mn. The higher concentrations in the tissue on the limed soil were probably due in part to more favorable conditions for microbial activity and degradation of soil organic matter. Total recovery of the individual nutrients from the manure by the three corn crops generally decreased with increasing rate of application, probably due to declining increases in yield and nutrient uptake with successive increments of manure. The dairy cattle manure, a mixture of 69% feces and 31% urine, contained 11.1% dry matter and, on the dry basis, 5.05% N, 0.87% P, 2.04% K, 1.59% Ca, 0.68% Mg, 0.46% S, 21 ppm Cu, 106 ppm Mn, 135 ppm Zn, 354 ppm Fe, 73 ppm B, and 4 ppm Mo. The data suggest that for soils near the neutral point, the nutrients in manure, even at very high rates of application, can be utilized in crop production and soil improvement with relatively little danger of plant toxicity."

B-197 Salmmelwitz, P.H., C.R. Richards and M.S. Cover. 1962. The influence of atmospheric ammonia on blood hemoglobin levels. Paper presented at 1961 Meeting North Atlantic Section, Amer. Soc. Anim. Sci., University Park, Pennsylvania. (cited in J. Anim. Sci., 21: 139, Abstr. No. 13.)
Report on research with chickens to determine the effect of inhaled ammonia on iron utilization in hemoglobin formation. The results suggested that sufficiently high levels of inhaled ammonia may in some way interfere with the normal utilization of iron in hemoglobin formation.

B-198 Brugman, H.H., H.C. Dickey, B.E. Plummer and B.R. Poulton. 1964. Nutritive value of poultry litter. Paper presented at 56th Annual Meeting Amer. Soc. Anim. Sci., University of Tennessee, Knoxville. (cited in J. Anim. Sci., 23: 869, Abstr. No. 92.)
Report on feeding trials with Hereford bulls in which poultry litter supplied

some of the nitrogen in the ration. It was noted that the poultry litter used was high in protein but low in energy and Vitamin A and D. Phosphorus needs to be added to poultry litter rations or the animals will chew wood. Analyses for drug residues in laying house litter were reported.

B-199 Durham, R.M. 1964. Observations on coprophagy in farm animals. Paper presented at 56th Annual Meeting Amer. Soc. Anim. Sci., University of Tennessee, Knoxville. (cited in J. Anim. Sci., 23: 873, Abstr. No. 111.)
Report on the value of feces from concentrate-fed cattle as a feed for poultry. When manure replaced milo in the ration of pullets, chickens receiving the manure gained faster and consumed more feed than those on a control diet. Early egg production was highest for manure-fed pullets. Feed consumption was higher for the manure ration but manure had a value of $10.00 to $25.00 per ton for the laying ration. Manure has also been fed to gestating sows and heifers with satisfactory results.

B-200 Diggs, B.G., B. Baker, Jr. and F.G. James. 1965. Value of pig feces in swine finishing rations. Paper presented at 1965 Meeting Southern Section, Amer. Soc. Anim. Sci., Dallas, Texas. (cited in J. Anim. Sci., 24: 291, Abstr. No. 48.)
Report on a feeding trial conducted with hogs to determine the value of dried pig feces as a ration constituent. Pigs were fed a ration of corn and soybean meal fortified with vitamins, minerals and antibiotics, and supplemented with 0, 15, or 30% pig feces. Rate of gain for pigs receiving the three levels of pig feces were 1.56, 1.53, and 1.71 lb/day, respectively. Feed consumption of the pigs averaged 3.63, 3.62, and 4.65 lb/day, respectively. No undesirable flavor was noted in the meat of any of the pigs.

B-201 Drake, C.L., W.H. McClure and J.P. Fontenot. 1965. Effects of level and kind of broiler litter for fattening steers. Paper presented at 57th Annual Meeting Amer. Soc. Anim. Sci., East Lansing, Michigan. (cited in J. Anim. Sci., 24: 879, Abstr. No. 140.)
Report on fattening trials with steers to study the relative value of peanut hull and wood shaving broiler litters as ration constituents. Differences in feed efficiency, daily gain, carcass grade, and meat flavor were reported.

B-202 Bhattacharya, A.N. and J.P. Fontenot. 1965. Utilization of different levels of poultry litter nitrogen by sheep. J. Anim. Sci., 24: 1174-1178. 28 ref. 4 tab.
Report on metabolism trials with yearling wethers to study the utilization of poultry litter nitrogen by sheep when 25, 50 and 100% of the total ration nitrogen was supplied by poultry litter. Increasing the level of litter nitrogen beyond 25% resulted in a significant decrease in crude protein digestibility. Percent nitrogen retention was 21.8, 15.0, 15.0 and 8.6 for the rations in which litter supplied 0, 25, 50 and 100% of the nitrogen, respectively. Percent utilization of absorbed nitrogen tended to decrease with increasing levels of litter nitrogen.

B-203 Bhattacharya, A.N. and J.P. Fontenot. 1966. Protein and energy value of peanut hull and wood shaving poultry litters. J. Anim. Sci., 25: 367-371. 20 ref. 5 tab.
Three digestion and metabolism trials were conducted with yearling wethers to study the protein and energy value of autoclaved poultry litters when

incorporated in corn-hay basal rations at levels of 25 and 50%. Crude fibre digestibility was higher, dry matter, NFE and energy digestibility were lower, and apparent digestibility of crude protein was the same for litter rations as compared to the control. Crude fibre digestibility, dry matter, NFE and energy digestibility of the litter were depressed when the level of litter was increased from 25 to 50%. There were no significant differences in digestible protein, digestible energy, metabolizeable energy and TDN content between the kinds or levels of litter.

B-204 Hintz, H.F., H. Heitman, Jr., W.C. Weir, D.T. Torrell and J.H. Meyer. 1966. Nutritive value of algae grown on sewage. J. Anim. Sci., 25: 675-681. 19 ref. 10 tab.
Report on trials. The predominant species of algae grown on sewage were Chlorella spp., Scenedesmus obliquus or S. quadricauda, depending upon the season. Algae contained 51% crude protein which was 73% digestible to cattle and sheep and 54% digestible to pigs. The digestible energy content was 2.6 Kcal/gm. Algae grown on sewage are not a high-energy feed because of their high ash content and low digestibility of nonprotein, nonfat organic matter but have potential for use as a livestock feed because of their high protein content and significant contents of carotene, phosphorus, calcium and trace minerals.

B-205 Rusnak, J.J., T.A. Long and T.B. King. 1966. Hydrolyzed poultry waste as a feed for cattle. Paper presented at 58th Annual Meeting Amer. Soc. Anim. Sci., Rutgers University, New Brunswick, New Jersey. (cited in J. Anim. Sci., 25: 909, Abstr. No. 125.)
Results of steer feeding trials conducted in Pennsylvania to determine the value of hydrolyzed poultry litter as a livestock feed. Average daily gain, feed consumption and carcass characteristics were not adversely affected by including 10% hydrolyzed poultry waste in the ration.

B-206 Kellog, T.F., V.W. Hays, D.V. Catron, L.Y. Quinn and V.C. Speer. 1966. Effect of dietary chemotherapeutics on the performance and fecal flora of baby pigs. J. Anim. Sci., 25: 1102-1106. 18 ref. 3 tab.
Report on investigations to determine the effects of chemotherapeutics on the rate of gain, feed efficiency and fecal flora populations of baby pigs. In general, there was an apparent inverse relationship between the rate and efficiency of body weight gains and the total counts of lactobacilli, streptococci, total aerobes and total anaerobes.

B-207 Anthony, W.B. 1967. Manure containing silage - production and nutritive value. Paper presented at 1967 Meeting Southern Section, Amer. Soc. Anim. Sci., New Orleans, Louisiana. (cited in J. Anim. Sci., 26: 217, Abstr. No. 73.)
Report on research at Auburn University, Alabama, in which manure from beef steers and dairy cattle was ensiled with Coastal bermudagrass. Ewes, steers, and beef heifers have been successfully fed this silage.

B-208 Brugman, H.H., H.C. Dickey, B.E. Plummer and B.R. Poulton. 1967. Digestibility of sterilized poultry litter. Paper presented at 59th Annual Meeting Amer. Soc. Anim. Sci., University of Nevada, Reno. (cited in J. Anim. Sci., 26: 915, Abstr. No. 129.)
Report on feeding trials with sheep to determine the effect of sterilization of litter on the digestibility of the nutrients. Sheep were first fed the

sterilized ration during a 7-day trial and then were changed over to unsterilized litter (or vice versa). The sterilized litter had significantly lower digestibility coefficients for fibre and protein than regular poultry litter in the first trials. In the reversal trial, the digestibility coefficient of the fibre in the sterilized litter was significantly higher than regular poultry litter and also significantly higher than the sterilized litter in the first trials. The possibility of a carryover effect was proposed to account for the observations reported.

B-209 Anthony, W.B. 1968. Wastelage - a new concept in cattle feeding. Paper presented at 1968 Meeting Southern Section, Amer. Soc. Anim. Sci., Louisville, Kentucky. (cited in J. Anim. Sci., 27: 289, Abstr. No. 28.)
Report on steer feeding trials conducted at Auburn University, Alabama, to determine the value of wastelage as a feed for livestock. Wastelage was made by ensiling fresh feedlot manure and ground Coastal bermudagrass or Johnsongrass hay in the ratio of 57:43. In both trials, wastelage-fed cattle out-gained corn silage-fed cattle. It was noted that wastelage should not be stored in a rusty structure.

B-210 Brugman, H.H., H.C. Dickey, B.E. Plummer, J. Goater, R.N. Heitman and M.R.Y. Taka. 1968. Drug residues in lamb carcasses fed poultry litter. Paper presented at 60th Annual Meeting Amer. Soc. Anim. Sci., Oklahoma State Univ., Stillwater. (cited in J. Anim. Sci., 27: 1132. Abstr. No. 47.)
Report on feeding trials with lambs fed poultry litter containing Amprolium-Plus and 3-Nitro Hydroxyphenylarsonic acid to determine the effect of such a ration on drug residues in the lamb carcass and growth rate of the lambs. The results suggested that Ampro-Plus and 3-Nitro impair growth in smaller lambs but not in larger lambs. In-vitro studies of volatile fatty acids indicated that increasing the dietary level of Ampro-Plus resulted in increased butyric acid and decreased propionic acid. Although Ampro and arsenic were found in the poultry litter fed, no residues of these drugs were found in the lambs being fed.

B-211 Singh, Y.K. and W.B. Anthony. 1968. Yeast production in manure solubles. Paper presented at 60th Annual Meeting Amer. Soc. Anim. Sci., Oklahoma State Univ., Stillwater. (cited in J. Anim. Sci., 27: 1136, Abstr. No. 64.)
Report on trials in which manure collected from concentrate-fed cattle was separated into solubles and fibre, the fibre was extracted with a 3% acid solution, the acid extractable material was neutralized and added to the solubles, and the combined solubles were innoculated with S. cerevisiae. All manure fractions studied were analyzed for sugar composition. Results of the study indicated that yeast can be grown on the soluble portion of manure and that 68.57% of the manure dry matter can be recovered as solubles. By the processes used, lignified fibre was concentrated and partially removed.

B-212 Goering, H.K., L.W. Smith, P.J. Van Soest and C.H. Gordon. 1968. In vitro evaluation of chemically treated feces. Paper presented at 60th Annual Meeting Amer. Soc. Anim. Sci., Oklahoma State Univ., Stillwater. (cited in J. Anim. Sci., 27: 1182, Abstr. No. 246.)
Preliminary report on in vitro fermentation studies to determine the effects of chemical treatments on true dry matter digestibility of feces from orchardgrass and alfalfa-fed cattle. Every chemical treatment except H_2O_2 increased

the dry matter digestibility of feces, much of the increase apparently being related to decreased amounts of cell wall constituents and acid detergent fibre. Chemical treatments were generally more effective on orchardgrass feces than on alfalfa feces. Lignin contents of alfalfa feces were generally decreased by chemical treatment whereas the opposite was true for orchardgrass feces. Chemical treatment of Sudax silage feces resulted in increased digestibility and decreased cell wall constituents and acid detergent fibre.

B-213 Long, T.A., D.E.H. Frear, M. Rugh and J. Miller. 1968. Effect of source of nitrogen on feedlot performance of steers. Paper presented at 1968 Meeting North Atlantic Section, Amer. Soc. Anim. Sci., Burlington, Vermont. (cited in J. Anim. Sci., 27: 1509, Abstr. No. 2.)
Report on feeding trials with Angus steers to evaluate the effect of four sources of supplemented nitrogen (soybean meal, hydrolyzed poultry waste, dried poultry waste and urea) in a finishing ration for steers on rate of gain, feed efficiency and carcass characteristics. Daily gains were significantly better with urea than with any of the other nitrogen supplements. Data collected concerning carcass characteristics included observations on conformation, marbling, texture, firmness, color of lean and fat, grade, rib eye area, external fat thickness, percent kidney knob and cutability.

B-214 Bratzler, J.W. and T.A. Long. 1968. Digestion of hydrolyzed and cooked poultry waste by ruminants. Paper presented at 1968 Meeting North Atlantic Section, Amer. Soc. Anim. Sci., Burlington, Vermont. (cited in J. Anim. Sci., 27: 1509, Abstr. No. 3.)
Report on feeding trials with wethers to evaluate the effect of source of nitrogen (soybean meal, hydrolyzed poultry waste, or cooked poultry waste) on energy and nitrogen utilization. No significant differences due to treatment were found.

B-215 El-Sabban, F.F., T.A. Long, D.E.H. Frear and R.F. Gentry. 1968. Composition of broiler and laying house litters. Paper presented at 1968 Meeting North Atlantic Section, Amer. Soc. Anim. Sci., Burlington, Vermont. (cited in J. Anim. Sci., 27: 1509, Abstr. No. 4.)
Report on a study conducted to determine the chemical composition of poultry litter, relevant to its use as a feedstuff. Proximate analysis and 12 mineral elements were determined on 60 litter samples. Broiler house litter had significantly more crude protein, ether extract, crude fibre, Na and Cu than laying house litter, but was inferior to laying house litter in total ash, Ca, P, K, Mg, Fe, Al, Zn and Ar. Factors such as type of birds raised, bird density, kind and amount of bedding, and management practices were found to influence poultry litter composition.

B-216 Weeth, H.J. and C.F. Speth. 1969. Refractometry of bovine urine. J. Anim. Sci., 28: 66-69. 13 ref. 1 tab. 2 fig.
Report on investigation to determine the refractive index of bovine urine and the specific gravity and total solids content of that same urine. Total solids content was adequately estimated from refractive index, a regression equation being presented showing that relationship.

B-217 Ciordia, H. and W.B. Anthony. 1969. Viability of parasitic nematodes in wastelage. Paper presented at 1969 Meeting Southern Section, Amer. Soc. Anim. Sci., Mobile, Alabama. (cited in J. Anim. Sci., 28: 133, Abstr. No. 36.)

Report on research to investigate the epizootiological implications of wastelage regarding nematode parasites in cattle. All samples of wastelage examined were found to be negative for larvae, although eggs were present in the feces used in preparation of the silage. Nematodes represented by eggs in cattle feces were Trichostrongylus axei, Ostertagia ostertagia and Cooperia oncophora. As no larvae were recovered, it appears that wastelage does not serve as a vehicle for transmission of the three species of nematodes which were studied.

B-218 Bandel, L.S. and W.B. Anthony. 1969. Wastelage - digestibility and feeding value. Paper presented at 1969 Meeting Southern Section, Amer. Soc. Anim. Sci., Mobile, Alabama. (cited in J. Anim. Sci., 28: 152, Abstr. No. 113.)
Report on steer feeding trials using wastelage as a source of protein. Various ratios of wastelage to corn were fed to the steers to determine the optimum ratio. A ratio of wastelage:corn of 1:4 was deficient in protein; a ratio of 3:2 provided too little corn and rate of gain was reduced. It appears that a ratio of wastelage:corn of 2:3 is an efficient plan for slaughter cattle.

B-219 Stombaugh, D.P., H.S. Teague and W.L. Roller. 1969. Effects of atmospheric ammonia on the pig. J. Anim. Sci., 28: 844-847. 7 ref. 2 tab. 2 fig.
Report on trials conducted in Ohio in which the effects of different concentrations of atmospheric ammonia on pigs were noted. Ammonia concentrations had a highly significant adverse effect upon feed consumption and average daily gain but no significant effect on efficiency of food conversion was noted. Except for the presence of Corynbacterium and Pasteruella in the ethmoid turbinates of two animals, ammonia concentrations did not affect gross microscopic and bacteriological observations. High ammonia levels induced increased frequency of coughing.

B-220 Harmon, B.G., A.H. Jensen and D.H. Baker. 1969. Nutritive value of oxidation ditch residue. Paper presented at 61st Annual Meeting Amer. Soc. Anim. Sci., Purdue University, Lafayette, Indiana. (cited in J. Anim. Sci., 29: 136, Abstr. No. 134.)
Report on trials with rats to evaluate the nutritive value of swine excreta which had been suspended in water and aerobically digested. It was shown that the digestible energy of the ration decreased linearly as oxidation ditch residue was added to the diet.

B-221 Brugman, H.H., H.C. Dickey and J.C. Goater. 1969. Poultry litter, barley, sawdust, urea in sheep rations. Paper presented at 61st Annual Meeting Amer. Soc. Anim. Sci., Purdue University, Lafayette, Indiana. (cited in J. Anim. Sci., 29: 153, Abstr. No. 200.)
Report on trials to investigate the value of poultry litter and various other "waste" materials as energy sources for lambs. Litter and barley provided a more economical ration than sawdust and barley. Lambs fed the experimental rations were free of parasites.

B-222 Anthony, W.B. 1970. Feeding value of cattle manure for cattle. J. Anim. Sci., 30: 274-277. 14 ref. 6 tab.
Report on steer feeding trials at Auburn University, Alabama, to reappraise the feeding of manure-containing rations to fattening cattle and to determine

if cooking the manure would improve its feeding value. Feed intake, liveweight gain, and carcass quality were not adversely affected by including wet cattle manure in the ration. Cooking or washing manure before mixing it into the ration did not improve its feeding value.

B-223 Fontenot, J.P., R.E. Tucker, B.W. Harmon, K.G. Libke and W.E.C. Moore. 1970. Effects of feeding different levels of broiler litter to sheep. Paper presented at 1970 Meeting Southern Section, Amer. Soc. Anim. Sci., Memphis, Tennessee. (cited in J. Anim. Sci., 30: 319, Abstr. No. 28.)
Report on a short-term experiment conducted to study possible toxicological effects of feeding sterilized broiler litter to sheep. No gross symptoms of toxicological effects were observed in slaughtered wethers which had received varying levels of broiler litter in their rations. Rectal temperatures were normal and were not affected by poultry litter feeding. Feeding different litter levels had no consistent effect on blood ammonia, blood urea, total red blood cell number, and total and differential white blood cell numbers. No glucose, ketones and bilirubin were detected in the urine. No adverse effects of feeding litter were evident from detailed necropsies and studies of histological sections.

B-224 Moore, J.D. and W.B. Anthony. 1970. Enrichment of cattle manure for feed by anaerobic fermentation. Paper presented at 1970 Meeting Southern Section, Amer. Soc. Anim. Sci., Memphis, Tennessee. (cited in J. Anim. Sci., 30: 324, Abstr. No. 49.)
"It was determined that by fermenting cattle manure under anaerobic conditions organic acid synthesis occurred and the pH of the fresh manure dropped from 6.25 to 4.0 within 16½ hr. when incubated at 37°C. By adjusting pH with ammonia once every 24 hr. for 3 days, the apparent crude protein level, as determined by Kjeldahl nitrogen analysis, increased from 16.99% to 43.26%. There was a net increase in amino acids greater than 20%. Organic acids (% DM) were acetic acid, 7.20; propionic acid, 1.27; butyric acid, 1.34, valeric acid, 0.11; and lactic acid, 16.83. From palatability tests with lambs, rations containing either manure or ammonium lactate were equal. In toxicity trials using sheep, ammonium acetate was more toxic than urea, but ammonium lactate was less toxic than urea. Dosages were made isonitrogenous with urea at the level of 0.88 g urea/kg body weight."

B-225 Muehling, A.J. 1970. Gases and odors from stored swine wastes. J. Anim. Sci., 30: 526-531. 18 ref.
General review of manure gases in confinement swine buildings which, under special conditions such as during ventilation failures and liquid manure agitation, can accumulate to toxic concentrations. The major gases considered were carbon-dioxide, ammonia, methane, and hydrogen sulfide, the latter being the most toxic to humans and animals. The odor problem of livestock production was discussed and the applicability of several industrial odor control methods to the control of livestock odors was considered (e.g. dilution, absorption, adsorption, masking, counteraction and burning).

B-226 El-Sabban, F.F., J.W. Bratzler, T.A. Long, D.E.H. Frear and R.F. Gentry. 1970. Value of processed poultry waste as a feed for ruminants. J. Anim. Sci., 31: 107-111. 16 ref. 5 tab.
Report on sheep and steer feeding trials to evaluate heat-treated poultry waste as a nitrogen and energy source for ruminants and to study carcass characteristics,

meat acceptability and pesticide residues in backfat and arsenic level in the liver of beef cattle fed autoclaved and dried poultry waste. Digestibility coefficients of the ration and urinary energy and fecal nitrogen levels were given for sheep fed rations containing autoclaved, cooked and dried poultry waste. Carcass characteristics and meat acceptability of steers were not significantly affected by including poultry litter in the ration. Chlorinated hydrocarbon compounds in backfat and liver arsenic were found in amounts less than 1 ppm.

B-227 Asplund, J.M. and I.I. Shahied. 1970. Fatty composition of feed and fecal fat. Paper presented at 62nd Annual Meeting Amer. Soc. Anim. Sci., Pennsylvania State University, University Park. (cited in J. Anim. Sci., 31: 235, Abstr. No. 311.)
Report on analysis of feces and feeds by gas chromatography to study the fatty acid composition. The most abundant fatty acids in beet pulp, alfalfa hay and sheep feces were determined. Several small peaks were observed on the chromatographic recordings suggesting the presence of some unusual isomers in the feces.

B-228 Galmez, J., E. Santisteban, E. Haardt, C. Crempien, L. Villalta and D. Torell. 1970. Performance of ewes and lambs fed broiler litter. Paper presented at 62nd Annual Meeting Amer. Soc. Anim. Sci., Pennsylvania State University, University Park. (cited in J. Anim. Sci., 31: 241, Abstr. No. 333.)
Report on sheep feeding trials conducted in Chile to test the value of broiler litter as a livestock feed. Broiler litter containing 21.7% crude protein, 31.1% crude fibre, and 9.7% ash was fed at various levels in the rations of ewes and wethers. Average daily gain and feed efficiency were reported and compared to those for animals receiving no poultry litter.

B-229 Harmon, B.W., J.P. Fontenot and K.E. Webb. 1970. Effect of processing methods of broiler litter on nitrogen utilization by lambs. Paper presented at 62nd Annual Meeting Amer. Soc. Anim. Sci., Pennsylvania State University, University Park. (cited in J. Anim. Sci., 31: 243, Abstr. No. 339.)
Report on metabolism trials with sheep to study the relative effects of three different methods of processing broiler litter on nitrogen utilization: (1) autoclaving under steam pressure; (2) heating in forced-draft oven at 150°C; and (3) acidifying with H_2SO_4 followed by heating in forced-draft oven at 150°C. Four rations were fed to wether lambs, namely, a control ration of soybean meal and 3 rations replacing soybean meal by broiler litter treated by one of the three methods. Nitrogen retention was higher for the control ration than for the litter rations, but was not affected by the method of processing litter. Rumen fluid pH and ammonia level were unaffected by the treatments. Crude protein and dry matter digestibility were unaffected by the method of processing litter.

B-230 Davey, R.J. and R.J. Gerrits. 1970. Lindane residues in tissues and excreta of swine. J. Anim. Sci., 31: 491-493. 6 ref. 1 tab.
Report on studies to determine the residual effects of lindane, a lipophilic chemical used to control ectoparasites, when used on swine as measured by residues in tissues and excreta. There were barely detectable traces of lindane in urine regardless of treatment, and the highest level in the dried feces did not exceed 0.61 ppm (0.02 to 0.61 ppm).

B-231 Johnson, W.H., R.D. Goodrich and J.C. Meiske. 1970. Appearance in the blood plasma and excretion of ^{35}S from three chemical forms of sulfur by lambs. J. Anim. Sci., 31: 1003-1009. 10 ref. 8 tab. 1 fig.
Report on sulfur metabolism trials with wether lambs. The time and pattern of appearance in plasma of radioactively marked sulfur were presented and discussed. The appearance of sulfur in the feces and urine was also noted. The major pathway of excretion of ^{35}S from elemental sulfur and methionine was via the feces. Losses of ^{35}S from sodium sulfate were about equally divided between feces and urine.

B-232 Kemp, G. and J. Kiser. 1970. Microbial resistance and public health aspects of use of medicated feeds. J. Anim. Sci., 31: 1107-1117. 29 ref. 19 tab. 4 fig.
Evidence was presented to show that the use of antibiotics in animals over the course of nearly two decades has not caused a public health problem. Although resistance has been shown to emerge readily, the resistant organisms are likely to be less virulent. The transfer of R factors from resistant to non-resistant strains of organisms in the gut and feces of domestic animals was discussed.

B-233 Smith, L.W., H.K. Goering and C.H. Gordon. 1970. In vitro digestibility of chemically treated feces. J. Anim. Sci., 31: 1205-1209. 16 ref. 4 tab.
Report on investigations to measure the capacity of various chemicals to disrupt the intricate polysaccharide-lignin complex in the indigestible cell wall of bovine excreta. Microbial fermentation and chemical degradation were used to determine increased nutrient availability of cell walls. Chemicals tested were grouped according to their degradative effect on the cell wall: (1) alkalies which caused non-specific degradation of hemicellulose, cellulose and lignin; and (2) oxidants, which were more specific towards lignin. Chemical treatment of both alfalfa and Sudax silage feces resulted in greater than 90% digestion, although Sudax and alfalfa fecal cell walls responded differently. It was concluded that sodium hydroxide is by far the most economical for treatment of fecal cell walls.

B-234 Anthony, W.B. 1971. Animal waste value - nutrient recovery and utilization. J. Anim. Sci., 32: 799-802. 46 ref.
Literature review dealing with the use of animal manures as feed for livestock. References cited deal with the feeding of poultry, swine and cattle manures to sheep, poultry, swine, cattle and rats. The feeding of packing house wastes was also considered.

B-235 Albin, R.C. 1971. Handling and disposal of cattle feedlot waste. J. Anim. Sci., 32: 803-810. 71 ref.
Literature review dealing with (1) the physical, chemical and biological characteristics of cattle feedlot waste as related to their pollution potential; (2) handling and disposal methods, namely land application, anaerobic digestion, anaerobic lagoons, aerobic lagoons, oxidation ditches, activated sludge processes, biofilters, air aspirators, anaerobic-aerobic systems, aerobic composting, complete (tertiary) treatment, dehydration, incineration, natural recycling, etc.; and (3) implications for the future.

B-236 Conrad, J.H. and V.B. Mayrose. 1971. Animal waste handling and disposal in confinement production of swine. J. Anim. Sci., 32:

811-815. 22 ref.
Literature review dealing with the handling and disposal of swine wastes. References cited are concerned with physical, chemical and biological properties of swine wastes, characteristics of ideal waste management systems, systems of waste management currently in operation and some prototypes, and future implications.

B-237 Clawson, W.J. 1971. Economics of recovery and distribution of animal waste. J. Anim. Sci., 32: 816-820. 14 ref.
Literature review dealing with the economics of animal waste management. It was emphasised that the new approach of charging manure removal as a debit to the livestock enterprise is more sensible than the previous concept of manure as a debit to the crop and a credit to the livestock enterprise. Considered in the review were transporting and spreading manure on cropland, transporting and processing before utilization, non-use disposal systems and dead animal removal.

B-238 Guggolz, J., R.M. Saunders, G.O. Kohler and T.J. Klopfenstein. 1971. Enzymatic evaluation of processes for improving agricultural wastes for ruminant feeds. J. Anim. Sci., 33: 167-170. 14 ref. 1 tab. 4 fig.
Report on development and testing of a convenient enzymatic procedure designed to predict in-vivo dry matter digestibility of forages, crop residues and animal wastes. Enzymatic solubilization of 29 forages, including composted and fresh cow manure, was highly correlated with dry matter digestibility.

B-239 McClure, K.E., R.D. Vance, E.W. Klosterman and R.L. Preston. 1971. Digestibility of feces from cattle fed finishing rations. Paper presented at 63rd Annual Meeting Amer. Soc. Anim. Sci., University of California, Davis. (cited in J. Anim. Sci., 33: 292, Abstr. No. 364.)
Report of an experiment conducted with sheep to determine the digestibility of feces from cattle which had been fed supplemented rations containing two forms of dry corn grain alone and with corn silage. Data were presented on both dry matter digestibility and protein digestibility of manure-supplemented and control rations. In general, a decrease in digestibility was noted for rations containing feces. A further decrease in digestibility was noted for the dry matter of feces from sheep fed the cattle manure ration.

B-240 Smith, L.W. and C.H. Gordon. 1971. Dairy cattle manure-cornmeal rations for growing heifers. Paper presented at 63rd Annual Meeting Amer. Soc. Anim. Sci., University of California, Davis. (cited in J. Anim. Sci., 33: 300, Abstr. No. 392.)
Report on trials conducted in Maryland with Holstein heifers fed rations containing various ratios of cornmeal to dehydrated dairy cattle manure. The effects of the cornmeal:manure ratio on the rate of passage of fecal residues, incidence of bloat, average growth rate and feed efficiency were noted.

B-241 Miller, E.C., C.M. Hansen and A.E. Erickson. 1971. An odor-free sow confinement system. Paper presented at 1971 Meeting Midwestern Section, Amer. Soc. Anim. Sci., Chicago, Illinois. (cited in J. Anim. Sci., 33: 1142, Abstr. No. 20.)
Report on the design and construction of an odor-free confinement housing system for sows. The housing unit incorporates partially slatted floors over a flushing gutter. Waste is automatically flushed twice daily into an outside

holding tank. The waste material is irrigated on a sand filter bed and the liquid filtrate recycled through the flushing system.

B-242 Harmon, B.G., D.L. Day, A.H. Jensen and D.H. Baker. 1971. Liquid feeding of oxidation ditch mixed liquor to swine. Paper presented at 1971 Meeting Midwestern Section, Amer. Soc. Anim. Sci., Chicago, Illinois. (cited in J. Anim. Sci., 33: 1149, Abstr. No. 50.)

Report on trials. Oxidation ditch mixed liquor (ODML) was collected from a pit receiving swine excreta and transferred to an oxygenation vat where aeration was sustained at 3.5 ppm dissolved oxygen. Transfer to the vat was to eliminate the chance feeding of fresh swine excreta and to maximize the development of single cell protein in the oxidation ditch. The ODML was mixed with corn-soybean meal and fed to hogs. Weight gain and feed efficiency were consistently greater for hogs receiving ODML mixed with feed than those receiving only water on the feed. Ascarid damage to the liver was minimal. The amino acid content of ODML was determined and reported.

B-243 Harmon, B.G., D.L. Day, A.H. Jensen and D.H. Baker. 1971. Nutritive value of oxidation ditch mixed liquor for rats. Paper presented at 1971 Meeting Midwestern Section, Amer. Soc. Anim. Sci., Chicago, Illinois. (cited in J. Anim. Sci., 33: 1149, Abstr. No. 51.)

Report on feeding and metabolism trials with rats. Oxidation ditch mixed liquor was collected from pits receiving hog excreta, screened and the filtrate frozen and freeze-dried. The ground, dried product (FDODML) was substituted into a fortified corn-soybean meal diet for rats at 0.0, 4.0, 8.0 and 12.0% of the diet. Weight gains and feed efficiency were similar for rats receiving 0.0 and 4.0% FDODML and greater than for rats fed the other diets. The amino acid and total protein content of FDODML was reported.

B-244 Orr, D.E., E.R. Miller, P.K. Ku, W.G. Bergen and D.E. Ullrey. 1971. Recycling of dried waste in swine. Paper presented at 1971 Meeting Midwestern Section, Amer. Soc. Anim. Sci., Chicago, Illinois. (cited in J. Anim. Sci., 33: 1152-1153, Abstr. No. 64.)

Report on two feeding trials conducted to evaluate dried swine feces as a source of nutrients in finisher rations of swine. An amino acid analysis of the dried feces indicated that lysine and methionine were limiting. In-vitro pepsin digestion of dried swine feces protein was lower than that of soybean meal, and availability of several amino acids may have limited performance of hogs fed the dried feces. Taste tests indicated no adverse effects on flavor acceptability as a result of feeding the test ration.

B-245 Parker, M.B., H.F. Perkins and H.L. Fuller. 1959. Nitrogen, phosphorus, and potassium content of poultry manure and some factors influencing its composition. Poultry Sci., 38: 1154. 8 ref. 4 tab.

Broiler and hen manure samples were obtained from poultry houses in Northeast Georgia and analyzed for their NPK value. Manure samples from 82 broiler houses contained, on average, 24.97 ($\pm$7.46)% moisture, 2.27 ($\pm$0.49)% nitrogen, 1.07 ($\pm$0.23)% phosphorus and 1.70 ($\pm$0.31)% potassium on a total basis. Thirty-one samples showed that 94% of the P was available and 86% of the K was water soluble. Manure samples from 31 hen houses contained 36.92 ($\pm$12.65)% moisture, 2.00 ($\pm$0.42)% N, 1.91 ($\pm$0.48)% P and 1.88 ($\pm$0.58)% K. 88% of the P was available and 86% of the K was water soluble. Management practices could account for the variability in the content of the manure.

B-246 O'Dell, B.L., W.D. Woods, O.A. Laerdal, A.M. Jeffay and J.E. Savage. 1960. Distribution of the major nitrogenous compounds and amino acids in chicken urine. Poultry Sci., 39: 426-432. 17 ref. 3 tab. 1 fig.
Results of studies. Uric acid and ammonia accounted for 81% and 10%, respectively, of the total urinary nitrogen. The percentage of these components varied with diet but the combined percentage was quite constant. Diet had noticeable effects on the proportions of urea, but did not affect the creatine-creatinine nitrogen or the distribution of amino acids. Amino acids, including (in order of decreasing concentration) glycine, proline, glutamic acid, hydroxyproline, aspartic acid, lysine, ornithine and arginine accounted for about 2% of the total urinary nitrogen. Hydroxyproline and glucosamine were found in all samples of chick urine.

B-247 Wehunt, K.E., H.L. Fuller and H.M. Edwards, Jr. 1960. The nutritional value of hydrolyzed poultry manure for broiler chickens. Poultry Sci., 39: 1057-1063. 17 ref. 5 tab.
Results of a study in Georgia to determine the value of hydrolyzed broiler litter and autoclaved hen and broiler manure, as a source of protein and unidentified growth factors in the diets of broiler chicks. About 1/2 and 1/3 of the crude protein of hen and broiler manure, respectively, exists as true protein. Crude protein of the manures was utilized less efficiently than that of soybean oil meal. Autoclaved manures were superior to either fish solubles or dried distillers' solubles as sources of unidentified growth factors. Reference was made to the nitrogen composition of various manures as reported in the literature.

B-248 Helbacka, N.V., J.L. Casterline, Jr. and C.J. Smith. 1963. The effect of high CO_2 atmosphere on the laying hen. Poultry Sci., 42: 1082-1084. 3 ref.
Exposure of laying hens to an atmosphere containing from 2 to 5% CO_2 caused distress in the birds, diuresis, anorexia and a drop in blood pH. During exposure, egg production dropped, shell thickness was reduced and Haugh units rose. After exposure, shell thickness rose above pretreatment levels and then returned to pretreatment levels.

B-249 Al-Timimi, A.A. and J.L. Adams. 1963. The rate of solids accumulations in experimental micro-lagoons as affected by various factors. Paper presented at 52nd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 42: 1251-1252.)
Report on trials to evaluate the effect of various factors on rate of solids accumulation in lagoons receiving hen manure. No significant effects were noted for the 5 physical factors studied. An association between hen weight, weight of eggs laid, weight of feed consumed and rate of dry matter build-up was noted, a regression equation describing this association being given.

B-250 Manoukas, A.G., N.F. Colovos and H.A. Davis. 1964. Losses of energy and nitrogen in drying excreta of hens. Poultry Sci., 43: 547-549. 2 ref. 1 tab. 2 fig.
Results of trials showing that there was a highly significant loss of energy and a significant loss of nitrogen due to drying. The use of N, N-dimethylformamide as a combustion primer eliminates the drying process in laboratory determinations of the energy and nitrogen contents of fresh feces. Further information is needed to establish a satisfactory correction factor for adjusting the energy and nitrogen content of fresh feces as determined by combustion.

B-251 Pryor, W.J. and J.K. Connor. 1964. A note on the utilisation by chickens of energy from faeces. Poultry Sci., 43: 833-834.
Report of a single trial with a limited number of birds to test whether or not the energy in feces of chickens could be further utilized by the chicken for its energy and protein value. Feces had a M.E. value of approximately 30% of the feed from which it originated. The results of other trials to determine the gross energy value and nitrogen content of feces are presented in tabular form.

B-252 Al-Timimi, A.A., W.J. Owings and J.L. Adams. 1964. The effects of air and/or heat on the rate of accumulation of solids in indoor manure digestion tanks. Poultry Sci., 43: 1051-1056. 6 ref. 4 tab.
Report on trials. Neither heating nor aerating was beneficial.

B-253 Ostrander, C.E. and S.A. Hart. 1964. Degradation of manure collected in water under chickens. Poultry Sci., 43: 1144-1151. 6 ref. 2 tab. 4 fig.
Report on trials to evaluate (1) degradation and organic matter breakdown in water under chickens, and (2) the possibility of reducing odors by pH control. Manure collected in liquid was less odoriferous than solid manure accumulations, and was most objectionable at high temperatures. Organic matter breakdown increased with temperature to a point and then levelled off. Liquid poultry manure, collected as in these trials, has a pH of 7.2; any change in this pH by artificial control only intensifies odors.

B-254 Al-Timimi, A.A. and J.L. Adams. 1964. The effects of a commercial additive on the reduction in poultry manure solids at various cubage allowances. Paper presented at 53rd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 43: 1299-1300.)
Report on trials. The additive did not change the % dry matter of the manure at any manure dilution tested.

B-255 Al-Timimi, A.A. and J.L. Adams. 1964. The effects of various additives on the reduction of the organic solids of poultry manure. Paper presented at 53rd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 43: 1300.)
Report on trials testing 8 additives. The overall average reduction in accumulated solids was 30.80% and varied from 37.71% for "Odorase", a commercial odor control product, to 25.27% for NaOH (pH = 11). Differences between treatments were not significant at the 0.05 level of probability.

B-256 Johnson, T.H. and G.J. Mountney. 1964. Use of pH change to determine end point of composting poultry litter. Paper presented at 53rd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 43: 1333.)
Results of trials. The measure for completion of composting was when the sample, held 48 hours anaerobically, did not fall into the acid pH range.

B-257 Magruder, N.D. and J.W. Nelson. 1964. Experiences with a poultry lagoon. Paper presented at 53rd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 43: 1337.)
Results of trials with Leghorn pullets housed over indoor lagoons for 80 weeks. No apparent deleterious effects were noted during a 21-day period in which all ventilating fans were stopped. Eggs suspended over the lagoons for 24 hours to 11 days exhibited no off-odors or tastes when fried, boiled or baked in a cake.

B-258 Willingham, H.E. 1964. Effect of enzymes and water-treated barley on carcass composition, water and feed consumption and feces moisture of chicks and poults. Paper presented at 53rd Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 43: 1376.)
Report on trials. Feces moisture was significantly decreased by enzyme supplementation and by the grain treatment.

B-259 Al-Timimi, A.A., W.J. Owings and J.L. Adams. 1965. The effects of volume and surface area on the rate of accumulation of solids in indoor manure digestion tanks. Poultry Sci., 44: 112-115. 4 ref. 3 tab.
Report on trials. Cubage and surface area per bird did not have any significant effects on the rate of accumulation of solids in indoor manure digestion tanks. At least 3.5 cu. ft. of water per bird is required to provide for biennial cleaning.

B-260 Magruder, N.D. and J.W. Nelson. 1965. Long term studies of the effect of slatted floor versus litter on laying performance. Paper presented at 54th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 44: 1395.)
Report on 3 years of trials. Percent hen-day production was higher, and percent mortality and pounds of feed required per dozen eggs were lower, for litter-housed birds; however, birds on slatted floors produced 31,169 dozen more eggs in the same allotted space. Larger eggs were laid by pullets on slatted floors. The two systems were equivalent with regard to interior egg quality, number of broken eggs, shell thickness and shell strength. Annual labor requirements per bird for the slatted floor system were nearly double that of the litter system.

B-261 Nordskog, A.W. and L.W. Schierman. 1965. Fertility on slat floors vs. solid floors. Paper presented at 54th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 44: 1403-1404.)
Report on trials. It appeared that slats cause a lag in normal mating activity in some males which may extend for a week or 10 days.

B-262 Ostrander, C.E. 1965. Methods of handling poultry waste materials. Paper presented at 54th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 44: 1404.)
This general review of waste management in high density poultry operations included references to the production, collection, storage and disposal of poultry manure. Special emphasis is given to materials handling concepts.

B-263 Ivos, J., A. Asaj, L.J. Marjanovic and Z. Madizirov. 1966. A contribution to the hygiene of deep litter in the chicken house. Poultry Sci., 45: 676-683. 8 ref.
An analysis of 114 samples of litter from Jugoslavian poultry houses indicated a close correlation between the sanitary quality of the litter and the microclimate of the house, the poultry population, and the physiochemical components of the litter. Good litter should contain less than 35% moisture. The biochemical process of decomposition of organic substances in the litter is reflected in the nitrogen content and the number of micro-organisms. The development of ammonia depends on temperature and humidity. The level of Ca, K, and P in hen manure is relatively high in comparison to other kinds of stable manures.

B-264 Bell, D.D., R.G. Curley and E.C. Loomis. 1966. Poultry manure removal systems used on California poultry ranches. Paper presented at 55th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 45: 1069.)
A general review of poultry waste management in California. The need to include manure management in the day-to-day routine of poultry ranches is emphasised.

B-265 Brown, L., G. Jaeger, F. Stevens, H.C. Whelden, Jr. and C. Kitteridge. 1966. Deep pit cage houses in Maine. Paper presented at 55th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 45: 1073.)
General review of poultry waste management. Storage of manure in deep pit storage facilities enhances handling and disposal by providing flexibility which, in turn, enhances many high density egg production systems. Deep pits are adaptable to slat or wire floor, slat-litter, or cage high density systems.

B-266 Ostrander, C.E. 1967. Storage of poultry manure to improve flexibility of handling. Paper presented at 56th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 46: 1302-1303.)
General paper on the design and operation of covered storage tanks and deep pits for storage of poultry manure.

B-267 Witter, R.L., B.R. Burmester and G.H. Burgoyne. 1967. Survival of Marek's disease agent in litter and droppings. Paper presented at 56th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 46: 1339.)
Report on trials. The maintenance of Marek's disease agent in litter or droppings is not understood but is apparently unrelated to the presence of arthropods. These findings suggest that litter or droppings contaminated with Marek's disease agent could be an important mechanism for the natural spread of this disease.

B-268 Gerry, R.W. 1968. Manure production by broilers. Poultry Sci., 47: 339-340. 4 ref.
Report on trials in which broilers were reared to 53 days of age and fed a modified New England College Conference starting ration. Actual manure production (dry matter) by the birds was measured as 867 Kg. per 1,000 males and 658 Kg. per 1,000 females. During the test period, there was a marked increase in the crude protein, calcium and phosphorus content of the litter, such that the final percentages of these nutrients in the litter were greater than the percentages usually included in the ration.

B-269 Howes, J.R. 1968. The digestion of poultry feces under cages. Paper presented at 57th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 47: 1682.)
Report on series of experiments under cages using various absorbent substrates for poultry feces. After an initial build-up period, the feces and substrate were inoculated with aerobic bacteria and aerobic conditions were maintained by weekly or semi-weekly stirring. A field trial was also conducted without any absorbent substrate. Odor and flies were not a problem. Material in field piles was homogenous, odorless and was used as fertilizer on urban gardens and golf greens.

B-270 Junnila, W.A., W.A. Aho and W.C. Wheeler. 1968. Twelve year performance of a heated septic tank. Paper presented at 57th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 47: 1686.)

Report on long term operation of such a tank heated to 100°F, for disposal of dead birds from a 45,000 broiler farm. Corrosion within the tank was a problem. The seepage field remained in excellent condition.

B-271 Quarles, C.L., G.O. Bressler and R.F. Gentry. 1968. Bacterial contamination and performance of Leghorn breeders on sloping wire versus litter floors. Presented at 57th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 47: 1709.)
Results of tests. Egg production, fertility, hatchability and atmospheric bacterial contamination were compared. Hatchability was significantly higher for eggs from the sloping wire floor houses. Average bacteria counts on eggs was higher for litter houses. Air in litter houses averaged 5 to 10 times as many bacteria per cu. ft. as air in wire floor houses. Coliform recovery studies indicated that bacterial penetration of the egg shells had occurred, suggesting a reason for the decreased hatchability of eggs from litter houses.

B-272 Cabes, L.J., Jr., A.R. Colmer, H.T. Barr and B.A. Tower. 1969. The bacterial population of an indoor poultry lagoon. Poultry Sci., 48: 54-63. 17 ref. 3 tab. 2 fig.
Results of a study initiated to enumerate, isolate and classify the predominant bacterial flora of an indoor poultry waste stabilization pond, and to determine the organisms most active in the degradation process. An antibiotic carry-over resulting from feeding of aureomycin and terramycin depressed the bacterial count of the feces. The indoor lagooning system for handling poultry wastes warrants further research.

B-273 Burnett, W.E. 1969. Odor transport by particulate matter in high density poultry houses. Poultry Sci., 48: 182-185. 9 ref. 1 tab. 1 fig.
High volume sampling of a commercial poultry house atmosphere revealed that several odoriferous compounds were being carried by the particulate matter. It should be investigated whether or not particulate matter plays a significant role in ambient odors from poultry houses since the particulates represent a retentive source of odors.

B-274 Moum, S.G., W. Seltzer and T.M. Goldhaft. 1969. A simple method of determining concentrations of ammonia in animal quarters. Poultry Sci., 48: 347-348. 9 ref. 1 tab.
Report on a quick, easy method for measuring ammonia concentrations based on the reaction of ammonia with water to form ammonium hydroxide which can be detected by its alkalinity. pH detector paper which gives a reading of 6 for distilled water is used. The paper is moistened and the time-color relationship is observed for the moistened paper exposed to the test atmosphere. The method is accurate within 5 ppm for concentrations less than 100 ppm, but is not accurate for higher concentrations. Interference with the method can occur from acid gases and other amines. A calibration chart is given. A review of the harmful effects of ammonia on animals is also included.

B-275 Adolph, R.H., V. Brown and C.M. McKell. 1969. Poultry manure as a rangeland fertilizer. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1778.)
Report on trials conducted in California for 4 years to evaluate the effect of poultry manure applied to rangeland on forage yields, soil analysis and forage species. Forage yields were improved for a period of 3 years after

fertilization with poultry manure. Forage quality was also improved. About 1,600 pounds of additional forage were obtained from each ton of dry chicken manure. Efficiency of the manure was unaffected by season of application.

B-276 Bressler, G.O. 1969. Solving the poultry manure problem economically through dehydration. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1789-1790.)
Report on development of a dehydration system at Penn. State University. Manure with an original moisture content of 75% by weight could be dried to 9% moisture automatically at a cost of less than $4.00/ton for electricity and fuel. The manure is first dried to 30% inside the house by stirring and aerating with strategically placed fans. This material is then either field spread or is fed automatically into a commercial dryer which produces 300 pounds per hour of finished product.

B-277 Calvert, C.C., R.D. Martin and N.O. Morgan. 1969. Dual roles for house flies in poultry manure disposal. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1793.)
Results of study. Fresh hen manure will support the growth of 3 pupae per gm at a temperature of 25°C. Feces with pupae lose about 20% more moisture than feces without pupae, and are essentially odorless, loose, and crumbly. Report on an experiment with dried, ground pupae (63.1% protein) as a feed for chickens. Diluted with cellulose to contain 50% protein, this material was equal to soybean meal (50% protein) as chick feed through the first two weeks of life.

B-278 Flegal, C.J. and H.C. Zindel. 1969. The utilization of dehydrated poultry waste by laying hens. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1807.)
Report on experiment to determine the value of dehydrated poultry feces as a feed for laying hens. No significant differences were found in egg production, egg weight or shell thickness for birds on diets containing graded levels of poultry waste in the diet, ranging from 10% to 40% of the total diet. Significant differences in Haugh unit scores were found.

B-279 Howes, J.R. and J.W. Bradley. 1969. Litter materials and management for broilers. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1822.)
Report on studies using 15 different litter treatments. These studies indicated that, where litter materials produce similar bird data (mortality, grade) these litters may be better evaluated by their absorbency or ability to cake. If these criteria are satisfactory, then litter may be safely reused. Composted city garbage was significantly more absorbent than any other litter material tested.

B-280 Lillie, R.J. 1969. A literature review of air pollutants affecting poultry. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1835.)
This review included references to the toxic effects on poultry of carbon monoxide, hydrogen sulfide, nitrogen oxides, dusts and ammonia, as well as several other toxic air pollutants. Poultry are much less susceptible to air pollution than other farm animals, and most toxic effects for poultry can be prevented through proper management practices.

B-281 Miller, B.F. and J.H. Shaw. 1969. Digestion of poultry manure by Diptera. Paper presented at 58th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 48: 1844-1845.)

Results of tests with five species of Diptera to determine their ability to grow and reproduce in fresh poultry manure. Musca domestica and Muscina stabulans were the most suitable, developing from egg to pupa in 5 to 6 days at 37°C and reducing manure to a more stable product. Harvesting of the larvae is discussed. The larvae removed 80% of the organic matter from fresh poultry manure in 5 to 6 days, and reduced the moisture content from 75% to 50%. Twenty-five to 30 grams of larvae were produced from each kilogram of fresh poultry manure.

B-282 Seltzer, W., S.G. Moum and T.M. Goldhaft. 1969. A method for the treatment of animal wastes to control ammonia and other odors. Poultry Sci., 48: 1912-1918. 10 ref. 4 tab.

Flake paraformaldehyde as it disintegrates has the unique ability to neutralize ammonia gas produced by animal wastes by a direct chemical reaction. Because formaldehyde is liberated, it has an antimicrobial action that destroys a variety of organisms capable of producing noxious gases and retains nitrogen at a much higher level than untreated wastes.

B-283 Peterson, R.A., M.A. Hellickson, W.D. Wagner and A.D. Longhouse. 1970. The effect of humidity and flooring type on the moisture content of broiler excrement. Poultry Sci., 49: 439-443. 2 ref. 2 tab. 1 fig.

Report on experiments. At various levels of relative humidity from 33% to 80%, the average moisture content was significantly ($P<0.01$) less in excreta collected under 1.9 cm flat slats than that collected beneath either 2.5 x 2.5 cm or 1.3 x 2.5 cm welded wire floors. No significant differences were found in moisture content of excreta from beneath the two types of welded wire flooring. The average moisture content of excreta from the 33% relative humidity chamber was significantly lower, in one experiment only, than that found for the 65% relative humidity chamber. No significant interactions were noted.

B-284 Calvert, C.C., N.O. Morgan and R.D. Martin. 1970. House fly larvae: biodegradation of hen excreta to useful products. Poultry Sci., 49: 588-589. 3 ref. 2 tab.

Results of experiments to establish the concentration of fly eggs that can be used to process hen excreta most efficiently and to develop a means of separating the house fly pupae from the processed hen excreta. The use of a light to prevent the negatively phototactic fly larvae from migrating upward, combined with a wire mesh bottom, allowed the larvae to collect on a solid floor beneath the manure chamber and to pupate there. A seeding rate of 3 eggs/gm of excrement was regarded as optimum. The stabilized manure was essentially odorless.

B-285 York, L.R., C.J. Flegal, H.C. Zindel and T.H. Coleman. 1970. Effect of diets containing dehydrated poultry waste on quality changes in shell eggs during storage. Poultry Sci., 49: 590-591. 3 ref. 1 tab.

Results of an experiment indicating that inclusion of 10, 20 or 30% dehydrated poultry waste in the diet of hens had no significant deleterious effect on the quality of shell eggs as measured by Haugh units, storage weight loss, color, odor and/or microbial content.

B-286 Bell, R.G. 1970. Fatty acid content as a measure of the odour potential of stored liquid poultry manure. Poultry Sci., 49: 1126-1129. 7 ref. 4 fig.
Results of a study which attempted to make a correlation between odor and the concentration of volatile fatty acids in stored liquid poultry manure. On the basis of this study, a fatty acid content of 0.1% was suggested as a maximum level deemed acceptable for new installations and 0.2% as a minimum level for the initiation of prosecution under any air pollution legislation contemplated for existing facilities.

B-287 Aho, W.A. 1970. Maxi-mixing poultry manure. Paper presented at 59th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 49: 1363.)
Report on trials to determine how much manure the soil can handle before it becomes polluted. Maxi-mix is a term used to describe a manure disposal system using a maximum amount of manure and a minimum amount of soil. Grasses grew better on a maxi-mixed soil (fine sandy loam) than on control soil; moisture holding capacity was also greater. No toxicity to plants was observed during the period of the trials.

B-288 Dendy, M.Y. and O.W. Charles. 1970. Studies on pH changes in litter under various management regimes, and Marek's condemnations in broilers. Paper presented at 59th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 49: 1381.)
Report on field studies to determine the effect of sulfur and sodium bi-sulfate on the pH of broiler litter. Sulfur was ineffective in lowering pH. Sodium bi-sulfate at 8 lbs/100 sq. ft. lowered the pH of fresh wood shavings from 5.6 to 1.8. The neutral point was reached after birds had been on the litter 4 to 5 weeks. Condemnations due to leukosis in commercial broilers was from 0.65 to 1.36% lower in flocks started on the "acidified" litter than in flocks on untreated litter.

B-289 May, J.D., F.N. Reece, J.W. Deaton and M.W. Barker. 1970. Control of poultry house odor. Paper presented at 59th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 49: 1413.)
Report on research. It was assumed that the majority of objectionable odors from chickens are due to sulfur-containing compounds. Approaches to the solution of the problem are treatment of the exhaust air with ultraviolet light to cause free radical formation and subsequent recombination and formation of less odorous compounds, filter pads saturated with solution to bind and remove sulfur compounds, a wet scrubbing process, and oxidation processes such as exposure to open flame or catalytic oxidation.

B-290 Teotia, J.S. and B.F. Miller. 1970. Factors influencing catabolism of poultry manure with *Musca domestica*. Paper presented at 59th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 49: 1443.)
Results of studies conducted in Colorado. The best growth and development of larvae occurred at a temperature of 25°C and a relative humidity of 38%. If temperature was increased, an increase in humidity was necessary for optimal development. Fungal development was observed on manure held at 37°C and 70% moisture. At 80% moisture content and above, developing larvae abandoned the manure. Hatchability of seeded fly eggs ranged from 50 - 87%. The catabolized manure residue and pupae contained 15% protein and very little non-protein. The manure residue had less odor, contained less moisture and was more granular than fresh manure. The entire stabilization process occurs within a few hours.

B-291 Teotia, J.S. and B.F. Miller. 1970. Nutritional value of fly pupae and digested manure. Paper presented at 59th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 49: 1443.)
Results of feeding trials with growing Leghorn chicks and broiler chicks. Leghorn chicks fed a diet containing fly pupae had better, but not significant, feed conversion and weight gains than controls. Replacement of soybean meal by manure residue failed to support growth at control levels. The M.E. value of fly pupae was 2,528 Cal./kg. No significant differences in body weight or feed conversion were observed for broiler chicks receiving control, fully balanced, diets and manure diets with no supplemental minerals or B-vitamins. Fly pupae grown on poultry manure have potential as a protein supplement in chick starter and broiler diets.

B-292 Jackson, S.W., B.E. Langlois and T.H. Johnson. 1970. Growth of microorganisms in fresh chicken manure under aerobic and anaerobic conditions. Poultry Sci., 49: 1749-1750. 5 ref. 1 fig.
Report on trials using fresh poultry manure containing no litter. Results suggested that fresh chicken manure contains substrates capable of supporting aerobic but not anaerobic growth of bacteria. Further studies are required to determine whether or not the growth during aerobic incubation parallels a breakdown of uric acid.

B-293 Burnett, W.E. 1971. Gases and odors from poultry manure: a selected bibliography. Poultry Sci., 50: 61-63. 33 ref.
A collection of some of the more pertinent articles related to odors and gases from poultry manure.

B-294 Bell, R.G. 1971. Aeration of liquid poultry manure; a stabilization process or an odour control measure? Poultry Sci., 50: 155-158. 9 ref. 3 fig.
Report on a study. Fatty acid content was considered to be a reliable odor assessment criteria for aerobically stored manure. For odor control, oxygen to satisfy only 37% of the daily BOD loading was sufficient, suggesting that aeration as used in this system must be considered as an odor control measure and not a stabilization process.

B-295 Walker, J.P., H.L. Orr and J. Pos. 1971. Caged layer performance in pens with oxidation ditches and liquid manure storage tanks. Poultry Sci., 50: 501-505. 4 ref. 1 tab.
Report on studies. Hen house egg production, egg quality, feed conversion and mortality performance of caged layers in a pen with oxidation ditches was similar to that of caged layers in pens with liquid manure storage tanks. The odor in the pen with the oxidation ditches was less offensive than in the pens with anaerobic liquid manure tanks.

B-296 Lovett, J., J.W. Messer and R.B. Read, Jr. 1971. The microflora of Southern Ohio poultry litter. Poultry Sci., 50: 746-751. 17 ref. 7 tab.
Results of a study. The microflora were enumerated and the fungal population classified to genera. Litter pH and total microflora counts increased with litter usage to about 1 month, then decreased slightly before levelling off. The microorganism density was not affected by moisture, pH or length of storage.

B-297 Messer, J.W., J. Lovett, G.K. Murthy, A.J. Wehby, M.L. Schafer and R.B. Read, Jr. 1971. An assessment of some public health problems resulting from feeding poultry litter to animals - microbiological and chemical parameters. Poultry Sci., 50: 874-881. 14 ref. 3 tab.
Results of a study. Salmonellae and Arizona spp. are not highly resistant to heat in poultry litter of normal moisture content but are more resistant to moist heat than Escherichia coli. Heat treatment for the protection against disease transmission by refeeding litter may be feasible. The levels of some medicinals, pesticides and ultraviolet-light-activatable compounds found in poultry manure suggest that the present ban on the interstate shipment of poultry litter for animal feed is warranted.

B-298 Ross, E. and A.Y. Miyahara. 1971. Fumigation and reuse of broiler litter. Poultry Sci., 50: 1096-1100. 12 ref. 4 tab.
Results of a study to determine the effect of methyl bromide fumigation of reused litter on chick growth, feed conversion and mortality. Increasing levels of fumigant reduced the bacterial count in the litter without achieving sterilization and without otherwise affecting poultry performance.

B-299 Adolph, R.H. 1971. A program of manure management to control fly breeding in a semi-arid climate. Paper presented at 60th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 50: 1544.)
A fly control program for Southern California is based upon maintaining a low moisture level in manure to minimize fly breeding and encourage biological control to assist in reducing fly emergence. Various practices aimed at achieving these objectives are outlined.

B-300 Holleman, K.A., W.S. Walker, J.B. Kissam, J.F. Welter and L.E. Priester, Jr. 1971. A multi-agency cooperative effort to educate poultrymen in pollution and fly control. Paper presented at 60th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 50: 1585-1586.)
Report on the aims and achievements of seven Pollution and Nuisance Schools held throughout the State of South Carolina. Legal aspects, management, chemical control procedures and pesticide residue problems were the four major areas considered.

B-301 Ostrander, C.E. and R.C. Loehr. 1971. Handling poultry wastes with an oxidation ditch. Paper presented at 60th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 50: 1613.)
Report on a pilot study. A description of the ditch and aerating equipment is given. Problems and merits of the system are discussed. A slight ammonia odor was evidenced during the first 3 to 4 weeks of operation, after which time there were no odors, even at cleaning time. No effects on production, feed efficiency or mortality were noticed, as compared to three other waste handling systems.

B-302 Ousterhout, L.E. and R.H. Presser. 1971. Increased feces production from hens being fed poultry manure. Paper presented at 60th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 50: 1614.)
Data is presented on the quantitative reduction in manure disposal that can be expected from recycling. This study indicated that recycling manure by refeeding reduces the manure disposal problem by no more than 25%, with no noticeable further reduction with repeated recycling.

B-303 Stephens, G.R., D.E. Hill, W.A. Aho and W.S. Hale. 1971. Utilizing liquid poultry manure safely in pine plantations. Paper presented at 60th Annual Meeting Poultry Sci. Assoc. (cited in Poultry Sci., 50: 1634.)

Report on trials conducted in Connecticut. Liquid poultry manure was sprayed on the litter beneath 35-year-old white pine plantations at 0, 17 and 100 wet tons per acre. A single application of 17 tons supplied nearly 400 pounds of nitrogen. On the basis of data collected on ammonia volatilization, nitrate-nitrogen concentrations in the surface soil and in the groundwater, and foliar nitrogen concentrations, it was suggested that the safe sustained annual rate of application will be nearer to 17 tons of manure per acre than to the higher rate of 100 tons per acre.

B-304 Williams, J.R.P. 1962. The effect of fumigating a poultry house with hexachlorocyclohexane (BHC) to control flies. British Poult. Sci., 3: 73-80. 9 ref. 3 tab. 2 fig.

Report on investigations over a period of 9 weeks. Weekly fumigation gave satisfactory control of _Musca domestica_ but not of _Fannia canicularis_. It was concluded that fumigation with BHC at 0.22 mg of toxicant per cu. ft. will give a cheap and reasonably effective control of _F. canicularis_ and _M. domestica_ if the operation is carried out every 2 - 3 days. No adverse effects on egg production or bird health were noted as a result of the fumigation. Data concerning adult _F. canicularis_ were presented and discussed in relation to biology, economic importance and improving control.

B-305 Williams, J.R.P. and G. Pickering. 1962. An attempt to control the development of _Musca domestica_ L. in poultry faeces using feed additives of _Bacillus thuringiensis_ Berliner. British Poult. Sci., 3: 195-201. 14 ref. 2 tab.

Report on trials to investigate the effect of adding varying levels of _B. thuringiensis_ to poultry rations on the development of _M. domestica_ in the droppings, and the possible side effects of this treatment on egg production, food consumption and mortality. A commercially prepared spore powder containing 75 x 10^9 spores of _B. thuringiensis_ per gm fed at rates up to 7.5 x 10^6 spores per gm of feed was ineffective in controlling the development of _M. domestica_. No deleterious effects on bird health, feed consumption or egg production were noticed for rations containing up to 52.5 x 10^6 spore/gm of feed.

B-306 Harry, E.G. 1963. The relationship between egg spoilage and the environment of the egg when laid. British Poult. Sci., 4: 91-100. 21 ref. 7 tab.

Report on investigations to determine the influence of different management systems on the nature of the bacterial flora of egg shells with particular reference to potential rot-producing bacteria and their probable source of origin. Data were presented on the bacterial content of various nest materials, of freshly voided hen feces, of hen feces after storage for 1 week, of deep litter, and of eggs. The results indicated that shells of deep litter unit eggs contained, on average, 15 times more bacteria and a higher proportion of probable spoilage organisms than the shells of battery unit eggs. Egg spoilage types of bacteria were those found to multiply saprophytically in the fecal matter present, indicating the importance of frequent cleaning of nest boxes. Of the various litter materials tested, hay and straw were the most heavily contaminated with bacteria.

B-307 Valentine, H. 1964. A study of the effect of different ventilation rates on the ammonia concentrations in the atmosphere of broiler houses. British Poultr. Sci., 5: 149-159. 6 ref. 3 tab. 8 fig.
Report on experiments to investigate how concentrations of ammonia increase naturally in the atmosphere of a broiler house under specified environmental conditions and to observe the effect, if any, of these concentrations on broilers. With a decrease in ventilation rate, the absolute humidity and ammonia concentration rose in the atmosphere, resulting in growth rate depression and poorer feed conversion by the broilers. Kerato-conjunctivitis was observed at ammonia concentrations between 60 and 70 ppm. There was also evidence of tracheitis caused by irritation due to the higher concentrations of ammonia.

B-308 Charles, D.R. and C.G. Payne. 1966. The influence of graded levels of atmospheric ammonia on chickens. I. Effects on respiration and the performance of broilers and replacement growing stock. British Poult. Sci., 7: 177-187. 23 ref. 9 tab.
Report on experiments to study the influence of high concentrations of ammonia on the performance of chickens. Ammonia at 100 ppm by volume caused reductions in respiration rate and increased respiratory depth and carbon dioxide production in adult hens. Feed intake and growth rate of broilers raised in atmospheres containing high concentrations of ammonia were reduced. Replacement laying pullets raised in ammonified atmospheres (78 ppm) ate less feed, gained less weight and came into lay later than pullets raised in ammonia-free atmospheres.

B-309 Charles, D.R. and C.G. Payne. 1966. The influence of graded levels of atmospheric ammonia on chickens. II. Effects on the performance of laying hens. British Poult. Sci., 7: 189-198. 15 ref. 7 tab.
Report on studies to ascertain the effects of ammonia on the performance of laying hens housed under specified environmental conditions. The adverse effects of ammonia on feed intake were modified by increasing the ambient temperature. Hens used in the experiments were able to adjust their feed intake according to energy requirements but could not adjust it according to energy supply. It was concluded that ammonia toxicity is, in effect, a shortage of protein, vitamins, minerals and essential amino acids, and in these experiments, was alleviated by providing a sufficiency of these nutrients.

B-310 Davidson, J. and O.A. Thomas. 1969. A scheme for the separation and estimation of nitrogenous components of the excreta from poultry. British Poult. Sci., 10: 53-66. 27 ref. 4 tab. 3 fig.
Report on development of a new scheme for assessing the relative proportions of nitrogenous end-products of digestion and metabolism in excreta from laying hens. A series of solvent extractions with methanol-chloroform-water, phenol-acetic acid-water, and lithium carbonate solution removed over 90% of the nitrogen from the excreta. Estimates were made of the concentrations of certain nitrogenous components, including urate, ammonia, urea, creatine, creatinine and amino acids. About 60% of the extractable nitrogen was derived from urate, 10% from large non-dialysable molecules, 9% from ammonia, 2% from free amino acids, 3% from peptides, 2% from urea, and 1% from creatine and creatinine.

B-311 Barnes, E.M. and C.S. Impey. 1970. The isolation and properties of the predominant anaerobic bacteria in the caeca of chickens and turkeys.

British Poult. Sci., 11: 467-481. 25 ref. 5 tab. 5 fig.
Report on several methods used to isolate anaerobic bacteria from chicken and turkey caeca. Bacteria isolated were divided into groups based on morphological and physiological criteria. Gram-negative non-sporing anaerobes (Bacteroidaceae) and the Gram-positive non-sporing rods and bifidobacteria were present in almost equal proportions, together forming about 80% of the flora isolated. Other flora consisted of peptostreptococci (15%) and a number of curved rod-shaped organisms. Five distinct groups of Bacteroidaceae, 3 groups of Gram-positive non-sporing rods and bifidobacteria, and four groups of peptostreptococci have been isolated so far from turkeys and chickens.

B-312 Shafie, M.M., A.L. Badreldin, M.A. Ghany and Y.A. Afifi. 1963. Effect of adding antibiotic, cow and buffalo manure to the ration on the blood constituents of chickens. World's Poult. Sci. J., 19: 104-109. 10 ref. 2 tab. 2 fig.
Report on trials at Cairo University, Egypt, to determine the effect of adding antibiotics (aurofac), or cow and buffalo manure to the poultry ration on some blood constituents related to vitality or production. The addition of antibiotic at 0.045 and 0.022% or of cow or buffalo manure at 10% of the ration caused a marked increase in total W.B.C., while the total blood calcium and phosphorus were reduced.

B-313 Taiganides, E.P. 1963. Anaerobic digestion of poultry manure. World's Poult. Sci. J., 19: 252-261. 10 ref. 4 fig.
"Anaerobic digestion as a method of treating farm poultry wastes was discussed. The main advantages are the stabilization of the manure, removal of the nuisance and pollutional characteristics of manure and the conservation of the fertilizer value of the manure. The major disadvantage of digestion is high initial cost. On the basis of a volatile solids loading rate of 0.2 $lb/d/ft^3$ and 23-day detention period, the digester capacity required is approximately 0.37 cubic feet per hen; i.e., a 20,000 hen flock will require a digester with 7,400 cubic feet capacity. The initial cost of such a digester will range from $11,000 to $25,000; the income from using the available combustible gas produced at 5,400 cubic feet per day could be between $900 and $1,200 per year. Design considerations and cost figures based on manufactured sludge digestion equipment for different size digesters were presented and discussed briefly."

B-314 Hart, S.A. 1963. Fowl fecal facts. World's Poult. Sci. J., 19: 262-272. 10 ref. 4 tab. 9 fig.
Volumetric, physical, biological and chemical information on poultry fecal material is presented. Values are assigned to various measurable parameters.

B-315 Livshutz, A. 1964. Aerobic digestion (composting) of poultry manure. World's Poult. Sci. J., 20: 212-215.
General discussion on aerobic composting of poultry manure using a system of forced aeration and plastic covered compost heaps. Odors and flies are not a problem, and the piles look neat and tidy as a result of covering with plastic. Care should be taken to have the material for composting at the optimum C/N ratio (25 - 30:1), pH range (pH = 7) and moisture content (50%). The composting process reduces the manure to a sterile, odorless, dry material which can be used for agricultural purposes.

B-316 Johnson, T.H. and G.T. Mountney. 1969. Poultry manure production, utilization and disposal. World's Poult. Sci. J., 25: 202-217. 61 ref. Literature review dealing with the production and composition of poultry excreta, fly and odor problems associated with poultry houses and manure, and treatment, utilization and/or disposal of manure by field application for its fertilizer value, incineration, dehydration, refeeding, methane digestion, composting, lagoons, discharge to municipal sewage works, irrigation, and rapid-cover land disposal.

B-317 Brady, J. 1970. Litter mites and their effects on poultry. World's Poult. Sci. J., 26: 658-668. 38 ref. 1 tab. 4 fig.
Report on a survey of 50 farms in England and Wales to determine the species and numbers of mites in poultry litter. A detailed examination of the monthly changes in the litter at 2 selected farms was conducted. The presence of at least 67 species of non-parasitic mites was revealed, as many as 32 species being detected at one farm. The mites were classified into two broad ecological groups, those normally inhabiting stored foods and their decomposition products, and those normally inhabiting vertebrate dung. The largest mite populations coincided with high summer temperatures. It was observed that mites penetrate the entire depth of litter, right down to the floor, and that the farms were continually being reinfected with mites from outside sources. Insects were uncommon in litter, species observed being associated with dropping pits.

B-318 Hintz, H.F. and H. Heitman, Jr. 1967. Sewage-grown algae as a protein supplement for swine. Anim. Prod., 9: 135-140. 11 ref. 5 tab.
"In two trials with 48 pigs it was found that when algae supplemented with certain B-vitamins replaced fish meal on an equal-nitrogen basis in a diet based on barley and fish meal there was no decrease in rate of gain or feed conversion efficiency. When vitamin B_{12} was omitted from the algal diet, there was a decrease in rate of gain. There were no consistent differences in carcass characteristics between pigs fed on the algal diets and those fed on diets containing fish meal. Digestibility studies indicated that algae are low in digestible energy, but their protein is 70% digestible."

B-319 Lowman, B.G. and D.W. Knight. 1970. A note on the apparent digestibility of energy and protein in dried poultry excreta. Anim. Prod., 12: 525-528. 4 ref. 4 tab.
"The nutritional value of dried poultry excreta was investigated by determining the apparent digestibility of dry matter, organic matter, nitrogen, energy and copper in five diets containing 0 to 100% of this feed. Dried poultry excreta supplied 20.21% apparently digestible crude protein and approximately 1.57 or 1.74 Mcal of metabolizable energy per kg dry matter. The copper in dried poultry excreta was found to be less digestible than the copper in barley. It is concluded that, as far as copper levels are concerned, dried poultry excreta are safe for ruminants and are a source of cheap protein. More detailed work is needed to determine the metabolizable energy of the material accurately."

B-320 Perez-Aleman, S., D.G. Dempster, P.R. English and J.H. Topps. 1971. A note on dried poultry manure in the diet of the growing pig. Anim. Prod., 13: 361-364. 5 ref. 2 tab.
"Dried poultry manure, produced locally by sterilization and drying, was evaluated as an addition to a conventional diet, at levels of 10, 20 and 30%, for growing pigs from 23 to 85 kg liveweight. The 32 pigs remained healthy and the dried manure had no apparent adverse effect on the carcass. There were significant linear relationships between the amount of manure added to the

conventional diet and growth rate, feed conversion efficiency and certain carcass characteristics. For every 10% addition of manure, growth was reduced by 0.02 kg/day, feed conversion efficiency by 0.25 units and killing-out percentage by 0.96. The dried manure contained about 30% crude protein and was a rich source of minerals."

B-321 Marten, G.C. and J.D. Donker. 1964. Selective grazing induced by animal excreta. I. Evidence of occurrence and superficial remedy. J. Dairy Sci., 47: 773-776. 8 ref. 3 tab. 1 fig.
"Recurring grazing patterns by dairy heifers and steers under rotational grazing of brome and alfalfa-brome were measured by mapping within staked areas over a 2-year period. An average of 81% of all dung deposited by the animals 3 to 4 wk before grazing caused complete refusal of the forage in the area. Complete refusal of dung-affected forage was reduced to 68% after two to three months. Dung deposited on brome caused a greater refusal of forage than that deposited on alfalfa-brome. Of all areas not grazed, 93% contained dung spots from periods prior to measurement, while only 1% of completely consumed forage areas contained dung. The effect of sprayed sugar or molasses on consumption of dung-affected brome was measured in 1961. Both sweetening agents resulted in consumption of grass over dung spots, while untreated controls remained ungrazed. Molasses was more effective than sugar in completely overcoming rejection of dung-affected forage."

B-322 Marten, G.C. and J.D. Donker. 1964. Selective grazing induced by animal excreta. II. Investigation of a causal theory. J. Dairy Sci., 47: 871-874. 18 ref. 2 tab.
"Two studies are reported which investigated the theory of Plice, that decreased sugar in forages heavily fertilized with dung or N fertilizers caused the forage to become unpalatable to cattle. The first study revealed that heavy applications of P would not overcome unpalatability of dung-affected brome and that heavy applications of N would not cause brome to become unpalatable, both being contradictory to the proposed theory. The second study confirmed earlier results which showed the failure of N fertilizers to render brome unpalatable... The unpalatability of brome growing on plots treated with a dilute mixture of feces, urine, and water, which failed to cause significant changes in chemical composition, further indicated that Plice's theory is invalid."

B-323 Friend, D.W., H.M. Cunningham and J.W.G. Nicholson. 1962. The production of organic acids in the pig. I. The effect of diet on the properties of volatile fatty acids in pig feces. Can. J. Anim. Sci., 42: 55-62. 11 ref. 4 tab.
"Experiments were conducted to determine the effect of diet, level of feeding and age and/or weight on the proportions of volatile fatty acids in the feces of pigs. Cellulose was added to the control ration fed in one experiment and dried whey or bran to that fed in another experiment. When the level of intake of the cellulose-supplemented ration was reduced, the digestibility of crude fiber in the ration increased. The proportion of fecal acetic acid also increased, but the difference observed did not reach statistical significance at $P = 0.05$. Differences in the proportion of acetic, butyric and valeric acid due to cellulose supplementation of the control ration were statistically significant ($P<0.05$). The whey and the bran-supplemented rations gave statistically significant differences ($P<0.05$ or $P<0.01$) for the proportions of fecal valeric, propionic or acetic acid. The proportions of fecal VFA

appeared to be relatively unaffected by the age and/or weight of pigs from weaning to market weight."

B-324 Krishnamurti, C.R. and L.W. McElroy. 1967. Studies on rumen coliform organisms. I. Incidence, isolation and characteristics. Can. J. Anim. Sci., 47: 193-198. 17 ref. 2 tab. 1 fig.
"Bacterial counts on the rumen fluid of two cows fed alfalfa hay revealed the presence of coliform organisms in a concentration in excess of 2% of the total microbial population. When grain was included in the ration of one of the cows, the viable coliform count was of the order of 2.3×10^9 per ml as compared to a maximum of 4×10^8 when hay alone was fed. However, total microscopic counts were also higher when grain was fed, so that the ratio of viable coliform counts to total microscopic counts was not changed. Diurnal variations were observed in viable coliform counts; the numbers increased immediately after feeding and fell off gradually to the prefeeding level after 10 hours..."

B-325 Cutcliffe, J.A., D.C. MacKay and D.C. Munro. 1967. Effect of nitrogen, phosphorus, potassium, and manure on size, rate of development, and yield of Brussels sprouts. Can. J. Plant Sci., 47: 641-648. 14 ref. 5 tab. 3 fig.
"A factorial experiment was conducted during three successive cropping seasons to investigate the effects of nitrogen, phosphorus, potassium, and manure on the growth and yield of Brussels sprouts. Plant development was delayed by a lack of phosphorus. Nitrogen and phosphorus applications decreased the yields of small sprouts and increased the yields of those greater than 2.3 cm in diameter. Total marketable yields were substantially increased by nitrogen and phosphorus but were only slightly affected by rates of applied potassium. Yield increases from high rates of nitrogen were obtained only when accompanied by adequate phosphorus. A manure treatment slightly increased marketable yields but the effect was usually not significant."

B-326 Cutcliffe, J.A., D.C. Munro and D.C. MacKay. 1968. Effect of nitrogen, phosphorus, potassium, and manure on terminal, lateral, and total yields and maturity of broccoli. Can. J. Plant Sci., 48: 439-446. 15 ref. 3 tab. 3 fig.
"A factorial experiment was conducted during three successive cropping seasons to investigate the effects of nitrogen, phosphorus, potassium, and manure on the yield and maturity of broccoli. Terminal, lateral and total yields were substantially increased by applications of nitrogen and phosphorus. For maximum yields, rates of 175 to 250 kg/ha of N and 100 to 150 kg/ha of P were necessary. Increases in lateral yields and total yields from high rates of nitrogen were obtained only when nitrogen was accompanied by adequate phosphorus. Yields of terminals were increased in only one of three seasons by added potassium. A manure treatment increased lateral and total yields in two seasons, and terminal yields in one season. Maturity was delayed by increasing the rates of nitrogen, and where no phosphorus was applied."

B-327 Haworth, F. 1961. The effects of organic and inorganic nitrogen fertilizers on the yield of early potatoes, spring cabbage, leeks and summer cabbage. J. Hort. Sci., 36: 202-215. 14 ref. 6 tab.
In a rotational field experiment, the responses of various crops to FYM, hoof-and-horn meal and Nitrochalk were observed. The response to Nitrochalk was generally greater than the response to an equivalent amount of nitrogen

supplied as hoof-and-horn meal. Applications of FYM produced large increases in the yield of all crops, and generally reduced the response of the crops to nitrogenous fertilizer. The factors responsible for the beneficial effect of FYM were discussed; an improvement in soil structure resulting in promotion of better root development was suggested as the major effect.

B-328 Haworth, F. 1963. The effects of different manurial treatments on the yield and mineral composition of runner beans (Phaseolus multiflorus). J. Hort. Sci., 38: 26-39. 5 ref. 7 tab. 1 fig.
A field experiment was conducted at Wellesbourne from 1957 to 1960 to compare the response of runner beans to FYM, peat and fertilizers and to study the nutrient uptake by the plants under the same treatments. FYM, in the year of application, produced more than twice the yield of bean pods than did fertilizers, but in succeeding years the difference decreased and disappeared in 1960. The response to peat was less than the response to FYM. Reasons for the differences between responses to the three treatments were discussed. Chemical analysis of plants and leaves did not indicate anything to account for the observed yield differences.

B-329 Haworth, F. 1963. The effects of different primary cultivations and manurial treatments on the yield of early peas, spring cabbage, leeks and Brussels sprouts. J. Hort. Sci., 38: 199-213. 14 ref. 7 tab.
The effects of different primary cultivations and manurial treatments on the yield of several crops were described. FYM with NPK fertilizers gave substantially higher yields of leeks, spring cabbage and Brussels sprouts than nitrogenous fertilizer alone, but a smaller increase of only 18% in the yield of peas. Several significant interactions between two or more of cultivation, years, and manurial treatments were discussed. Water availability was suggested as one of the factors responsible for some of the significant yield differences and interactions.

B-330 Austin, R.B. 1963. A study of the growth and yield of carrots in a long-term manurial experiment. J. Hort. Sci., 38: 264-276. 10 ref. 7 tab. 3 fig.
Report on 4 years of a long-term manurial experiment with carrots. Significant increases in the yield of roots were produced by FYM and potassic fertilizer but not by nitrogenous or phosphatic fertilizers. Mean annual yields and responses to FYM and K varied considerably from year to year. Net assimilation and relative growth rates were increased 15 - 20% by FYM but the increase persisted for only 4 - 7 weeks. The initial assimilation rates influenced the leafiness of the plants and hence the yield of roots.

B-331 Haworth, F. and J.M. Bray. 1965. The effects of different primary cultivations and manurial treatments on the yield of early peas, autumn lettuce, early summer cauliflowers, leeks and Brussels sprouts. J. Hort. Sci., 40: 73-81. 4 ref. 4 tab.
Report on 3 years of field experiments on a sandy loam at Wellesbourne to observe the effects of various cultivation and manurial treatments on the yield of vegetable crops. Yields were maintained at a high level by the use of NPK fertilizers alone on plots where a high level of fertility had been established by the use of FYM.

B-332 Haworth, F., T.J. Cleaver and J.M. Bray. 1966. The effects of different manurial treatments on the yield and mineral composition of early potatoes. J. Hort. Sci., 41: 225-241. 12 ref. 9 tab.
Report on field plot experiments conducted on a sandy loam at Wellesbourne from 1954 to 1964 to study the effects of N, P and K fertilizer and FYM on the yield and mineral composition of early potatoes. FYM at 20 tons/acre/crop with NPK fertilizer consistently produced much higher yields than mineral fertilizers alone. In years where moisture supplies were adequate, the beneficial effect of FYM was attributed to promotion of early plant growth and increased bulking of the tubers: in dry years, the beneficial effects of FYM were magnified. Leaves of plants manured with FYM contained much more K and slightly more P than leaves from unmanured plants. Growth was more uniform on manured than on unmanured plots.

B-333 Haworth, F., T.J. Cleaver and J.M. Bray. 1966. The effects of different manurial treatments on the yield and mineral composition of red beet. J. Hort. Sci., 41: 243-255. 8 ref. 8 tab.
Report on factorial manurial experiments on sandy loam at Wellesbourne from 1954 to 1964 and on fine sandy loam at Efford in 1959 to study the effects of manurial treatments on the yield and mineral composition of red beet grown in a rotation of vegetable crops. At Wellesbourne, application of 20 tons/acre/crop of FYM together with NPK fertilizers consistently gave much higher yields than mineral fertilizers alone. Applications of FYM increased the K and decreased the Ca and Mg contents of red beet leaves and had only small effects on the N and P contents; in the roots only the K content was altered (increased) by FYM. In the absence of FYM, only K fertilizer had consistent significant effects on the mineral composition of roots and leaves, but all mineral fertilizers alone and in combination increased yields.

B-334 Page, E.R. 1966. The micronutrient content of young vegetable plants as affected by farmyard manure. J. Hort. Sci., 41: 257-261. 11 ref. 2 tab.
"Concentrations of copper, zinc, iron and manganese found in the laminae of five species of vegetable plants grown in a field experiment with added FYM or potash fertilizers are reported. Manganese concentrations were depressed by FYM additions and this was associated with increased soil pH. Generally the other micronutrient concentrations were little affected by the presence or absence of FYM, and no differences were detected which could be attributed to the effects of potassium nitrate as against potassium sulfate, although plant growth was stimulated markedly on the plots receiving FYM. It is concluded that the effects of FYM on growth and yield are unlikely to be the result of increased availability of the micronutrients measured."

B-335 Haworth, F., T.J. Cleaver and J.M. Bray. 1966. The effects of different manurial treatments on the yield and mineral composition of carrots. J. Hort. Sci., 41: 299-310. 10 ref. 7 tab.
Report on a long-term factorial manurial experiment on a sandy loam at Wellesbourne from 1954 to 1962 to study the effects of FYM and mineral fertilizers on the yield and mineral composition of carrots. FYM at 20 tons/acre/crop gave consistently higher yields than fertilizers alone and the increases were greater in dry years than in wet years. In the presence of FYM, applications of N, P and K fertilizer had only small effects on the yield of carrots. In the absence of FYM, P and K increased yields but N depressed

yields when applied at more than 31 lb of N/acre. Plants from FYM plots contained twice as much K and 30% more P than those from unmanured plots.

B-336 Austin, R.B. and P.C. Longden. 1966. The effects of manurial treatments on the yield and quality of carrot seed. J. Hort. Sci., 41: 361-370. 5 ref. 5 tab.
Report on field experiments conducted from 1962 to 1964 to study the effects of N, P and K fertilizers and FYM on the yield and composition of carrot seed. Yield responses to all fertilizers and manure were significant. Manurial treatments had no significant effects on germination of the seeds. Composition of the seed was affected by N and FYM but these variations in composition did not affect the yields of roots obtained from such seeds. It was suggested that both seed quality and yield can benefit from high levels of soil fertility.

B-337 Haworth, F., T.J. Cleaver and J.M. Bray. 1967. The effects of different manurial treatments on the yield and mineral composition of spring cabbage. J. Hort. Sci., 42: 13-21. 8 ref. 4 tab.
Report on long-term field experiments on sandy loam soil to study the effect of FYM and mineral fertilizers on the yield and mineral composition of spring cabbage. FYM produced large yield increases by reducing winter-kill and increasing early spring growth. Yield responses to N fertilizers were about the same in the presence of FYM as in its absence. K fertilizer had a significant effect on yields whereas P did not. Plants from FYM plots had higher K contents than plants from unmanured plots, but the differences in contents of other minerals were small. Fertilizer treatments in the presence of FYM produced only small differences in the composition of plants. In the absence of FYM, K fertilizer increased the K content and N fertilizer increased the N content of plants.

B-338 Haworth, F. and T.J. Cleaver. 1967. The effects of different manurial treatments on the yield and mineral composition of winter lettuce. J. Hort. Sci., 42: 23-29. 5 ref. 3 tab.
Report on long-term field experiments to study the effects of FYM and NPK fertilizers on the yield and mineral composition of winter lettuce. Yields were increased twofold by FYM, the extra yield coming from the greater number of lettuces that reached marketable condition. Lettuce grown on FYM plots reached maturity 8 days earlier than lettuce from unmanured plots. FYM increased the K content of lettuce. In the absence of FYM, fertilizer applications had marked differential effects on the mineral composition of the plants.

B-339 Salter, P.J. and J.B. Williams. 1968. Effects of additions of farmyard manure and peat on the moisture characteristics of a sandy loam soil and on crop yields. J. Hort. Sci., 43: 263-273. 17 ref. 2 tab.
Report on five years of field experiments on sandy loam at Wellesbourne to assess the mode of action of FYM and peat on this soil. In all but the first year of the experiment, soil in both FYM and peat-treated plots had a higher available water capacity than that of controls; the effect of peat was greater than that of FYM. FYM-treated plots always outyielded peat-treated and control plots, the difference in yields between the latter two being insignificant. It was concluded that the beneficial effect of FYM on this sandy loam soil was due primarily to the nutrient content of the manure, rather than to its effect on the quantity or availability of moisture supply in the soil.

B-340 Ende, B. van den and B.K. Taylor. 1969. Influence of pre-planting applications of nitro-chalk, superphosphate, sheep manure and a fertilizer mixture, in factorial combination on the growth of one-year-old peach trees. J. Hort. Sci., 44: 247-255. 5 ref. 2 tab. 2 fig.
Report on field experiments to determine the effect of N, P, sheep manure and micronutrients on the growth of newly planted one-year-old peach trees. Maximum growth was attained by application of 3 lb P and 36 lb SM per tree. All fertilizers depressed leaf bud development and early shoot growth, 3 lb N resulting in tree death. SM increased tree growth more in the absence of N than in its presence. SM depressed tree growth early in the season, probably because some of its components are readily soluble, but promoted growth later in the season and partly alleviated the detrimental effect on tree growth induced by 3 lb N per tree. SM supplied larger quantities and a wider range of elements than the inorganic fertilizers.

B-341 Taylor, B.K. and B. van den Ende. 1970. Influence of split and non-split applications of nitrochalk, superphosphate and sheep manure, in factorial combination, on the growth of one-year-old peach trees. J. Hort. Sci., 45: 57-68. 7 ref. 4 tab. 2 fig.
Report on a field experiment to study the effect of single and multiple applications of N, P and sheep manure (SM), in factorial combination, on the growth of peach trees during the first growing season. Maximum growth was attained by application of 3 lb P and 35 lb SM in October. Split fertilizer applications were generally beneficial due to better regulation of nitrogen supply. SM acted as an N source in the absence of N fertilizer and as a P source at low soil fertility levels. Application of SM partly overcame growth depression induced by N fertilizer, probably due to decreased N/P ratio in the leaves.

B-342 Campbell, A.I. and C. Bould. 1970. Virus, fertilizer and rootstock effects on the growth and precocity of young apple trees. J. Hort. Sci., 45: 75-85. 16 ref. 5 tab.
Report on field experiments to study the growth and precocity of young apple trees on three clonal rootstocks, with four different latent virus infections grown on plots receiving different N, P, K and FYM treatments. One-year-old trees on FYM-treated plots were significantly larger in all respects than those where K was omitted. Omission of P also reduced diameter and feather. The ratio of rootstock to scion weight of two-year-old trees was much higher in the FYM treatment than in the others. Several interactions between fertilizer, rootstocks, and virus infections were noted and discussed.

B-343 Bould, C. and A.I. Campbell. 1970. Virus, fertilizer and rootstock effects in the nutrition of young apple trees. J. Hort. Sci., 45: 287-294. 10 ref. 4 tab.
Report on field experiments to study the chemical composition of the leaves of young apple trees on three clonal rootstocks, with four different virus infections, grown on plots receiving different N, P, K and FYM treatments. Soil analyses indicated that organic matter, available-P and exchangeable-K and -Mg were significantly higher on FYM plots than on the NPK plots. Several significant effects of fertilizers on the chemical composition of leaves were noted, and some significant interactions were discussed.

B-344 Nichols, A.A., P.A. Davies, K.P. King, E.J. Winter and F.L.C. Blackwall. 1971. Contamination of lettuce irrigated with sewage effluent. J. Hort. Sci., 46: 425-433. 9 ref. 1 tab. 2 fig.
"Faecal contamination on lettuce growing in the open as indicated by the presence of Escherichia coli I was demonstrated for up to 21 days after irrigation with sewage effluent, although the level of contamination usually decreased after 3 - 7 days. Recovery of other coliform bacteria gave parallel results; counts of these organisms and of other bacteria also indicated the persistence of more general pollution."

B-345 Dias, F.F. and J.V. Bhat. 1964. Microbial ecology of activated sludge. I. Dominant bacteria. Appl. Microbiol., 12: 412-417. 29 ref. 7 tab.
"Over 300 bacterial strains were isolated from seven samples of activated sludge by plating on sewage agar. Gram-negative bacteria of the genera Zoogloea and Comamonas predominated. Many isolates (51%) showed sudanophilic inclusions of poly-β-hydroxy-butyric acid, whereas 34% accumulated iodophilic material on media containing starch. A large number required either vitamins or amino acids, or both, for growth. None of the isolates tested for their ability to bring about changes in autoclaved sewage produced an effluent comparable in quality to the activated sludge control, although the Zoogloea did produce activated sludgelike flocs. A study of 150 bacterial strains isolated from raw sewage revealed that the differed from the sludge isolates in several respects. Coliforms which constitute nearly a quarter of the sewage isolates, were rarely encountered in sludge."

B-346 Dias, F.F. and J.V. Bhat. 1965. Microbial ecology of activated sludge. II. Bacteriophages, Bdellovibrio, coliforms, and other organisms. Appl. Microbiol., 13: 257-261. 23 ref. 3 tab. 1 fig.
"A comparative estimation of the coliform population of raw sewage, activated sludge, and the effluent derived therefrom revealed that raw sewage had a preponderance of Escherichia coli (75%), as compared with 25 and 30%, respectively, in sludge and effluent. Nitrogen-free mannitol-sucrose enrichments of activated sludge resulted in the isolation of Azotobacter agilis, Aerobacter aerogenes, Corynebacterium laevaniformans, and Achromabacter species. Sludge had a large population of C. laevaniformans and A. aerogenes but not of Azobacter. The bacterial parasites, Bdellovibrio and bacteriophages, were not active during activated-sludge treatment. A 10-fold reduction in phage content occurred after 2 hr of aeration, but the Bdellovibrio population was unaffected."

B-347 Irgens, R.L. and H.O. Halvorson. 1965. Removal of plant nutrients by means of aerobic stabilization of sludge. Appl. Microbiol., 13: 373-386. 8 ref. 8 tab. 16 fig.
"In the conventional treatment of sewage, the solids are normally disposed of by anaerobic digestion. This leaves a considerable amount of plant nutrients, such as nitrogen and phosphate, as soluble compounds which will eventually find their way into the plant's final effluent, since the supernatant fluid from the digestors is normally returned to the raw sewage. In a recent investigation, we found that, if the sludges were treated by an aerobic process, a significant portion of the carbonaceous matter was oxidized to carbon dioxide and water, and the rest was assimilated so that practically none remained dissolved in the suspending liquid. The accumulated solids, consisting mostly of microbial cells, were separated very easily from the liquid, leaving a slightly colored supernatant fluid that was water-clear, free from plant nutrients, and very

low in BOD and COD. The overall process was accomplished in a detention time not exceeding 20 days, in contrast to anaerobic digestion which requires from 50 to 70 days."

B-348 Post, F.J., A.D. Allen and T.C. Reid. 1967. Simple medium for the selective isolation of Bacteroides and related organisms, and their occurrence in sewage. Appl. Microbiol., 15: 213-218. 14 ref. 4 tab.
"A medium composed of 0.009% sodium azide, 0.07% sodium deoxycholate, and 0.0007% ethyl violet in Brain Heart Infusion Agar (Difco) and a process of incubation in an atmosphere of 90% N_2 and 10% CO_2 for the selective isolation of certain members of the intestinal bacteroides are described. The medium appears to select predominantly members of the genus Bacteroides and a few of the genus Sphaerophorus. A survey of the occurrence of these organisms in sewage and various stages of sewage treatment indicated that they survive complete sewage treatment in low numbers and that their rate of decline parallels that of the coliforms. Large numbers were recovered from sludge digestion tanks, suggesting a possible role in the anaerobic breakdown of organic matter."

B-349 Miner, J.R., L.R. Fina and C. Piatt. 1967. Salmonella infantis in cattle feedlot runoff. Appl. Microbiol., 15: 627-628. 10 ref. 1 tab.
"Ten isolates of Salmonella infantis were found in litter and runoff collected from two experimental feedlots near the Kansas State University Campus. Pathogenic implications are discussed relative to recreation water sites. Agricultural runoff may be a source of viable salmonellae."

B-350 van Donsel, D.J., E.E. Geldreich and N.A. Clarke. 1967. Seasonal variations in survival of indicator bacteria in soil and their contribution to storm-water pollution. Appl. Microbiol., 15: 1362-1370. 27 ref. 4 fig.
"Survival of a fecal coliform and a fecal streptococcus was studied through several years at shaded and exposed outdoor soil plots. Death rates for both organisms were calculated for the different seasons at both sites. The 90% reduction times for the fecal coliform ranged from 3.3 days in summer to 13.4 days in autumn. For the fecal streptococcus, 90% reduction times were from 2.7 days in summer to 20.1 days in winter... There was evidence of aftergrowth of nonfecal coliforms in the soil as a result of temperature and rainfall variations. Such aftergrowth may contribute to variations in bacterial count of storm-water runoff which have no relation to the sanitary history of the drainage area."

B-351 Sharma, R.M. and R.A. Packer. 1969. Evaluation of culture media for the isolation of Salmonellae from feces. Appl. Microbiol., 18: 589-595. 25 ref. 7 tab.
Report on studies. 300 fecal samples from a cow and a pig were used to evaluate the effectiveness, in the isolation of Salmonella organisms, of three enrichment broths in conjunction with three selective media.

B-352 Kraft, D.J., C. Olechowski-Gerhardt, J. Berkowitz and M.S. Finstein. 1969. Salmonella in wastes produced at commercial poultry farms. Appl. Microbiol., 18: 703-707. 13 ref. 4 tab.
"Composite samples of freshly voided excreta from 91 poultry houses were tested qualitatively for Salmonella; 26 (29%) were positive. The houses were located on 36 farms, 18 of which (50%) yielded one or more positive samples.

In a separate, quantitative study, Salmonella densities ranged from less than 1 to over 34,000 per g of excreta (dry weight). High densities were noted in waste from cage houses, but not in waste from floor houses (litter or wire floors). Salmonella-shedding chickens were located in only one small area of the row of cages examined in detail. A total of 15 Salmonella serotypes were identified during the study."

B-353 Wiley, B.B. and S.C. Westerberg. 1969. Survival of human pathogens in composted sewage. Appl. Microbiol., 18: 994-1001. 17 ref. 3 tab. 1 fig.
"Studies were conducted to assess the effectiveness of an aerobic composter in destroying pathogens that may possibly be present in raw sewage sludge. Experiments conducted in this study were designed to determine whether or not selected indicator organisms (i.e., Salmonella newport, poliovirus type I, Ascaris lumbricoides ova, and Candida albicans) could survive the composting process. The results of the assay showed that after 43 hours of composting, no viable indicator organism could be detected. The poliovirus type I was the most sensitive, being inactivated within the first hour, whereas C. albicans was the most resistant, requiring more than 28 hr. of composting for its inactivation. The data from this study indicated that aerobic composting of sewage sludge would destroy the indicator pathogens when a temperature of 60 to 70°C is maintained for a period of 3 days."

B-354 Rall, G.D., A.J. Wood, R.B. Wescott and A.R. Dommert. 1970. Distribution of bacteria in feces of swine. Appl. Microbiol., 20: 789-792. 12 ref. 3 tab. 2 fig.
"A new technique is described for evaluating bacterial cell distribution in fecal samples. Spatial relationships of cells within an area rather than number of cells per unit volume or weight are measured by this technique. Measurements of cell distribution by this method indicated that bacteria occurred in freshly voided swine feces as pure, discrete colonies rather than as single cells distributed randomly or uniformly throughout the sample."

B-355 Pocurull, D.W., S.A. Gaines and H.D. Mercer. 1971. Survey of infectious multiple drug resistance among Salmonella isolated from animals in the United States. Appl. Microbiol., 21: 358-362. 22 ref. 2 tab.
"Salmonella cultures were obtained from outbreaks of animal disease from 37 states and 1 territory. They were screened for resistance to 11 antimicrobial drugs. Of the 1,251 strains studied, 935 were resistant to one or more of these agents. The three most common resistance patterns were ampicillin, dihydrostreptomycin, sulfamethoxypyridazine, tetracycline; ampicillin, dihydrostreptomycin, sulfamethoxypyridazine; dihydrostreptomycin, sulfamethoxypyridazine, tetracycline. Resistance transfer was demonstrated on 267 multiply resistant cultures, of which 181 were able to transfer all or part of their resistance pattern to a drug-sensitive recipient."

B-356 Sturtevant, A.B., G.H. Cassell and T.W. Feary. 1971. Incidence of infectious drug resistance among fecal coliforms isolated from raw sewage. Appl. Microbiol., 21: 487-491. 12 ref. 5 tab.
"Raw sewage was examined for the incidence of antibiotic-resistant coliforms present among both total and fecal coliforms. In both groups, it was found that approximately 3% of the coliform bacteria were resistant to two or more antibiotics. Of these organisms, 48% were capable of transferring all or part

of their antibiotic resistance to an antibiotic-sensitive, F^-, derivative of Escherichia coli K-12. Among the R factors identified, those conferring resistance to streptomycin-tetracycline, ampicillin-streptomycin-tetracycline, and ampicillin or ampicillin-streptomycin accounted for 23, 20, and 15%, respectively, of the total R factors detected. The data indicate a significant level of infectious drug resistance among the fecal coliforms of the urban population..."

B-357 Claudon, D.G., D.I. Thompson, E.H. Christenson, G.W. Lawton and E.C. Dick. 1971. Prolonged Salmonella contamination of a recreational lake by runoff waters. Appl. Microbiol., 21: 875-877. 11 ref. 2 tab. 1 fig.
"In the summer and fall of 1968, various Salmonella serotypes were isolated from a portion of Lake Mendota, the major recreational lake for Madison, Wis. The apparent sources of these organisms were a residential storm sewer and a University of Wisconsin Experimental Farms' washwater drain. Salmonellae were isolated with regularity from a swimming beach located approximately 0.5 miles from these sources."

B-358 Mercer, H.D., D. Pocurull, S. Gaines, S. Wilson and J.V. Bennett. 1971. Characteristics of antimicrobial resistance of Escherichia coli from animals: relationship to veterinary and management uses of antimicrobial agents. Appl. Microbiol., 22: 700-705. 13 ref. 8 tab.
"Five hundred fifty-five isolates of Escherichia coli were obtained from fecal specimens of a representative number of animals from five farms in the United States. Antibiotic exposure of the selected herds was determined by an epidemiological survey of these farms. The incidence of multiple resistance in the E. coli isolates was higher in herds exposed to continuous feeding of antimicrobial agents (84.8%) than in a herd not receiving antimicrobials (15.7%). The most common resistance configuration observed was the triple pattern of dihydrostreptomycin (DS), sulfonamide (SU), and tetracycline (TE). The second most frequent pattern consisted of four resistances: ampicillin (AM), DS, SU, and TE. The frequency of transfer factors was much higher in multiply resistant organisms from the herds exposed to antimicrobial medicaments. The E. coli isolates were relatively efficient in fostering and transferring heterologous resistant factors. AM resistance factors occurred more frequently in herds which were exposed to feed levels of penicillin (27.9%) than in those that were not (6.4%)."

B-359 McInnes, P., P.J. Austin and D.L. Jenkins. 1968. The value of a poultry litter and wheat mixture in the drought feeding of weaner sheep. Aust. J. Exp. Agr. Anim. Husbandry, 8: 401-404. 16 ref. 1 fig.
Feeding trials were conducted with wether weaners to investigate the value of deep poultry litter as a source of roughage and nitrogen for sheep. At the end of 23 weeks, the mean daily dry matter intake of the wethers on the experimental ration was 190 gm poultry litter and 235 gm wheat. On the experimental ration, the mean weekly body weight gain was 210 gm/sheep as compared to 180 gm/sheep for sheep receiving the control ration of 365 gm/day of wheat. Wethers fed wheat only developed calcium deficiency, whereas those fed the litter supplemented ration did not, indicating the relatively high calcium content of the litter. Reasons for caution in the use of poultry litter in the manufacture of commercial feedstuffs for ruminants were discussed.

B-360 Watson, E.R. and P. Lapins. 1969. Losses of nitrogen from urine on

soils from south-western Australia. Aust. J. Exp. Agr. Anim. Husbandry, 9: 85-91. 16 ref. 3 tab. 3 fig.
"Nitrogen loss from sheep urine was measured on two soil types under different surface cover and moisture conditions at a location with high summer temperatures. Some of the factors influencing nitrogen loss were studied in pots and lysimeters. Grass plants utilized almost half the nitrogen applied in urine. Loss of nitrogen by volatilization and leaching was considerably less under a grass cover than on bare soil. When urine was applied during the hot summer months, there were large losses (50 per cent) of nitrogen even under a grass cover. During the summer, rewetting of urine patches to simulate rainfall increased the amount of nitrogen lost. Eighty per cent of the urine nitrogen was lost after three wettings. Frequency of wetting was more important than volume of water applied. Urine application markedly increased the pH of the soils over a long period."

B-361 Ende, B. van den and B.K. Taylor. 1969. Responses of peach seedlings in sand culture to factorial combinations of nitrogen, phosphorus, and sheep manure. Aust. J. Exp. Agr. Anim. Husbandry, 9: 234-238. 15 ref. 4 tab.
"A factorial experiment was done on Elberta peach seedlings growing in sand culture to test tree response to applied solutions of calcium nitrate and sodium dihydrogen phosphate, and to sheep manure which had been mixed throughout the sand before planting. Results showed that the phosphate and sheep manure treatments exerted a more pronounced influence on seedling growth and leaf nutrient composition when harvested after 9 weeks than did the nitrogen treatments. In the absence of sheep manure, seedling growth was increased by increasing the phosphate supply to the maximum tested (64 ppm P). A strong negative interaction was found between phosphate and sheep manure treatments in both seedling growth and leaf composition data, and it is concluded that the sheep manure served as a rich source of phosphate in this situation. In addition, application of sheep manure (except in the presence of 64 ppm P) apparently increased uptake of N, P, K, Ca, and Mg by the seedlings, and also increased the concentrations of Ca, K, and P in the leaves. Other results relating to leaf composition are discussed and it is suggested that a Ca/Mg antagonism was operative."

B-362 Leibholz, J. 1969. Poultry manure and meat meal as a source of dietary nitrogen for sheep. Aust. J. Exp. Agr. Anim. Husbandry, 9: 589-592. 18 ref. 4 tab.
Two experiments were performed with wethers to investigate the feasibility of using poultry manure as a nitrogen source with a low quality roughage in maintenance diets of sheep. In Experiment I, it was shown that replacing meat meal by poultry manure had no effect on weight gains. Experiment II showed that 15% sawdust may be included in the diet of sheep, suggesting that poultry litter with a sawdust base may serve as a valuable ration constituent for ruminant animals.

B-363 Tinsley, J. and J.Z. Nowakowski. 1959. The composition and manurial value of poultry excreta, straw-droppings composts and deep litter. I. Introduction; Experimental materials, methods of sampling and analysis. J. Sci. Food Agr., 10: 145-150. 17 ref. 1 tab.
"In order to study changes in the composition, particularly the transformation of nitrogen compounds in composts and deep litter, reliable procedures were

devised for the determination of total nitrogen, uric acid nitrogen and forms of nitrogen soluble in 0.1 N H_2SO_4 in fresh sub-samples. The experimental errors have been estimated for each stage of the nitrogen determinations."

B-364 Tinsley, J. and J.Z. Nowakowski. 1959. The composition and manurial value of poultry excreta, straw-droppings composts and deep litter. II. Experimental studies on composts. J. Sci. Food Agr., 10: 150-167. 20 ref. 8 tab. 1 fig.

"An experimental study was made of the changes in composition and losses of organic matter and nitrogen (especially that soluble in cold 0.1 N H_2SO_4) occurring in composts prepared from cereal straw mixed with fresh poultry droppings in various proportions and stored for up to 3 years. A comparison was also made of composts prepared with droppings and with ammonium sulphate plus calcium carbonate, each at two levels of total nitrogen. Tests were made on composts prepared on a small scale kept under cover in brick cells and in large heaps. Loss of organic matter and changes in nitrogen components could be followed indirectly from the ratios of ash to loss on ignition and of ash or P or K content to nitrogen content. There was accumulation of NO_3^--N up to about 1% of the dry matter in composts stored for 2 - 3 years, the composition of the compost then being fairly stable and differing little whether a high or low proportion of droppings was used initially. The optimum ratio of straw to droppings was 1:1.5 by weight. Composts made with ammonium sulphate and calcium carbonate in place of droppings had lower N, P and K contents."

B-365 Tinsley, J. and J.Z. Nowakowski. 1959. The composition and manurial value of poultry excreta, straw-droppings composts and deep litter. III. Experimental studies on deep litter. J. Sci. Food Agr., 10: 224-232. 9 ref. 5 tab. 3 fig.

"Using the methods described in Part I, an experimental study was made of the changes in composition and of the losses of organic matter and nitrogen from deep litter in a manner similar to the study made on composts and described in Part II. Over a period of 11 months, losses of organic matter and of nitrogen by decomposition were approx. 50 and 40%, respectively. Results indicated that deep litter should be moistened before storage to prevent escape of ammonia and encourage formation of nitrate. Indirect calculations of the losses of organic matter and nitrogen throughout the experimental period were made from the changes in the ratios of each to the ash, the phosphorus and the potassium contents, assuming that these three components of the straw and droppings accumulated in the litter without loss."

B-366 Tinsley, J. and J.Z. Nowakowski. 1959. The composition and manurial value of poultry excreta, straw-droppings composts and deep litter. IV. Results of manurial trials, and general conclusions. J. Sci. Food Agr., 10: 232-241. 17 ref. 5 tab.

"Results of previous manurial trials with poultry droppings and bulky organic manures are reviewed in relation to experiments designed to compare the manurial values of fresh droppings, composts prepared from straw and droppings, and of deep litter, with ammonium sulphate as a standard nitrogen fertiliser. A pot trial with spinach beet and two field trials with potatoes were conducted using adequate basal quantities of phosphate and potassium in order to test the availability of the nitrogen in the organic manures... Deep litter has several advantages over composts: thus it affords a more economical means of absorbing droppings, it is more concentrated in organic matter and it requires only half the weight to provide the same quantity of dry matter. Under moist soil conditions, half the total nitrogen in fresh droppings and deep litter may be equivalent to ammonium sulphate, but the proportion in composts depends on the initial composition and state of maturity of the compost. Suggestions are made for further work, particularly with large heaps stored under cover for one to three years."

B-367 Cornfield, A.H. 1960. Studies on straw and composts. I. Characterising straw, composts and bulky organic manures by optical extinction of alkaline extracts and cation-exchange capacity measurements. J. Sci. Food Agr., 11: 125-128. 10 ref. 1 tab. 2 fig.
"Both optical extinction of extracts made with 0.05 N NaOH (containing 0.5% of 'Calgon') and cation-exchange capacity measurements are suitable for characterising straw, compost prepared in various ways, farmyard manure and peat. Straw had the lowest and peat the highest optical extinction value and cation-exchange capacity, whilst the other materials had intermediate values depending on their method of preparation, composition or time of rotting. The high correlation between the two measurements for all the materials studied indicates a difference in the number but only a small difference in the nature of the chemical groups with exchange properties."

B-368 Williams, R.J.B., A. Stojkovska, G.W. Cooke and F.V. Widdowson. 1960. Effects of fertilisers and farmyard manure on the copper, manganese, molybdenum and zinc removed by arable crops at Rothamsted. J. Sci. Food Agr., 11: 570-575. 10 ref. 6 tab.
"The Cu, Mn, Mo and Zn contents of five different crops grown in an experiment testing farmyard manure (F.Y.M.) and N, P and K fertilisers were measured. Fertilisers and F.Y.M. had similar and rather small effects on the percentages of micronutrients in the crops; the total amounts of micronutrients removed were related mainly to the yields. Clover and kale removed much more molybdenum than did the other crops; clover had a high requirement for all the micronutrients examined. The fertilisers used supplied only insignificant amounts of micronutrients, whereas the 15 tons/acre of F.Y.M. supplied as much Cu, Mn and Mo as the five crops together removed and nearly as much Zn. The soil used contains enough of these micronutrients for very many rotations of arable crops provided the total quantities present become available. Although the F.Y.M. dressing used supplied more of each of the micronutrients than was needed by any of the crops grown, its effect on crop growth was due to the N, P and K supplied and to improved physical conditions in the soil."

B-369 Boyd, D.A. 1961. Fertiliser responses of maincrop potatoes: a re-examination of the experimental evidence. J. Sci. Food Agr., 12: 493-502. 21 ref. 5 tab. 2 fig.
Review of recent manurial experiments on maincrop potatoes to assess changes in the level of response to fertilizers in the past 20 years, and to determine the nature of the interactions between nutrients and their influence on the form of the fertilizer response curve and optimal fertilizer dressings. In over 100 experiments conducted since 1940, average responses to N (0.8 cwt), P_2O_5 (1.0 cwt) and K (1.5 cwt) were 1.8, 1.4 and 2.0 tons per acre, respectively. On average, 10 tons of FYM provided the equivalent of 0.3 cwt N, 0.4 cwt P_2O_5 and 0.75 cwt K_2O to the potato crop to which it was applied.

B-370 Floate, M.J.S. and C.J.W. Torrance. 1970. Decomposition of the organic materials from hill soils and pastures. I. Incubation method for studying the mineralisation of carbon, nitrogen and phosphorus. J. Sci. Food Agr., 21: 116-120. 17 ref. 6 tab.

"Plant materials and sheep faeces from 2 hill sites were used to develop a method suitable for measuring the production of CO_2 and mineral N and P during incubation with aqueous soil extract..."

B-371 Clarke, E.G.C. and D.J. Humphreys. 1970. Toxic factors in pea haulm silage effluent: the factor affecting germination and growth in plants. J. Sci. Food Agr., 21: 225-227. 4 ref. 2 tab.

The effluent of pea haulm silage at a farm in East Anglia was reported to kill vegetation when poured over grassland, to stunt the subsequent wheat crop when applied to plowed land and to kill fish when allowed to run into streams. This paper reports experiments conducted to isolate and identify the factors affecting germination and growth in plants. The toxic factor responsible appeared to be a mixture of volatile fatty acids, including acetic, propionic, butyric, valeric and caproic.

B-372 Laura, R.D. and M.A. Idnani. 1971. Increased production of biogas from cowdung by adding other agricultural waste materials. J. Sci. Food Agr., 22: 164-167. 8 ref. 4 tab. 3 fig.

"It was found that the addition of nitrogenous materials, such as casein, urea or urine, increased the extent of decomposition of cowdung, resulting in higher gas production. The effect appears to be due to the maintenance of pH>7 during fermentation. With the addition of urea or $CaCO_3$, materials such as dry leaves and cane sugar have yielded high proportions of methane in the gas mixtures and these additions also increased the rate of gas production by promoting anaerobic conditions in the medium. Addition of cellulose also increased the rate but the gas mixture obtained had a lower methane content."

B-373 Clarke, E.G.C. and D.J. Humphreys. 1971. Toxic factors in pea haulm silage effluent: the factors toxic to fish. J. Sci. Food Agr., 22: 205-207. 4 ref. 1 tab.

"The liquor expressed from decomposing pea haulm has been shown to contain volatile fatty acids, volatile sulphides, ortho-, meta- and para-cresol, and phenol. These have been found to be responsible for the toxicity of this material to fish. The greatest contribution to the toxicity is made by the fatty acids, followed in decreasing order by the volatile sulphides, and the phenolic substances."

B-374 Rhodes, D.N. 1971. Flavour of beed fed on dried poultry waste. J. Sci. Food Agr., 22: 436. 1 ref. 1 tab.

"In direct comparisons of beef roasts from steers fed on rations containing 25% dried poultry waste and from control animals, taste panels were unable to distinguish between the two meats on the basis of odour or flavour."

B-375 Mugera, G.M. 1967. Respiratory diseases of poultry and their control. E. Afr. Agr. Forestry J., 33: 145-158. 41 ref.

Discussion on the symptoms, effects, pathogenicity, transmission, carriers and vectors, and prevention of Newcastle disease, infectious coryza, infectious bronchitis, chronic respiratory disease, and aspergillosis. Specific references were made to the transmission of these diseases by excreta, litter, and dust, and to the importance of good manure management and sanitation in their control and prevention.

B-376 Stephens, D. 1969. The effects of fertilizers, manure and trace elements in continuous cropping rotations in southern and western Uganda. E. Afr. Agr. Forestry J., 34: 401-417. 43 ref. 5 tab.
Fertilizer trials in Uganda have indicated that the main benefit conferred to crops by FYM is the supply of ample K; a lesser benefit is probably the supply of P. An unexplained residue of benefit probably remains which may be due to the supply or rendering available of small amounts of a range of nutrients which collectively add up to an appreciable effect, hormones or antibiotics in the manure, or changes in the population of soil microorganisms. Evidence was presented to suggest that manure exerts an effect different from that of fertilizers.

B-377 Gathecha, T.W. 1970. The maintenance and improvement of soil fertility under arable crops and grass leys in the 1st and 2nd rotation cycles of a fertilizer trial at Embu. E. Afr. Agr. Forestry J., 35: 246-253. 11 ref. 5 tab.
Field trials conducted in Kenya have shown that phosphorus is the most important crop nutrient that is commonly deficient in Embu soils. FYM generally increased crop yields; annual application at a rate of 5 or 6 tons per hectare gave better yields than heavy doses of 20 to 30 tons applied at intervals of 4 or 5 years.

B-378 McCulloch, B. and S. Kasimbala. 1970. The pathogenic importance of gastro-intestinal nematodes for sheep and goats in relation to the need for the economic development of the livestock industry of Sukumaland, Tanzania. E. Afr. Agr. Forestry J., 36: 20-34. 17 ref. 4 tab. 9 fig.
"The distribution of gastro-intestinal nematodes in 321 haired sheep and 160 goats were studied at Mwanza and Shinyanga in Sukumaland, Tanzania. The work was carried out over a one-year period. The incidences of H. contortus, T. colubriformis, Oe. columbianum, B. Trigonocephalum and Cooperia spp. were recorded separately and, as "composite strongyloid worm units". Occurrences of T. ovis and S. papillosus were disregarded. Female sheep carried smaller "unit" burdens and excreted less eggs than male sheep. No sex differences were observed in goat host resistance to worms. In sheep and goats worm loads were generally light under semi-arid and arid conditions. By and large, and in both host species, significant regressions were established between the geometric progressions of the strongyloid faecal egg counts and those of worm burden..."

B-379 Anderson, M.S. 1962. Development and use of composts in the United States. Advancing Frontiers Plant Sci., 1: 1-6. 5 ref. 1 tab. 4 fig.
Composts used in the United States were considered in three groups: (1) composts used for growing mushrooms and spent mushroom compost for soil improvement; (2) garbage composts; and (3) farm manure composts. The NPK and total mineral contents of various composts were given in tabular form. Composts prepared without additives rarely contain more than 5% of primary plant nutrients, thereby limiting their use in place of commercial mixed fertilizers. Composts are used generally as mulch materials and as soil amendments.

B-380 Novák, B. and F. Löbl. 1966. The complex effect of manures and fertilizers on the yields of crops. Advancing Frontiers Plant Sci., 14: 161-169. 16 ref. 1 tab. 2 fig.
"The effect of different kinds of organic manures and of increasing doses of

mineral fertilizers applicated individually and mutually were investigated in different soils and climate conditions in Czechoslovakia... Organic manures are firstly a rich source of mineral nutrients to plants and secondly they are a source of organic matter to soil. The effect of mineral nutrients is more pronounced in the anaerobically stored stable manure than it is in the semi-aerobically ripened compost. In such cases, where the plant nutrition is dependent on the nutrients of organic manure, the yields of crops are greater after the manuring with the anaerobically stored manure than they are with the compost. The more humified organic matter in compost acts better in improving the physical and biological properties of soil than the biochemically unstabile organic matter of the stable manure. In the conditions of good plant nutrition from other sources than from the organic manures, the yields of crops are higher after the manuring with compost than with stable manure."

B-381 Balla, H. 1966. Yield, nutrient content and nutrient utilization as affected by farmyard manure and mineral fertilizers in the Hungarian People's Republic. Advancing Frontiers Plant Sci., 15: 1-15. 10 ref. 6 tab.

"On a soil of neutral reaction developed on loess of a 3 per cent humus content with a 40 to 60 cm humus horizon the effect of farmyard manure and mineral fertilizers applied with equal nutrient content has been examined for 8 years. For the test crops - maize, wheat, Sudan grass - farmyard manure did not prove to be indispensable and mineral fertilizers even gave higher yields and had a more favourable influence on the crop quality than farmyard manure. This experience makes it possible to utilize farmyard manure in the vicinity of the stockyard while using on more distant plots where a high transport cost would arise, only mineral fertilizers."

B-382 Herriott, J.B.D. and D.A. Wells. 1962. Gülle as a grassland fertilizer. British Grassland Soc. J., 17: 167-170. 10 ref. 2 tab.

"An estimate was made of the fertilizer value of gülle for grassland under conditions in the East of Scotland. Organic nitrogen from liquid manure had an efficiency in herbage production about half that of inorganic nitrogen. The liquid manure was a rich source of potassium. Generally, nitrogen response in this trial was low owing to the strong growth of clovers."

B-383 Purves, D. and P. McDonald. 1963. The potential value of silage effluent as a fertilizer. British Grassland Soc. J., 18: 220-222. 6 ref. 1 tab.

"Results of the analysis for dry-matter, nitrogen and major base content of 9 silage effluents obtained from farm silos and 3 effluents from experimental tower silos are presented. The mean values obtained for the principal plant nutrients in the 12 effluents examined were 0.19% N, 0.037% P and 0.38% K. The results indicate that effluents may be a useful source of plant nutrients, particularly when undiluted with rainwater, and that, in general, silage effluents appear to be superior to liquid manure in manurial value."

B-384 Herriott, J.B.D., D.A. Wells and P. Crooks. 1963. Gülle as a grassland fertilizer (Part II). British Grassland Soc. J., 18: 339-344. 8 ref. 9 tab.

"A further report is made of work on the fertilizer value of gülle for grassland. Organic N had an efficiency in grass production about 84% of that of inorganic N. The gülle used in this trial was particularly rich in available N and K. The abundance of K in gülle may require balancing with supplementary N in order to achieve efficient utilization of plant nutrients. Potassium/

magnesium relationships in the nutrition of the grass plant are discussed."

B-385 Herriott, J.B.D., D.A. Wells and P. Crooks. 1965. Gülle as a grassland fertilizer (Part III). British Grassland Soc. J., 20: 129-138. 7 ref. 9 tab. 2 fig.
"Results from current trials indicate that soil type, time of application and weather influence responses to applications of gülle. Over 3 sites gülle N had an efficiency of about 60% of that of fertilizer N. Best results were obtained from heavy clay soils or those containing much organic matter. Winter applications of dilute gülle to light soils under wet conditions may result in large losses of N through leaching. Generally, winter gülle applications may lead to severe losses of plants in short-term ryegrasses with associated heavy uptakes of K in spring. It is concluded that much of the gülle produced should be broadcast in winter on to swards destined for mowing in early summer. Optimum utilization of gülle calls for supplementation with fertilizer N, when the full potential of the K derived from the sludge can be exploited."

B-386 Herriott, J.B.D., D.A. Wells and P. Crooks. 1966. Gülle as a grassland fertilizer (Part IV). British Grassland Soc. J., 21: 85-92. 6 ref. 9 tab.
"Further investigation into the value of gülle as a fertilizer for grassland indicated that weather affects responses. Dry weather permits good recovery of gülle N. On the other hand, on dry soil, losses of gülle N by volatilization may be increased if the quantity of sludge applied is insufficient to penetrate the soil. Cow-and-pig gülle may be more efficient than the pure-cow type as a fertilizer, the former being well balanced in N and K, whereas cow gülle requires N supplementation."

B-387 Williams, I.G., C.J. Mee and E.L. Jones. 1970. A method for distributing slurry on small experimental plots. British Grassland Soc. J., 25: 72.
Report on development of a man-drawn slurry spreader for use on small experimental plots. A fairly even distribution of slurry can be applied if certain precautions are taken. Using the machine, it is possible to apply 4.25 tons/acre on a one-third acre plot in about 6 hours.

B-388 MacDiarmid, B.N. and B.R. Watkin. 1971. The cattle dung patch. I. Effect of dung patches on yield and botanical composition of surrounding and underlying pasture. British Grassland Soc. J., 26: 239-245. 8 ref. 2 tab. 5 fig.
Report on research to examine various ecological aspects of dung patches on a dairy pasture. The effect of the dung patch on the yield and botanical composition of the surrounding and underlying sward under several defoliation regimes was reported. Future papers will describe the effect of the dung patch on soil nutrient levels, and the distribution and persistency of dung patches in the pasture and the possible effect on pasture utilization.

B-389 Millar, E.S. 1965. Bacillus thuringiensis in the control of flies breeding in the droppings of caged hens. N.Z. J. Agr. Res., 8: 721-722. 3 ref. 1 fig.
"Bacillus thuringiensis was examined as a means of controlling the breeding of house-flies (Musca domestica) in hen droppings. Results suggested that the bacterium was more effective when applied to the droppings than when administered in the food."

B-390 Weeda, W.C. 1967. The effect of cattle dung patches on pasture growth, botanical composition, and pasture utilisation. N.Z. J. Agr. Res., 10: 150-159. 14 ref. 7 tab.
"The effect of cattle dung patches on pasture growth, botanical composition, and pasture utilisation was studied over a period of five years. The rate of disappearance of the dung varied with the seasons. The bulk of the dung disappeared in one-two months in autumn and four-six months in late spring and summer, although extremes ranged from half a month to 17 months. The effect of dung patches on pasture growth was generally fairly small. White clover was more prevalent on dung patches than in the remainder of the trial area and often remained so for one to one-and-a-half years. Grazing was most uneven in spring, when herbage around dung patches was left 2-3 in. higher than unaffected pasture. Chain-harrowing after each grazing depressed pasture growth but improved pasture utilisation in spring by grazing steers."

B-391 Roy, S.C. and F.J. Newhook. 1970. The influence of cattle excreta on sporulation of _Phytophthora cinnamomi_ Rands. N.Z. J. Agr. Res., 13: 308-314. 6 ref. 2 tab. 1 fig.
"The number of sporangia on mycelial mats of _Phytophthora cinnamomi_ Rands floated in non-sterile extracts of Auckland soils was increased more than twofold by first amending the soils with aqueous extracts of freshly collected cow's dung or urine 1 week previously. Autoclaving the extracts or passing them through a 100 mμ millipore filter removed the enhancement factor which appears to be ineffectual unless sporangial initiation factors are already present, as in non-sterile soil extract. The enhancement factor from a dung extract which had been passed through a 0.45 μ filter remained effective in resuspended residue from a 100 mμ filter. The factor may have been associated with some of the gut flora which remained in the residue. The enhancement factor is present in naturally amended farmyard soil. It reached comparable levels within 2 weeks in soils below a surface layer of added excreta in an ungrazed area of grassland and was maintained by a further addition of excreta at the end of the second week. In the absence of continual replenishment of cattle excreta the enhancement factor disappeared from naturally amended soil in 1 week. It seems likely that cattle excreta could directly aggravate mortality of conifers in farm shelterbelts by increasing the number of zoospores of _P. cinnamomi_ available for infection of the roots of host plants."

B-392 Martin, J.K. and L.F. Molloy. 1971. A comparison of the organic phosphorus compounds extracted from soil, sheep faeces, and plant material collected at a common site. N.Z. J. Agr. Res., 14: 329-333. 5 ref. 2 tab.
"Organic phosphorus in samples of topsoil, herbage, roots, and sheep faeces, collected from a grazed pasture, was extracted with dilute acid, then alkali, and the combined extracts fractionated by anion-exchange resin chromatography. The herbage, roots, and faeces contained organic phosphorus components having properties similar to the soil organic phosphorus fraction associated with humic acids and to an uncharacterised component previously observed in some soils. All samples contained material with properties corresponding to inositol phosphates. Myo-inositol was identified after dephosphorylation of the inositol hexaphosphate fraction isolated from sheep faeces..."

B-393 Klipple, G.E. and J.L. Retzer. 1959. Response of native vegetation of the Central Great Plains to applications of corral manure and commercial

fertilizer. J. Range Manage., 12: 239-243. 3 ref. 4 tab. 1 fig.
"Manure and several commercial fertilizer treatments were applied to a good stand of native short-grass vegetation on the Central Plains Experimental Range in northeastern Colorado during 1951, 1952 and 1953... Manuring was the most effective treatment. It increased herbage yields 15 to 50 percent. Yields from plots treated with commercial fertilizers seldom exceeded those from the untreated native range. Commercial nitrogen applied in 1953 had little, if any, effect upon the protein content of blue grama herbage produced in 1956. Manure and phosphorus treatments improved the protein content of blue grama herbage. Manure and nitrogen reduced the phosphorus content, but phosphorus fertilization gave little increase in the phosphorus content of the herbage."

B-394 Smoliak, S. 1965. Effects of manure, straw and inorganic fertilizers on Northern Great Plains ranges. J. Range Manage., 18: 11-15. 14 ref. 2 tab. 1 fig.
Forage production was significantly increased up to 8 years after fertilization with manure, straw and straw-plus-fertilizer. Forage on treated plots generally contained greater amounts of nutrients than forage on control plots. Different pasture species responded differently to the various treatments. Response from applications of FYM was due to the nutrients and to the mulch supplied by the manure. It was concluded that fertilization can be used as a range management technique to increase livestock production through increased forage yields, increased nutritional qualities of the forage, and favourable induced changes in the botanical composition of the sward.

B-395 McKell, C.M., V.W. Brown, R.H. Adolph and C. Duncan. 1970. Fertilization of annual rangeland with chicken manure. J. Range Manage., 23: 336-340. 4 ref. 6 tab. 2 fig.
"Changing patterns of land use caused by urban expansion may bring poultry operators into foothill areas and thus provide a cheap source of plant nutrients for rangeland fertilization. Research results with chicken manure applied to annual range indicate that application may be made in any season, with forage responses lasting into the third year after application. Forage quality and palatability are increased but the initial abundance of legumes is decreased by increased rates of chicken manure. Additional first year feed obtained from fertilization can be obtained for a cost of between $1.56 and $2.18 per AUM."

B-396 Owensby, C.E. and J.L. Launchbaugh. 1971. Acidifying nitrogen compounds and range fertilization. J. Range Manage., 24: 203-206. 16 ref. 3 tab.
The acidifying effects of some nitrogen fertilizers limits their application to sites which inherently contain high amounts of calcium carbonate in the upper soil profile. Animal manures were considered as a source of nitrogen, but it was suggested that high salt concentrations and ammonia nitrogen (acidifying agent) limits their usefulness as a range fertilizer. Feedlot wastes could also introduce detrimental weed seeds.

B-397 Månsson, I. and B. Olsson. 1961. The intestinal flora of pigs. I. Quantitative studies of coliforms, enterococci, and clostridia in the faeces of pigs self-fed a high-protein and high-calcium diet. Acta Agr. Scand., 11: 197-210. 20 ref. 4 tab.
Report on studies. No changes in the numbers of coliforms and enterococci or

the pH values could be seen in the feces as a result of feeding the two diets. Clostridia never exceeded 1,000 per gm moist feces in the control group, but reached counts as high as 10^6/gm moist feces in the experimental groups.

B-398 Månsson, I. and B. Olsson. 1961. The intestinal flora of pigs. II. Further quantitative studies of coliforms, enterococci, and clostridia in the faeces of pigs self-fed a high-protein and high-calcium diet. Acta Agr. Scand., 11: 257-264. 4 ref. 3 tab. 1 fig.
Report on studies. The counts of Cl. perfringens and of coliforms were significantly higher in the feces of pigs of the experimental group as compared to the control group. There were no significant differences in the enterococci counts or pH values for the control and experimental groups.

B-399 Månsson, I. and B. Olsson. 1961. The intestinal flora of pigs. III. The effect of dietary zinc on the number of coliforms, enterococci, and clostridia in the faeces of pigs self-fed a high-protein and high-calcium diet. Acta Agr. Scand., 11: 265-269. 7 ref. 3 tab. 1 fig.
Report on studies. The number of clostridia and coliforms was increased by the high-protein high-calcium diet regardless of whether or not zinc was added to the ration. Addition of zinc did not affect the number of coliforms, enterococci, or clostridia, but did increase liveweight gains and decrease the incidence of parakeratosis.

B-400 Månsson, I. and B. Olsson. 1962. The intestinal flora of pigs. IV. The effect of dietary citric acid on the number of coliforms, enterococci, and clostridia in the faeces of pigs self-fed a high-protein and high-calcium diet. Acta Agr. Scand., 12: 3-8. 4 ref. 3 tab. 1 fig.
Report on studies. Coliform counts were unaffected but enterococci counts, clostridia counts and fecal pH values were depressed by the addition of citric acid to the diet. The effect of dietary citric acid upon the intestinal flora is a reduction of that part of the flora which is extremely numerous in parakeratosis.

B-401 Månsson, I. and B. Olsson. 1962. The intestinal flora of pigs. V. Quantitative studies of coliforms, enterococci, and clostridia in the faeces of pigs self-fed a high vegetable protein diet and determination of histamine and histaminase in the blood. Acta Agr. Scand., 12: 335-343. 14 ref. 5 tab.
Report on studies. The diet with soybean meal caused an alteration of the intestinal flora much the same as the fish meal diet. The number of Cl. perfringens and enterococci were smaller when vegetable protein was used in the diet as compared to animal protein.

B-402 Månsson, I. and B. Olsson. 1962. The intestinal flora of pigs. VI. Quantitative studies of coliforms, enterococci, and clostridia in the faeces of pigs fed a high animal protein and calcium diet and determination of histamine and histaminase activity in the blood. Acta. Agr. Scand., 12: 344-354. 9 ref. 4 tab.
Report on studies. The effects of moisture content of the diet on the intestinal flora were noted.

B-403 Månsson, I. 1963. The intestinal flora of pigs. VII. Urinary histamine levels and coliforms, enterococci, and clostridia in the faeces

of pigs fed a high protein diet. Acta Agr. Scand., 13: 239-248. 8 ref. 3 tab.
Report on studies. The fecal flora were analyzed and the levels of histamine in the urine were noted.

B-404 Bromfield, S.M. 1961. Sheep faeces in relation to the phosphorus cycle under pastures. Australian J. Agr. Res., 12: 111-123. 30 ref. 3 tab. 4 fig.
"Faeces from sheep grazing natural Danthonia pastures and improved subterranean clover pastures have been analysed for total phosphorus and inorganic phosphate over a period of 2 years. Both total and inorganic phosphorus contents (milligrams P per gram) varied widely with type of pasture and with season. The variation in organic phosphorus content (by difference) remained, relative to total phosphorus, fairly constant throughout. Total phosphorus content varied from 1.8 to 17 mg P/g whilst organic phosphorus varied from 1.5 to 4.0 mg P/g. Sheep grazing the improved pastures voided approximately 2.5 - 3 lb P as inorganic phosphate and 0.5 - 0.75 lb P as organic phosphorus per sheep per year. The organic phosphate was readily soluble in acid but not in water and was readily available to wheat grown in pot culture. The organic phosphorus was not readily available to plants and was not rapidly mineralized to inorganic phosphate..."

B-405 Barrow, N.J. 1961. Mineralization of nitrogen and sulphur from sheep faeces. Australian J. Agr. Res., 12: 644-650. 9 ref. 4 fig.
"Samples of sheep faeces were mixed with soil and incubated in conditions similar to those in a previous investigation with plant material. Mineralization of nitrogen and sulphur from faeces is compared with that from plant material. The amount of nitrogen mineralized from faeces was closely related to the total nitrogen content of the faeces, but faeces were more resistant to decomposition than was plant material and a smaller proportion of the nitrogen was mineralized. Similarly the amount of sulphur mineralized was closely related to the sulphur content of the faeces and the proportion of the sulphur mineralized was less than with plant material. However, the nitrogen and sulphur present in faeces was only a proportion of the nitrogen and sulphur in the feed since much nitrogen and sulphur were excreted in the urine. It is pointed out that where plant material is eaten by an animal and both the urine and the faeces are allowed to return to the soil, the proportion of the nitrogen and sulphur mineralized will be greater than if the plant material were returned directly to the soil."

B-406 Durie, P.H. 1961. Parasitic gastro-enteritis of cattle: the distribution and survival of infective strongyle larvae on pasture. Australian J. Agr. Res., 12: 1200-1211. 19 ref. 2 tab. 3 fig.
"Observations are reported on the behaviour and longevity of infective cattle strongyle larvae in faecal pats and on pasture in south-eastern Queensland. Environmental conditions within the pat were favourable for the development of infective larvae at all seasons of the year except midsummer and midwinter. Larvae were distributed for the most part either in the pat or on pasture vegetation. Larvae migrated laterally from the pat for distances up to at least 3 ft, but usually not more than 1 ft, and these movements occurred only after suitable rain. At no time was a single mass movement of all larvae in the pat observed. If rainfall was continuous, migration was continuous, and when rainfall was alternated with periods of dryness, migration occurred in waves. Pats exposed in the summer remained a source of larvae for 5 months.

This period was extended to 7 - 8 months with pats exposed in the winter. Larvae survived on pasture for up to 6 and 8 weeks respectively for these seasons of the year. Vertical migration on pasture was also observed."

B-407 Barrow, N.J. and L.J. Lambourne. 1962. Partition of excreted nitrogen, sulphur, and phosphorus between the faeces and urine of sheep being fed pasture. Australian J. Agr. Res., 13: 461-471. 23 ref. 5 fig.
"Merino wethers in metabolism cages were fed a range of pasture samples at a level sufficient to maintain body weight nearly constant. The quantities of food eaten and of faeces and urine produced were recorded. The nitrogen, sulphur, and phosphorus contents of the feed and of the faeces and urine were determined. The phosphorus content of the faeces was further fractionated into organic and inorganic forms..."

B-408 Ashton, G.C. 1963. Weight gain and faecal nitrogen excretion in grazing British and Zebu crossbred steers. Australian J. Agr. Res., 14: 898-908. 11 ref. 4 tab. 2 fig.
"The excretion of faecal nitrogen by 16 grazing steers, eight Hereford x Shorthorn and eight Zebu crossbreds, was determined at intervals over a period of 11 months. It was found that the non-dialysable faecal nitrogen fraction was the one most strongly correlated with gain. Statistically this fraction accounted for 68% of the variation in average gain of the two breed groups between measurement intervals, and for 75% of the variation in weight gain between individual steers during the summer gain period. The data gave no indication of inherent breed differences in intake, as judged by non-dialysable nitrogen excretion."

B-409 Vercoe, J.E. 1967. Breed and nutritional effects on the composition of faeces, urine, and plasma from Hereford and Brahman x Hereford steers fed on high and low quality diets. Australian J. Agr. Res., 18: 1003-1013. 16 ref. 5 tab. 1 fig.
A comparison is presented of the composition of the faeces, urine, and plasma when Hereford and Brahman x Hereford steers were fed two different quality diets at three levels of intake. On a high quality diet (lucerne hay), the Brahman x Hereford steers produced significantly less faecal dry matter, total nitrogen and non-dialysable nitrogen than the Hereford steers, but there were no significant differences between the breeds or between animals within a breed in total urinary nitrogen or any of its major constituents. On a low quality diet (blue grass-spear grass hay) the two breeds were not significantly different in faecal dry matter, total nitrogen, or non-dialysable nitrogen. The Brahman x Hereford steers excreted more total nitrogen, urea, and creatinine in their urine, part of which could be attributed to a higher liveweight; and they had significantly lower nitrogen balances..."

B-410 Beal, A.M. and O.E. Budtz-Olsen. 1968. A potassium and sodium balance study in two breeds of sheep. Australian J. Agr. Res., 19: 113-117. 15 ref. 3 tab.
"A balance experiment measuring potassium and sodium intake and excretion was carried out on Romney Marsh and Merino sheep. For either potassium or sodium the correlation between total intake and total excretion was high and no difference was found between the two breeds in the relative importance of the urinary and faecal routes of excretion. A mean value of 11% of the total potassium excretion and 12% of the total sodium excretion appeared in the faeces, with the respective remainders, 89 and 88%, being voided in the urine.

The relative importance of cutaneous losses of the two cations in suint is discussed briefly. Neither total intake of potassium nor gain or loss in weight by the sheep could be shown to influence the relative importance of the two routes of potassium excretion investigated in this work. This was also true of sodium."

B-411 Till, A.R. and P.F. May. 1971. Nutrient cycling in grazed pastures. IV. The fate of sulphur-35 following its application to a small area in a grazed pasture. Australian J. Agr. Res., 22: 391-400. 8 ref. 3 tab. 4 fig.
"Simultaneous measurements of sulphur content and specific radioactivity were made on soil fractions, two pasture species, and the fleece of grazing animals following the application of high specific radioactivity gypsum labelled with sulphur-35 (^{35}S) to small randomly located sites in grazed pastures... Positive evidence of recycling of sulphur voided by the animals on the unlabelled areas of the pasture was found, and the rate of translocation of sulphur from the sites of its application to the remainder of the paddock was measured at two rates of stocking."

B-412 Bird, P.R. and I.D. Hume. 1971. Sulphur metabolism and excretion studies in ruminants. IV. Cystine and sulphur from the rumen and upon sulphur excretion by sheep. Australian J. Agr. Res., 22: 443-452. 53 ref. 5 tab.
"In a 4 x 4 Latin square design experiment, sheep were fed on a basal ration which supplied 0.61 g sulphur per day, or the basal ration supplemented with 1.4 g inorganic sulphate sulphur, or 1.4 g cystine sulphur, or 1.4 g sulphate sulphur plus 1.4 g cystine sulphur per day... The influence of the amount and the form of the dietary sulphur on the excretion of faecal and urinary sulphur fractions is discussed."

B-413 Brady, J. 1970. The mites of poultry litter. J. Appl. Ecol., 7: 331-348. 34 ref. 5 tab. 6 fig.
Arthropods were extracted from 215 samples of poultry deep-litter and droppings collected from 50 farms in England and Wales. About 14 species of insects were found and 67 species of non-parasitic mites. The mites were classified into two ecological groups, the dung inhabiting species and the stored cereal pests. Monthly litter samples were collected from two farms for 14 months and their mite populations were extracted quantitatively. Peak densities coincided with high summer temperatures, rather than with any particular age or conditions of the litter.

B-414 Wahhab, A. and R. Ahmad. 1960. Manuring of cotton in West Pakistan. III. Effect of rate and kind of manuring and date of sowing on the yield of seed cotton. Empire J. Exp. Agr., 28: 65-73. 6 ref. 5 tab.
"Experiments to study the effect of dates of sowing and manuring were conducted over a period of four years at five stations representing various varietal zones. There were two dates of sowing at each station, one normal and the other 1 month later. There were three levels of manuring, 0, 50, and 75 lb. N per acre, applied as ammonium sulphate, as farmyard manure, and as a combination of the two with an equal amount of nitrogen supplied by each. The earlier sowing gave better yields than late sowing at all stations except Wazirkot where the reverse obtained. Ammonium sulphate was a more effective source of nitrogen than farmyard manure for the earlier-sown cotton, and there were indications that worth-while responses might be obtained with dressings in

excess of 75 lb. N per acre. On the lower-yielding late-sown cotton, however, farmyard manure alone, or in combination with ammonium sulphate, gave better responses than the latter alone. The yields were very markedly affected by weather conditions."

B-415 Wahhab, A. and R. Ahmad. 1960. Manuring of cotton in West Pakistan. IV. Effect of the source of nitrogen on the yield of seed cotton. Empire J. Exp. Agr., 28: 145-150. 20 ref. 4 tab.
Report on an investigation to study the relative efficiency of various organic (FYM, cotton seed cake, bonemeal) and inorganic (ammonium sulfate, ammonium nitrate, urea) sources of nitrogen with respect to their effect on the yield of seed cotton. Ammonium nitrate and FYM gave similar yield responses, but the profit from using ammonium nitrate was greater. FYM was better than either cotton seed cake or bonemeal. Urea was considered the most economical source of fertilizer nitrogen on the basis of U.S. fertilizer prices.

B-416 Jameson, J.D. and R.K. Kerkham. 1960. The maintenance of soil fertility in Uganda. I. Soil fertility experiment at Serere. Empire J. Exp. Agr., 28: 179-192. 19 ref. 7 tab.
"A comprehensive rotation experiment of phasic design has completed three cycles of a five-year rotation, making fifteen years in all. The main effects studied comprise crop-rest sequence, type of resting cover, and farmyard manure. Fertilizers are not included. The trend shown by the sum of all crops in the rotation is used as an index of the trend of soil fertility. In the absence of manure the land could not be cropped safely for more than three years in five. Given 5 tons of farmyard manure per acre every fifth year it was possible to crop four years in five, and the results suggest that with slightly more manure continuous cropping may be possible... Response to farmyard manure is the dominant feature of the experiment, and residual effects can be traced through to the fifth year after application. The bearing of these results on the local farming system is considered."

B-417 Gokhale, N.G. 1960. Estimating the probable change in yield with time, on altering the level of manuring of tea. Empire J. Exp. Agr., 28: 315-326. 3 ref. 5 tab. 2 fig.
"The manner in which yields change in the years immediately following an alteration in the level of manuring of unshaded mature tea grown in north-east India has been investigated. Explaining the theoretical basis on which the equation is derived, the author now proposes the general equation $y = A(I - e^{-zt-ut^2})$, which is applicable to all types of manures and fertilizers, to estimate the probable change in yield with time when the level of manuring is either increased or decreased in and from a given year... The shape of the yield/time curves are entirely different for cattle manure and for inorganic fertilizer treatments. The physical meaning of the constants is explained and it is shown that the values of the constants are such that an 'S' type of curve is possible only with cattle manure (which has low availability but a high residual effect) treatment, whereas inorganic fertilizers (which have high availability but low or negligible residual effect) give curves of the 'constantly falling' type. The method of obtaining the 'least square' solution is described in an Appendix."

B-418 Jones, P.A., J.B.D. Robinson and J.A.N. Wallis. 1960. Fertilizers, manure, and mulch in Kenya coffee growing. Empire J. Exp. Agr., 28:

335-352. 21 ref. 14 tab.
"Results obtained since 1947 are presented, from field trials and laboratory studies carried out in Kenya to investigate responses of coffee to fertilizers, manure, and mulch. It is shown that economic yield increases were obtained to applications of nitrogen fertilizers, grass mulch, and to cattle manure in certain circumstances."

B-419 Hemingway, R.G. 1961. The mineral composition of farmyard manure. Empire J. Exp. Agr., 29: 14-18. 6 ref. 1 tab. 1 fig.
"Fifty samples of farmyard manure have been examined for nitrogen, phosphorus, potassium, calcium, magnesium, manganese, boron, cobalt, copper, and molybdenum. The average quantities of fertilizer equivalents supplied by 10 tons of manure were 3.5 cwt. of ammonium sulphate, 1.2 cwt. of superphosphate, and 1.0 cwt. of muriate of potash. These values are considerably lower than previous estimates. The mean content of magnesium in the dry matter was 0.34 per cent. The equivalent of 0.68 cwt. of anhydrous magnesium sulphate is supplied by 10 tons of manure and this is a useful contribution to soil magnesium. The mean trace-element contents were (in ppm): Mn, 182; B, 23.5; Cu, 19.8; Co, 1.7; Mo, 2.3. Although above-average samples can supply considerable amounts of trace-elements, the quantities in general are much below those required for the correction of deficiencies when given as soil applications rather than foliar sprays."

B-420 Djokoto, R.K. and D. Stephens. 1961. Thirty long-term fertilizer experiments under continuous cropping in Ghana. I. Crop yields and responses to fertilizers and manures. Empire J. Exp. Agr., 29: 181-195. 8 ref. 2 tab.
"Thirty fertilizer trials of factorial design have been continued for between three and nine years... The organic treatments have nearly always given better results than the inorganic fertilizers, especially after some years of cropping; the greater part of their action seems to be due to their nutrient content, but a residue of unexplained benefit remains which is probably connected with the balanced nutrient reserves slowly released during the crops' growth by the decomposition of organic matter, and, in the case of mulch, with the improved rain acceptance and slower drying out of the top soil..."

B-421 Djokoto, R.K. and D. Stephens. 1961. Thirty long-term fertilizer experiments under continuous cropping in Ghana. II. Soil studies in relation to the effects of fertilizers and manures on crop yields. Empire J. Exp. Agr., 29: 245-258. 8 ref. 6 tab.
Report on soil studies in relation to yield responses to fertilizers and manures. Manure brought about a general improvement in the nutrient status of the soil. Manure increased the soil nutrient status more and the organic matter less than an equal weight of mulch, and concentrated its organic matter increases in the 0 - 6 inch layer to a greater extent than mulch. The large effects of manure on crop yields could not be wholly accounted for by the P and K contents. A further part of the cereal responses may have been due to its nitrogen, and all crops may have benefited from the higher pH produced by manure application. An appreciable fraction of its efficacy was probably due to the additional organic matter it provided.

B-422 Dennison, E.B. 1961. The value of farmyard manure in maintaining fertility in Northern Nigeria. Empire J. Exp. Agr., 29: 330-336. 22

ref. 2 tab. 3 fig.
"The results of experiments on the use of farmyard manure on the principal crops grown in Northern Nigeria, extending over a period of more than twenty years, are reviewed and discussed, with special reference to the relative responses of different crops, for which recommended rates of application are given."

B-423 Peat, J.E. and K.J. Brown. 1962. The yield responses of rain-grown cotton, at Ukiriguru in the Lake Province of Tanganyika. I. The use of organic manure, inorganic fertilizers, and cotton-seed ash. Empire J. Exp. Agr., 30: 215-231. 8 ref. 3 tab. 4 fig.
"On the hill-sand soils at Ukiriguru most soil treatments bring handsome rewards. There have been very good responses to applications of cattle manure, lasting with the heavier dressings for at least fourteen growing seasons. There have been responses to phosphorus applications, probably for more than three seasons. In most seasons there have been valuable nitrogen-phosphorus interactions. The mean responses, from cattle manure certainly, and phosphorus probably, over a succession of three-season cycles, indicate that a build-up in fertility takes place. The heavier dressings of phosphorus with top-dressed nitrogen, allowing for variations in application, have given mean responses of the order of 500 lb. seed cotton per acre per season. This tends to be slightly better than the responses to 6 tons of cattle manure per acre applied once in every three seasons - but without the long-continuing residual benefits. The responses to nitrogen and phosphorus at more than one level are discussed, and recommendations are made on the use of cattle manure and inorganic fertilizers."

B-424 Garner, H.V. 1962. Experiments with farmyard manure, sewage sludges, and town refuses on microplots at schools, 1940-9. Empire J. Exp. Agr., 30: 295-304. 2 ref. 6 tab.
"A group of seventy-three microplot experiments testing bulky organic manures was organized from Rothamsted and done at schools over the period 1940-9. Dung, raw and digested sewage sludges, treated town refuses, and screened dust were tested, mainly on potatoes, but some centres grew root and vegetable crops. The experiments included tests of the three main nutrients with and without the organic manures. On main-crop potatoes all organic manures gave greater increases than fertilizers only, but at the rates employed dung was better than any of the refuses. The domestic and industrial sludges at 10 tons of dry matter per acre usually gave 35-45 per cent of the increase in yield produced by 16 tons of dung... On most vegetable crops dung was much superior to the sludges, the chief exceptions being savoys and kale for which the sludges were very effective. Where organic manure was applied only once the residual effects were positive but unimportant, but with repeated dressings of sludge residual effects with potatoes, spring cabbage, and turnip tops were large."

B-425 Singh, A. 1964. Effect of long-term application of organic and inorganic sources of nitrogen on the yield of sugar cane, and on soil fertility. Empire J. Exp. Agr., 32: 205-210. 10 ref. 5 tab.
The effects of long-term applications of FYM, groundnut cake and ammonium sulfate were studied in a monoculture sugar cane rotation from 1949 to 1962. The yield responses from the three sources of nitrogen were in the ratio of 24:37:46, ammonium sulfate giving the greatest and FYM the least response. Soil pH, organic matter content and total nitrogen were not affected by these

treatments. Aggregation of soil was improved by all three treatments, but the difference in improvement by the organic sources as compared to the inorganic source was not great. It was concluded that the continuous use of ammonium sulfate is conducive to higher yields and does not adversely affect the fertility and productivity of the soil.

B-426 Culpin, C. 1960. Developments in methods of handling manure. N.A.A.S. Quart. Rev., No. 51. pp. 104-108. 10 ref. 1 tab.
Discussion on the use of liquid manure handling systems with emphasis on mechanization of the waste disposal chore. Some equipment specifications were given, including costs. Data were presented on the fertilizer value of various manures based on Tasmanian, European, and American research. It was recommended that the hose-pump method of slurry disposal should be given further consideration.

B-427 Riley, C.T. 1965. The utilization of poultry manure. N.A.A.S. Quart. Rev., No. 69. pp. 32-37.
General discussion of de-watering, digestion, lagooning and field application as techniques for the utilization of poultry manure. Processes considered were mechanical de-watering, thermal drying, electro-osmosis, methane digestion, aerobic lagooning, hydraulic handling, and field spreading. Some figures were given for the fertilizer value of manures and the costs of handling and processing the manure prior to utilization.

B-428 Rutherford, I.R. 1966. Manure disposal lagoons and ponds - a review of current literature. N.A.A.S. Quart. Rev., No. 73. pp. 15-22. 27 ref. 4 tab.
Literature review on the use of lagoons and ponds in agriculture. References were made to early applications of lagoons, and to operational features of lagoons now in use in America and Europe. Recommendations were presented on loading rates, dimensions and expected BOD reductions in stabilization ponds and lagoons.

B-429 Sainsbury, D.W.B. 1969. Disease and the development of large livestock units. N.A.A.S. Quart. Rev., No. 83. pp. 93-98.
In this general discussion, it was stressed that disease risks become magnified by increasing the size and intensity of animal housing units. Dangers associated with manure accumulations in close proximity to their point of generation include: (1) the proliferation of external and internal parasites, viruses, and bacteria; (2) noxious gases released from stored liquid manure. It was recommended that buildings should be kept small enough to allow complete de-population if necessary for hygienic reasons.

B-430 Riley, C.T. 1969. Farm waste disposal. N.A.A.S. Quart. Rev., No. 86. pp. 59-65. 2 tab.
Discussion on present-day problems of farm waste disposal. Farm wastes include excreta and other animal wastes, exhaust air and wash waters, packaging materials, chemicals, feed wastes, dead animals, and nonserviceable equipment, vehicles and buildings. Emphasis in this report was on the value of excreta as a fertilizer and on several points to consider when planning waste management systems.

B-431 Reith, J.W.S. and R.H.E. Inkson. 1958. Effects of fertilizers and dung

on potatoes. J. Agr. Sci., 51: 218-224. 12 ref. 4 tab.
Results of field experiments carried out in north-east Scotland on potatoes to measure the responses to, and the two-factor interactions between, nitrogen, phosphate, potash and dung. The responses to N, P and K were positive but variable. Responses to N and P were unaffected by the presence or absence of dung, whereas the response to K was reduced by 2/3 in the presence of dung. The effect of dung was reduced by the presence of NPK fertilizer. Tuber quality was affected by N, K and dung treatments. Suggested fertilizer dressings for potatoes were given.

B-432 Boyd, D.A. 1959. The effect of farmyard manure on fertilizer responses. J. Agr. Sci., 52: 384-391. 8 ref. 6 tab.
Results of trials with potatoes. FYM dressings decreased the interaction between each of the fertilizer nutrients. FYM increased the response to N applied alone, but decreased the N response where basal PK fertilizer was also applied; a similar effect was noted for P and K. Recommendations were given for suitable fertilizer dressings for potatoes.

B-433 Cornfield, A.H. 1959. Metabolism of nitrogen during long-term incubation of soil treated with fresh and rotted organic materials. J. Agr. Sci., 53: 327-329. 12 ref. 1 tab. 1 fig.
Results of incubation trials with a soil treated with 1% by weight of five different organic manures and 0.5% calcium carbonate. The only material to show mineralization of nitrogen over the entire incubation period of 184 days was a good straw compost (C/N = 20.6). Rotted FYM (C/N = 15.6) caused a small, and fresh grass (C/N = 22.6) caused a fair, amount of nitrogen fixation early in the incubation period but the overall mineralization of nitrogen was small. Considerable fixation of N in the early stages was observed for a poor straw compost (C/N = 42.5) and for straw (C/N = 147.0).

B-434 Castle, M.E. and A.D. Drysdale, 1962. Liquid manure as a grassland fertilizer. I. The response to liquid manure and to dry fertilizer. J. Agr. Sci., 58: 165-171. 20 ref. 6 tab.
Results of a preliminary trial in which liquid manure, collected from a cowshed, was used as a grassland fertilizer and compared in value to a conventional dry fertilizer over a period of 3 years. Yields were increased by the application of both manure and fertilizer; addition of extra phosphate on the liquid manure treatments had no significant effect; the crude-protein contents of the herbage were not affected; the content of clover increased and the meadow fescue and dicotyledonous weeds decreased under liquid manure treatments as compared to the control; K_2O contents of the soil increased but pH and P_2O_5 remained constant with the manure treatment; and, in 2 of the 3 years, the liquid manure treatments produced herbage with higher K and lowered Ca, Mg and Na content.

B-435 Adams, S.N. 1962. The response of sugar beet to fertilizer and the effect of farmyard manure. J. Agr. Sci., 58: 219-226. 12 ref. 7 tab. 1 fig.
Results of factorial experiments with varying levels of N, P_2O_5 and K_2O and FYM. Optimum dressings for sugar yield were changed from 1.0 cwt N, 0.5 cwt P_2O_5 and 1.6 cwt K_2O per acre to 0.6 cwt N, 0.0 cwt P_2O_5 and 0.8 cwt K_2O per acre by the presence of 12 tons FYM per acre.

B-436 Bunting, A.H. 1963. Experiments on organic manures, 1942-49. J. Agr.

Sci., 60: 121-140. 13 ref. 21 tab.
Report on 113 experiments on 56 sites during 8 years on the composition and agronomic effects of FYM, sewage sludge, and composts of straw with sewage sludge or inorganic-N sources, and on the effects of straw plowed in with sludge or inorganic-N sources. Results were reported in detail in tabular form. FYM was generally superior to all other organic manures tested as a fertilizer.

B-437 Reith, J.W.S. and R.H.E. Inkson. 1963. Effects of fertilizers and farmyard manure on swedes and turnips. J. Agr. Sci., 60: 145-157. 17 ref. 10 tab.
Results of 38 experiments to measure the responses and two-factor interactions produced by N, P and K. The effect of FYM was measured in 14 of these experiments. The response to FYM was very variable. The effect of FYM on N and P response was variable whereas the addition of FYM consistently produced a substantial reduction in the response to K. These experiments suggest that 15 tons of FYM will supply at least 15 lb N, 15 lb P_2O_5 and 70 lb K_2O to the first crop grown after its application.

B-438 Byng, A.J. 1963. A study of the fauna of poultry deep litter. J. Agr. Sci., 60: 251-257. 16 ref. 3 tab. 8 fig.
Results of observations over a limited period of time and with first-use litter. Arthropods of the Orders Acarina, Collembola and Psocoptera were found, and their sources speculated upon. Poultry food appeared to be the most important source of mites and insects. Some aspects of predation were considered. The population was not constant, changing from month to month but becoming more stable as the litter aged. Temperature, relative humidity and moisture content of the litter were considered near optimum for arthropod development. Ammonia concentrations were not high enough to be harmful to adult species of most arthropods. Implications of the fauna to poultry health were discussed.

B-439 Widdowson, F.V., A. Penny and G.W. Cooke. 1963. Results of an experiment at Rothamsted testing farmyard manure and N, P and K fertilizers on five arable crops. I. Yields. J. Agr. Sci., 60: 347-352. 5 ref. 6 tab.
Results of a rotation experiment with small plots to test the responses to N, P, K and FYM by wheat, kale, barley, grass-clover ley, and potatoes. The best response was obtained with potatoes. The responses to FYM were large for all crops, but were reduced by fertilizer applications.

B-440 Williams, R.J.B., G.W. Cooke and F.V. Widdowson. 1963. Results of an experiment at Rothamsted testing farmyard manure and N, P and K fertilizers on five arable crops. II. Nutrients removed by crops. J. Agr. Sci., 60: 353-357. 5 ref. 9 tab.
Results of experiments with various levels and combinations of N, P and K fertilizers and FYM on five crops. FYM supplied large amounts of N, P and K to all crops, similar amounts of nutrients being recovered from FYM whether or not NPK fertilizer was also used. A 10 ton/acre dressing of FYM supplied about 30 lb N, 4 lb P and 75 lb K to crops like kale, potatoes and permanent grass.

B-441 Drysdale, A.D. 1963. Liquid manure as a grassland fertilizer. II. The response to winter applications. J. Agr. Sci., 61: 353-360. 15 ref. 4 tab.
Report on the effect of applications of liquid manure made during different

months of the winter period (November to March) on contrasting sward types, and a comparison with conventional inorganic fertilizers. February applications gave the maximum increase in dry matter yields, while March applications gave the maximum increase in crude protein. A mixture of Italian and perennial ryegrasses gave the highest response to liquid manure. Conventional inorganic fertilizer gave slightly higher yields of dry matter and crude protein than liquid manure but the difference in herbage yield was insignificant. The carry-over or residual value of liquid manure was negligible compared with a small but positive carry-over effect from dry fertilizers.

B-442 Hanley, F., W.J. Ridgman and R.H. Jarvis. 1964. The effect of previous cropping and manuring on the yield of potatoes. J. Agr. Sci., 62: 39-46. 7 ref. 9 tab. 5 fig.
Results of an experiment conducted on a light gravelly soil at Cambridge to compare the effects of different crop rotations, different levels of N fertilization and the application of FYM on the yield of potatoes. The response to FYM was greater on an all arable sequence than on sequences containing leys which included lucerne, on which the response to FYM was small and non-significant. FYM applications increased the total N content of the topsoil.

B-443 Holliday, R., P.M. Harris and M.R. Baba. 1965. Investigations into the mode of action of farmyard manure. I. The influence of soil moisture conditions on the response of main crop potatoes to farmyard manure. J. Agr. Sci., 64: 161-166. 15 ref. 5 tab. 1 fig.
Results of 10 consecutive field experiments to investigate the action of FYM (supplemented with high basal dressings of PK fertilizer) on the yield of maincrop potatoes. The response to FYM under various moisture conditions was measured. In wet years, the effect of FYM appeared to be a reflection of its content of available N (PK not limiting); in dry years, however, the effect of FYM was considerably less.

B-444 Smith, C.A. 1965. Studies on the Hyparrhenia veld. VI. The fertilizer value of cattle excreta. J. Agr. Sci., 64: 403-406. 18 ref. 4 tab.
Results of a plot to test the fertilizer value of cattle dung and urine evenly spread on Hyparrhenia veld which was very deficient in N and slightly deficient in P. Urine increased herbage yield, but less effectively than urea fertilizer. Dung itself was ineffective, but when combined with urine, the mixture was equal to an NPK fertilizer treatment. Urine concentrated in a small area was relatively ineffective, due to nitrogen losses. The implications of these findings to pasture management were discussed.

B-445 Drysdale, A.D. 1965. Liquid manure as a grassland fertilizer. III. The effect of liquid manure on the yield and botanical composition of pasture and its interaction with nitrogen, phosphate, and potash fertilizers. J. Agr. Sci., 65: 333-340. 26 ref. 6 tab.
Report on experiment designed to investigate, in detail, the effect of liquid manure on the yield of herbage and on the content of clover in the sward, and also the interaction between liquid manure and N, P and K fertilizers. The percent and yield of clover in the sward increased with the use of liquid manure, but not with addition of corresponding weights of N, P and K in commercial fertilizer. The pH of manure was 8.6, and this was supposed to have caused the desirable effect on clover. Other results were presented in detail.

B-446 Garner, H.V. 1966. Experiments on the direct, cumulative and residual effects of town refuse manures and sewage sludge at Rothamsted and other centres 1940-1947. J. Agr. Sci., 67: 223-233. 4 ref. 14 tab.
Results of trials comparing several town-refuse manures with FYM. The first year effect and residual effect of pulverized refuses on root crops were 64% and 72%, respectively, of the effects of an equal amount of FYM. FYM was also better than town refuses when used on horticultural crops. Results of cumulative experiments and of experiments with inorganic fertilizers were reported.

B-447 Garner, H.V. 1966. Comparisons of farmyard manure, sewage sludge, and other organic manures tested on potatoes and a succeeding cereal crop at Rothamsted. J. Agr. Sci., 67: 267-280. 6 ref. 18 tab.
Results of field experiments at Rothamsted for 9 years to compare organic manures, FYM and inorganic fertilizers. Eight kinds of FYM made under controlled conditions from the same quantity of feed, sewage sludges from 7 sources, composts of sewage sludge with straw from 4 sources, 5 types of town refuse, cut-bracken stacked over winter, and peat, were tested on potatoes at single and double dressings. All organic manures were compared with and without fertilizers supplying 0.6 cwt N, 0.6 cwt P_2O_5 and 1.0 cwt K_2O. The soils were heavy loams. Results were reported in detail in tabular form.

B-448 Drysdale, A.D. and N.H. Strachan. 1966. Liquid manure as a grassland fertilizer. IV. The effect of liquid manure on the mineral content of grass and clover. J. Agr. Sci., 67: 337-343. 22 ref. 2 tab. 2 fig.
Report on a comprehensive investigation of the effect of liquid manure on the K, Na, Ca, Mg, and P contents of the grass and clover fractions of a perennial rye-grass and white clover sward. Liquid manure and potash fertilizer, either separately or together, increased the K content of both the grass and the clover. Fertilizer nitrogen had an almost insignificant effect which was generally opposite to that of liquid manure. It was suggested that the increase in clover content of the sward may help to counteract the increase in the K/(Ca + Mg) ratio in herbage upon application of liquid manure.

B-449 Castle, M.E. and A.D. Drysdale. 1966. Liquid manure as a grassland fertilizer. V. The response to a mixture of liquid manure (urine) and dung. J. Agr. Sci., 67: 397-404. 16 ref. 9 tab. 2 fig.
Report on a small-scale plot experiment to study the comparative effect of applications of various mixtures of dung and urine on the yield and quality of an established rye-grass and white clover sward. A direct relationship was shown to exist between the proportion of NH_3-N in the total N content and the efficiency of the nitrogen relative to fertilizer nitrogen. This may provide a quick and accurate method of assessing the efficiency of a slurry.

B-450 Widdowson, F.V. and A. Penny. 1967. Results of an experiment at Woburn testing farmyard manure and N, P and K fertilizers on five arable crops and a long ley. I. Yields. J. Agr. Sci., 68: 95-102. 5 ref. 8 tab.
Results of experiments to measure the responses to several combinations of FYM and N, P and K inorganic fertilizers during a five-course rotation of barley, grass-clover ley, potatoes, oats and sugar beets. FYM generally increased yields, although the response of various crops varied. Responses to FYM were usually less when fertilizers were also used.

B-451 Widdowson, F.V., A. Penny and R.J.B. Williams. 1967. Results of an

experiment at Woburn testing farmyard manure and N, P and K fertilizers on five arable crops and a long ley. II. N, P and K removed by crops. J. Agr. Sci., 68: 293-300. 2 ref. 10 tab.
Results of experiments in which the amounts of N, P and K removed from the soil by barley, grass-clover ley, potatoes, oats and sugar beets were measured, when the soil received various combinations of FYM and N, P and K inorganic fertilizers. Differences in total nutrient removal by different crops were observed. The mean amounts of N, P, and K added in 20 ton/acre of FYM were 292, 124 and 315 lb/acre, respectively, but crops differed in their ability to use these nutrients, relative to the same nutrients supplied as inorganic fertilizers.

B-452 Gunary, D. 1968. The availability of phosphate in sheep dung. J. Agr. Sci., 70: 33-38. 11 ref. 4 tab. 3 fig.
"The amount of labile phosphate released in two soils from incorporated sheep dung (of two phosphate levels) was determined in a pot experiment. The inorganic phosphate in dung was initially highly available but it diminished in value after a period of contact with soil. The organic fraction of the phosphate had only small availability. A further pot experiment where dung was applied to the surface of the two soils indicated that, although dung phosphate may be readily available, its value for grass depends on the extent of dung/root contact."

B-453 Widdowson, F.V. and A. Penny. 1968. Results of an experiment at Rothamsted testing farmyard manure and N, P and K fertilizers on five arable crops and permanent grass. III. Yields 1961-1965. J. Agr. Sci., 70: 53-58. 2 ref. 6 tab. 1 fig.
FYM increased yields of all crops, potatoes responding the most. Yields were maintained best by applying FYM and fertilizer together, although combined applications reduced the effects of FYM.

B-454 Paquay, R., F. Lomba, A. Lousse and V. Bienfet. 1968. Statistical research on the fate of dietary mineral elements in dry and lactating cows. I. Calcium. J. Agr. Sci., 71: 173-180. 10 ref. 4 tab. 1 fig.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary calcium contents were reported in tabular form.

B-455 Lomba, F., R. Paquay, V. Bienfet and A. Lousse. 1968. Statistical research on the fate of dietary mineral elements in dry and lactating cows. II. Magnesium. J. Agr. Sci., 71: 181-188. 20 ref. 3 tab. 2 fig.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary magnesium contents were reported in tabular form.

B-456 Greenhalgh, J.F.D. and G.W. Reid. 1969. The effects of grazing intensity on herbage consumption and animal production. III. Dairy cows grazed at two intensities on clean or contaminated pasture. J. Agr. Sci., 72: 223-228. 11 ref. 4 tab.
Results of experiments to compare the intake and milk production of cows grazing on either clean or fouled pastures with either a small or a large allowance of herbage. Fouled herbage offered contained more protein than the clean, but did not differ from the fouled herbage rejected. Interactions between milk yields, herbage allowances and degree of feces contamination were reported. The relationship of these findings to pasture management was discussed.

B-457 Mason, V.C. 1969. Some observations on the distribution and origin of nitrogen in sheep faeces. J. Agr. Sci., 73: 99-111. 44 ref. 8 tab. 2 fig.
Results of experiments. "The quantitative distribution of nitrogen between undigested dietary residues, bacterial residues, endogenous debris residues and the water soluble fraction was determined chemically. It was concluded that 57 - 81% of the non-dietary faecal nitrogen was associated with bacterial material. Indirect evidence suggested that most of the bacterial nitrogen in faeces originated in the rumen."

B-458 Draycott, A.P. 1969. The effect of farmyard manure on the fertilizer requirement of sugar beet. J. Agr. Sci., 73: 119-124. 12 ref. 6 tab.
Results of 38 experiments conducted on commercial farms. One group of experiments, with uniformly applied FYM, tested the value of additional fertilizer nutrients, with and without agricultural salt (crude sodium chloride); a second group tested the value of fertilizer N and agricultural salt with and without FYM. Results were given in detail, including some references to economically optimum fertilizer dressings.

B-459 Lomba, F., R. Paquay, V. Bienfet and A. Lousse. 1969. Statistical research on the fate of dietary mineral elements in dry and lactating cows. III. Phosphorus. J. Agr. Sci., 73: 215-222. 15 ref. 8 tab.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary phosphorus contents were reported in tabular form.

B-460 Paquay, R., F. Lomba, A. Lousse and V. Bienfet. 1969. Statistical research on the fate of dietary mineral elements in dry and lactating cows. IV. Chloride. J. Agr. Sci., 73: 223-230. 4 ref. 5 tab. 1 fig.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary chloride contents were reported in tabular form.

B-461 Paquay, R., F. Lomba, A. Lousse and V. Bienfet. 1969. Statistical research on the fate of dietary mineral elements in dry and lactating cows. V. Potassium. J. Agr. Sci., 73: 445-452. 18 ref. 5 tab. 2 fig.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary potassium contents were reported in tabular form.

B-462 Lomba, F., R. Paquay, V. Bienfet and A. Lousse. 1969. Statistical research on the fate of dietary mineral elements in dry and lactating cows. VI. Sodium. J. Agr. Sci., 73: 453-458. 6 ref. 8 tab.
Statistical analyses of data collected from strictly controlled metabolism trials. Fecal and urinary sodium contents were reported in tabular form.

B-463 Manston, R. and M.J. Vagg. 1970. Urinary phosphate excretion in the dairy cow. J. Agr. Sci., 74: 161-167. 15 ref. 3 tab. 3 fig.
Results of experiments in which 10% of housed cows excreted phosphate greatly in excess of the normal excretion rate of 0.5 gm P per day. This abnormal excretion rate did not occur in grazing cows, except when these cows were temporarily transferred to housed conditions. Complete phosphorus balance measurements showed that this phosphaturia was accompanied by an increase in absorption of dietary phosphorus. The effects of orally administered acidic and alkaline salts on urinary phosphate excretion were discussed.

B-464 Mason, V.C. 1971. Some preliminary observations on the nature of factors influencing the excretion of non-dietary faecal nitrogen by ruminant animals. J. Agr. Sci., 76: 157-166. 62 ref. 4 tab.
Report on trials to gather background information on the influence of various dietary factors on the excretion of non-dietary fecal nitrogen and bacterial + endogenous debris nitrogen. It was concluded that the responses to the various rations reflect the dominating influence of nitrogen of microbial residues from the rumen and hind-gut on the excretion of bacterial + endogenous debris nitrogen and non-dietary nitrogen.

B-465 Jones, M.J. 1971. The maintenance of soil organic matter under continuous cultivation at Samaru, Nigeria. J. Agr. Sci., 77: 473-482. 11 ref. 8 tab.
"Treatment effects on levels of soil carbon and nitrogen in four long-term experiments at Samaru are reviewed in relation to an expected change in the future away from a bush-fallowing agricultural system towards an intensive mechanized system of permanent agriculture. Where different rates of farmyard manure were applied to the soil annually for nearly 20 years marked differences in soil organic matter contents developed. The mean soil carbon (0.82 per cent) of plots that received 12.5 tonnes ha^{-1} $annum^{-1}$ is now almost four times as great as the mean content (0.22 per cent) of control-plot soils. Phosphate applications tended to encourage higher levels of soil organic matter, but where mineral fertilizers (N, P and K) were applied with farmyard manure lower soil organic matter levels and C:N ratios than those of manure-only plots resulted. Apparent retention in the soil of carbon and nitrogen applied as farmyard manure was of the order of 12-15 and 30% respectively..."

B-466 Masefield, G.B. 1965. The effect of organic matter in soil on legume nodulation. Exp. Agr., 1: 113-119. 9 ref. 3 tab.
"Pot experiments were used to test the effect of incorporating various organic materials in the soil on the nodulation of peas. Only farmyard manure gave a consistent increase in the number and weight of nodules, and also in plant growth, increases which were also produced by the aqueous extract of farmyard manure, although none of these increases were as large as those obtained by the addition of a combination of P and K fertilizers or activated vermiculite. Field beans and French beans in general reacted in the same way as peas."

B-467 Brown, P. 1966. Maize growing in Nyasaland (Malawi). II. Fertilizer requirements. Exp. Agr., 2: 49-60. 5 ref. 6 tab.
Report on over 400 field experiments with organic and inorganic fertilizers. The main nutrient deficiency in Malawi is a chronic lack of nitrogen, although phosphorus and sulfur are occasionally limiting. Results of these experiments indicate that the beneficial effect of organic manures in Malawi comes from their nutrient content, and possibly their microflora and fauna, rather than from the presence of organic matter itself. Recommendations on the use of farmyard manure were given.

B-468 Oke, O.L. 1967. The sulphur content of Nigerian manures. Exp. Agr., 3: 322-326. 22 ref. 1 tab. 1 fig.
"Faeces of different birds and animals were analysed for sulphur and nitrogen. Chick faeces contained the highest amount of sulphur while farmyard manure gave the highest value for mineralized S after incubation. There was a high degree of correlation between the total S and total N."

B-469 Singh, A. and R.P. Roysharma. 1968. Long term experiments with fertilizers and manures on sugarcane in India. Exp. Agr., 4: 67-75. 10 ref. 3 tab. 5 fig.

Report on four long-term field experiments with organic and inorganic soil amendments in India. Yield and soil data were presented in detail. On soils where P and K were not limiting, application of ammonium sulfate gave higher yields than FYM and did not adversely affect the fertility status of the soil. It was concluded that the effect of the organic composts on yield and soil fertility is explainable on its nutrient content rather than on its effect on physical properties of the soil.

B-470 Bache, B.W. and R.G. Heathcote. 1969. Long-term effects of fertilizers and manure on soil and leaves of cotton in Nigeria. Exp. Agr., 5: 241-247. 5 ref. 7 tab.

"On a site in the Sudan Savanna, chemical properties of soils (except for phosphate) and the composition of cotton leaves were determined after fifteen annual treatments including dung, ammonium sulphate, single superphosphate and potassium chloride, in all combinations of three levels. In the soils dung increased C, N, cation exchange capacity, exchangeable Ca and Mg and Mn, and pH, and decreased soluble Al and Mn; ammonium sulphate decreased pH, increased soluble Al and Mn, and decreased exchangeable Ca and Mg; potassium chloride had no obvious effects. In the plants dung increased P and reduced Mn; ammonium sulphate reduced Ca and Mg, and increased Mn; superphosphate increased P, Ca and Mg, and reduced K; potassium chloride increased K slightly. The most important results were the ability of ammonium sulphate to acidify the soil, as shown by soil properties and reflected in tissue composition, and the ability of dung to ameliorate these effects. Reduction of crop yield in the presence of adequate nutrient supply seems to have been due to excessive soil acidity."

B-471 Stephens, D. 1969. Changes in yields and fertilizer responses with continuous cropping in Uganda. Exp. Agr., 5: 263-269. 9 ref. 5 tab.

"In sixteen factorial field trials with N, P, K, Mg, trace element and farmyard manure treatments, yields declined during the first four years of cropping following a resting period under grass, responses to K and farmyard manure increased, and other treatments showed no significant changes. After a few years of continuous cropping potassium deficiency may seriously limit yields, especially of sweet potatoes. N, P and K fertilizers maintained yields as well as the farmyard manure treatment."

B-472 Dilz, K. and E.G. Mulder. 1962. The effect of soil-pH, stable manure and fertilizer nitrogen on the growth of red clover and of red clover associations with perennial ryegrass. Neth. J. Agr. Sci., 10: 1-22. 22 ref. 4 tab. 11 fig.

"An investigation was made into the effect of soil-pH, fertilizer nitrogen and stable manure on the growth of red clover and of red clover-perennial ryegrass associations... Stable manure, particularly when residual in the soil, promoted nodulation and nitrogen fixation of clover plants on uninoculated acid soil (pH 5.0); on inoculated acid soil this effect was still clearly perceptible, but weaker."

B-473 Lehr, J., J. Grashuis and E.E. van Koetsveld. 1963. Effect of fertilization on mineral-element balance in grassland. Neth. J. Agr.

Sci., 11: 23-37. 6 ref. 6 tab.
"In a 14-year fertilization experiment on pasture a study was made of the changes in mineral composition of the soil on the one hand and of grass and hay on the other. The experiment ended with a grazing trial on yearling cattle... The application of farmyard and liquid manure as the basis of the fertilization programme with additional application of small amounts of artificial fertilizers appeared to exercise a favourable influence on the botanical composition of the sward and also on the magnesium economy, but could not check the impoverishment in sodium. Moreover, heavy dressings of organic manure lead to a rather excessive supply of potash and phosphate."

B-474 Boekel, P. 1963. The effect of organic matter on the structure of clay soils. Neth. J. Agr. Sci., 11: 250-263. 19 ref. 3 tab. 8 fig.
"The effect of organic-matter content on intrinsic and actual soil structure was studied in a great number of plots under practical conditions. Figures relating to the intrinsic soil structure were obtained by determining the lower plastic limit, the upper plastic limit and the moisture percentage at pF = 2 (field capacity). The actual soil structure was determined by measuring the pore space and air content and by visual estimation. The effect of organic manuring on the actual soil structure was studied in a number of experimental fields with town refuse, farmyard manure, green manuring and ley farming..."

B-475 St. George, T.D. 1971. The isolation of Chlamydiae from faeces of sheep in Australia. Aust. Vet. J., 47: 74. 5 ref.
Report on the isolation of Chlamydia organisms from the feces of healthy and diseased sheep, but not from sheep yards or sheep resting places or camps. This is the first report of isolations of Chlamydiae from sheep feces in Australia. It is likely that the organisms isolated are normal inhabitants of the intestinal tracts of Australian sheep and are unlikely to produce ill effects.

B-476 Waddell, A.H., H.M.D. Hoyte and R.C.W. Daniel. 1971. Four species of Eimeria in pigs in Queensland. Aust. Vet. J., 47: 462. 2 ref.
Report on isolation of large numbers of oocysts in the feces of dry sows grazing pasture. All sows were passing well-formed feces with fecal oocyst counts varying from 6,000 to 214,000 per gm of feces. The counts fell to 200 per gm of feces three weeks later. Four species of oocysts were identified. Unusually high rainfall during the three months prior to the reported investigation undoubtedly created ideal conditions for the development and survival of oocysts on pasture.

B-477 Tannock, G.W. and J.M.B. Smith. 1971. Studies on the survival of Salmonella typhimurium and Salmonella bovismorbificans on pasture and in water. Aust. Vet. J., 47: 557-559. 5 ref. 3 tab.
"Enumeration of salmonellae (Salmonella typhimurium and Salmonella bovismorbificans) on experimentally contaminated pasture under the climatic conditions occurring during the months of January to April and June to September, and under different environmental conditions (exposure to sunlight, shaded, presence of faecal material), showed a relatively rapid decline in numbers in all situations. Where water was grossly contaminated with faeces the decline in numbers was about ten thousand-fold after ten weeks compared with a one million-fold decrease within two weeks when faecal material was absent."

B-478 Bryans, J.T., E.H. Fallon and B.P. Shephard. 1961. Equine salmonellosis. Cornell Vet., 51: 467-477. 12 ref. 1 tab.
Repeated fecal cultures have shown that horses may act as carriers of salmonellae. Both foals and older animals may become carriers of salmonellae without showing frank signs of disease.

B-479 Zimmermann, W.J., E.D. Hubbard, L.H. Schwarte and H.E. Biester. 1962. Trichiniasis in Iowa swine with further studies on modes of transmission. Cornell Vet., 52: 156-163. 14 ref. 1 tab.
Report on pig-to-pig and wild animal-to-pig transmission studies. Experimental fecal transmission of Trichinella spiralis to swine was obtained using pigs, fox cubs, hawks and owls as donor animals. Tail chewing was also noted as a possible mode of transmission of trichiniasis within a herd of swine.

B-480 Niederman, R.A., R.E. Luginbuhl and C.F. Helmboldt. 1963. The separation and characterization of two enteric cytopathic bovine viruses isolated from a sample of bovine feces. Cornell Vet., 53: 550-560. 19 ref. 1 tab. 2 fig.
Report on the separation and study of two strains of cytopathic bovine viruses from a single fecal sample collected from an apparently healthy calf. When inoculated intranasally into calves, the agents did not produce any significant illness.

B-481 Crofton, H.D. 1965. Ecology and biological plasticity of sheep nematodes. I. The effect of temperature on the hatching of eggs of some nematode parasites of sheep. Cornell Vet., 55: 242-250.
First in a series of five papers (all published on succeeding pages of the same journal - pp. 242-279) on research conducted to study the effects of temperature on the hatching times of eggs of various sheep nematodes passed out in the feces of infected sheep. Results were presented in detail in each of the five reports.

B-482 Firehammer, B.D. 1965. The isolation of vibrios from ovine feces. Cornell Vet., 55: 482-494. 21 ref. 6 fig.
Report of attempts to recover Vibrio fetus, a pathogen of cattle and sheep, from the feces of artificially inoculated sheep. Recovery of V. fetus intestinalis was made from the feces of infected sheep for as long as 25 days after inoculation indicating establishment of the organism in the intestinal tract. The name V. fecalis was suggested for an organism frequently isolated from sheep feces and much resembling V. bubulus. The epidemiology of ovine vibriosis was discussed and the need for care in identifying vibrios isolated from feces was emphasized.

B-483 Vetterling, J.M. 1966. Prevalence of coccidia in swine from six localities in the United States. Cornell Vet., 56: 155-166. 65 ref. 3 tab.
Report on isolation of coccidia from the feces of swine. Species identified were of the genera Eimeria and Isospora. Data on the prevalence of swine coccidia as determined by investigators in 12 countries were tabulated. It was concluded that raising swine on concrete keeps infections with coccidia to a minimum, and that hogs on pasture can become heavily infected.

B-484 Mann, P.H., G. Bjotvedt and J.W. Winter. 1966. Survey of poultry,

dogs, cats, and monkeys for the presence of Salmonella and Cryptococcus neoformans. Cornell Vet., 56: 195-199. 24 ref. 1 tab.
Salmonellae but no cryptococci were isolated from the cecal contents of chickens. Salmonella serotypes isolated were S. enteritidis, S. heidelberg and S. infantis.

B-485 Gossling, J. and H.E. Rhoades. 1966. Serologic types of Escherichia coli isolated from certain pigs with enteric disorders. Cornell Vet., 56: 344-353. 14 ref. 2 tab.
Five hundred and sixty-two isolates of E. coli from 100 baby pigs with a variety of enteric disorders were examined by serological methods. Fifty-two different E. coli O groups were identified.

B-486 Rovozzo, G.C. and R.E. Luginbuhl. 1967. Bovine enteric cytopathogenic viruses. IV. Attempts to identify three prototype strains by neutralization tests with bacterial, bovine, and human reference antigens and antisera. Cornell Vet., 57: 268-276. 13 ref. 3 tab.
Final paper in a series of research reports describing research in which enteric cytopathogenic viruses were isolated from bovine feces and serologically typed.

B-487 Hoadley, A.W. and E. McCoy. 1968. Some observations on the ecology of Pseudomonas aeruginosa and its occurrence in the intestinal tract of animals. Cornell Vet., 58: 354-363. 17 ref. 4 tab.
Report on studies conducted in Wisconsin to determine the incidence of P. aeruginosa in the intestinal tracts of animals, and to suggest factors which influence its occurrence. P. aeruginosa is apparently not a normal inhabitant of the intestinal tract of most domestic animals, but is found in animals closely associated with man, such as small calves. The carrier state among calves was transient, its duration possibly dependant upon the feeding regime.

B-488 Griel, L.C., Jr., D.C. Kradel and E.W. Wickersham. 1969. Abortion in cattle associated with the feeding of poultry litter. Cornell Vet., 59: 226-235. 7 ref. 3 tab.
Report on an outbreak of abortion in a group of cows which had been fed poultry litter from birds that had received dienestrol-treated feed. Bioassay results indicated that the estrogenic activity of the litter was at least 10 μg DES equivalents per 100 g of litter. Of 20 cows fed the poultry litter, 7 were actually observed aborting and 6 others were suspected of having aborted. Abortion had not been observed the previous year when poultry litter had been fed at half the succeeding-year level or in the following year when no poultry litter was fed. Behavior of the cows indicated that some pattern of hormonal imbalance was responsible for the abortions, implicating the poultry litter as a cause of the abortion. Further research is being conducted to determine the interaction of all the factors present.

B-489 Gordon, W.A.M. 1963. Environmental studies in pig housing. III. Ventilation and odour intensity. British Vet. J., 119: 219-229. 3 ref. 3 tab.
"Factors relating to the reduction of pig house odour including ammonia are discussed. As a result of experiments in piggeries it would appear that a small cubic space per pig offers considerable advantages over a large cubic area. The importance of frequency of ventilation in comparison with that of ventilating volume is clearly shown."

B-490 Gordon, W.A.M. 1963. Environmental studies in pig housing. IV. The bacterial content of air in piggeries and its influence on disease incidence. British Vet. J., 119: 263-273. 23 ref. 2 tab. 4 fig.
"Air sampling of a number of piggeries at two centres showed both the extent and the variation of the bacterial complement which may be found in piggeries. The number of bacterial colonies was lowest in those houses with the highest absolute humidity. The types of bacteria differed at the two centres. The value of sedimentation rate in reducing the bacterial complement in the high-temperature high-humidity atmosphere was particularly striking. The investigation shows why an atmosphere of high temperature and humidity, which only a few years ago would have been regarded as inimical to the health and productivity of pigs, may in fact be favourable."

B-491 Hemesley, L.A. and R.J. Durrant. 1964. The effect of respiratory disease, age of litter and disinfection practices on the performance of young chickens. British Vet. J., 120: 567-575. 5 ref. 4 tab.
"The incidence of respiratory disease in broiler chickens, and the performance of the chickens in terms of liveweight and feed consumption, did not appear to be influenced by renewing the litter or disinfecting the poultry house before the chickens were introduced. The liveweight of chickens from flocks where respiratory symptoms were noted was lower than that of chickens not showing respiratory symptoms, particularly when the affected flocks also showed a rise in mortality."

B-492 Tucker, J.F. 1967. Survival of salmonellae in built-up litter for housing of rearing and laying fowls. British Vet. J., 123: 92-103. 16 ref. 4 tab.
"The persistence of *Salmonella pullorum* and *Salmonella gallinarum* in built-up litter varied from three weeks in old litter to eleven weeks in new litter. When litter was infected with *Salmonella thompson* the survival times increased to four to five weeks in old litter and eight to 20 weeks in new litter. When the infected pens were left unoccupied the survival time in both types of litter was increased to more than 30 weeks. In these experiments a relationship was noted between the survival of salmonella organisms and the moisture content of the litter. Other factors affecting bacterial survival may also be present and these are discussed together with suggested methods for the management of contaminated litter."

B-493 Arbuckle, J.B.R. 1968. The distribution of certain *Escherichia coli* strains in pigs and their environment. British Vet. J., 124: 152-159. 10 ref. 3 tab. 3 fig.
"The *E. coli* strains associated with disease in pigs were widespread in the faeces of lactating sows and their litters. They were frequently recovered in small numbers from the faeces of healthy litters but their proliferation in litters was accompanied by diarrhoea or death. Such strains were also widely distributed in farrowing houses. These organisms were rarely found in the faeces of pigs during late pregnancy but they were frequently recovered from the faeces after entry into farrowing houses. The *E. coli* strains associated with disease were never recovered from colostrum or milk of sows, although they were often found on the udders and teats of lactating sows."

B-494 Timms, L. 1968. Observations on the bacterial flora of the alimentary tract in three age groups of normal chickens. British Vet. J., 124:

470-477. 14 ref. 4 tab. 1 fig.
"Differential bacterial counts were made on the intestinal contents of three groups of six healthy chickens aged 18 days, 7 weeks and 5 months respectively. Samples were taken immediately after death from anterior and posterior sections of the small intestine and from the caeca, and were examined for specific microorganisms. The flora were found to be qualitatively similar in all age groups, consisting of lactobacilli, streptococci, E. coli and Cl. welchii in descending order, the concentration of bacteria in all groups being highest in the caeca and progressively lower in the posterior and anterior small intestine. Bacteroides were confined to the caeca of each age group examined where they were present in similar concentration to that of the lactobacilli. The slight variation that occurred with age was most noticeable in the 18-day-old chicks which gave higher counts of lactobacilli, streptococci and E. coli in the caecal contents. The 7-week and 5-month-old birds gave very similar quantitative and qualitative results at all three sites of the intestine."

B-495 Clarke, E.G.C. 1969. Poisoning in the pig. British Vet. J., 125: 289-293. 92 ref.
A review of poisoning of pigs due to accidents connected with its habitation, its food, its medicaments and with various environmental hazards. Poisoning by nitrite and by manure gases was reviewed.

B-496 Cartwright, S.F. 1969. Transmissible gastroenteritis of swine (TGE). British Vet. J., 125: 410-413. 29 ref.
Review of TGE in swine, including references to excretion and survival of the causative virus in the feces of infected pigs.

B-497 Heard, T.W., N.E. Jennett and A.H. Linton. 1969. The incidence of salmonella excretion in various pig populations from 1966 to 1968. British Vet. J., 125: 635-644. 16 ref. 3 tab. 1 fig.
"The Salmonella excretion rate in various pig populations was surveyed throughout 1967 and 1968. They included farms, progeny testing centres, markets, weaner groups and abattoirs; some of the situations were chosen because of a history of enteric problems. Pigs from 344 farms were represented in the survey. Three thousand, one hundred and twenty-seven pooled faecal samples were examined, representing 13,355 pigs. The isolation rate for the 2-year period was 1.3 per cent but a bi-monthly analysis revealed rates varying from 0 to 12 per cent. These fluctuations indicate that similar surveys must be analysed on a time basis before a general assessment of Salmonella excretion rates can be made. All the serotypes found in the survey have been isolated on numerous occasions from pig foods."

B-498 Baker, J.R. 1970. Salmonellosis in the horse. British Vet. J., 126: 100-105. 29 ref. 1 tab. 2 fig.
Report on salmonellosis in horses as observed by the author, and a summary of literature describing the isolation of salmonellae, other than S. abortus equi (host-specific salmonella of horses), in the feces and other excretions and tissues of horses.

B-499 Goyal, S.M. and I.P. Singh. 1970. Probable sources of Salmonellae on a poultry farm. British Vet. J., 126: 180-184. 17 ref. 2 tab.
"A study was undertaken to determine various sources of Salmonellae on a poultry farm. Besides poultry, domestic animals, lizards, rats and free-flying

birds found on the farm were screened. Eight Salmonellae types were isolated from poultry, pigs, rats, wall lizards and house sparrows. S. anatum was isolated from all these sources and S. stanley from rats and poultry, indicating the possibility of cross-infection due to multiple foci of Salmonellae infections. Rodents, free-flying birds and lizards were considered as important sources of Salmonellae.

B-500 Taylor, R.J. and M.R. Burrows. 1971. The survival of Escherichia coli and Salmonella dublin in slurry on pasture and the infectivity of S. dublin for grazing calves. British Vet. J., 127: 536-543. 3 ref. 3 tab.
"Slurry, contaminated with either Escherichia coli or Salmonella dublin (strain 51), was applied under varying climatic conditions to growing pasture. Survival was measured by daily assessment of the number of viable organisms per gram of grass or soil. It was found that under the conditions of the test E. coli survived for up to 7 or 8 days. S. dublin persisted for 18 days on the lower levels of grass and up to 12 weeks in the soil. When the grass was cropped, however, no recoveries were made after 7 days. An assessment was made of the palatability for calves of slurry-polluted pasture. Calves were allowed to graze a pasture, half of which had been heavily polluted with slurry. For two days they rejected the polluted area but by seven days had grazed it well. Calves that grazed pasture to which 10^6 S. dublin/ml of slurry had been applied on the previous day became infected but no cases resulted when the contamination rate was reduced to 10^3/ml."

B-501 McCaughey, W.J., T.G. McClelland and J. Hanna. 1971. Some observations on Salmonella dublin infection in clinically healthy beef cattle. British Vet. J., 127: 549-556. 13 ref. 6 tab. 2 fig.
"Faecal swabs from 2199 adult cattle were examined for S. dublin. The organism was isolated in culture from 0.72 per cent of 1108 cattle which had travelled direct to a local abattoir and from 2.65 per cent of 1091 cattle which were examined following a longer period of transport. Faeces, bile and blood samples were taken from 510 apparently normal adult cattle at slaughter. S. dublin was isolated only from faeces samples on 25 occasions, only from the bile samples on 10 occasions and from both specimens on 14 occasions. The blood samples were examined for the presence of antibodies to S. dublin. Only in those cases where the antibody titre exceeded 1/256 was a consistent relationship to the cultural isolation demonstrated. During the study Rappaports and Selenite F broths were compared as enrichment media for S. dublin."

B-502 Konishi, S. and R.A. Bankowski. 1968. Characteristics of two enteroviruses isolated from swine with diarrhea. Amer. J. Vet. Res., 29: 627-633. 13 ref. 5 tab. 2 fig.
"Two viral agents (classified as porcine enteroviruses) cytopathogenic for pig kidney (PK) cell cultures were isolated from the gastrointestinal tracts of swine. One of them, isolated from diseased pigs and designated Santa Rosa virus, was neutralized by anti-T80 and anti-T52A serums, and there was a slight cross neutralization with E4 virus isolated from normal pigs. The 2nd virus was isolated as a concurrent infection in a pig with transmissible gastroenteritis (TGE) and designated L virus. The L virus showed a close serologic relationship to the Chico strain of porcine enterovirus; however, the Chico virus appeared to have a lesser pathogenic potential."

B-503 Anderson, D.P., R.R. Wolfe, F.L. Cherms and W.E. Roper. 1968. Influence of dust and ammonia on the development of air sac lesions in turkeys. Amer. J. Vet. Res., 29: 1049-1058. 8 ref. 5 tab. 18 fig.
"Under conditions of the present experiment, high concentrations of dust in the atmosphere significantly increased the incidence and severity of air sac lesions in turkeys. Flocks with a high rate (47%) or a low rate (2%) of infection with Mycoplasma meleagridis were similarly affected. No significant interaction between dust and ammonia concentrations with regard to their effect on the development of air sac lesions was found. Mortality and feed conversion were not significantly affected by exposure to dust and ammonia. In turkeys exposed to high concentrations of dust and ammonia there were considerable loss of cilia from the epithelium lining the lumen of the trachea and increase in mucus-secreting goblet cells. Areas of consolidation and inflammation were frequently observed in lungs of these turkeys. The air sac lesions ranged from mild (lymphocytic infiltration) to severe (masses of caseous material)."

B-504 Dulaney, E.L., M.J. Carey and P.J. Glantz. 1968. Extrachromosomal drug resistance in Escherichia coli from diseased animals. Amer. J. Vet. Res., 29: 1067-1072. 37 ref. 2 tab.
"Two of 23 multiple drug-resistant isolates of Escherichia coli from diseased animals transferred tetracycline (TC), streptomycin (SM), and sulfonamide (SU) resistance to Salmonella typhosa. Most of the remaining 21 and other drug-resistant isolates contained extrachromosomal determinants of resistance to TC, SM, and SU but lacked a functional resistance transfer factor. These strains became efficient donors of drug resistance to S. typhosa and Salmonella typhimurium after they had received an effective resistance transfer factor."

B-505 McDougald, L.R., R.G. White and M.F. Hansen. 1968. Efficacy of naphthalophos and coumaphos against nematodes of goats. Amer. J. Vet. Res., 29: 1077-1079. 5 ref. 1 tab.
"Thirty-two naturally parasitized Angora goats were used in a controlled anthelmintic experiment. Naphthalophos in the form of oral drench at dose levels of 25 and 50 mg./kg of body weight was at least 97% efficacious in removing haemonchus from 16 goats. An efficacy ranging between 48 and 88% was recorded for trichostrongylus, nematodirus, and ostertagia, whereas no efficacy was recorded against oesophagostomum and trichuris. Coumaphos given in feed at dose level of 0.86 mg./kg. of body weight daily for 6 days removed 28 to 73% of haemonchus, trichostrongylus, nematodirus, and ostertagia from goats. Trichuris and oesophagostomum were not removed."

B-506 Hill, C.H. 1968. Fecal transmission of Trichinella spiralis in penned hogs. Amer. J. Vet. Res., 29: 1229-1234. 19 ref.
Results of 6 experiments with hogs to investigate the transmission of trichinae through the feces. Noninfected recipient hogs were exposed to the feces of donor hogs which had been infected with trichinae. Transfers of the disease to noninfected recipients were observed in several cases, some of which were caused by coiled infective larvae and possibly some by intestinal forms. It was shown that transfers could be more readily effected in hogs kept in the same pen where the donors were reinfected.

B-507 Glantz, P.J., H. Rothenbacher and J.F. Hokanson. 1968. Escherichia coli isolated from dams and their calves: bacteriologic and serologic test results. Amer. J. Vet. Res., 29: 1561-1566. 6 ref. 1 tab.

"A total of 375 fecal swabs were collected from 15 cows and their calves for 7 consecutive days after parturition had occurred. The fecal swabs were streaked on violet red bile agar, and 1,500 bacterial colonies were transferred for biochemical examination. Of this number, 1,311 colonies were Escherichia coli, and the remainder belonged to Klebsiella, Enterobacter, Proteus, Pseudomonas, Citrobacter, and Alcaligenes groups.... The E. coli isolates identified belonged to 81 different serogroups, with 12 serogroups predominating. Serogroups in the feces of the dam did not always occur in the feces of the respective calf. A few of the serogroups were resident strains, whereas others were constantly being replaced in the animals. Five calves were treated prophylactically, and 1 died. Of the 10 calves not treated, 5 died."

B-508 Train, C.T., R.G. White and M.F. Hansen. 1968. Efficacy of coumaphos and naphthalophos against nematodes of lambs. Amer. J. Vet. Res., 29: 2331-2335. 6 ref. 2 tab.

"Naturally parasitized native lambs given coumaphos mixed with the feed at the dose level of 2 mg./kg. of body weight per day for 6 days brought about 84.7% reduction in the fecal egg count. The same compound given as an additive to the drinking water at the dose level of 2 mg./kg./day for 6 days reduced the fecal egg count by 90.8%. Naphthalophos given in the form of an oral drench at the dose level of 50 mg./kg. or body weight brought about 94.7% reduction of the fecal egg count and, in the form of a bolus at the same dose level, 98.4% reduction...."

B-509 Jacobson, R.H. and D.E. Worley. 1969. Incidence and distribution of helminth parasites and coccidia in Montana cattle. Amer. J. Vet. Res., 30: 1113-1117. 12 ref. 3 tab. 1 fig.

"Results of a survey of endoparasitism in Montana beef cattle during 1965-1966 indicated that 85.6% of 486 calves and 59.1% of 479 adult cattle were infected with gastrointestinal nematodes. Incidence of the Cooperia-Trichostrongylus-Ostertagia complex was greatest (69.7%); it was less for Nematodirus (11.3%), Haemonchus (4.8%), Trichuris (2.0%), and Strongyloides (1.3%), and least for Capillaria (0.3%). Nematode egg counts ranging between 0 and 49 eggs per gram of feces (e.p.g.) occurred in 88.1% of the calves and in 98.3% of the adult cattle. Of 965 animals in the survey, 3.4% had counts greater than 100 e.p.g...."

B-510 Smibert, R.M. 1969. Vibrio fetus var. intestinalis isolated from the intestinal content of birds. Amer. J. Vet. Res., 30: 1437-1442. 21 ref. 1 tab.

"Microaerophilic vibrios isolated from the intestinal content of sparrows, starlings, pigeons, blackbirds, chickens, and turkeys were identified as Vibrio fetus var. intestinalis. These isolates were similar to strains isolated from intestinal tracts of normal sheep as well as from sheep affected with ovine abortion. Isolation of V. fetus var. intestinalis from birds commonly found around sheep and cattle barns is important in the determination of the epizootiologic factors of vibriosis in animals as well as of the epidemiologic factors of vibriosis in man...."

B-511 Cox, D.D., M.T. Mulle and A.D. Allen. 1969. Effect of coumaphos and fenthion feed additives on gastrointestinal nematode egg counts in feedlot cattle. Amer. J. Vet. Res., 30: 1933-1943. 7 ref. 4 tab. 2 fig.

The efficacies of coumaphos and fenthion in reducing gastrointestinal nematode egg counts of cattle were examined in feedlot experiments with 264 naturally parasitized cattle. Coumaphos, but not fenthion, significantly reduced the number of cattle with positive fecal counts up to 34 days after treatment. At 76 and 118 days after treatment, there was no difference between the number of parasites in treated and untreated cattle.

B-512 Beasley, J.N., L.T. Patterson and D.H. McWade. 1970. Transmission of Marek's disease by poultry house dust and chicken dander. Amer. J. Vet. Res., 31: 339-344. 17 ref. 1 tab. 4 fig.
"Dust collected from 3 poultry houses containing chickens with Marek's disease and dander (dandruff or scales) vacuumed from 2 groups of birds with Marek's disease induced the disease in chickens inoculated intra-abdominally with the material and in chickens exposed to dust placed in the isolators. Few deaths occurred in the experimental chickens and paralysis was almost nonexistent. Gross lesions consisted of swollen feather follicles, large mottled spleen, and focal lymphoid tumors in the liver and gonad. Histopathologic changes were identifiable as those of Marek's disease. Preliminary results suggest infectivity of poultry house dust lasted for 4, but not for 6, weeks at room temperature."

B-513 Bennett, D.G. and D.B. Copeman. 1970. Gastrointestinal helminth infections in feeder pigs. Amer. J. Vet. Res., 31: 1093-1096. 7 ref. 2 tab.
"Total gastrointestinal helminth burdens were determined in 246 feeder pigs (av. body weight, 16.1 kg.) shipped from Kentucky, Arkansas, Missouri, and Tennessee into Indiana. Helminth parasites were found in 95% of the pigs, with an average of 63.9 worms per infected pig. The most frequently encountered parasite was Trichuris suis, which was found in 77.2% of the pigs, with an average of 34.9 worms per infected pig. The other parasites found (along with the percentage of the pigs infected with each) were as follows: Ascaris suum (64.6%), Oesophagostomum spp. (47.1%), Ascarops strongylina (19.1%), Macracanthorhynchus hirudinaceus (6.1%), Globocephalus urosubulatus (1.6%), and Physocephalus sexalatus (1.2%). The major difference between the helminth burdens in these feeder pigs and the worm burdens reported in market-weight or heavier swine in other surveys was the complete absence of Hyostrongylus rubidus in the feeder pigs; in older swine the incidence was 15.0 to 49.5%."

B-514 Kolacz, J.W., R.B. Wescott and A.R. Dommert. 1970. Microflora of Hormel miniature swine: fecal flora of adult sows. Amer. J. Vet. Res., 31: 1173-1178. 12 ref. 3 tab.
"Four 12- to 13-month-old Hormel miniature sows were each sampled 15 times over a 9-month period to determine fecal microflora. The numbers of Escherichia coli, other coliforms, enterococci, lactobacilli, clostridia, gram-negative anaerobic rods, veillonellae, staphylococci, molds, and yeast present in freshly collected fecal specimens were quantitated. The values obtained indicated that the fecal microflora of these Hormel miniature swine was similar to that of conventional swine and that it differed in some respects from the fecal microflora of man. The number of organisms quantitated were remarkably similar in the 4 sows. The variation in numbers of lactobacilli, enterococci, staphylococci, clostridia, and veillonellae among sows was less than that observed among samples."

B-515 Haddock, R.L. 1970. Efficacy of examining rectal swabs to detect swine Salmonella carriers. Amer. J. Vet. Res., 31: 1509-1512. 5 ref. 1 tab.
"Salmonellosis in a swine herd was studied by bacteriologic examination of rectal swabs, pooled fecal samples, and cecal swabs collected after slaughter. Six Salmonella carriers were identified in a 16-pig market-age cohort after 3 rectal swabs from each pig had been examined; 6 more carriers were detected after a total of 16 rectal swabs from each pig had been examined. Four Salmonella serotypes were detected at the farm only by means of pooled fecal samples."

B-516 Sterne, R.B., R.B. Wescott and J.T. Parisi. 1970. Phage types of Escherichia coli isolated from swine. Amer. J. Vet. Res., 31: 2101-2103. 9 ref. 2 tab.
"A total of 571 isolates of Escherichia coli, obtained from fecal samples collected from 4 miniature sows, 6 miniature baby pigs, 2 normal conventional baby pigs, and 25 diarrheal conventional baby pigs, were typed with 13 phages isolated from human sewage. More than 61% of these isolates were lysed by 1 or more phages. Most samples contained from 1 to 5 phage types, but samples from young pigs usually contained more types than did samples from adult pigs. Diarrheal pigs had phage type patterns similar to those found in normal pigs."

B-517 Ernst, J.V., R.O. Stevens and C. Cooper, Jr. 1971. Redescription of oocysts of the bovine coccidium Eimeria brasiliensis Torres and Ramos, 1939. Amer. J. Vet. Res,, 32: 223-228. 27 ref. 1 tab. 5 fig.
"Oocysts of Eimeria brasiliensis Torres and Ramos, 1939, from Alabama cattle were examined, and comparisons were made with previous descriptions."

B-518 Kolacz, J.W., R.B. Wescott and A.R. Dommert. 1971. Influence of age and rations on fecal microflora of Hormel miniature swine. Amer. J. Vet. Res., 32: 597-602. 16 ref. 1 tab. 5 fig.
"Samples of feces were collected from 6 swine during a 7-month period to determine fecal microflora in young miniature swine. Fecal samples were taken from pigs at 2- to 3-day intervals from birth to 4 weeks of age and at 1-week intervals thereafter until they were 26 weeks old. The numbers of Escherichia coli, other coliforms, enterococci, lactobacilli, clostridia, gram-negative anaerobic rods, veillonellae, staphylococci, molds, yeasts, and gram variable anaerobic cocci in the samples were determined...."

B-519 Weaver, A.D. 1971. Seasonal variations in ovine urinary constituents, with special reference to pH and potassium concentration. Amer. J. Vet. Res., 32: 813-816. 17 ref. 2 fig.
"Samples of urine were collected by catheter from 20 ewes at pasture at 1-month intervals for 7 years. In years 1 through 4, samples were obtained from Border Leicester x Cheviot sheep and in years 5 through 7, from Cheviots. Mean urinary pH was 6.3 (minimum, 4.8; maximum, 8.2). Values were significantly ($P<0.01$) higher in May to July than in winter months November to March. In years 6 and 7, urinary potassium concentration was significantly correlated with urinary pH ($P<0.01$). In the ewes housed after year 7 and fed hay and sugar beet pulp, the pH increased to 8.22 ± 0.21 (mean and S.D.), the data being highly significantly different from those of any month in the same sheep at pasture ($P<0.001$). Urinary concentrations of calcium, magnesium, and inorganic phosphate were low. Proteinuria and ketonuria occurred infrequently in the ewes except in the spring months when lambing took place."

B-520 Loken, K.I., L.W. Wagner and C.L. Henke. 1971. Transmissible drug resistance in enterobacteriaceae isolated from calves given antibiotics. Amer. J. Vet. Res., 32: 1207-1212. 21 ref. 5 tab.
"A high prevalence of multiple antibiotic resistance was observed in populations of Escherichia coli isolated from 2 large groups of calves in a commercial veal-rearing unit. Almost all of the cultures isolated were resistant to tetracyclines, streptomycin, neomycin, and kanamycin after the calves had been given rations containing neomycin for 1 week. The number of cultures with resistance to ampicillin also increased during antibiotic feeding, despite the fact that it was not utilized in the ration or for therapy. Association between the therapeutic use of chloramphenicol and isolation of E. coli with resistance to this antibiotic was observed. A total of 65% of the multiply resistant cultures of E. coli examined was capable of transferring resistance determinants to a laboratory strain of E. coli K-12 or to Salmonella saintpaul isolated from the calves."

B-521 Molony, V. 1965. Carbon dioxide poisoning in pigs? Vet. Rec., 77: 944.
In this letter to the editor, a recent case of sudden deaths of pigs was reported. A closed septic tank running directly behind the pens had been partially pumped out shortly before the pigs had been found dead. Although the cause of death was not definitely established, carbon dioxide poisoning was suspected. Gases could have entered the building from the septic tank via the underfloor dunging channels.

B-522 Boothroyd, A. 1966. Carbon dioxide poisoning in pigs. Vet. Rec., 78: 770.
In this letter to the editor, a case of gas poisoning of pigs was reported. The slurry tanks located adjacent to the building had been emptied shortly before the pigs were found dead. The ventilation fans had not been functioning that day. Toxic gases which had backed up into the channel and up through the slatted floor could not be carried away and, in all likelihood, were responsible for death of the pigs.

B-523 Jack, E.J. and P.T. Hepper. 1969. An outbreak of Salmonella typhimurium infection in cattle associated with the spreading of slurry. Vet. Rec., 84: 196-199. 10 ref. 1 tab. 1 fig.
"This paper describes an outbreak of S. typhimurium infection in cattle grazing pasture which had been irrigated with slurry three weeks before. S. typhimurium was isolated from the slurry system and from four carrier cows after the outbreak. The methods of isolation of the organism and the possible dangers of this type of disposal of dung are discussed."

B-524 Heard, T.W. 1969. Housing and Salmonella infections. Vet. Rec., 85: 482-484. 11 ref.
Discussion of salmonellosis with particular emphasis given to the influence of building design and waste handling systems on the transmission of the causative organism by fecal matter. It was suggested that animals should be segregated from their feces (i.e. slatted floor systems) and from their neighbors (i.e. individual pens or group pens throughout the finishing period).

B-525 Rankin, J.D. and R.J. Taylor. 1969. A study of some disease hazards which could be associated with the system of applying cattle slurry to

pasture. Vet. Rec., 85: 578-581. 7 ref. 3 tab. 5 fig.
"Physical and bacteriological examinations of 16 samples of cattle 'slurry' have been carried out. On three occasions potentially pathogenic bacteria were isolated, namely, one strain of Salmonella dublin and two strains of haemolytic Escherichia coli. Five strains of potentially pathogenic bacteria survived for 11 to 12 weeks in slurry, although none of them appeared to multiply. The system of slurry disposal on pasture and its implications are discussed."

B-526 Lawson, G.H.K. and J.V.S. McAllister. 1966. Toxic gases from slurry. Vet. Rec., 79: 274. 2 ref.
In this letter to the editor, a number of mortalities associated with slurry gas poisoning of pigs were reported. Several gases could have been responsible. The danger to humans and livestock of gases being released from slurry during agitation was emphasized.

B-527 Moran, A.B. 1960. Salmonella and Arizona cultures of animal origin: 1958. Avian Diseases, 4: 73-78. 2 ref. 2 tab.
Results of serological typing of 1,855 cultures of Salmonellae isolated from agricultural sources in the United States during 1958. Of the Salmonellae identified 68% were from animals, 87.2% of these being of avian origin. Sixty-one different Salmonella serotypes and 11 different Arizona serotypes were encountered.

B-528 Moran, A.B. 1961. Salmonella and Arizona cultures from agricultural sources: 1959. Avian Diseases, 5: 145-149. 2 ref. 2 tab.
Results of serological typing of 2,350 cultures of Salmonella isolated from agricultural sources in the United States during 1959. Of the Salmonellae identified 73.6% were from animals, the largest proportion of these being of avian origin.

B-529 Anderson, D.P., C.W. Beard and R.P. Hanson. 1964. The adverse effects of ammonia on chickens including resistance to infection with Newcastle disease virus. Avian Diseases, 8: 369-379. 14 ref. 1 tab. 1 fig.
"Chickens, turkeys, guinea pigs, and mice exposed continuously to 20 ppm of ammonia showed gross or histopathological signs of damage to the respiratory tract after six weeks of exposure. A 72-hour exposure of 20 ppm of ammonia significantly increased the infection rate of chickens subsequently exposed to an aerosol of Newcastle disease virus. The same phenomenon was observed when chickens were exposed to 50 ppm of ammonia for 48 hours. Infection was demonstrated clinically and serologically."

B-530 Khanna, P.N. 1964. Studies on cytopathogenic avian enteroviruses. I. Their isolation and serological classification. Avian Diseases, 8: 632-637. 12 ref. 2 tab.
"Chicken kidney tissue cultures from chickens up to one week old were used successfully in isolating 86 chloroform-resistant cytopathogenic agents from 205 fecal samples from healthy chickens of 7 different flocks. The percentage of isolations was highest from chickens 2 to 3 months old; attempts failed to isolate such agents from chickens about 1 year old. The 86 cytopathogenic agents were found to belong to at least 6 serological groups on the basis of serum neutralization tests using antisera prepared in rabbits. Antigenic group I, which was serologically identical to the EV-89 strain, was most prevalent."

B-531 Anderson, D.P. and R.P. Hanson. 1965. Influence of environment on virus diseases of poultry. Avian Diseases, 9: 171-182. 27 ref.
"The environmental factors most often considered by the poultry industry include temperature, humidity, air composition, air movement, light, radiations, and litter. Singly or in combination, these factors have all been incriminated as contributing to disease and condemnation losses of poultry.... An evaluation of environmental influences meaningful to the poultry industry must include the effects of the environment not only on the physiology of the birds but also on the causative agents of diseases and on the host-parasite relationship."

B-532 Khanna, P.N. 1966. Studies on cytopathogenic avian enteroviruses. II. Influence of age on virus excretion and incidence of certain serotypes in a colony of chicks. Avian Diseases, 10: 27-32. 9 ref. 2 fig.
"Fecal samples of a group of 34 chickens were examined monthly from one month of age up to eleven months. Of 308 samples examined, 49 contained chloroform-resistant agents. The earliest and the highest number of isolates were made in the second- and third-month materials. The results indicate that excretion of enterovirus is definitely correlated with age. Attempts to isolate these agents from one chicken failed during the whole observation period. No chicken was found shedding virus belonging to one serotype for more than two months...."

B-533 Baker, E.D., F.A. Van Natta and A.R. McLaughlin. 1966. Salmonella isolations on a turkey farm - a field study. Avian Diseases, 10: 131-134. 7 ref. 1 tab.
"Contaminated buildings and carrier turkeys yielded the greatest number of positive cultures upon the investigation of potential Salmonella sources on a turkey farm. Nineteen Salmonella isolations were made during the study (April 2-July 9). The serotypes isolated were S. worthington, S. chester, S. anatum, S. melagridis, and S. st. paul. A turkey house remained heavily contaminated with Salmonella for 9 months following removal of an infected flock."

B-534 Anderson, D.P., C.W. Beard and R.P. Hanson. 1966. Influence of poultry house dust, ammonia, and carbon dioxide on the resistance of chickens to Newcastle disease virus. Avian Diseases, 10: 177-188. 16 ref. 2 tab. 8 fig.
"Chickens exposed artificially to 'poultry house dust' showed no gross or microscopic damage to the respiratory tract after 6 hr of continuous exposure or 2-hr exposures for 8 consecutive days. Chickens exposed 'naturally' to ammonia, carbon dioxide, and dust in the environment of a poultry house for 6 days had some loss of cilia from the epithelium of the upper portion of the trachea and the turbinates. Dust particles were visible in the macrophages of the lungs. When these chickens were exposed to a secondary stress in the form of a respiratory infection initiated by an aerosol of NDV, there was no statistically significant difference in mean death time or percent mortality from control birds receiving only the NDV aerosol."

B-535 Anderson, D.P., C.W. Beard and R.P. Hanson. 1966. The influence of inhalation of carbon dioxide on chickens, including resistance to infection with Newcastle disease virus. Avian Disease, 10: 216-234. 15 ref. 2 tab.
"Chickens and turkeys exposed continuously to 5,000 ppm (0.5%) of carbon

dioxide for 8 weeks showed no gross or microscopic signs of damage to the respiratory tract. There were no significant differences in weekly weight gains or feed conversion ratios between birds exposed to CO_2 and their hatch-mate controls. Chickens exposed to CO_2 for varying periods followed by exposure to an aerosol of Newcastle disease virus exhibited a prolonged mean death time in only one of six trials when compared to control birds receiving only the aerosol of NDV."

B-536 Snoeyenbos, G.H., V.L. Carlson, B.A. McKie and C.F. Smyser. 1967. An epidemiological study of Salmonellosis of chickens. Avian Diseases, 11: 653-667. 11 ref. 3 tab. 1 fig.

"Extensive culturing of environmental samples during a 75-week period was used to determine the dependability of such sampling to determine the salmonella status of a flock. Additional cultural procedures were used to determine the source of flock infection and the dynamics of transmission of infection between pens and houses of chickens on a commercial farm. Litter from pens containing chicks known to be infected with S. montevideo yielded a high percentage of positive samples during the first 16 weeks of age (87.5%), and then sharply declined to very low levels of recovery. The decline in recovery rate was much less pronounced in pens containing chickens originally infected with S. braenderup. Cultures from water troughs, pneumatic egg lifters, and air dust samples were much less dependable sources of isolation than was floor litter. Nest litter from the mature flocks yielded a higher frequency of isolations than floor litter. Culturing litter proved to be a dependable and efficient method to detect flock infection under some circumstances. Additional work is required to determine the capabilities and limitations of this method of examination...."

B-537 Carlson, H.C. and G.R. Whenham. 1968. Coliform bacteria in chicken broiler house dust and their possible relationship to coli-septicemia. Avian Diseases, 12: 297-302. 15 ref. 1 fig.

"Air sampling for total bacterial content and coliform organisms and relative humidity studies was conducted in 6 broiler houses during the 9-week growing period. The coliform count rose steeply from zero on the first day, reached a maximum of about 33 organisms per cubic foot of air between 2½ and 3 weeks, dropped sharply to 8 per cubic foot at about 6 weeks, and then rose slowly to 30 per cubic foot at 9 weeks. Total bacteria count began at approximately zero and rose gradually from about zero to an average of 360,000 organisms per cubic foot of air at about six weeks, then leveling off at approximately 200,000 organisms at nine weeks. A coliform septicemia which generally affected the birds developed about 1 week after coliform numbers peaked in the dust samples. The atmospheric humidity did not appear to have any effect on the relative humidity inside the house, which remained at 50-60%."

B-538 Witter, R.L., G.H. Burgoyne and B.R. Burmester. 1968. Survival of Marek's disease agent in litter and droppings. Avian Diseases, 12: 522-530. 14 ref. 2 tab.

"Thirty samples of droppings and litter from chickens inoculated with the JM or GA strain of Marek's disease (MD) were tested for infectivity by direct contact exposure of chicks. Seventeen of 23 JM samples and one of 7 GA samples induced MD in assay chicks when tested one day after collection. Infectivity was demonstrated in 8 of 14 JM samples following 4 to 16 weeks of storage at room temperature. MD was not observed in any of 27 lots of uninoculated control chicks or chicks exposed to heated samples. Survival of the MD agent appeared unrelated to the presence of mites in the samples but may be adversely affected by moisture. These data suggest that litter and droppings may be potential environmental reservoirs of MD agent."

B-539 Eidson, C.S. and S.C. Schmittle. 1968. Studies on acute Marek's disease. V. Attempted transmission of isolate GA with feces and nasal washings. Avian Diseases, 12: 549-553. 8 ref. 3 tab.
"The GA agent of Marek's disease was transmitted in nasal washings from 3-week-old donor birds to one-day-old chicks; however, the data suggest that infectivity could be removed from nasal washings by centrifuging them for 10 min at 2000 x g. Feces taken directly from GA-infected birds were not infective when injected into day-old chicks, nor did one-day-old chicks develop MD when placed in direct contact with fecal droppings collected from GA-infected birds."

B-540 Snoeyenbos, G.H., V.L. Carlson, C.F. Smyser and O.M. Olesiuk. 1969. Dynamics of Salmonella infection in chicks reared on litter. Avian Diseases, 13: 72-83. 5 ref. 1 tab. 11 fig.
"Ten Salmonella serotypes, including a number of those most commonly found in poultry, were shown to spread rapidly from infected day-old chicks to penmates reared on litter. Infection of contact chicks in some trials reached or approached 100% by the seventh day of exposure. In all trials except one, infection was demonstrated in a majority or in all contact chicks by the third week of age. Mortality was low and confined chiefly to the infected principals. Clinical signs in the groups were minimal or undetected."

B-541 Snoeyenbos, G.H. and C.F. Smyser. 1969. Isolation of Arizona 7:1,7,8 from litter of pens housing infected turkeys. Avian Diseases, 13: 223-224. 7 ref.
Arizona 7:1,7,8 was recovered from most litter samples analyzed. It was suggested that examination of litter for this organism might be used as an aid in identifying infected flocks of turkeys.

B-542 Domermuth, C.H. and W.B. Gross. 1969. A medium for isolation and tentative identification of fecal streptococci and their role as avian pathogens. Avian Diseases, 13: 394-399. 12 ref.
"A selective differential medium is described which is useful in primary isolation and identification of Streptococcus fecalis, S. faecium, S. durans, and other bacteria, notably Staphylococcus aureus. In laboratory studies, S. fecalis strains were found to be much more pathogenic than strains of S. durans and S. faecium. Methods of isolation and the importance of enterococci as primary pathogens are discussed."

B-543 Fanelli, M.J., W.W. Sadler and J.R. Brownwell. 1970. Preliminary studies on persistence of Salmonellae in poultry litter. Avian Diseases, 14: 131-141. 10 ref. 1 tab. 3 fig.
"Preliminary studies with Salmonella infantis and S. typhimurium showed that those salmonellae do not persist as long in built-up poultry litter as in fresh litter. The shed rate of birds on built-up litter suggests an inhibitory effect for salmonellae in the litter. This effect may reduce salmonellae in either the litter or the intestinal tract. Cycling of salmonellae between litter and the intestinal tract appears of significance in maintaining intestinal infection. This cycling is more evident in unchanged new litter than

in built-up litter or in fresh litter changed periodically. Fresh litter replaced periodically did not appear to differ from built-up litter in infection rate. Contamination levels of the two litters were similar."

B-544 Jurajda, V. and B. Klimes. 1970. Presence and survival of Marek's disease agent in dust. Avian Diseases, 14: 188-190. 9 ref. 1 tab.
"Dust collected from the ventilation system of poultry houses harbored Marek's disease agent. Dust infectivity was demonstrated 1, 9, and 44 days after collection."

B-545 Smyser, C.F., G.H. Snoeyenbos and B. McKie. 1970. Isolation of Salmonellae from rendered by-products and poultry litter cultured in enrichment media incubated at elevated temperatures. Avian Diseases, 14: 248-254. 13 ref. 6 tab.
"Three enrichment media incubated at 42 ± 1 C were compared for isolating salmonellae from rendered animal and marine by-products, and two of the media were compared for poultry litter. Salmonellae were recovered from 317 of the 755 rendered samples and from 203 of the 235 litter samples examined...."

B-546 Naqi, S.A., D.H. Lewis and C.F. Hall. 1970. The intestinal microflora of turkeys. Avian Diseases, 14: 620-625. 10 ref. 3 tab.
"Techniques were developed for the collection and processing of turkey intestinal material for microflora studies. Repeatable bacteriological procedures were developed which should be applicable to other avian species as well. Studies on the development of the bacterial flora in the intestines of apparently healthy turkey poults revealed that the alimentary tract is invaded by several bacterial species shortly after hatching. Such organisms multiply extensively and reach very high levels within 24-72 hours posthatching. Later, however, bacterial numbers slowly decrease and a characteristic gastrointestinal microflora is established early in life."

B-547 Olesiuk, O.M., G.H. Snoeyenbos and C.F. Smyser. 1971. Inhibitory effect of used litter on _Salmonella typhimurium_ transmission in the chicken. Avian Diseases, 15: 118-124. 9 ref.
"Four sequential trials were conducted to determine the effect of used litter on the transmission pattern of _S. typhimurium_ in chickens. The pens were unoccupied for only 3 to 5 days between trials and the litter in the pens was not changed during the 32-week study. The pens were initially populated with four-week-old chicks infected with _S. typhimurium_. Pens were repopulated at approximately bimonthly intervals with 25 uninoculated one-day-old chicks or with one or two inoculated principals and 23 or 24 contacts, totaling 326 birds. Infection was determined by culturing litter and cloacal swabs from all birds at weekly intervals. None of the uninoculated chicks reared in pens on used litter following removal of infected groups of chicks yielded _S. typhimurium_ even though sporadic isolations were made from the litter. When infected principals and contacts were introduced into the test-pens, the used litter yielded a lower rate of salmonella recovery in the contacts than in the controls started on new litter, and sharply moderated the rate of transmission and duration of infection."

B-548 Fuller, R., L.G.M. Newland, C.A.E. Briggs, R. Braude and K.G. Mitchell. 1960. The normal intestinal flora of the pig. IV. The effect of dietary supplements of penicillin, chlortetracycline or copper sulphate

on fecal flora. J. Appl. Bacteriol., 23: 195-205. 27 ref. 6 tab. 2 fig.
"Streptococci, lactobacilli and coli-aerogenes organisms were isolated from pigs receiving penicillin, chlortetracycline or copper sulphate as dietary supplements. Changes in their numbers, physiological type and sensitivity to the supplements fed are described. Penicillin and chlortetracycline rapidly induced a population resistant to the antibiotic fed, but no changes were detected in numbers or types of organisms isolated. Copper sulphate caused a reduction in the numbers of streptococci and a change of predominant type from non-lactose-fermenting to lactose-fermenting; there was also a change from a flora in which _L. acidophilus_ predominated to one in which _L. brevis_ and _L. cellobiosus_ tended to become dominant."

B-549 Smith, H.W. 1961. The development of the bacterial flora of the faeces of animals and man: the changes that occur during ageing. J. Appl. Bacteriol. 24: 235-241. 6 ref. 4 tab. 4 fig.
Report on examination of the bacterial flora of cattle, sheep, swine, humans, horses, poultry and other animals. Data on the number of viable bacteria found in the feces of adult animals of different species are presented in tabular form. Data are also given on the phage types of _E. coli_ present in the feces of calves and cows and the effect of age on the counts of other microorganisms in several different species. The effects of diet and pattern of feeding on the bacterial flora of the feces were discussed.

B-550 Dickinson, A.B. and G. Mocquot. 1961. Studies on the bacterial flora of the alimentary tract of pigs. I. Enterobacteriaceae and other Gram-negative bacteria. J. Appl. Bacteriol., 24: 252-284. 110 ref. 10 tab.
Report on research to identify the dominant component groups of Gram-negative facultative anaerobes from samples of the feces of pigs which were receiving a standard fattening diet, and from samples of their gastric, intestinal and caecal contents at slaughter. In some cases, organisms in the subdominant flora were also identified. A total of 1,670 strains of facultative anaerobes was studied. _Escherichia_ strains were dominant among the Enterobacteriaceae groups except in one case, when they were outnumbered by Providence strains accompanied by _Proteus rettgeri_. Both _Pasteurella pseudotuberculosis_ and _Actinobacillus_ strains were isolated from apparently healthy animals which showed normal growth.

B-551 Raibaud, P., M. Caulet, J.V. Galpin and G. Mocquot. 1961. Studies on the bacterial flora of the alimentary tract of pigs. II. Streptococci: selective enumeration and differentiation of the dominant group. J. Appl. Bacteriol., 24: 285-306. 55 ref. 12 tab. 1 fig.
Report on studies conducted in France aimed at enumerating and identifying the dominant streptococci present in the alimentary tract of pigs. Average counts (per gm. of wet material) of streptococci obtained were 9.5×10^4 in the gastric contents, 3.6×10^7 in the caecal contents and 6.9×10^7 in the feces. Characteristics and classification of the organisms isolated are reported in detail.

B-552 Barnes, E.M. and H.S. Goldberg. 1962. The isolation of anaerobic Gram-negative bacteria from poultry reared with and without antibiotic supplements. J. Appl. Bacteriol., 25: 94-106. 23 ref. 6 tab.

"A number of methods advocated for the isolation of bacteroides have been tested. By using an ethyl violet-azide agar medium under strictly anaerobic conditions, as many as 10^8/g of a group of obligately anaerobic Gram-negative bacteria were detected in the caeca of chickens. Freshly isolated organisms from chlortetracycline fed chickens showed a slightly greater resistance to chlortetracycline than those isolated from the control birds, but there was little difference after further subculture."

B-553 Medrek, T.F. and E.M. Barnes. 1962. The distribution of group D streptococci in cattle and sheep. J. Appl. Bacteriol., 25: 159-168. 20 ref. 5 tab.
"Numbers and types of Lancefield group D streptococci have been determined in samples from the colons of 17 cattle and 9 sheep. Mean total streptococcal counts of 8 x 10^4/g in cattle and 2 x 10^6/g in sheep were obtained. Streptococcus bovis was found in every sample and was the predominant species in 15 of the cattle and 6 of the sheep. Other group D streptococci (Strep. faecalis, Strep. faecium and Strep. durans) were rare in cattle, but in sheep they formed a significant proportion of the population. Of 60 Strep. faecium, Strep. durans and related strains, 51 fermented raffinose. Many of the strains of Strep. faecium were also atypical in that they fermented sorbitol and appreciably reduced tetrazolium in broth at pH 6.0. Strep. bovis remained the predominant streptococcus in faeces samples from 4 dairy cows when they were tested again after an interval of 17 and 18 months."

B-554 Schefferle, H.E. 1965. The microbiology of built up poultry litter. J. Appl. Bacteriol., 28: 403-411. 7 ref. 5 tab.
"The numbers of viable bacteria in built up poultry litter were found to be 10^{10}-10^{11}/g fresh weight and appeared to be little affected by factors such as age, temperature, moisture content and pH. Counts for unused litter and poultry droppings were lower. In built up litter of high alkalinity coryneform bacteria were predominant; micrococci occurred sporadically and small numbers of nocardias, streptomycetes, aerobic spore formers and streptococci were encountered. A variety of Gram negative bacteria also occurred, the numbers of which appeared to be controlled by alkalinity; they were less abundant in litters where the pH and buffering capacity were high. Strongly alkaline conditions also tended to lower the fungal counts but had no effect on the count of enterococci."

B-555 Schefferle, H.E. 1965. The decomposition of uric acid in built up poultry litter. J. Appl. Bacteriol., 28: 412-420. 19 ref. 1 tab.
"The decomposition of uric acid in built up poultry litter appears to be brought about almost exclusively by the action of aerobic bacteria. Organisms decomposing uric acid usually comprised about one quarter of the bacterial population. There were strains of Corynebacterium and less frequently strains of Nocardia, Streptomyces, Pseudomonas, Alcaligenes and Achromobacter. Uric acid was converted to ammonia by some of the organisms but only to urea by the majority. Hydrolysis of urea to ammonia could be brought about by strains of Corynebacterium, Micrococcus, Alcaligenes, Achromobacter and Cytophaga which had no action on uric acid. It is suggested that the ammoniacal smell and high alkalinity of built up poultry litter result largely from the decomposition of uric acid. The identity of the bacteria concerned is discussed."

B-556 Schefferle, H.E. 1966. Coryneform bacteria in poultry deep litter.

J. Appl. Bacteriol., 29: 147-160. 57 ref. 2 tab.
This paper discusses the characteristics and classification of the coryneform bacteria isolated during a prior investigation.

B-557 Wilssens, A.T.E. and J.C. Vande Casteele. 1967. Occurrence of micrococci and staphylococci in the intestines of piglets and pigs. J. Appl. Bacteriol., 30: 336-339. 9 ref. 2 tab.
"Over 300 Gram positive, catalase positive cocci isolated from the intestinal contents of piglets and pigs were examined and classified by the methods of Baird-Parker (1963). Most of the subgroups of the Micrococcaceae were represented in the samples, but Staphylococcus subgroups I, III, and VI were present only in the piglets. Subgroup VI could be clearly subdivided further into VI (the original subgroup of Baird-Parker) and VIa, according to the response in the acetoin test. The organisms belonging to subgroup VIa were quite frequently isolated. In adult pigs Micrococcus subgroups 2, 3, 4, 5, 6 and 7 were found, but in piglets only subgroups 3, 5 and 7 occurred. A high proportion of the strains isolated belonged to Micrococcus subgroups 5 and 7."

B-558 Barnes, E.M. and C.S. Impey. 1968. Anaerobic Gram negative nonsporing bacteria from the caeca of poultry. J. Appl. Bacteriol., 31: 530-541. 21 ref. 3 tab.
"Four groups (1, 4, 5 and 6) of Gram negative, nonsporing anaerobic rods (family Bacteroidaceae) which have been isolated from the caeca of chickens, turkeys and ducks, are described. Two of the groups (1 and 6) belong to the genus Sphaerophorus but differ in a number of characteristics from named strains. The group 5 strains belong within the genus Bacteroides and resemble Bact. fragilis. The group 4 strains differ from Sphaerophorus and Bacteroides and have not yet been assigned to a genus. The methods used for isolating and identifying these organisms are discussed."

B-559 Grau, F.H., L.E. Brownlie and M.G. Smith. 1969. Effects of food intake on numbers of salmonellae and Escherichia coli in rumen and faeces of sheep. J. Appl. Bacteriol., 32: 112-117. 6 ref. 3 fig.
"When 10^7-10^8 Salmonella anatum or Salm. typhimurium were inoculated into the rumen of sheep consuming 1.3 kg of lucerne chaff daily, salmonellae were eliminated from the rumen in 2 days, and could not be detected in the faeces after c. 1 week. During starvation, both Escherichia coli and salmonellae grew in the rumen. Resumption of feeding after starvation for 3 days caused further multiplication of E. coli and salmonellae in the rumen. The organisms were subsequently eliminated with further feeding. Inoculation with as few as 400 salmonellae cells into a starved sheep led to large numbers of salmonellae appearing in the faeces and being excreted in varying numbers for at least 5 weeks after resumption of feeding."

B-560 LaBrecque, G.C. and C.N. Smith. 1960. Tests with young poultry for the control of house fly larvae under caged laying hens. J. Econ. Entomol., 53: 696. 1 ref.
Report on research to determine whether or not house fly infestations in Florida poultry houses could be controlled by giving young cockerels access to the droppings in which the larvae were developing. Effective fly control was achieved, and no undesirable taste was imparted to the meat of the cockerels. Application of this method transformed fly control from a costly procedure into a minor asset, and eliminated resistance, residue, and toxicity problems.

Further studies are being conducted with young pullets instead of cockerels.

B-561 Harvey, T.L. and J.R. Brethour. 1960. Feed additives for control of house fly larvae in livestock feces. J. Econ. Entomol., 53: 774-776. 12 ref. 4 tab.
"There was no reduction in the numbers of house flies (Musca domestica L.) completing development from egg to adult in feces from a steer fed up to 100 gm./day of Polybor 3, (containing 98% of disodium octoborate tetrahydrate ($Na_2B_8O_{13}$ - $4H_2O$)). When mixed directly with cattle manure, Polybor 3 was an effective larvicide; a possible explanation for relatively higher rates in a steer ration not controlling larvae in feces is discussed. Bacillus thuringiensis Berliner spores containing 25 billion/gm. mixed directly with cattle feces at rates of 0, 50, 100, 200, and 300 mg./kg. and inoculated with 100 house fly eggs resulted in an average of 43, 44, 9, 5, and 0 adult house flies completing development, respectively. Feeding 20 gm. B. thuringiensis/day to a steer prevented development of house flies in manure, and 0.125 gm. B. thuringiensis/kg. ration greatly reduced the number of adult flies emerging from hen droppings. The presence of aureomycin did not decrease the effectiveness of this pathogen."

B-562 Anthony, D.W., N.W. Hooven and O. Bodenstein. 1961. Toxicity to face fly and house fly larvae of feces from insecticide-fed cattle. J. Econ. Entomol., 54: 406-408. 5 ref. 1 tab.
Co-Ral, Bayer 22408 and ronnel were administered to Holstein heifers in the grain ration for 5 consecutive days to determine whether the treated animals would produce droppings that were toxic to the larvae of face flies (Musca autumnalis DeGeer) and house flies (Musca domestica L.). Tests in which the feces from the treated animals were infested with newly hatched larvae showed that Co-Ral and Bayer 22408 completely inhibited the development of face fly larvae at dosages of 1.0 and 0.5 milligrams per kilogram of animal weight. House fly larvae failed to survive at the 1.0 mg./kg. dosages of both chemicals. The 0.5 mg./kg. dosages were highly effective, but did not completely stop house fly development. Feces from animals fed ronnel at 5.0 mg./kg. gave complete kill of face fly and house fly larvae. Ronnel at 2.5 mg./kg. was effective against the larvae of face flies, but not house flies.

B-563 Eddy, G.W. and A.R. Roth. 1961. Toxicity to fly larvae of the feces of insecticide-fed cattle. J. Econ. Entomol., 54: 408-411. 7 ref. 3 tab.
"Studies were conducted on the toxicity to newly hatched house fly larvae (Musca domestica L.) of the feces of cattle fed 25 different compounds. The materials were incorporated in he animals' diet for 5 days and fecal samples collected for tests at different intervals during feeding and after it was discontinued. Fourteen of the 25 compounds were not completely lethal to the larvae at the dosages tested. Bayer 22408 and Co-Ral, the two most effective materials, were lethal to the larvae when administered to the animals at dosages as low as 1 mg./kg. Comparative data are presented on the susceptibility of newly hatched larvae of the house fly, stable fly (Stomoxys calcitrans (L.)), and horn fly (Siphona irritans (L.)) to four of the more effective insecticides."

B-564 Dorough, H.W. and B.W. Arthur. 1961. Toxicity of several organophosphates administered in the diet of broilers to house fly larvae in

the feces. J. Econ. Entomol., 54: 1117-1121. 19 ref. 3 tab.
"Ronnel, butonate, Ruelene, Bayer 29493, Bayer 22408, Bayer 34098 and Bayer 37342 were mixed in poultry-growing mash at 50, 100, 200, 400, and 800 p.p.m. and fed to 5- to 7-week-old broilers for 7 days. Bayer 22408, Bayer 29493, Bayer 34098, and Bayer 37342 at all concentration levels in the feed resulted in 100% control of house fly (Musca domestica L.) larvae in the feces. Ronnel was effective at the 200, 400,and 800 p.p.m. levels, but was ineffective at the lower concentrations against house fly larvae; butonate and Ruelene were ineffective. Polymer and nonpolymer formulations of Bayer 22408 in the feed were equally effective against 1- and 3-day-old house fly larvae in poultry droppings. Negative gains in weight were observed of birds receiving Bayer 29493 and Bayer 37342 at 200 p.p.m. or higher in the feed. Fifty per cent of the broilers died that were on feed containing 400 or 800 p.p.m. Bayer 37342."

B-565 Skaptason, J.S. and C.W. Pitts. 1962. Fly control in feces from cattle fed Co-ral. J. Econ. Entomol., 55: 404-405. 5 ref. 1 tab.
Report on trials to study the effect of Co-ral on the development of insects in the feces of steers fed the insecticide. Results indicated that Co-ral fed at 5, 10 and 50 ppm significantly reduced emergence of flies compared with controls.

B-566 Rodriguez, J.L. and L.A. Riehl. 1962. Control of flies in manure of chickens and rabbits by cockerels in southern California. J. Econ. Entomol., 55: 473-477. 1 ref. 4 tab. 1 fig.
"Reduction of fly larvae and pupae (Musca domestica L.,) to zero in chicken manure, under cages with a raised wire mesh floor, by cockerel chicks released on the ground was demonstrated in commercial poultry ranches in southern California. Control was maintained with ratios of 20 to 100 hens in cages per one cockerel on the ground. The cockerels developed satisfactorily and were left on the ground until they were 12 to 16 weeks old; extension to 24 weeks was tried successfully when management practices were good in all aspects. The number of chicks needed and the discernible factors in varying conditions were studied to ascertain management practices favorable to fly control by the chicks. Desirable practices are listed in a résumé. The use of cockerels was extended in a trial with rabbits; control of fly larvae and pupae in the droppings was obtained with one cockerel per five rabbits."

B-567 Treece, R.E. 1962. Feed additives for control of face fly larvae in cattle dung. J. Econ. Entomol., 55: 765-768. 6 ref. 3 tab. 2 fig.
"Dairy cattle were fed measured doses of insecticides mixed with grain. Dung collections were infested in the laboratory with newly hatched larvae of the face fly (Musca autumnalis De Geer) and survival was observed. The lowest effective daily doses were approximately as defined follows: Co-ral and Bayer 22408 - 0.125 to 0.25 mg./kg., Bayer 29493 - 1 to 2 mg./kg., SD-4294 - 2 to 5 mg./kg., ronnel and Zytron - 2 mg./kg. Effective control did not persist beyond 24 hours after termination of treatment. DDVP, Ruelene, and dimethrin, when fed at 5 mg./kg., were not effective. Mineral blocks containing 5.5% ronnel were fed ad libitum to Hereford cattle for 1 month. Survival of face fly larvae in dung samples was extremely variable, although average consumption of ronnel was 3.5 mg./kg. daily. There was some reduction in face fly populations on the animals."

B-568 Axtell, R.C. 1963. Effect of Macrochelidae (Acarina: Mesostigmata) on house fly production from dairy cattle manure. J. Econ. Entom., 56: 317-321. 6 ref. 6 tab.

"Caged areas of intact calf pen manure with the mite population undisturbed produced 61% to 67% fewer house flies (Musca domestica Linnaeus) than did areas with the mites destroyed by Kelthane when 20,000 fly eggs were added to each area. Outdoor piles of dairy cattle manure with the mite population undisturbed produced 31% to 45% fewer house flies than did piles with the mites destroyed by Kelthane, when 50,000 fly eggs were added to each pile. Indoor caged piles of fresh dairy cattle manure to which 20,000 house fly eggs were added produced 94% fewer flies when 200 Macrocheles muscaedomesticae (Scopoli) and 200 Glyptholaspis confusa (Foà) were added than did piles to which no mites were added. Similar reductions in fly production in the presence of the mites resulted when 20,000 and 60,000 eggs and fresh manure were added to the piles 3 weeks later. Addition of 60,000 eggs to indoor caged piles of fresh dairy cattle manure, to which were added 200 M. muscaedomesticae and 200 G. confusa, resulted in 83% fewer house flies than were produced from piles with no mites. The reductions in numbers of house flies by the mites were large compared to the actual fly production from manure but were small compared to the potential production of flies from the numbers of eggs added."

B-569 Drummond, R.O. 1963. Toxicity to house flies and horn flies of manure from insecticide-fed cattle. J. Econ. Entomol., 56: 344-347. 6 ref. 2 tab.

"In feeding tests extending 91 days, 0.5 and 1 mg./kg./day of Co-ral and 1 mg./kg./day of Bayer 22408 were essentially 100% effective in preventing development of larvae of horn flies (Haematobia irritans (L.)), and partially effective against house flies, Musca domestica L., in manure of cattle. In 10-day feeding tests with 10 insecticides, Bayer 37341 at 5 mg./kg./day, Bayer 37342 at 10 mg./kg./day, and General Chemical 4072 at 2.5 mg./kg./day were effective against both species. Famophos at 10 mg./kg./day, V-C 13 Nemacide at 3 mg./kg./day, and Bayer 29493 and Stauffer R-1504 both at 2.5 mg./kg./day, were effective against horn flies but only partially so against house flies."

B-570 Ode, P.E. and J.G. Matthysse. 1964. Feed additive larviciding to control face fly. J. Econ. Entomol., 57: 637-640. 22 ref. 1 tab.

"Insecticides were fed to dairy cattle to face-fly-larvicide subsequent manure. Effectiveness was tested by introducing first-instar larvae. Effective were zinc oxide (40 mg/kg body weight); fenthion, barthrin, dimethrin, and 3-4 dimethyl benzyl ester of chrysanthemumic acid (10 mg/kg); coumaphos (0.25 to 10 mg/kg); ronnel (1 mg/kg); and Bayer 22408 (0.25 and 1 mg/kg). Bacillus thuringiensis, ground Ryania speciosa stem (wood(alkaloid ryanodine) $C_{25}H_{35}O_9N$ or $C_{26}H_{37}O_9N$), carbaryl, methoxychlor, malathion, diazinon, and sodium zirconium lactate were ineffective at dosages tested.

B-571 Pitts, C.W. and T.L. Hopkins. 1964. Toxicological studies on dichlorvos feed-additive formulations to control house flies and face flies in cattle feces. J. Econ. Entomol., 57: 881-884. 8 ref. 2 tab. 3 fig.

"Polyvinyl chloride resin formulations of dichlorvos (DDVP) designed for rapid release (XP-515) and slow release (XP-602) were tested for efficacy in controlling house fly, Musca domestica L., larvae, in manure when mixed in cattle feed for 33 and 32 days, respectively. Bioassays of manure from cattle receiving the feed formulations at 0.5, 1.0, 2.0, and 4.0 mg/kg per day exhibited excellent fly control. Blood cholinesterase levels of animals receiving XP-515 showed no depression at 0.5 and 1.0 mg/kg level but a significant depression occurred at 2.0 and 4.0 mg/kg. XP-602 caused no depression at 0.5 mg/kg but significant depressions at 1.0, 2.0 and 4.0 mg/kg levels. Weight gains, feed consumption, palatability, and feed conversion were generally unaffected. No clinical signs of toxicity to cattle were observed and no gross pathological changes were evident. The comparative toxicity of dichlorvos to larvae of the house fly and face fly, M. autumnalis DeGeer, was studied by mixing purified dichlorvos in bovine manure before implanting it with newly hatched larvae. Face fly larvae were approximately twice as susceptible as house fly larvae with LD_{50}'s of 0.013 and 0.028 µg/gm, respectively. In view of the greater susceptibility of the face fly to dichlorvos in manure, the PVC resin formulations would be expected to control both species at the dosage levels tested."

B-572 Brydon, H.W. 1965. A sampler for immature flies in poultry droppings. J. Econ. Entomol., 58: 697-699. 2 fig.
"Construction details are given for a sampling device that can extract an intact 2-inch-wide cross-section segment of coned poultry droppings. Samples taken thereby facilitate the gathering of detailed information regarding immature fly inhabitants."

B-573 Eversole, J.W., J.H. Lilly and F.R. Shaw. 1965. Comparative effectiveness and persistence of certain insecticides in poultry droppings against larvae of the little house fly. J. Econ. Entomol., 58: 704-709. 17 ref. 3 tab.
"A method was developed for testing insecticides against newly hatched larvae of the little house fly, Fannia canicularis (L.), which were exposed continuously to a toxicant mixed in poultry droppings as a culture medium. In screening tests, 13 insecticides were mixed with poultry droppings prior to insertion of the larvae. These materials were: Bacillus thuringiensis, fenthion, coumaphos, dimethoate, Ciodrin (alpha-methylbenzyl 3-hydroxycrotonate dimethyl phosphate), diazinon, dicapthon, dimetilan, ronnel, malathion, trichlorfon, carbaryl, and Zytron (O-2, 4-dichlorophenyl O-methyl isopropylphosphoramidothioate). Of these, B. thuringiensis, dicapthon, malathion, and carbaryl were eliminated in the preliminary tests. The remaining materials were compared for initial effectiveness and for persistence in poultry droppings after 48 hr...."

B-574 Eversole, J.W., J.H. Lilly and F.R. Shaw. 1965. Toxicity of droppings from coumaphos-fed hens to little house fly larvae. J. Econ. Entomol., 58: 709-710. 4 ref. 1 tab.
"White leghorn hens were fed mixtures of 50% coumaphos oral drench powder, and pelleted poultry feed. The insecticide levels were 0, 25, 75, and 125 mg of active ingredient per kg of feed. The mean mortalities of larvae of Fannia canicularis (L.) exposed to the droppings from these birds were 7.3, 18.0, 42.5, and 91.0%, respectively. Therefore coumaphos provided an effective degree of control when fed at the 125 mg/kg level. By a comparison of the concentrations of coumaphos required to produce approximately 90% mortality of the fly larvae in this field test with the results of our laboratory tests, it was estimated that approximately a 70-fold decrease in effectiveness occurred during passage of the insecticide through the birds."

B-575 Brydon, H.W. and R.G Fuller. 1966. A portable apparatus for separating fly larvae from poultry droppings. J. Econ. Entomol., 59: 448-452. 3 ref. 1 tab. 4 fig.
"Construction details are given for a field unit used to separate fly larvae from a maximum of 18 1-quart samples of poultry droppings."

B-576 Larsen, J.R., R.E. Peadt and L.G. Peterson. 1966. Olfactory and oviposition responses of the house fly to domestic manures, with notes on an autogenous strain. J. Econ. Entomol., 59: 610-615. 21 ref. 4 tab. 5 fig.
"The odor or odors in a manure that stimulate olfactory response of house flies, Musca domestica L., were most effective during the first minute of exposure in an olfactometer. The responses of 2-, 4-, and 8-day-old flies, fed on sucrose and on protein, to the odors of 8 manures were not significantly different in olfactometer tests. Odor source taken from air passed over the surface of manure was not effective in eliciting a positive response in house flies, while an odor source taken from air passed through a mixture of water and manure was effective. In the olfactometer tests cow manure was the most attractive odor to house flies. Pig manure was the most favorable site for oviposition. A strain of house flies that exhibit the phenomenon of autogeny was colonized. The preoviposition period of autogenous house flies was more than twice as long as that of anautogenous flies. They laid fewer eggs, which were less viable, than the anautogenous strain."

B-577 Simco, J.S. and J.L. Lancaster, Jr. 1966. Field test to determine the effectiveness of coumaphos as a feed additive to control house fly larvae under caged layers. J. Econ. Entomol., 59: 671-672. 5 ref. 1 tab.
"Twenty and 40 ppm of a 1% coumaphos premix were incorporated into the ration of White Leghorn hens held in individual cages suspended above a concrete floor. This ration was fed for 49 days. Weekly larval counts were made from a square-foot sample taken to the total depth of the droppings. Control for the 20 ppm averaged 52% and 87% for the 40 ppm treatment when compared with an untreated control. All treatments were in the same house.

B-578 Morgan, N.O. and O.H. Graham. 1966. Influence of cattle diet on survival of horn fly larvae. J. Econ. Entomol., 59: 835-837. 5 ref. 3 tab.
"Four widely different roughages (alfalfa, sorghum, prairie hays, and freshly cut green oats) were evaluated for their influence on the suitability of cattle dung for larval growth of the horn fly, Haematobia irritans (L.). Animal feces were tested by 2 methods: (1) the surface of unaltered feces was seeded with horn fly eggs or newly emerged larvae; (2) a liquid extract of feces (on cotton pads) was seeded with newly emerged larvae. Pupae produced in prairie hay manure were lightest in weight whether the medium was unaltered feces or extract of liquefied feces, and averaged at least 1 mg less than pupae produced in other manures. Unaltered alfalfa and sorghum hay manures produced the heavier pupae, and the heaviest pupae produced from liquid extracts of manure were produced from oat manure extract. Adult emergence was lowest from pupae produced in prairie hay feces."

B-579 Eastwood, R. and R. Schoenburg. 1966. An evaluation of two methods for extracting Diptera larvae from poultry droppings. J. Econ. Entomol., 59: 1286. 1 tab.

To reduce the amount of time required per sample and to increase the accuracy, a hydraulic pressure system was developed and compared with the flotation method for the recovery of larvae from poultry litter.

B-580 Brydon, H.W. 1966. A core sampler for immature flies in poultry manure. J. Econ. Entomol., 59: 1313. 2 fig.
An adjustable volume core sampling device was developed for recovering immature Fannia populations from poultry droppings.

B-581 Eastwood, R.E., J.M. Kada and R.B. Schoenburg. 1966. Plastic tarpaulins for controlling flies in stockpiled poultry manure fertilizer. J. Econ. Entomol., 59: 1507-1511. 2 ref. 5 tab. 2 fig.
"Three woven saran, 2 woven polypropylene, and 2 polyethylene film tarpaulins were used as a cover on stockpiled poultry manure to control adult and immature Musca, Fannia, and Ophyra. Larvae were collected prior to covering, at the time of uncovering, and 1 week following uncovering to test the effectiveness of each tarpaulin as a larval control. Adult flies were collected periodically during the test, identified, and counted. Information on the chemical composition of the manure and the effect each tarpaulin had on it during the covering period is presented. Also included are internal and external environmental conditions which affect fly production. The polyethylene tarpaulins were found to provide the best overall fly control and the black polyethylene was one of the better tarpaulins for retaining the major fertilizer elements."

B-582 Brady, V.E., Jr., and G.C. LaBrecque. 1966. Larvicides for the control of house flies in poultry houses. J. Econ. Entomol., 59: 1521. 1 ref. 1 tab.
Sixteen compounds were tested as larvicides for the control of natural populations of house fly larvae in droppings under caged poultry in Florida.

B-583 Eastwood, R.E., J.M. Kada, R.B. Schoenburg and H.W. Brydon. 1967. Investigations on fly control by composting poultry manures. J. Econ. Entomol., 60: 88-98. 5 ref. 7 tab. 7 fig.
"Windrow composting of poultry manure was investigated during several months of the year. Results obtained indicated that manure does not have to be ground prior to composting. Bulking and drying materials are not required in composting poultry manure. Fly larvae were reduced in numbers during the composting process so that they would not create a fly problem. Poultry manure once composted is not suitable as an oviposition site for adult flies and the subsequent development of larvae. A twice-weekly turning schedule with a manure spreader is desirable to help prevent fly larvae from pupating and emerging by bringing them into contact with the hot interior of the pile."

B-584 Steelman, C.D., A.R. Colmer, L. Cabes, H.T. Barr and B.A. Tower. 1967. Relative toxicity of selected insecticides to bacterial populations in waste disposal lagoons. J. Econ. Entomol., 60: 467-468. 1 ref. 2 tab.
"The toxicity of several insecticides to bacterial populations in waste-disposal lagoons was compared at five concentrations. Dursban and naled caused the highest levels of mortality to the bacterial population, having LD_{50}'s of 0.028 and 0.02%, respectively. Abate and fenthion with LD_{50}'s of 0.9 and 0.66%, respectively, caused the lowest mortality. Bacterial mortality as low as that found in tests using 0.0001% (1 ppm) concentrations would probably not cause a functional disruption of the lagoon process. To control mosquito

breeding, the daily addition of fecal material along with bacterial development in a lagoon could offset the bacterial mortality caused by insecticide application at 1 ppm or less."

B-585 Pickens, L.G., N.O. Morgan, J.G. Hartsock and J.W. Smith. 1967. Dispersal patterns and populations of the house fly affected by sanitation and weather in rural Maryland. J. Econ. Entomol., 60: 1250-1255. 6 ref. 2 tab. 5 fig.
"Daily removal of fly-attractive materials from a dairy complex reduced the population of Musca domestica L. to 2/3 that found at a farm with poorly cleaned barns. Marked house flies tended to disperse upwind when a steady 2.7 mph wind blew from only 1 quarter, but dispersed randomly when the winds were variable. About 3 times as many males as females were recovered, but no differences were apparent in the rates or directions of dispersal of 1-, 2-, or 3-day-old house flies or of the 2 sexes. Rate of dispersal increased when temperatures were above 53°F and when suitable breeding materials were scarce at the emergence sites."

B-586 Drummond, R.O., T.M. Whetstone and S.E. Ernst. 1967. Control of larvae of the house fly and the horn fly in manure of insecticide-fed cattle. J. Econ. Entomol., 60: 1306-1308. 19 ref. 2 tab.
"Larvae or eggs of the house fly, Musca domestica L., or the horn fly, Haematobia irritans (L.), or both, were added to manure from cattle fed 11 insecticides for 10 days. The numbers of adults that emerged were used to calculate the effects of the treatments...."

B-587 Sherman, M., G.H. Komatsu and J. Ikeda. 1967. Larvicidal activity to flies of manure from chicks administered insecticide-treated feed. J. Econ. Entomol., 60: 1395-1403. 14 ref. 2 tab.
"The toxicity to larvae of house flies, Musca domestica L.; Fannia pusio Wiedemann); Chrysomya megacephala (F.); and Parasarcophaga argyrostoma (Robineau-Desvoidy) of droppings from chicks administered feed containing 44 insecticides was determined. The insecticides included 6 phosphates, 6 phosphorothionates, 2 phosphorothiolates, 10 phosphorodithioates, 1 phosphorotrithioate, 3 phosphonothioates, 3 phosphonodithioates, 2 phosphonotrithioates, 9 carbamates, 1 carbonate, and 1 chlorinated hydrocarbon ...."

B-588 Hower, A.A., Jr., and T.H. Cheng. 1968. Inhibitive effect of Bacillus thuringiensis on the development of the face fly in cow manure. J. Econ. Entomol., 61: 26-31. 10 ref. 8 tab. 2 fig.
"During the summers of 1965 and 1966 a concentrate containing Bacillus thuringiensis var. thuringiensis Berliner at 25 x 10^9 spores per gram was employed as a feed additive for Holstein dairy cattle to render their manure unsuitable as a medium for development of face fly, Musca autumnalis De Geer.... The B. thuringiensis feed additive employed at the higher dosage caused on an average 99.6% reduction in the numbers of face flies developing from eggs to adults in the resulting manure. At the lower dosage, development from eggs to adults was reduced by 84.9%.... Extensive studies on the oviposition habits of female face flies showed that manure containing B. thuringiensis at either concentration had no deterrent effect on their egg-laying activities. With the exception of 1 cow, which developed diarrhea in the course of experiments, all animals employed in the tests were apparently healthy during the 2 summers."

B-589 Axtell, R.C. 1968. Integrated house fly control: populations of fly larvae and predaceous mites, Macrocheles muscaedomesticae, in poultry manure after larvicide treatment. J. Econ. Entomol., 61: 245-249. 24 ref. 5 tab.
"The populations of 3rd-instar larvae of house fly, Musca domestica L., and adults of Macrocheles muscaedomesticae (Scopoli) (Acarina: Macrochelidae), which are predaceous on the eggs and 1st-instar larvae of the house fly, were determined at intervals before and after the application of 12 insecticides to the manure under caged laying hens. Selective toxicities which could be used to advantage in larviciding for fly control were not found.... It was concluded that larviciding of the manure with nonselective insecticides is detrimental to mite predators of the immature stages of the house fly and should not be practiced. Selective application methods for adult fly control are preferable and efforts to refine these methods should be intensified."

B-590 Bowman, M.C., M. Beroza, C.H. Gordon, R.W. Miller and N.O. Morgan. 1968. A method of analyzing the milk and feces of cows for coumaphos and its oxygen analog after feeding coumaphos for control of house fly larvae. J. Econ. Entomol., 61: 358-362. 33 ref. 1 tab. 2 fig.
"Milk and feces from dairy cows fed coumaphos (0-44 ppm in air dried feed) to control house fly larvae, Musca domestica L., were analyzed for coumaphos and its oxygen analog. Coumaphos was recovered only from feces of animals fed this compound while the oxygen analog was undetected. The extracts of feces and milk were analyzed by separating the 2 compounds by liquid chromatography on silica gel, hexane-acetonitrile partition, and gas chromatography of an aliquot of each fraction on a column containing 10% DC-200 on Gas Chrom Q. The compounds were detected with a phosphorus-sensitive flame photometric cell. Sensitivity of the analysis was better than 0.003 ppm for milk and 0.005 ppm for feces. Larval control was incomplete but was related to the level of coumaphos fed. Potasan, which was found in small amounts in the feces, is very likely a metabolite of coumaphos. Its contribution to the larvicidal activity of the feces is not considered significant."

B-591 Loomis, E.C., A.S. Deal and W.R. Bowen. 1968. The relative effectiveness of coumaphos as a poultry feed additive to control synanthropic fly larvae in manure. J. Econ. Entomol., 61: 904-908. 13 ref. 4 tab. 1 fig.
"Coumaphos was fed at 0, 20, 33, 40, and 60 ppm in poultry rations to White Leghorn layers during 2 fly-control field trials in 1964 and 1965. Adult fly emergence from insect-caged treated manure samples showed poor control of the little house fly, Fannia canicularis (L.), and the false stable fly, Muscina stabulans (Fallén); from 50 to 84% control of the coastal fly, F. femoralis Stein; from 84 to 99% control of the black garbage fly, Ophyra leucostoma (Weidemann), and only 43% control with the house fly, Musca domestica L. Infectious coryza in all birds on the 1964 test, drug treatment, and the low daily bird intake of coumaphos were responsible for depressed egg production; depression of egg production occurred with hens fed 60 ppm in 1965."

B-592 Bay, D.E., C.W. Pitts and G. Ward. 1968. Oviposition and development of the face fly in feces of six species of animals. J. Econ. Entomol., 61: 1733-1735. 6 ref. 5 tab.
"Although bovine manure has heretofore been considered the substrate of choice for propagation of Musca autumnalis De Geer, evidence presented here suggests

that oviposition and larval development may successfully occur in manures of other animal species. Fresh bison and swine feces served as substrates for larval development comparable to that of bovine manure, as evidenced by similar pupal weight and percent adult emergence. Oviposition also readily occurred in fresh feces of bison and swine. Horse manure supported satisfactory larval development but was an unsatisfactory oviposition site, apparently because of its coarse texture. Fresh sheep and deer feces were unsatisfactory for larval development and adult oviposition, apparently because of their pelleted form and lower moisture contents. Development and oviposition readily occurred in such lyophilized feces reconstituted to a moisture content comparable to that of fresh bovine manure."

B-593 Bay, D.E., C.W. Pitts and G. Ward. 1969. Influence of moisture content of bovine feces on oviposition and development of the face fly. J. Econ. Entomol., 62: 41-44. 6 ref. 6 tab. 1 fig.
"Bioassays of Musca autumnalis De Geer with lyophilized bovine feces reconstituted with distilled water demonstrated a definite relationship between fecal moisture content and fly productivity. Maximum pupal weight and percent adult emergence occurred in feces reconstituted to 85% moisture. Larvae failed to survive at extremes of the moisture range tested (65-95%). Adult oviposition also was related to moisture content; most eggs were deposited in reconstituted feces in the 80-85% moisture range. An unknown factor (s), lost during lyophilization, decreased oviposition preference. Four bovine diets, designed for fecal production of high and low moisture contents, also were evaluated. Moist feces from animals maintained on low-roughage, grain-supplemented diets supported greater fly production. Fly production of the drier manures from animals maintained on roughage diets could not be increased by lyophilizing and reconstituting to a higher moisture level, demonstrating the importance of chemical composition. Adult flies also favored fresh feces from low-roughage, grain-supplemented diets as oviposition sites. Flies had an oviposition preference for reconstituted feces from animals maintained on an alfalfa hay, grain-supplemented diet."

B-594 Ivey, M.C., R.A. Hoffman, H.V. Claborn and B.F. Hogan. 1969. Residues of Gardona in the body tissues and eggs of laying hens exposed to treated litter and dust boxes for control of external arthropod parasites. J. Econ. Entomol., 62: 1003-1005. 5 ref. 2 tab.
"Gardona placed in dust-bath boxes and in floor litter in chicken houses for 4 weeks produced maximum residues of 0.058 ppm in the back skin and 0.048 ppm in the body fat of chickens. Also, 6 samples of egg white contained residues ranging from 0.003 to 0.022 ppm, and 1 sample of egg yolk had a residue of 0.003 ppm. No residues were detectable in eggs or tissues the 2nd week after the insecticide was removed from the houses. Gardona, as used, had no apparent ill effect on the birds."

B-595 Peck, J.H. and J.R. Anderson. 1970. Influence of poultry-manure-removal schedules on various Diptera larvae and selected arthropod predators. J. Econ. Entomol., 63: 82-90. 7 ref. 11 fig.
"The effects of weekly manure removal, monthly removal, and no removal on populations of fly larvae and selected predators (Acarina: Macrocheles muscaedomesticae Scopoli, Fuscuropoda sp. (undescribed), Parasitidae; Coleoptera: Staphylinidae, Histeridae, Hydrophilidae; Diptera: Ophyra leucostoma (Wiedemann)) were studied for a full fly season at each of 2

northern California ranches. Third instar larvae of the house fly, Musca domestica L., the false stable fly, Muscina stabulans (Fallén), and Calliphoridae were most abundant in 1-week-old manure; those of the little house fly, Fannia canicularis (L.), the coastal fly, Fannia femoralis Stein, and the black garbage fly, O. leucostoma, reached greatest numbers in 2- to 3-week-old manure. Unremoved manure had the least numbers of dipterous larvae, with the exception of the stable fly, Stomoxys calcitrans (L.). All predators studied were most abundant in unremoved manure. Abstention from manure removal favored the predators; monthly or bi-weekly removal favored the dipterous larvae."

B-596 Dobson, R.C. and F.W. Kutz. 1970. Control of house flies in swine-finishing units by improved methods of waste disposal. J. Econ. Entomol., 63: 171-174. 3 ref. 6 fig.
"Four swine-finishing units were equipped with different waste-disposal systems to determine their effectiveness in preventing development of the house fly, Musca domestica L. Each unit was completely screened to prevent contamination from outside sources. No insecticides were used. One of the 4 was a standard shed-type house used as a control. The other 3 units were equipped with new and improved waste-disposal systems. Results from 2 years of study indicate that house fly production in and around swine-finishing units can be greatly reduced by using 1 of the 3 improved methods of waste disposal described."

B-597 Axtell, R.C. 1970. Integrated fly-control program for caged-poultry houses. J. Econ. Entomol., 63: 400-405. 3 ref. 9 fig.
"In 1967 and 1968, populations of house flies, Musca domestica L., little house flies, Fannia canicularis (L.); black garbage flies, Ophyra leucostoma (Wiedemann), and predaceous manure-inhabiting mites (Parasitidae, Macrochelidae, and Uropodidae) at 3 poultry (caged laying hens) farms having a fly control program were compared with 3 similar farms with no fly-control measures.... A fly-activity index based on fecal spotting of white paper cards provided useful comparisons of farms, and development of that simple sampling tool is recommended."

B-598 Miller, R.W., C.H. Gordon, N.O. Morgan, M.C. Bowman and M. Beroza. 1970. Coumaphos as a feed additive for the control of house fly larvae in cow manure. J. Econ. Entomol., 63: 853-855. 15 ref. 3 tab.
"The mortality of first-stage larvae of the house fly, Musca domestica L., seeded into the manure of dairy cows consuming 0-144 ppm coumaphos in their ration increased as the concentration of coumaphos in the ration was increased. At the 144 ppm level, larval mortality approached 100%. Although coumaphos residues were found in the feces no residues (<0.002 ppm) appeared in the milk of cows at any level of coumaphos fed. Neither feed intake nor milk production was affected by the feeding of coumaphos. The blood cholinesterase of 1 cow fed 150 ppm coumaphos over a 6-week period dropped to 20% of pre-experimental levels."

B-599 Kunz, S.E., R.R. Blume, B.F. Hogan and J.J. Matter. 1970. Biological and ecological investigations of horn flies in central Texas: influence of time of manure deposition on oviposition. J. Econ. Entomol., 63: 930-933. 10 ref. 5 fig.
"Fresh bovine manure was covered with emergence traps at 2-hr intervals during

the day and night once a week from May to October to study the oviposition habits of the horn fly, Haematobia irritans (L.). The average production of adult horn flies per manure pat ranged from 39.9 between 8 and 10 AM to 99.0 between 2 and 4 AM. The overall production averages for the 22 weeks were 66.5 flies per pat; night average 81.5 per pat; day average 61.0 per pat. Thus, if provided with an oviposition medium, the horn fly female will oviposit day or night."

B-600 Chiang, H.C. 1970. Effects of manure applications and mite predation on corn rootworm populations in Minnesota. J. Econ. Entomol., 63: 934-936. 4 ref. 3 tab.
"Manure was applied in corn plots in 1967 at the rate of 50 tons per acre. The northern and western corn rootworms, Diabrotica longicornis (Say), and D. virgifera LeConte, populations in these plots were reduced to about half the level of those in the check plots. Quantitative observations of the predaceous arthropods in the manured and the check plots showed that the total populations of ground beetles and spiders were not changed because of the manure application. However, the populations of mites, both predaceous and nonpredaceous, were 3 or more times as high in the manured as in the check plots. On the basis of the vertical distribution of these mites and of corn rootworms, it was concluded that the predaceous mites could be feeding on corn rootworms. This trophic relationship was confirmed by laboratory observations on the feeding activity of some predaceous mites. The effect of manure on mite populations dissipated in the following year, 1968, and the difference in rootworm population also diminished. All the above facts suggested that the predaceous mites were responsible for the reduction in rootworm populations. Data also show that the presence of the corn rootworms may have served as a stabilizing factor in the predaceous mite populations...."

B-601 Blume, R.R., S.E. Kunz, B.F. Hogan and J.J. Matter. 1970. Biological and ecological investigations of horn flies in central Texas: influence of other insects in cattle manure. J. Econ. Entomol., 63: 1121-1123. 13 ref. 1 tab. 1 fig.
"Cattle droppings exposed to insect activity for 5 minutes produced significantly greater numbers of Haematobia irritans (L.) than droppings exposed for 30 minutes or for 2, 4, 6, or 24 hours. There was a significant negative correlation ($r = -0.9^{*}$) between the mean numbers of horn flies and the mean numbers of insects of other species produced per dropping during the 6 time intervals studied."

B-602 Lloyd, J.E. and J.G. Matthysse. 1970. Polyvinyl chloride-insecticide pellets fed to cattle to control face fly larvae in manure. J. Econ. Entomol., 63: 1271-1281. 38 ref. 7 tab. 2 fig.
"Polyvinyl chloride (PVC) pellets containing diazinon, dichlorvos, dimethoate, and dimetilan, and acetone solutions of these insecticides were added directly to cattle manure and fed to cattle to determine effectiveness against larvae of Musca autumnalis De Geer in manure. All insecticides in PVC or in acetone solution were very effective when added directly to manure, producing 100% mortality at 0.0003% in manure...."

B-603 Wasti, S.S., F.R. Shaw and C.T. Smith. 1970. Detection of residues of Rabon in manure of Rhode Island Red hens. J. Econ. Entomol., 63: 1355-1356. 2 ref. 1 tab.

Manure samples were collected from hens fed Rabon and from hens receiving no insecticides in the ration. Samples of manure from birds fed 800 ppm of Rabon showed residues as high as 580 ppm. The residues in samples from birds fed 100 and 400 ppm were lower but were sufficiently high for larvicidal action against maggots of the house fly, Musca domestica L., in manure. Non-detectable amounts of Rabon were present in the control samples.

B-604 Miller, R.W., C.H. Gordon, M.C. Bowman, M. Beroza and N.O. Morgan. 1970. Gardona as a feed additive for control of fly larvae in cow manure. J. Econ. Entomol., 63: 1420-1423. 12 ref. 3 tab. 3 fig.
"In a series of 3 trials, Gardona fed to lactating dairy cows at levels of 22, 37, and 48 ppm of the air-dry ration killed 94% or more larvae of the house fly, Musca domestica L., seeded onto the feces. No Gardona (< 0.001 ppm) appeared in the milk of cows in the 1st two trials, but several milk samples from cows in the 3rd trial contained Gardona residues up to 0.005 ppm, which is believed to be due to contamination. In a separate experiment an average of 0.3% of Gardona fed to cows appeared in the feces."

B-605 Axtell, R.C. 1970. Fly control in caged-poultry houses: comparison of larviciding and integrated control programs. J. Econ. Entomol., 63: 1734-1737. 14 ref. 5 fig.
"Weekly larviciding of the manure under caged laying hens with 1% RaVap (EC consisting of 2 lb/gal Rabon and 0.2 lb/gal dichlorvos) or with 1% Zytron gave satisfactory control of the house fly, Musca domestica L., and the little house fly, Fannia canicularis (L.). An integrated control program based on selective adulticiding with RaVap at 2- to 5-week intervals gave control as satisfactory as the weekly larviciding. The populations of manure-inhabiting mites, Macrocheles muscadomesticae (Scopoli) and Fuscuropoda vegetans (De Geer), which are predaceous on the immature stages of the house fly, were destroyed by larviciding but were unharmed by selective adulticiding...."

B-606 Axtell, R.C. and T.D. Edwards. 1970. Hermetia illucens control in poultry manure by larviciding. J. Econ. Entomol., 63: 1786-1787. 6 ref. 1 tab.
"Effectiveness of 5 larvicides at the rate of 1 gal/100 ft^2 (100 ml/m^2) for the control of larvae of Hermetia illucens (L.) in manure under caged laying hens was determined. Excellent control was achieved by 0.5% RaVap consisting of 2 lb/gal Rabon and 0.2 lb/gal dichlorvos, and 0.5% Zytron. Ronnel was slower acting but did give satisfactory control at 0.5%. Equivalent control by dimethoate was obtained with a 1% spray but not with 0.5%. Malathion gave little or no control at concentrations as high as 1%. In the presence of H. illucens larvae, larvae of the house fly, Musca domestica L., were absent. Following control of the H. illucens larvae, house fly larvae became abundant in the manure. A single larvicidal treatment may be expected to satisfactorily control H. illucens because of the slow development of that species. However, frequent retreatments may often be necessary to control the resurgent population of house fly larvae."

B-607 Wasti, S.S. and F.R. Shaw. 1971. Residues of encapsulated Rabon in tissues and eggs of poultry. J. Econ. Entomol., 64: 225-226. 7 ref. 1 tab.

"Three formulations of encapsulated Rabon were fed to 4 groups of hens by mixing it with poultry mash for a treatment period of 14 days. Then, half the hens was slaughtered; the other half was slaughtered shortly after cessation of treatment. Body tissues extracted after slaughter, and eggs collected during treatment were analyzed. Small amounts of residues were recovered, mostly from the fat of hens fed 800 ppm. Other tissues and egg yolks at this level contained traces or no residues of Rabon, and no detectable amount was recovered from the body tissues and egg yolks of hens receiving dosages lower than 800 ppm. Residues when present were eliminated shortly after termination of treatment."

B-608 Miller, R.W., L.G. Pickens and C.H. Gordon. 1971. Effect of *Bacillus thuringiensis* in cattle manure on house fly larvae. J. Econ. Entomol., 64: 902-903. 11 ref. 2 tab.
"A commercial formulation of *Bacillus thuringiensis* Berliner, Biotrol BTB 183-25 W, was fed to dairy cattle in an attempt to control house fly, *Musca domestica* L., larvae in the feces. A maximum larval mortality of 32% was obtained when cows were fed 3200 ppm of this formulation. In an in vitro experiment, complete control of house fly larvae was obtained at a level of 12,800 ppm of feces."

B-609 Chamberlain, W.F., D.E. Hopkins and C.C. Barrett. 1971. Absorption and excretion of ^{14}C-labeled Stauffer R-3828 by a steer. J. Econ. Entomol., 64: 1471-1473. 10 ref. 3 tab.
"When a steer was treated orally with ^{14}C-labeled Stauffer R-3828, 90% of the administered dose was eliminated in the urine and feces within 20 days. Of this amount, 52.7% was excreted in the urine. The plotted curves for the amounts of radioactive materials in the blood, urine, and feces were very flat, and there were multiple peaks; however, the greatest quantities occurred at either 48 or 96 hr posttreatment. The elimination of Stauffer R-3828 or its products was slow compared with the elimination of other organophosphorus insecticides."

B-610 Axtell, R.C. 1963. Acarina occurring in domestic animal manure. Entomol. Soc. Amer. Ann., 56: 628-633. 12 ref. 3 tab. 7 fig.
"A total of 211 samples from 92 different farms in New York State were collected from manure of dairy cattle, horses, sheep, chickens, and ducks. Macrochelidae, Uropodidae, Parasitidae, Oribatidae, and Laelaptidae were collected in that order of abundance. Seven species of Macrochelidae were found, in order of abundance: *Macrocheles muscaedomesticae*, *M. medarius*, *M. subbadius*, *Glyptholaspis confusa*, *M. glaber*, *M. matrius*, and *M. robustulus*. These seven species are illustrated. The first four were common in manure from dairy cattle, the last three rare. In chicken manure *M. muscaedomesticae* was usually the only macrochelid found."

B-611 Axtell, R.C. 1964. Phoretic relationship of some common manure-inhabiting Macrochelidae (Acarina: Mesostigmata) to the house fly. Entomol. Soc. Amer. Ann., 57: 584-587. 7 ref. 6 tab. 1 fig.
"House flies, *Musca domestica* (L.), were trapped from mite-infested dairy cattle manure and collected by net inside dairy barns. *Macrocheles muscaedomesticae* and *M. subbadius* were commonly found attached to the house flies. Although *M. medarius*, *M. robustulus* and *Glyptholaspis confusa* were present in the manure, only 1 specimen of each of the first 2 species and none of the third were found attached to a house fly. In a comparison of the behavior of

macrochelids from laboratory colonies, M. muscaedomesticae and M. subbadius were phoretic on the house fly and the other 3 species were not."

B-612 Sanders, D.P. and R.C. Dobson. 1966. The insect complex associated with bovine manure in Indiana. Entomol. Soc. Amer. Ann., 59: 955-959. 3 ref. 1 fig.
"In the summers of 1962 and 1963, 98 bovine manure samples were field collected at Lafayette, Indiana, after they had been exposed to insect oviposition for periods ranging from 1 to 120 hr. The samples were maintained in a greenhouse until all adult insects had emerged. These included 20 species of Diptera, 15 of Coleoptera, and 3 of parasitic Hymenoptera. Two species of mites were also taken from the manure. As the manure pads were collected, observations were made on the activities of various insect species in and around them, and these are reported here."

B-613 Legner, E.F. and H.W. Brydon. 1966. Suppression of dung-inhabiting fly populations by pupal parasites. Entomol. Soc. Amer. Ann., 59: 638-651. 50 ref. 3 tab. 9 fig.
"Populations of hymenopterous pupal parasites of house flies were charted on Fannia femoralis Stein and Ophyra leucostoma (Wiedemann) in 2 coastal southern California poultry ranches with weekly random samples made over a period of 18 months. Although 6 parasite species were active in the area, Muscidifurax raptor Girault and Sanders and Spalangia endius Walker accounted for more than 95% of the observed parasitism on both hosts. Maximum parasite activity (more than 60% parasitism) was correlated with weather.... Results are compared with other areas in southern California. Possible ways to improve biological control of house flies in southern California are discussed."

B-614 McDaniel, B. and E.U. Balabaugh, Jr. 1968. Bovine manure as an overwintering medium for Coleoptera in South Dakota. Entomol. Soc. Amer. Ann., 61: 765-768. 14 ref. 1 tab.
"During the winter of 1966-67, cow dung specimens from 2 South Dakota areas were collected and their included coleopterous fauna were determined. These are the first studies of this medium as an overwintering habitat for these insects in the State. From 4 dung samples, beetles of 10 families were discovered. All were in the adult stage, except 4 larval specimens of Cantharidae. The imagoes included 2 species of Carabidae, 2 Hydrophilidae, 4 Staphylinidae, 1 Ptiliidae, 2 Scarabaeidae, 2 Anthicidae, 2 Orthoperidae, 2 Lathridiidae, and 2 Curculionidae."

B-615 Steelman, C.D. and A.R. Colmer. 1970. Some effects of organic wastes on aquatic insects in impounded habitats. Entomol. Soc. Amer. Ann., 63: 397-400. 4 ref. 3 tab.
"Introduction of organic waste material from swine pens to an impounded aquatic habitat caused population suppression of certain species of insects. Decreases in aquatic insect fauna paralleled the increase in the organic waste concentration as judged by the changes in the numbers of coliform bacteria present. The Southern house mosquito, Culex pipiens quinquefasciatus Say, began laying eggs in the lagoon when coliform counts approximated 7000 organisms per milliliter of lagoon water. Water suspensions of pure cultures of the coliforms Escherichia coli, E. freundii, and E. intermedia were found to be more attractive as oviposition sites for C. p. quinquefasciatus than were water suspensions of Aerobacter aerogenes or sterile water."

B-616 Stone, R.S. and H.W. Brydon. 1965. The effectiveness of three methods for the control of immature Fannia species in poultry manure. J. Med. Entomol., 2: 145-149. 2 ref. 2 tab.
"Of the three methods tested for the control of immature Fannia species in poultry manure, the only satisfactory control (99.1%) was the stirring of manure plus the application of diazinon and gypsum dust. The mere stirring of poultry manure (47.4%), and the stirring plus applying a diazinon-water spray (91.4%) were considered unsatisfactory."

B-617 Volkinburg, D. van. 1969. Thinoseius spinosus found in new and unusual habitat. Pan-Pac. Entomol., 45: 318-319. 3 ref.
Thinoseius spinosus, a mite previously thought to inhabit only the beach-zone litter between high tide and the terrestrial border, was isolated in all stages of its life cycle from chicken litter and manure, 50 - 65 miles inland from the Pacific Coast. The fact that T. spinosus is so abundant and breeding in the "new" microhabitat raises the question as to whether coastal debris or chicken litter is the preferred and original habitat for the organism.

B-618 Axtell, R.C. 1963. Manure-inhabiting Macrochelidae (Acarina: Mesostigmata) predaceous on the house fly. In J.A. Naegele, (ed.), Advances in Acarology, Volume I. Comstock Publishing Associates, Ithaca, New York. pp. 55-59. 8 ref.
"Seven species of Macrochelidae were collected from domestic animal manure in New York State. Field experiments showed that certain Macrochelidae reduced house fly production from dairy cattle manure and from chicken droppings. This suggests the need for a selective larvicide allowing manure treatment without harm to the mites. The combined use of chemicals and macrochelid mites to control the house fly seems sufficiently promising to deserve further investigation...."

B-619 Wallwork, J.H. and J.G. Rodriguez. 1963. The effect of ammonia on the predation rate of Macrocheles muscaedomesticae (Acarina: Macrochelidae) on house fly eggs. In J.A. Naegele, (ed.), Advances in Acarology, Volume I. Comstock Publishing Associates, Ithaca, New York. pp. 60-69. 2 ref. 2 tab. 8 fig.
"Ammonia compounds added to a medium of fresh, oven-dried, ground steer manure plus 10% soybean oil meal were tested to determine their effect on the biological control of the house fly by Macrocheles muscaedomesticae. On steer manure with water added, each mite killed an average of 16.9 house fly eggs during the 3-day experiment period. These mites, however, exercise significant predatory action only at the egg stage. Biological control was increased to more than 25 eggs per mite by the ammonia additives, which at the optimum concentrations had no direct effect on the hatching of house fly eggs. The maximum concentrations of the additives inhibited the hatching of house fly eggs to some degree...."

B-620 Gupta, U.C. 1971. Influence of various organic materials on the recovery of molybdenum and copper added to a sandy clay loam soil. Plant Soil, 34: 249-253. 7 ref. 2 tab. 2 fig.
"In most cases, the lowest percentage recoveries of added Mo and Cu were obtained after 0 weeks. The highest recoveries of Mo were found after 12 weeks except in the case of peat, where it was after 8 weeks; and of Cu after 4 to 12 weeks of incubation. The exch. Mo content of soil was lower when

organic materials and Mo were added than from soil where only Mo was added. However, in the absence of added Mo, the exch. Mo content was higher in soils where O.M. was added. Addition of peat resulted in lowest quantities of exch. Mo. Exch. Cu was higher in the presence of added organic materials, with or without the additions of Cu, when compared with soils without added O.M. The largest quantities of exch. Cu were obtained where F.Y.M. was used as a source of O.M., with or without added Cu."

B-621 Gaur, A.C., K.U. Sadasivam, O.P. Vimal and R.S. Mathur. 1971. A study on the decomposition of organic matter in an alluvial soil: CO_2 evolution, microbiological and chemical transformations. Plant Soil, 35: 17-28. 32 ref. 1 tab. 6 fig.
Report on an investigation of the rate of decomposition of various organic materials, including FYM, when applied to an alluvial sandy loam soil and incubated at 30°C. The effect of organic amendments on the development of soil microflora (bacteria, actinomycetes, fungi, Azotobacter) was also studied. FYM showed a uniform and steady rate of decomposition and had a marked influence on the fungal population of the soil. It was shown that FYM and crop residues have a positive effect on the maintenance of organic matter in soil.

B-622 Legner, E.F. and G.S. Olton. 1970. Worldwide survey and comparison of adult predator and scavenger insect populations associated with domestic animal manure where livestock is artificially congregated. Hilgardia, 40: 225-266. 51 ref. 5 tab. 6 fig.
Report on a survey of fauna in artificial accumulations of animal manure from various geographical areas around the world. Tables and graphs were used extensively to compare species and their distribution. Emphasis was placed on noting the presence of a certain species in a sampling location rather than trying to establish its absence in another location. Results of this survey may serve as a guide to further exploration for natural enemies of medically important Diptera and may suggest promising species to be considered for introduction elsewhere.

B-623 Legner, E.F. and G.S. Olton. 1971. Distribution and relative abundance of Diptera pupae and their parasitoids in accumulations of domestic animal manure in the southwestern United States. Hilgardia, 40: 505-535. 16 ref. 1 tab. 22 fig.
"This paper describes and provides graphs to show the native parasitoid complexes associated with key muscoid and predatory Diptera in the southwestern United States before the intensive introduction of exotic species. An attempt is made to measure the distribution and abundance of viable hosts and parasitoids in a wide variety of climatic zones in the Southwest, which might serve as a comparison with post-introduction data. The results of five survey years are pooled, and average values are derived that transect yearly climatic fluctuations."

B-624 Rodney, D.R. and G.C. Sharples. 1961. Responses of Lisbon lemon trees to applications of nitrogen, phosphate and manure. Proc. Amer. Soc. Hort. Sci., 78: 181-185. 10 ref. 2 tab.
"Yield and leaf composition data are presented from a 3 x 2 x 2 (nitrogen x phosphate x steer manure) factorial experiment on Lisbon lemons growing in a calcareous sandy soil on the Yuma Mesa in southwestern Arizona. Increasing

N fertilization from 1 pound/tree/year to 2½ or 4 pounds resulted in no increase in the number of fruit produced except where phosphate or steer manure were applied in addition to the N. Fruit sizes were increased by applications of steer manure, but not by the other fertilizer treatments...."

B-625 Faith, W.L. 1964. Odor control in cattle feed yards. J. Air Pollut. Contr. Assoc., 14: 459-460.
Report on an experimental odor control program initiated in 1961 at a large cattle feedlot in California in response to complaints from a nearby residential area. Adequate odor control was not achieved by a "good housekeeping" program alone involving frequent removal of manure and prevention of anaerobic decomposition. A variety of odor counteractants, masking agents and disinfectants were evaluated, the most satisfactory being judged to be a dilute water solution of potassium permanganate. The adequate control program finally accepted involved manure removal every 4 months, maintenance of aerobic conditions and application of a 1% solution of potassium permanganate at 20 lb $KMnO_4$/acre.

B-626 Moorman, R., Jr. 1965. Controlling odors from cattle feedlots and manure dehydration operations. J. Air Pollut. Contr. Assoc., 15: 34-35.
Review of livestock feedlots as a potential source of odor, and of various odor control measures which are currently available to livestock producers. It was recommended that water drainage, feed spoilage and carcass removal should be given strict attention to avoid possibilities of odor production, and that a system of regular manure removal should be practiced. The use of air and ground sprays to deodorize lots or to mask or counteract odors was discussed. Dehydration will likely become more and more necessary at cattle feedlots as part of the odor control system. It was emphasized that public relations between feedlots and the community are very important.

B-627 Brandt, C.S. 1966. Agricultural burning. J. Air Pollut. Contr. Assoc., 16: 85-86. 15 ref.
"The various uses of fire in agricultural practice are discussed in a framework of three general purposes: (1) waste disposal, (2) disease control, and (3) land and crop management. In each purpose the use of fire or burning is discussed in relation to the general requirements and to the problems of air pollution control."

B-628 McQuitty, J.B., J.S. Boyd and C.M. Hansen. 1960. Factors affecting hydraulic removal of manure from concrete. Agr. Eng., 41: 22-23, 27. 5 ref. 3 fig. 1 tab.
Report of a study to determine the effects of nozzle type, pressure and floor surface roughness on the removal of manure from concrete floors. A nozzle with a solid-spray pattern was superior to nozzles with either cone or flat-spray patterns in its ability to flush manure from concrete surfaces. Pressure increases from 60 to 80 psi and from 80 to 100 psi resulted in a significant improvement in cleaning effectiveness. Surface roughness had a negligible effect on cleaning effectiveness.

B-629 Eby, H.J. 1962. Manure lagoons ... design criteria and management. Agr. Eng., 43: 698-701, 714-716. 38 ref. 1 tab. 6 fig.
Discussion of manure lagoons, with references to site selection, the biological, physical and chemical factors involved, loading rates, the nature of the algal-

bacterial symbiotic relationship in lagoons, and management problems encountered in the operation of lagoons.

B-630 Koon, J., J.R. Howes, W. Grub and C.A. Rollo. 1963. Poultry dust: origin and composition. Agr. Eng., 44: 608-609. 4 fig.
Report on experiments with laying hens and broiler chicks in litter and cage houses to determine the origin and composition of poultry dust and to establish the effects of temperature on the dust produced. Two major types of dust particles were identified, namely skin debris and feed particles, and broken feather barbules. Chemical composition of the dust was relatively independent of environmental conditions, but the production of dust varied considerably with temperature changes.

B-631 Schleusener, P.E. 1964. Research needs in rural waste utilization. Agr. Eng., 45: 492-495, 499. 28 ref.
Description of several sources of rural wastes with emphasis on the lack of information regarding the handling of these wastes. A challenge was presented to agricultural engineers to find answers to the large numbers of problems involving rural waste disposal and utilization.

B-632 Hart, S.A. 1965. Our wastrel world. Agr. Eng., 46: 684-685, 691. 2 fig.
General discussion of wastes, including animal wastes, as they relate to each other. Wastes can either be converted into usable materials (e.g., field application of manure) or discharged into the environment (e.g., pumping of sewage into a river). The need for further research on resource management was emphasized.

B-633 Taiganides, E.P. 1967. Farm waste management in Europe and India. Agr. Eng., 48: 710-713. 5 fig.
Report on five methods of waste management used in Europe and India: (1) spreading waste on land by irrigation; (2) oxidation ditches; (3) digestion of waste with gas utilization; (4) composting; and (5) algae production and utilization as an animal feed or as a fertilizer in rice paddies.

B-634 Hammond, W.C., D.L. Day and E.L. Hansen. 1968. Can lime and chlorine suppress odors in liquid manure? Agr. Eng., 49: 340-343. 8 tab. 4 fig.
Report on laboratory and field trials to evaluate the effects of lime and chlorine treatments and sand-bed filtering on gas production from liquid manure. Liming suppressed the production of hydrogen sulfide and carbon dioxide, but did not prevent the liberation of ammonia. Chlorination effectively deterred the production of hydrogen sulfide, carbon dioxide, ammonia and methane. Both chlorine and lime controlled maggots and rodents in the building. Costs of odor control by liming and chlorination were estimated. The effect of sand-bed filtering on solids removal was reported.

B-635 Hart, S.A. 1968. Agricultural wastes management in the future. Agr. Eng., 49: 729, 752.
Discussion of rural wastes management with a section dealing specifically with animal manure. Emphasis was given to the role of agricultural scientists and engineers in solving the current problems. It was recognized that odor control is a serious problem requiring further research and that the real limitation in manure management is economics.

B-636 Loehr, R.C. 1969. Water pollution control legislation. Agr. Eng., 50: 468-470. 8 ref.
Discussion of water pollution control regulations in the U.S.A. and Europe and of various methods of handling, treating, and disposing of animal wastes as they affect the environment.

B-637 Singley, M.E., W.J. Roberts and D.R. Mears. 1970. Experimental circular dairy barn. Agr. Eng., 51: 78-79.
Report on the design, construction and operation of a circular dairy barn, including a description of the manure handling facilities.

B-638 Bressler, G.O. 1970. Drying poultry manure inside the poultry house. Agr. Eng., 51: 136.
Report on a system for obtaining dried manure from sloping wire-floor poultry houses. The droppings are dried in the house by frequent stirring and by constant aeration with strategically positioned fans. Advantages of drying poultry manure were cited.

B-639 Taiganides, E.P. 1970. Water quality/pollution - agricultural wastes and the environment. Agr. Eng., 51: 358-359.
Discussion of animal wastes, sediment, phosphate, nitrate and salts as potential pollutants arising from agricultural operations. Recycling of wastes into the production system is the only meaningful way of handling the agricultural waste problem.

B-640 Jedele, D.G. 1970. Water quality/pollution - urbanization and the livestock industry. Agr. Eng., 51: 360.
Discussion on the need for zoning to avoid urban-rural conflicts involving animal producers. Other research needs were outlined.

B-641 Moore, J.A. and D.B. Brooker. 1970. The future of farm animal waste management. Agr. Eng., 51: 414, 417.
Discussion of recent developments and future trends in animal waste management. Most states in the U.S.A. now have pollution control agencies which have or contemplate regulations setting standards for the handling, treatment and disposal of animal manures. The authors foresee the replacement of the domestic animal by a more efficient machine but, in the meantime, agricultural engineers must work on today's problems with today's technology.

B-642 Gilbertson, C.B. 1970. The case of the misguided number or "You don't say". Agr. Eng., 51: 511, 529.
Discussion on the fallacy of indiscriminately applying the term population equivalent to describe the waste production and pollution potential of farm animals.

B-643 Amer. Soc. Agr. Eng. 1970. To house 20,000 head of cattle. Agr. Eng., 51: 516-517. 3 fig.
Description of a 20,000-head covered feedlot recently constructed in Ohio. The soil on which the pens were constructed was compacted prior to introduction of animals, thereby reducing infiltration and groundwater contamination. Since no rain or snow can fall on the urine and feces, odor and runoff are controlled. The solid wastes are transported to an aerobic digestor where they are sterilized in a 6-day process and then sold as a weed- and pathogen-free organic fertilizer.

B-644 Walker, W.R. 1970. Legal restraints on agricultural pollution. Agr. Eng., 51: 636-637.
Discussion of the legal aspects of agricultural pollution including the concepts of trespass, nuisance, negligence, litigation, and strict, joint and independent liability. The most common defenses used in agricultural pollution cases are described. Current and proposed state and federal regulations affecting agricultural operators are noted.

B-645 Miner, J.R. 1970. The urban-agricultural interface: raising livestock in the urban fringe. Agr. Eng., 51: 702-703.
Description of the problems created by livestock operations which are situated close to urban residential areas. It was suggested that all livestock operations should be planned as though they were to operate in the urban fringe. Examples of nuisances from livestock production were cited, with special emphasis on odor. Guidelines for prevention of rural-urban disputes were suggested.

B-646 Alverson, R.M. 1971. How environmental problems affect farm equipment design. Agr. Eng., 52: 20-22. 3 fig.
Discussion of why, when and how environmental trends affect farm equipment design. Ecological considerations in the design of such machines as manure spreaders were discussed.

B-647 Day, D.L., D.D. Jones, J.C. Converse, A.H. Jensen and E.L. Hansen. 1971. Oxidation ditch treatment of swine wastes. Agr. Eng., 52: 71-73. 1 tab. 3 fig.
Report on laboratory and field investigations to study the application of the Pasveer oxidation ditch to the treatment of swine wastes. The oxidation ditch system of waste management provides some measure of odor control, and greatly reduces the pollution potential of the wastes. Design data and management recommendations were reported.

B-648 Robbins, J.W.D., R.M. George, C.G. McNabb and G.B. Garner. 1971. Helping farmers produce -- not pollute. Agr. Eng., 52: 258-259.
Report on the waste management program of the University of Missouri College of Agriculture. The program is focused on determining the nature and extent of pollution caused by animal production operations, developing animal waste management systems applicable to present farm feeder operations and developing new and improved methods to cope with future animal waste problems.

B-649 Yeck, R.G. 1971. Waste management programs. Agr. Eng., 52: 623.
General discussion on the motivation of public interest in waste management programs. Farmers must be encouraged to be proud of clean farmsteads, clean streams and pleasant rural surroundings. Threats of damage suits, fines, and closure of operation orders are also used to motivate farmers to prevent pollution.

B-650 Nagy, J.G. and J.G. Gilbert. 1968. Fecal pH values of mule deer and grazing domestic sheep. J. Wildlife Management, 32: 961-962. 1 ref. 1 tab.
"Comparisons were made between the pH values of fecal pellet groups of mule deer (Odocoileus hemionus) and range sheep on two different winter ranges. No statistically significant differences were found between the pH values of pellet groups deposited by mule deer on two different ranges. However,

significant differences were found when data obtained from either or both of mule deer pellet pH values (with means of 5.90 and 6.14, range 5.72-6.18) were compared with that of domestic sheep (mean 7.31, range 7.10-7.48)."

B-651 Loehr, R.C. 1970. Animal waste management - Problems and guidelines for solutions. Paper presented at Amer. Assoc. Advancement Sci., Section "O" Agriculture Symposium on Agriculture and the Quality of the Environment in the Seventies, Chicago, Illinois. (reprinted in J. Environ. Quality, 1(1): 71-78.) 11 ref. 2 tab.
General discussion on the problems of waste management being encountered by todays livestock producers. Some of the most pressing problems include large quantities of waste for disposal, odor, dust, and water pollution caused by land runoff and seepage into groundwater. Cropland will probably continue to be the ultimate disposal point of animal wastes.

B-652 Post, F.J. and F.J. Foster, Jr. 1965. Distribution and characteristics of fecal streptococci in Muscoid flies. J. Invertebrate Pathol., 7: 22-28. 11 ref. 5 tab.
"Fecal streptococci were recovered from 78 percent of 1174 muscoid flies representing 18 species trapped in rural and urban areas of Los Angeles County. The largest number of flies was taken in a rural farm area and the lowest number in an isolated rural area. Enterococcus and enterococcus biotype groups of fecal streptococci were recovered most frequently from 249 individual flies. The frequency of occurrence of fecal streptococci in the flies indicates relatively common contact with streptoccal sources which could be feces, refuse, plants, or soil. The low recovery of these bacteria in isolated rural areas suggests that contact with streptococcal sources is less common in these areas. The possibility that carriage of these organisms is transitory and in small numbers cannot be overlooked."

B-653 Austin, R.B. 1964. A study of the growth and yield of red-beet from a long-term manurial experiment. Ann. Bot. (London), 28: 637-646. 9 ref. 6 tab.
"During three years 1959-61 a study was made of the growth of the red-beet crops on a long-term manurial experiment in which significant increases in the yields of red-beet were produced by the applications of farmyard manure (FYM), and by nitrogenous fertilizer (N), but not by potassic or phosphatic fertilizers. On the average, the FYM increased the relative leaf and root growth-rates during the exponential phase of growth by 9 and 25 percent respectively. Subsequently, from about 6 weeks after sowing until harvest at about 17 weeks, the corresponding rates were 14 and 12 per cent less on the FYM than on the no-FYM plots. The main effect of N was to sustain the relative growth-rate of the leaves, which between the age of 6 and 17 weeks was 13 per cent greater on the high-N plots. In an attempt to account for yearly and other differences in yield, a generalized form of the logistic equation was fitted to the leaf and root growth data using as time-scales age in days and three scales based on meteorological elements. . . ."

B-654 Joffe, A.Z. 1963. The mycoflora of a continuously cropped soil in Israel, with special reference to effects of manuring and fertilizing. Mycologia, 55: 271-282. 19 ref. 2 tab.
"A comparative study of the soil mycoflora has been carried out under semi-arid conditions in the central coastal plain of Israel on the plots of a

fertilizer trial that has been running continuously from 1923. . . . In plots supplied annually with NPK fertilizers or once in 5 years with cow manure, the number of fungal isolates greatly exceeded that on unfertilized control plots. However, while the plots under NPK treatment outyielded the manured plots in 4 out of 5 crops, fungal isolates tended to be more numerous in the manured plots. No relation was found to exist between fertility level and number of fungal species found under the various treatments."

B-655 Ogilvie, J.R. and F.R. Hore. 1964. Confined livestock manure disposal. Can. Agr. Eng., 6: 42-43. 1 ref.
Discussion of field spreading, dehydration and stabilization ponds as three ultimate disposal methods. Factors involved in the decision to use one of the three disposal methods, and some features of each method, were outlined.

B-656 McQuitty, J.B. and P.L. Rutledge. 1971. Failure in concrete slats. Can. Agr. Eng., 13: 36-40. 14 ref. 8 fig.
"Experiences of failures and excessive lateral deformation of individual precast concrete slats are described. Drying shrinkage of the concrete resulted in warping in a lateral direction, the extent of this condition increasing with time. Loading tests indicated that the slats were adequate to meet design requirements in normal bending but that even light lateral loads applied to the convex side of the warped slats caused excessive deflection. Compressive strength tests indicated that the problem was not due to defective concrete. The cause of the failures was attributed to off-centre positioning of the top reinforcing bar in the conventional two-bar arrangement. The apparent lack of valid data relating to the lateral loads to which slats are subjected was noted and the need for such data for design purposes stressed."

B-657 Bell, R.G. and J. Pos. 1971. Winter high rate composting of broiler manure. Can. Agr. Eng., 13: 60-64. 5 ref. 11 tab. 10 fig.
"A 30 ft. x 6 ft. aerated horizontal silo type high rate composting unit was constructed to treat commercial broiler manure. Operation of the unit was hampered by large accumulations of snow and by very low ambient temperatures. Nevertheless, a compost of reasonably consistent analysis was produced throughout the winter without the use of supplementary heating equipment. A forced aeration system was essential to maintain aerobic conditions. Ideally the unit should be operated daily to maintain high temperatures throughout the composting mass. The carbon to nitrogen ratio of broiler manure (14.4:1) was too narrow for an ideal composting mixture. Blending of the manure with other wastes such as ground garbage could prove advantageous."

B-658 Feldman, M. and F.R. Hore. 1971. A plow-down method for rapid cover of liquid manure. Can. Agr. Eng., 13: 65-68. 2 ref. 3 tab. 5 fig.
"In response to odour problems resulting from conventional methods of spreading liquid manure from confined housing for animal production, a rapid plow-cover system was devised at the Canada Department of Agriculture, Animal Research Institute farm. Simple hoods are fitted to the rear outlets of vacuum, liquid manure tankers to direct the slurry downward and spread it over a width of about 50 to 60 inches. A second tractor with wheels set 60 inches apart, inside measurement, and towing a 4-bottom, 16-inch moldboard plow (64-inch width of coverage) follows immediately behind the tanker to plow down the manure. Inversion of the furrow slice completely buries the manure, resulting in little odour from the disposal operation. Three

or four tankers may be used with one plow, resulting in a high capacity system. Use of 3-inch tanker outlets, reduction of tanker pressure through reduced tractor ptc speed, and operation at ground speeds of 4 to 5 miles per hour resulted in reasonable application rates."

B-659 Brannigan, P.G. and J.B. McQuitty. 1971. The influence of ventilation on distribution and dispersal of atmospheric gaseous contaminants. Can. Agr. Eng., 13: 69-75. 15 ref. 5 tab. 8 fig.
"This study investigated the effects of ventilation on the mean concentrations and the distribution patterns of atmospheric ammonia and carbon dioxide in an enclosed chamber representing a full scale section of a pig barn. . . . Results showed no practical differences between the distribution patterns of ammonia and carbon dioxide. Ventilation rate was the only independent variable of importance in determining the concentrations of either gas. Under non-isothermal conditions, ventilation outlet height had a negligible effect on gas concentrations. An increase in gas concentrations from inlet to outlet was observed. The importance of sensible heat production of livestock in the diffusion of gases in the atmosphere was apparent."

B-660 Witz, R.L. and G.L. Pratt. 1971. Experimental facilities for studies on beef housing and equipment. Can. Agr. Eng., 13: 81-84. 4 ref. 4 tab. 9 fig.
". . . To study the two major problems, manure handling and control of the environment, a test facility was built at North Dakota State University in 1969. The facility was built in two units, each capable of holding a block of 20 feeder calves. One unit used conventional designs with a deep manure storage under the slotted floor and two standard ventilating systems were used in this area. The other unit was designed with a sloping concrete floor about two feet below the slotted floor. The liquids flow by gravity to one end and are pumped out to a lagoon, and the solids are scraped to the other end with a poultry-house type of cable scraper and conveyed out of the building. This provides a method of studying the treatment of manure that has been separated into liquids and solids. The ventilation system uses a fan and heat sink on both the intake and exhaust. This flow of air is reversed on a five to ten minute cycle and the heat sinks are used to retrieve part of the heat from the exhaust air."

B-661 Steelman, C.D., J.M. Gassie and B.R. Craven. 1967. Laboratory and field studies on mosquito control in waste disposal lagoons in Louisiana. Mosquito News, 27: 57-59. 19 ref. 2 tab.
Report on attempts to control mosquito larvae in swine lagoons using 8 different insecticides, all applied at 1 ppm. Three different methods of application were compared; all three were reported to be effective. Of the chemicals tested, Dursban was the most effective, providing complete control for 144 days. No bacterial mortality occurred as a result of treating the lagoons with 1 ppm of any of the insecticides.

B-662 Smith, W.L., Jr. and W.R. Enns. 1967. Laboratory and field investigations of mosquito populations associated with oxidation lagoons in Missouri. Mosquito News, 27: 462-466. 11 ref. 2 tab.
Report on a study to ascertain the mosquito species present and to acquire additional data on mosquito behaviour in animal waste, municipal, residential, school, slaughterhouse and trailer court lagoons. The animal waste lagoons were generally overloaded, inadequately designed, frequently anaerobic

and poorly maintained, thereby making them ideal environments for excessive mosquito production. Mosquito production was influenced by density of vegetation, dissolved oxygen content, available food and presence of parasites and predators, and was enhanced by phytotoxic wastes. Anaerobic conditions generally favoured mosquito production. Twelve species of mosquitoes were identified, only 5 of which were found within the lagoons proper.

B-663 Atkinson, H.J., G.R. Giles and J.G. Desjardins. 1954. Trace element content of farmyard manure. Can. J. Agr. Sci., 34: 76-80. 19 ref. 3 tab. 1 fig.

"Forty-four samples of farmyard manure, representing fresh cow, horse, swine, sheep, poultry and mixed manures and composted cow and mixed manures, were analysed for their contents of boron, manganese, cobalt, copper, zinc, molybdenum and ash. Maximum, minimum and average values for the trace elements are presented and the frequency distribution of their concentrations given in the form of histograms. Average values on a dry matter basis were: 20.2 ppm B, 201.1 ppm Mn, 1.04 ppm Co, 15.6 ppm Cu, 96.2 ppm Zn and 2.37 ppm Mo. The correlation coefficients between the element and ash contents were all positive and all except that for cobalt and ash were significant at P 0.05. On the basis of an acre application of 20 tons of manure containing 80 per cent moisture, the maximum quantities of the trace elements in the manure samples were, with the exception of zinc, somewhat less, and the average quantities considerably less, than the minimum amounts commonly used when treatment is applied as a chemical compound."

B-664 Bunting, A.H. 1965. Effect of organic manures on soils and crops. Nutrition Soc. Proc., 24: 29-38. 14 ref. 4 tab.

Discussion on the effects of organic manures on the yield of crops and on measurable characteristics of soils. In most cases, a desireable effect is achieved by the use of organic manures, including farmyard manure. In some soils, a purely physical effect is noted.

B-665 Loehr, R.C. and S.A. Hart. 1970. Changing practices in agriculture and their effect on the environment. CRC Critical Reviews in Environmental Control, 1(1): 69-100. 67 ref.

"With less man hours and acreage per production unit, agricultural productivity has increased significantly. The increased efficiency has been associated with a number of environmental quality problems. This review emphasizes animal production as an example of the changes that have occurred in agriculture. The major topic areas include land disposal of wastes, runoff, odors, water pollution, and waste management."

B-666 Hart, S.A. and P.H. McGauhey. 1964. The management of wastes. Food Tech., 18(4): 30-36. 13 ref. 7 fig.

Discussion on the generation of wastes in agriculture. For every pound of food produced, five to ten pounds of solid wastes are left in the field or processing factory, and many gallons of process water become wastewater. Field and animal wastes, food processing wastes, municipal wastes, the conflict of interest in agricultural production and research and possible solutions to the total waste problem are discussed.

B-667 Hutchinson, G.L. and F.G. Viets. 1969. Nitrogen enrichment of surface water by absorption of ammonia volatilized from cattle feedlots. Science, 166: 514-515.

Data are presented to quantify the nitrogen enrichment of surface water by the absorption of ammonia that had been volatilized from cattle feedlots. It was found that a direct relationship exists between the amount of ammonia absorbed from the air and the proximity to cattle feedlots. The authors concluded that runoff and percolation are not the only means whereby water near feedlots might be enriched with nitrogen.

B-668 Stepanoff, A.J. 1964. Pumping of solid-liquid mixtures. Mech. Eng. J., 86(9): 29-35. 10 fig. 11 ref.
Report on investigations to study the hydraulic transport of solid-liquid mixtures, with special emphasis on coal slurries. Pump characteristics were discussed, as well as flow characteristics of the slurry. The results do not appear to be very closely related to pumping of manure slurries.

B-669 Adamse, A.D. 1967. Bacteriological studies on dairy waste activated sludge. Thesis, Wageningen, 1966. (cited in Neth. J. Agr. Sci., 15: 77-79.)
Report on field and laboratory studies of dairy waste activated sludge, including its formation, ultimate composition and response to different physiological conditions. Ultimately, the bacterial flora of the sludge consisted of coryneform bacteria, Achromobacteraceae and Pseudomonadaceae. The brown color of activated sludge was shown to be due to Flavobacterium species. Factors affecting the relative abundance of each group of bacteria were discussed.

B-670 O'Callaghan, J.R., K.A. Pollock and V.A. Dood. 1971. Land spreading of manure from animal production units. J. Agr. Eng. Res., 16: 280-300. 22 ref. 8 tab. 6 fig.
"In order to quantify the manure output from pig fattening houses, a computer simulation model of a group of pigs has been devised, using empirical ratios of output to dietary input. Values from the model, and from different sources for other animals, are used in a second simulation model of land spreading of manure. This is designed to indicate, in any particular farming situation, the maximum hydraulic and chemical loading rates that may be applied without producing subsequent water pollution or soil and crop damage. Purification of organic pollutants is confined to the topsoil by precluding land spreading when the soil is saturated or the temperature is too low for rapid degradation of organic matter. Maximum hydraulic loading is assessed as a balance between rainfall and evapotranspiration. Maximum chemical loading is dependent upon the expected removal of fertilizer nutrients in the crop to which manure is applied."

B-671 Hodgson, A.S. 1971. The elimination of odour from the effluent gases of chicken manure drying plant. J. Agr. Eng. Res., 16: 387-393. 1 ref. 3 fig.
"An investigation has been carried out to determine practical means of reducing odour from a chicken manure drying plant waste gas stream. Experiments have been performed to determine the cause of the odour and possible means of removal from the waste gas. It was found that although odour removal was possible the cost is high. The problem should be considered during the plant design stage rather than after commissioning."

B-672 O'Callaghan, J.R., V.A. Dood, P.A.J. O'Donoghue and K.A. Pollock. 1971. Characterization of waste treatment properties of pig manure.

J. Agr. Eng. Res., 16: 399-419. 8 ref. 15 tab. 13 fig.
"The daily faecal and urinary production from individual pigs were measured over the liveweight range 20-90 kg. Three different feeding regimes were employed. It was found that the faecal and urinary production can be expressed as a percentage of meal and water consumed and that the values are influenced by feeding regime. The results from the study on individual pigs were, in general, confirmed by the trial carried out on groups of pigs. There was no significant difference in the quantity of manure produced by hogs and gilts. Feeding regime was also found to influence significantly the major properties of pig manure. The properties studied included biochemical oxygen demand, chemical oxygen demand, total solids, volatile solids, pH and the major nutrient elements, nitrogen, phosphorus and potassium. No significant reduction in either oxygen demand or volatile solids was achieved by storing the manure in dung channels for periods of up to 18 weeks."

B-673 Cassell, E.A. and T.W. Walker. 1970. Solidification of sludges with Portland cement. J. Sanit. Eng. Div., Proc. Amer. Soc. Civ. Eng., 96(SA1): 15-26. 13 ref. 7 tab. 7 fig.
Report on research to investigate the solidification of sewage sludge and chicken manure in a matrix of Portland cement and fly ash. It was suggested that the solidified matrix could serve as a controlled nutrient release soil conditioner. The rate of phosphate leaching from the matrix, the compressive strength of the matrix, and the time required for the mix to set were influenced by the fly ash to cement ratio, the sludge (or manure) to cement ratio, and the water to cement ratio.

B-674 Edwards, G. 1969. Disposal of farm waste. Engineering, 208(5405): 570-571. 4 fig.
Discussion on the application of engineering principles to biological processes, and more specifically, to solving the problems of waste disposal on farms. An aerobic digestor was described which has overcome some of the problems involved with the Pasveer oxidation ditch. Design aspects of the system and of the associated equipment were reported in detail.

B-675 Pasveer, A. 1962. The oxidation ditch. Reprint from Envir. Health, 4: 245-257. 2 tab. 8 fig.
"A modified activated sludge process known as 'oxidation ditch' has been presented. Operation of a few hundred of these ditches showed that apart from an excellent, completely purified effluent, the oxidation ditch gives a surplus sludge which can be readily dewatered and dried without causing any offensive odour. The per capita capital and running expenses were reasonably low and comparable to that of large plants."

B-676 Stewart, B.A. 1970. A look at agricultural practices in relation to nitrate accumulation. Nutrient Mobility in Soils - Accumulation and Losses. Special Publ. No. 4, Soil Science Society of America. pp. 47-60. 22 ref. 2 tab. 5 fig.
This literature review covers recent work completed on the determination of the hazards of nitrate accumulations, conditions affecting nitrate accumulations (cultivation, fertilizers and manure, feedlots, and denitrification), and nitrate accumulations in plants.

B-677 Cooper, G.S., J.W. Ketcheson and L.R. Webber. 1969. Agriculture as a contributor to pollution. AIC Review, 24(3): 9-15. 11 ref.

Discussion of pollution in Canada caused by animal manures, fertilizers and biocides. Pollution arising from animal manures may be in the form of odors, dust, toxic gases, and nitrogen, phosphorus and potassium. Currently available techniques for control of such pollution are reviewed.

B-678 Frink, C.R. 1970. Animal waste disposal. Compost Sci., 11(6): 14-15. 7 ref.
Discussion on the economics of spreading manure on fields. Research findings are reported which have shown that the fertilizer value of manure is less than the costs of hauling and spreading. However, the costs of alternative disposal methods are high and may not provide for adequate pollution control. It was suggested that manure handling costs could be passed on to the consumer, and that means of increasing the nitrogen-conversion efficiency of manure should be researched. Spreading of effluent on forests was one suggested approach for improving the economics and feasibility of land disposal of manure.

SECTION C

Farm animal wastes in recent years have been the subject of a number of conferences at which many papers on various aspects of the topic have been presented. Papers on animal wastes also have been included in the programmes at several conferences concerning wider environmental issues. These papers usually have been published as part of the conference proceedings. Collectively, these represent a major source of information and data relating to farm animal wastes. Consequently, this third section is devoted to the material contained in such proceedings.

C-001 Kneese, A.V. 1967. Scope and challenge of the water pollution situation. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 3-12.
Discussion of water pollution control and administration in the U.S.A. The author advocated the implementation of regional organizations as the principal water quality management authorities. The use of effluent charges as used in Germany was discussed in some detail with indications that such a system of water quality management is efficient and could be adopted in North America.

C-002 Baumann, E.R. 1967. Physical, scientific and engineering aspects of pollution. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 13-32.
Standards and concern for water quality must be based on public health, aesthetic, and economic considerations. Rather than establishing stream standards which place undue responsibility on the design engineer, effluent standards should be used which place responsibility for predicting the future in the hands of the water pollution control agency. Sources of pollution in Iowa are discussed with emphasis on agriculture and some reference to animal wastes. Methods of measuring pollution are illustrated. Some primary and secondary treatment facilities in use today are also discussed.

C-003 Timmons, J.F. 1967. Economics of water quality. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 33-50. 11 ref. 2 fig.
Water quality problems must be considered in three dimensions: (1) What is physically possible? (2) What is economically feasible? and (3) What is structurally permissible? The fundamental characteristics of the supply and demand relationship for water, and the types of relationships that can exist between water users, are discussed. Water quality standards are considered in terms of public and private optimums, and on the basis of incidence of benefits and costs.

C-004 Hines, N.W. 1967. Legal and regulatory aspects of water pollution control. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 51-70.
Review of the development of legal controls of water quality and appraisal of the efficacy of particular types of regulations. Private (Riparian Rights) are not generally effective. State, interstate, and federal controls are discussed in considerable detail with many specific examples being given to evaluate the working and effectiveness of each of these public controls on water pollution. Even though legal regulations have been adopted to adequately control pollution in some cases, economics and technology have sometimes limited the institution of the optimum pollution control practices.

C-005 Clarenbach, F.A. 1967. Water pollution policies and politics. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and

Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 71-84.
Discussion of the strengths and weaknesses of state control, interstate and interstate-federal control, and federal control. The water quality standards approach, as used in the U.S. Water Quality Act of 1965, is evaluated. The difficulties in establishing water quality standards for the purpose of abating or preventing pollution are emphasized. Pollution control systems including direct regulation, government grants, and effluent charges are discussed. The author indicated that it is unreasonable to demand that all streams and lakes be potable.

C-006 Morris, R.L. 1967. The water pollution situation and controls. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 89-97.
Review of the situation in Iowa. Existing controls are discussed and the need for further water quality controls is emphasized. Specific reference was made in one section to the pile-up of animal wastes and the danger of such concentrations of waste on small streams and impoundments.

C-007 Browning, G. 1967. Agricultural pollution - sources and control. In Willrich, T.L. and N.W. Hines (ed.). Water Pollution Control and Abatement, Proc. Iowa Water Resources Pollution Control and Abatement Seminar, Iowa State Univ. Iowa State Univ. Press. pp. 150-160.
Review of erosion, crop production, and livestock production as the three major sources of agricultural wastes. Methods for control of pollution from each source, and specific topics needing further research, were outlined.

C-008 Verduin, J. 1970. Significance of phosphorus in water supplies. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 63-71. 12 ref. 4 tab. 1 fig.
Discussion of the significance of phosphorus as a water pollutant and an attempt to evaluate agriculture's contribution to the total phosphorus pollution problem. One section dealt specifically with animal manure disposal in which the author suggested that a concentration of animal manure should be regarded as a valuable source of fertilizer and soil conditioner, and that the problem is not one of disposal but simply one of transportation and application. Manure is valued for its trace elements, vitamins, major plant nutrients and soil conditioners and is the only economically feasible source of CO_2 fertilization.

C-009 Black, C.A. 1970. Behavior of soil and fertilizer phosphorus in relation to water pollution. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 72-93. 57 ref. 1 tab. 10 fig.
Discussion on selected aspects of the behavior of soil and fertilizer phosphorus as a basis for understanding how phosphorus from these sources may contribute to water pollution. Reference was made to work which indicated deeper penetration into the soil profile of phosphorus derived from manure than of phosphorus derived from inorganic fertilizers. Because of the greater

mobility of organic phosphorus, the efficiency of the soil as a treatment system for sewage or livestock wastes may not be as great as its efficiency in removing inorganic phosphorus from waste water.

C-010 Goldberg, M.C. 1970. Sources of nitrogen in water supplies. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 94-124. 72 ref. 8 tab. 4 fig.
Review of the literature on nitrogen supplies in nature, the chemistry of nitrogen in water and the entrance of nitrates into both surface and groundwater. A list of sources of nitrogen in water supplies was given and included agriculture (irrigation, rural runoff, tile drainage), animals, atmospheric (industrial air pollutants, pollen, precipitation), feedlots, fertilizer, geologic (caves, minerals), industrial wastes, lake sediments, pond water, rural waste (barnyards, feeds, privies), storm water, topsoil, and urban waste. The contribution of each source was documented. Movement of nitrogen in soil and nitrogen transformations were discussed.

C-011 Stevenson, F.J. and G.H. Wagner. 1970. Chemistry of nitrogen in soils. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 125-141. 26 ref. 8 fig.
Report on the present state of knowledge with respect to the kinds and amounts of nitrogen compounds in soil. Brief mention was also made of chemical and biological nitrogen transformations in the soil. Bacterial denitrification may serve as a means of reducing the potential nitrate content of groundwater where land is used for the disposal of nitrogenous wastes.

C-012 Martin, W.P., W.E. Fenster and L.D. Hanson. 1970. Fertilizer management for pollution control. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 142-158. 68 ref.
Review of fertilizer use in the U.S.A. and various management practices being used, as well as some recommended management practices to reduce the pollution potential of applied fertilizers. Some references were made to the controlled use of animal manure as fertilizer, and selected references were given showing the contribution made by animal manure to nitrate and phosphate pollution of surface and groundwater.

C-013 Miner, J.R. and T.L. Willrich. 1970. Livestock operations and field-spread manure as sources of pollutants. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 231-240. 25 ref. 2 tab.
Discussion of seven major potential pollution sources which exist in connection with livestock wastes: (1) runoff from range and pasture operations; (2) runoff from cropland following manure application; (3) runoff from feedlots and other unroofed animal enclosures; (4) discharges from waste storage or treatment units; (5) percolate from feedlots and other unroofed animal enclosures; (6) percolate from disposal areas; and (7) percolate from field-

spread manure.

C-014 McCalla, T.M., L.R. Frederick and G.L. Palmer. 1970. Manure decomposition and fate of breakdown products in soil. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 241-255. 38 ref. 11 tab. 2 fig.
Review of (1) the chemical, physical and microbiological properties of animal excreta, (2) manure decomposition in storage facilities, on feedlot surfaces and in the soil, and factors affecting such decomposition, and (3) the fate of manure breakdown products in the soil. Much is known about the application of small to moderate amounts of manure to soil for its fertilizer value; considerably less is known about the effects of very large applications of manure to cropland on the pollution of surface and groundwater.

C-015 McKinney, R.E. 1970. Manure transformations and fate of decomposition products in water. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 256-264. 15 ref.
Discussion of the chemical composition of manures, the microbial population, environmental conditions and the time of exposure, and interactions between these variables, as they relate to manure transformations in water. A number of aqueous treatment systems currently available to livestock producers are discussed and evaluated. These included oxidation ponds, aerated lagoons, oxidation ditches, and anaerobic lagoons. Aqueous treatment systems are not desirable for animal wastes except in special situations.

C-016 Diesch, S.L. 1970. Disease transmission of water-borne organisms of animal origin. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 265-285. 93 ref.
Discussion of (1) the origin of man's concern of disease transmission between man and animals; (2) concepts of disease transmission; (3) the effects of modern technology on disease transmission; and (4) several infectious diseases of animals and man. Those diseases discussed included bacterial diseases (Salmonelloses, Leptospirosis, anthrax, tularemia, brucellosis, erysipelas, tuberculosis, tetanus, colibacillosis), rickettsial diseases (Q fever), viral diseases (Newcastle, hog cholera, foot-and-mouth disease, and others), fungal diseases (deep systemic mycoses, histoplasmosis, superficial mycoses), and parasitic diseases (balantidiasis, toxoplasmosis, ascariasis, strongyloides, taeniasis).

C-017 Moore, J.A. 1970. Animal waste management to minimize pollution. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 286-297. 35 ref.
General article on what is presently known about the collection, storage, treatment and utilization and/or disposal of manure as part of the total animal waste management system. Treatment systems may be either "wet" or "dry" and may involve primary treatment by screening and sedimentation, secondary treatment by anaerobic systems (lagoons, digestors), aerobic

systems (aerated lagoons, oxidation ponds, oxidation ditches, trickling filters) or combined aerobic-anaerobic systems, and tertiary treatment which is not at all common in livestock operations.

C-018 LeGrand, H.E. 1970. Movement of agricultural pollutants with groundwater. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 303-313. 18 ref. 2 fig.
Review of some potential agricultural pollutants, including animal wastes, the behavior of such pollutants in the ground, and hydrogeological aspects of groundwater pollution. Some of the problems encountered in the development of simple anti-pollution standards for agriculture are outlined and include the widespread occurrence of substances which could be pollutants, geographical and hydrological variations, and the distribution and attenuation rates of pollutants Most earth materials have the capacity to attenuate pollutants to some degree.

C-019 Armstrong, D.E. and G.A. Rohlich. 1970. Effects of agricultural pollution on eutrophication. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 314-330. 26 ref. 14 tab. 2 fig.
Review of work which has been done showing that the contribution by agriculture to eutrophication of lakes is significant. Animal wastes form an important portion of the total supply of agricultural wastes. Several nutrient budgets were presented. Factors controlling nitrogen and phosphorus transport in agricultural drainage were also discussed.

C-020 Campbell, R.S. and J.R. Whitley. 1970. Effects of agricultural pollutants on recreational uses of surface waters. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 331-343. 43 ref. 3 tab. 1 fig.
Review of agricultural pollutants that can have an impact on the aquatic community, including a section dealing specifically with animal wastes. The most serious polluting agents with respect to recreational waters were judged to be eroded soil, nutrients, and pesticides. A section on public law was included.

C-021 Baumann, R.E. and S. Kelman. 1970. Effects of surface runoff on the feasibility of municipal advanced waste treatment. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 344-362. 19 ref. 1 tab. 7 fig.
General review of water pollution sources, implications, and legislation in Iowa. Attempts were made to determine the contribution of pollutants by various sources to the total pollutant load on several watersheds. In many cases, tertiary treatment of municipal and industrial waste water will be of little benefit unless runoff contributions of nitrogen and phosphorus are also controlled.

C-022 Hines, N.W. 1970. Legal aspects. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 365-376.

The purpose of this report was (1) to describe what is now required and permitted in the area of agricultural pollutants, and (2) to suggest in what ways the law might influence the implementation of pollution policy which affects agricultural production. Specific attention was given to feedlot waste regulation, since feedlot pollution emanates from a source which can be readily defined.

C-023 Timmons, J.F. 1970. Economic aspects. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 377-389. 9 ref.

Review of some of the more relevant economic concepts that, combined with the knowledge of other disciplines, might help to assess agriculture's role in water quality management. Specifically three aspects were considered: (1) What levels of water quality are desired? (2) How can these levels be obtained at least cost? and (3) How should the costs and benefits of water management be distributed?

C-024 Rademacher, J.M. 1970. Alliance for action. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 390-396. 10 ref.

A detailed examination of the animal waste management problem with special emphasis on feedlots. The various steps leading to a solution of the problem, including acquiring the technical information, estimating the extent of the problem, making available existing information and putting the same into practice, and enforcing that the best technology is used, are discussed in some detail. Agriculture must accept waste treatment as a legitimate production cost and must recognize that the ultimate cost of pollution abatement will be borne by the public.

C-025 Bernard, H. 1970. Accomplishments and goals. In Willrich, T.L. and G.E. Smith (ed.). Agricultural Practices and Water Quality, Proc. Conference on the Role of Agriculture in Clean Water, Iowa State Univ. Iowa State Univ. Press. pp. 397-407. 2 ref.

Review of the accomplishments and goals of the U.S. Federal Water Pollution Control Agency. One of their recommendations for areas of concern refers specifically to animal wastes: "A research and action program for controlling animal wastes involves minimizing pollution by improved use of existing technology as well as by developing new and improved animal management methods and facility design; waste treatment and disposal methods; and methods for converting wastes to useful products. It also involves minimizing pollution through assisting in the establishment and enforcement of standards and providing criteria for land use planning."

C-026 Mehren, G.L. 1966. Aesthetics, economics - Animal waste. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 4-7.

The present and future research role of the USDA in animal waste management is discussed. It is unreasonable to ask for zero pollution: an acceptable balance must be found between aesthetic and economic goals. The USDA recognizes the need for further research into the relevant incidence of the animal waste problem. It was estimated that, if dairy manure was collected in the same manner as domestic sewage, the cost of milk would increase by 4 cents per quart.

C-027 Wittwer, S.H. 1966. Animal waste management. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan, pp. 7-8.
Agricultural engineers must cooperate with animal scientists, plant physiologists, natural resources people, microbiologists, and biochemists in an effort to develop suitable methods for the disposal or reuse of animal wastes and for the prevention of excess environmental degradation.

C-028 Morrison, C.S. 1966. Farm animal waste problem. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. p. 8.
Agricultural engineers have helped create the problem of animal waste disposal but the ASAE is now doing much to solve the problem. Progress of the ASAE Rural Waste Disposal Committee X-12 was discussed, as well as other research activity by agricultural engineers in North America.

C-029 Cheney, L.T. 1966. Farm animal waste problem as viewed by civil engineers. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. p. 9.
Civil engineers are concerned about the animal waste problem as it affects city planners in areas where feedlots are close to city boundaries and sanitary engineers who work to develop treatment facilities. Presently, few conventional treatment processes used for domestic sewage are feasible for animal wastes. Animal wastes are similar in some respects to domestic sewage, but generally have a much lower moisture content and a higher volatile content.

C-030 Hobbs, C.S. 1966. Farm animal waste problem. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 9, 14.
Concern by animal scientists for the animal waste problem was expressed. Animal management and nutrition are both destined to play a major role in waste management. Animal scientists realize their responsibility and role as co-workers within a large interdisciplinary system which is needed to find solutions to the problems of animal waste management.

C-031 Maw, A.J.G. 1966. Poultry science viewpoint of farm animal waste problem. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. p. 10.
Poultry farmers operate on a very narrow margin of profit and so are vitally concerned that waste management costs be kept down. Conferences such as the

A.S.A.E. Symposium on Animal Waste Management are essential since they give research workers an opportunity to exchange ideas.

C-032 Witzel, S.A., E. McCoy, L.B. Polkowski, O.J. Attoe and M.S. Nichols. 1966. Physical, chemical and bacteriological properties of farm wastes (bovine animals). Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 10-14. 19 ref. 10 tab.

Report on the work of an interdisciplinary committee involving agricultural and sanitary engineers, bacteriologists and soil scientists formed to learn more about the pollution sources and health hazards in intensified livestock-crop production systems and to develop constructive solutions to correct major problems. Data were collected on the chemical, physical and bacteriological characteristics of bovine wastes. Further bacteriological studies were conducted to determine the potential activities of bacteria in waste lagoons. The value of liquid manure as a fertilizer was tested and liquid manure systems were evaluated. It was concluded that the most feasible method for waste disposal is land application. Nine problems facing the engineer who designs a liquid manure handling system were listed.

C-033 Morris, G.L. 1966. Duck-processing waste. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 15-18. 6 ref. 6 tab.

Report on field studies to measure and evaluate duck processing plant waste loads and to observe plant operations for possible reduction in total water use by redistribution or reuse of water. Data were presented on water supply and waste flow rates, and raw waste characteristics at two processing plants. Duck and chicken processing plant wastes were compared. Three possibilities for reduction in water use were given.

C-034 Decker, W.M. and J.H. Steele. 1966. Health aspects and vector control associated with animal wastes. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 18-20. 12 ref.

Review of the health hazards associated with animal waste disposal and utilization. Animal wastes play a significant role in the transmission of bacterial, fungal, rickettsial and viral diseases, examples of which were given. A cautious approach to utilization of animal excreta as animal feed was recommended.

C-035 Anderson, J.R. 1966. Biological interrelationships between feces and flies. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 20-23. 35 ref.

Review of the current problem of excessive populations of flies in confinement animal housing units. Control methods and potential uses for insects reared on animal manure were discussed.

C-036 Miner, J.R., L.R. Fina, J.W. Funk, R.I. Lipper and G.H. Larson. 1966. Stormwater runoff from cattle feedlots. Management of Farm Animal

Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 23-27. 11 ref. 9 tab. 9 fig.

Report on studies in Kansas to determine the nature of feedlot runoff and to evaluate factors that influence it. Runoff collected at two experimental feedlots (one was concrete surfaced, the other was unsurfaced) using simulated rainfall equipment was analyzed for nitrogen content and form, organic matter content, suspended solids concentration and bacterial populations. It was shown that runoff was a concentrated source of organic matter, nitrogen and pollution bacteria, concentrations of these being highest with low rainfall intensity, moist conditions preceding rainfall and during warm weather. Various techniques to minimize the polluting effects of feedlot runoff were considered.

C-037 Sobel, A.T. 1966. Physical properties of animal manures associated with handling. Management of Farm Animal Wastes,' Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 27-32. 11 ref. 5 tab. 8 fig.

Results of a survey which yielded information on the physical properties of poultry and dairy cow manure which have a direct influence on handling, including basic physical composition, particle and bulk densities, settling rate, production rates, particle size distribution, dilution, suspended and dissolved solids, flowability and freezing point. It was concluded that: (1) environmental factors cause significant changes in animal manures; (2) significant differences in manure characteristics exist between species; (3) manure production is extremely variable; (4) reduction in solids in stored manure by biological activity does not sifnificantly change the mass of material to be handled; and (5) dilution does not appear to be a desirable method for handling manure.

C-038 Ostrander, C.E. 1966. Methods of handling poultry-waste materials. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 32-33.

Discussion on methods of collecting, removing, storing, loading, spreading, processing, and disposing of poultry manure. Incineration and dehydration show more promise of success than composting and lagooning.

C-039 Hart, S.A., J.A. Moore and W.F. Hale. 1966. Pumping manure slurries. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 34-38. 5 ref. 2 tab. 22 fig.

Report on tests with five different pumps to determine manure characteristics which affect pumping and to evaluate the performance of each pump when handling manure slurries. Characteristic pump curves were developed and each pump was evaluated for its performance under various conditions.

C-040 Myers, E.A. 1966. Engineering problems in year-round distribution of waste water. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 38-41. 6 ref. 1 tab. 2 fig.

Discussion of certain pumping, pipe system and irrigation head problems encountered in year-round land disposal of wastewater with reference to experimental projects underway in Pennsylvania. Problems considered were those which might be encountered in the design, installation, and operation of irrigation systems for animal waste disposal.

C-041 Morrison, S.R., V.E. Mendel and T.E. Bond. 1966. Sloping floors for beef-cattle feedlots. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 41-43. 3 ref. 3 tab. 4 fig.
Report on three years' work on sloping floors at the University of California Imperial Valley field station. Tests were run to determine the effect of slope of the feedlot floor on manure movement, cattle behavior, weight gains and feed efficiency. Slopes up to 7 degrees did not depress weight gains or feed efficiency. Incorporated with slatted floors on the lower end, sloping floors provided satisfactory manure removal at slopes of 5 degrees.

C-042 Schmisseur, W.E., C.M. Brown, Jr., J.L. Albright, W.M. Dillon and A.C. Dale. 1966. Materials handling and labor in free-stall and loose housing. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 43-45. 17 ref. 3 tab.
Results of an investigation in Indiana comparing free stalls to loose housing. It was shown that, with the free stalls, cows were cleaner, injuries were reduced and bedding requirements were less than in loose housing systems. However, with conventional equipment, materials handling and labor requirements favor loose housing systems.

C-043 Davis, E.H. 1966. Cattle-manure handling and disposal systems on the West Coast. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 45-47. 3 ref.
Discussion of stall housing as an acceptable practice in Washington, but a practice which produces special manure handling problems. Disposal of wastes is part of the livestock enterprise and so should be charged to this operation. Additional research is needed concerning lagoons, nitrate contamination of groundwater, units for grinding manure and agitation equipment for large holding tanks.

C-044 Moore, J.A. and W.C. Fairbank. 1966. Maceration for disposal of dead poultry. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 47-49. 2 ref. 2 fig.
Review of information available on poultry carcass size reduction and consideration of the various principles of cutting, shredding and shearing with respect to the heterogeneous character of poultry tissue. Final treatment and/or disposal of macerated poultry by land spreading, lagooning, heated septic tanks, artificial composting and thin bed drying was also investigated. It was concluded that maceration could be one of the new systems for dead bird disposal in place of rendering which has been used in the past.

C-045 Quisenberry, J.H., D.D. Makik and R. Ibarbia. 1966. Water metabolism studies may assist with waste disposal. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 49-51. 10 tab.
Report on trials with three methods used to obtain drier droppings or to dry the droppings from poultry. These were: (1) use of baffle boards below cages; (2) use of dietary additives such as clays and bentonites; and (3) genetic selection for low water excretors. Some success was obtained with all three methods.

C-046 Reed, C.H. 1966. Disposal of poultry manure by plow-furrow-cover method. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 52-53. 4 ref. 1 tab. 1 fig.
Discussion on the development of the plow-furrow-cover method of manure disposal, the initial research programs with the method, and the proposed experimental program to determine the maximum rate of disposal on a limited land area. Injection rates to soil of up to 200 tons/acre of slurry have been made successfully, but the effects of such rates of application on the soil and on plant growth are not known.

C-047 Jones, J.H. and G.S. Taylor. 1966. Disposal of household wastes in the soil. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 53-55. 5 ref. 1 tab. 2 fig.
Discussion of the septic tank soil absorption system for disposing of human excreta and household wastes in rural areas. Necessary soil properties, construction and installation practices and reasons for system malfunctions were reviewed.

C-048 Berry, E.C. 1966. Requirements for microbial reduction of farm animal wastes. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 56-58. 13 ref. 2 tab. 1 fig.
Report by a bacteriologist on the types of microorganisms which convert manure to other products and the requirements which must be met for biological reduction of organic wastes. Organisms considered were bacteria, fungi, actinomycete, protozoa, algae and phage (viruses). It was noted that the lack of odor from a manure lagoon suggests a lack of chemical action in the lagoon, thereby reducing the lagoon function to that of storage but no treatment. The use of anaerobic lagoons for South Dakota was not highly recommended.

C-049 Irgens, R.L. and D.L. Day. 1966. Aerobic treatment of swine waste. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 58-60. 3 tab. 8 fig.
Report on laboratory and field studies to determine the potential of aerobic treatment of swine wastes. In the laboratory, effluent BOD's of 10 - 15 ppm were achieved with dilutions of 6 cu. ft. of liquid per 150-lb hog per day and air volumes of 2500 cu. ft. per lb of BOD. The process was odor-free and did not attract flies. CO_2 was the only gas produced. Power requirements for aerobic stabilization of swine wastes in oxidation ditches were estimated at

50 - 60 Kwh per pig per year.

C-050 Webster, N.W. and J.T. Clayton. 1966. Operating characteristics of two aerobic-anaerobic dairy manure treatment systems. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 61-65. 20 ref. 14 fig. 2 tab.
Two combination aerobic-anaerobic settlement waste treatment systems were designed and tested in the laboratory to determine the capability of each to reduce the pollution potential of the waste to a level where the effluent could be recycled. A system incorporating primary aeration with secondary anaerobic settlement was found unsatisfactory. A system of anaerobic primary settlement and secondary aeration was working on a bench scale.

C-051 Bridgham, D.O. and J.T. Clayton. 1966. Trickling filters as a dairy-manure stabilization component. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 66-69. 9 ref. 3 tab. 6 fig.
Report on investigations of the use of trickling filters as components of more complete dairy-manure processing systems, with the ultimate objectives of providing a final effluent which could be discharged directly into a stream and of providing high-quality recirculation water. The results indicated that trickling filters have potential worth developing. Both loading rate and water temperature were found to have a great effect on effluent quality.

C-052 Howes, J.R. 1966. On-site composting of poultry manure. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 68-69.
Report on trials with on-site composting of poultry litter using a commercially prepared substrate containing 46 species of microorganisms. The culture was mixed into a base of peat and various minerals and spread on the litter in the poultry house. Birds were placed on the litter after the heat of composting had subsided. The system was odor-free, fly-free and allowed for humidification to keep dust to a minimum without the problem of ammonia or litter pathogens. Research is being conducted to investigate optimal rates of application of the culture, nutritional value of the compost, and the possibility of disease carryover.

C-053 Willrich, T.L. 1966. Primary treatment of swine wastes by lagooning. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 70-74. 14 ref. 7 tab. 2 fig.
Report on the performance of an anaerobic lagoon used to treat the wastes from a 630-head total confinement swine finishing unit at Iowa State University. Design criteria were developed on the basis of data collected with the lagoon. It was recommended that lagoons receiving wastes at a non-uniform rate should be designed to provide at least two cu. ft. of lagoon water per pound of total animal weight confined in the building, plus additional lagoon volume for sludge storage.

C-054 Curtis, D.R. 1966. Design criteria for anaerobic lagoons for swine

manure disposal. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 75-80. 5 tab. 5 fig.
Report on a survey of lagoons in operation in South Dakota in an attempt to develop design criteria and suggest operational procedures to improve the chances of success for lagooning as a method of hog manure disposal. The successful operation of a lagoon was evaluated on the basis of odor and aesthetics, convenience and efficiency, and economics. It was concluded that several lagoon operations have been successful although the system is not widely practiced in South Dakota. Design criteria and operational procedures were suggested.

C-055 Agnew, R.W. and R.C. Loehr. 1966. Cattle-manure treatment techniques. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 81-84. 10 ref. 5 tab. 1 fig.
Report on laboratory studies of feedlot waste treatment techniques, including anaerobic digestion, anaerobic lagooning and an activated sludge system. A combined anaerobic-aerobic system has significant potential, combining the attributes of solids degradation in the anaerobic phase and soluble organics reduction in the aerobic phase. The advantages of the lagoon system for waste treatment and disposal at feedlots include reasonable costs of installation and operation, and efficient handling and disposal of solids and runoff.

C-056 Cassell, E.A., A.F. Warner and G.B. Jacobs. 1966. Dewatering chicken manures by vacuum filtration. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 85-91. 32 ref. 5 tab. 9 fig.
Report on preliminary studies on the evaluation of the feasibility of dewatering chemically conditioned chicken manure by vacuum filtration. The research is expected to ultimately allow a comparison of vacuum dewatering and other dewatering techniques. Tests were conducted to determine raw sludge characteristics. Various chemicals were tested to assess their effectiveness in promoting the dewaterability of raw chicken manures: a combination of anionic and cationic polyelectrolytes yielded the best results. Chemical conditioning and vacuum filtration were shown to be effective.

C-057 Sobel, A.T. and D.C. Ludington. 1966. Destruction of chicken manure by incineration. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 95-98. 12 ref. 2 tab. 3 fig.
Report on investigations of the incineration of poultry manure. Trials with a laboratory incinerator have yielded considerable information on the incineration of partially dried poultry wastes. In the incineration process, the energy tied up in volatile solids is used for the destruction of the organic portions of the manure. More research will be required before an economic evaluation of the process can be made. Future application will depend on cost and air pollution hazards.

C-058 Davis, R.V., C.E. Cooley and A.W. Hadder. 1966. Treatment of duck wastes and their effects on water quality. Management of Farm Animal

Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 98-105. 10 tab. 7 fig.

Report on treatment facilities installed at two duck farms near Urbanna, Virginia to protect the public and private oyster beds in the area and the recreational uses of the adjoining river. Settling basins and plastic-lined lagoons provided satisfactory treatment of the waste waters. Further studies are required to refine presettling techniques, to determine coliform reductions after presettling and retention, and to ascertain the nutrient contribution from the treated duck wastes.

C-059 Fontenot, J.P., A.N. Bhattacharya, C.I. Drake and W.H. McClure. 1966. Value of broiler litter as feed for ruminants. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 105-108. 11 ref. 7 tab.

Report on a series of experiments conducted at the Virginia Agricultural Experiment Station to study the value of broiler litter as feed for ruminants. Feeding and metabolism trials were conducted with steers and wethers. Litter used in the trials contained, on average, 32% crude protein, dry basis; in autoclaved litter, true protein accounted for 45% of the total nitrogen. No significant effects on nitrogen retention were noted when up to 50% of the total nitrogen in the ration of wethers was supplied by broiler litter. No significant differences in ration quality existed when wood-shaving or autoclaved peanut hull broiler litters were used. Rate of gain, feed efficiency and carcass grade were not adversely affected by including up to 25% broiler litter in the fattening ration of feedlot steers.

C-060 Anthony, W.B. 1966. Utilization of animal waste as feed for ruminants. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 109-112. 23 ref. 13 tab.

Report on research at Auburn University, Alabama, to determine the feasibility of using fresh feedlot manure as feed for steers and to investigate the making and feeding of a high dry-matter silage for cattle by combining fresh feedlot manure with ground coastal bermuda-grass. Analysis of feedlot manure showed it to be a valuable source of vitamins and amino acids. Fresh feedlot manure proved to be a valuable ration component when it was either washed or autoclaved. Fresh feedlot manure blended with coastal bermuda-grass hay provided a palatable and nutritious low-moisture silage.

C-061 Durham, R.M., G.W. Thomas, R.C. Albin, L.G. Howe, S.E. Curl and T.W. Box. 1966. Coprophagy and use of animal waste in livestock feeds. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 112-114. 6 tab.

Report on feeding trials conducted in Texas with laying hens, growing pullets, cattle, sheep, swine, fattening steers and catfish to determine the value of all-concentrate cattle manure as a feed supplement. The manure was fed successfully to growing pullets and laying hens; results of other trials suggested that feedlot manure could be used in maintenance rations for cattle, sheep and swine. All-concentrate cattle manure was successfully fed to feedlot steers to limit feed consumption. Catfish were able to make rapid gains on feedlot manure if care was taken to prevent oxygen depletion.

C-062 Cross, O.E. 1966. Removal of moisture from poultry waste by electro-osmosis (Part I). Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 91-93. 7 fig.
Report on investigations to determine the effectiveness of electro-osmosis for expelling water from poultry excrement. Regression analysis indicated that the quantity of water expelled was a significant function of current, time and sample length, the highest values of all three variables leading to the greatest moisture removal. However, the lowest final moisture content was achieved with short sample lengths and high current flows. The resulting moisture content of the poultry excreta was not reduced to a pelletable level.

C-063 Nurnberger, F.V., C.J. Mackson and J. Davidson. 1966. Removal of moisture from poultry waste by electro-osmosis (Part II). Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 93-95. 7 fig.
Report on investigations to utilize the effects of Joule heating and gravitational flow to reduce the moisture content of chicken manure to an acceptable level using electro-osmosis. Various materials and types of electrodes were tested. Of the materials tested, stainless steel gave the best performance, copper the poorest and steel was intermediate. The maximum moisture content reduction was 4.8% w.b. based on 22 hr. of operation at 20 v. Costs for this treatment were 12.7 cents per gallon of liquid removed.

C-064 Foerster, E.L., Sr. 1966. Role of the renderer in the use and disposal of animal wastes. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 114-117.
Discussion on the evolution of today's rendering establishments, as well as a forecast for the future rendering business. Indirect uses of poultry wastes via rendering plant operations were discussed and evaluated. A scheme for dead bird disposal was presented.

C-065 Eby, H.J. 1966. Evaluating adaptability of pasture grasses to hydroponic culture and their ability to act as chemical filters. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 117-120. 6 fig.
Discussion on the principles of the hydroponic system of plant growth and report on research to evaluate the use of such a system for the removal of nitrogen, phosphorus and potassium from the effluent of sewage treatment facilities. Various grasses were tested to determine their applicability to hydroponic culture. While the results of the study are preliminary, they do indicate that such a system has potential worth developing. The effectiveness of the hydroponic system is contingent upon some form of primary treatment such as in lagoons.

C-066 Stubblefield, T.M. 1966. Problems of cattle feeding in Arizona as related to animal-waste management. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No.

SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 120-122. 11 ref.

Discussion on the present and the future feedlot situation in Arizona. Odor nuisance problems and inadequate markets for manure are causing major revisions in the feedlot industry. New legislation and land use planning are part of the developing scene.

C-067 Kesler, R.P. 1966. Economic evaluation of liquid-manure disposal from confinement finishing of hogs. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 122-125. 2 ref. 6 tab.

Report on a costing analysis of three alternative systems for handling the manure from a confinement swine-feeding operation. Total hauling and spreading when cropland was available, combination hauling-spreading-lagooning, and total lagooning provided least cost methods in that order. Availability of labour, capital and land, natural land terrain, changes in the value of manure and personal preferences will affect the choice of an optimal system for a particular operation.

C-068 Morris, W.H.M. 1966. Economics of liquid-manure disposal from confined livestock. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 126-131. 16 ref. 7 tab. 1 fig.

Discussion of some of the problems in estimating costs and returns from handling manure. Anaerobic and aerobic treatment of manure in special low-cost facilities designed for farm use was considered practical. No profitable industrial utilization of livestock manure was foreseen. Control of odors and insects, and disposal of solid manure will continue to present problems and will likely determine the existence or non-existence of animal enterprises in particular locations.

C-069 Jordan, H.C. 1966. Poultry manure marketing. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 132-133.

Report on a survey of poultry manure marketing in the U.S.A. Questions and answers dealt with the chemical and physical characteristics of the marketed product, bagging, processing, supplementation, production costs and price of the marketed product, and general marketing aspects. It was concluded that poultry manure has value and should be used rather than destroyed. Odor is one of the biggest problems to be dealt with.

C-070 Allred, E.R. 1966. Farm-waste management trends in Northern Europe. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 133-136. 1 fig.

Considerable research effort in Northern Europe is directed toward reducing costs of handling and hauling manure to the field rather than toward designing and constructing major treatment facilities at each farm. Types of storage facilities were discussed. Manure dehydration plants in Sweden, Germany and the Netherlands, and oxidation ditches in Holland and Scotland were also discussed. Differences in attitude toward waste management problems in Europe and America were cited.

C-071 Tietjen, C. 1966. Plant response to manure nutrients and processing of organic wastes. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 136-140. 12 ref. 9 fig.
Report on the production and utilization of gülle in the Alpine forelands of Germany. In the first part of the paper, results of experiments were presented to demonstrate the high yield effect of liquid manures as compared to usual barnyard manures and the influence of various treatments on the properties of the manure. The second part of the paper reported experimental values for the quantity and nutrient composition of pig and cow excrement and considered various factors affecting the percentage of wastes excreted as feces and urine and the nutrient content of each fraction. Factors considered included kind and species of animal, individual animal characteristics, feeding, dilution, barn arrangement, and collection and storage facilities. In a third section, data were presented to illustrate the advantages of processing animal excrements to a standardized manure - a full gülle that could be characterized by its ratio of plant nutrients.

C-072 Scheltinga, H.M.J. 1966. Biological treatment of animal wastes. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 140-143. 10 ref. 7 tab. 3 fig.
Report on research conducted in Holland with a small oxidation ditch receiving hog wastes. Sedimentation characteristics, the desirable influence of shock loading, foaming problems and effluent quality were discussed. Nitrification and the nitrogen balance in the ditch were considered. Some costing figures were also presented.

C-073 Gilbertson, W.E. 1966. Animal wastes: Disposal or management. Management of Farm Animal Wastes, Proc. National Symposium on Animal Waste Management, A.S.A.E. Publ. No. SP-0366. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 144-145.
Ultimately it will be imperative that animal waste products be reused rather than merely disposed of. Composting to yield an organic soil conditioner, and fluidized-bed combustion for heat generation are two of the possible processes worth looking at.

C-074 von Hammer, W. 1964. Entmisten, dunglagern und dungausbringen in schweineställen mit spaltenboden. Proc. 6th Congress, Commission Internationale de Génie Rural, Lausanne-Suisse, 2: 563-571. 5 ref. 4 fig. 1 tab.
"At present, there are only incompleted results available in Germany on manure handling under slotted floors in pig houses. The excreta of pigs are dropped in thick liquid form. Solid manure can be produced by adding absorptive materials and by separation of the thin liquid components so it can be handled by frontend-loader or graps and manure-spreaders. When using liquid manure handling favourable climatic conditions should exist in the pig house. The temperature of the sludge should not go beyond 15°C. The slope of the dung storage pit toward the outlet may not exceed 1% - 1.5%. At the beginning of each storage period a thin layer of water should cover the total floor of the

dung pit. Useful types of these containers are reported on."

C-075 Taiganides, E.P. and T.E. Hazen. 1964. Animal waste disposal practices and their influence on farm building design. Proc. 6th Congress, Commission Internationale de Génie Rural, Lausanne-Suisse, 2: 598-609. 27 ref. 2 tab.
Discussion of the properties of animal wastes as a basis for relating their influence on building design. Specific applications to illustrate the modifications in design directly attributable to the waste properties are given. Current areas of research pertinent to the subject were reviewed and referenced.

C-076 Lips, I.J. 1964. Etude technique, du travail et économique de différentes méthodes pour l'évacuation du fumier des étables à stabulation entravée. Proc. 6th Congress, Commission Internationale de Génie Rural, Lausanne-Suisse, 3: 647-657. 1 tab.
Discussion of different systems for the mucking out of cow-houses under Belgian conditions from a technical, ecological, and economic point of view. Methods compared were mucking out by hand, liquid manure system with grids over channels, scraper blades on a chain, foreloader mounted on a tractor, endless chain fitted with scraper blades, automatic and semi-automatic scraper, and a simplified liquid manure system incorporating evacuation of manure from the stables through turning, self-made dung-grids into simple concrete silos.

C-077 Rockey, J.W. 1964. Agricultural sanitation in the United States. Proc. 6th Congress, Commission Internationale de Génie Rural, Lausanne-Suisse, 3: 699-707.
General review of farm animal waste disposal in the U.S.A., current practices, problems encountered, and pertinent research.

C-078 Bosma, A.H. 1969. The identification of liquid manure and the establishment of standards for vacuum tanker pumps. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 181-186. 2 tab. 1 fig.
Report on four methods used in Europe to indicate the handling quality of liquid manure: (1) dry matter content; (2) dry matter content plus dry weight of coarse components; (3) penetration test; and (4) flow-out test. Four stages in handling liquid manure were recognized and discussed: (1) preparing for pump transfer (homogenizing); (2) transferring by pump; (3) transporting; and (4) spreading. Vacuum levels required for pumping different types of liquid manure were given. The required pump capacity was given by an empirical formula.

C-079 Dale, A.C., D.E. Bloodgood and C.M. Robson. 1969. Aerobic decomposition of dairy cattle manure. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 187-196. 3 ref. 4 tab. 8 fig.
Report on research at the University of Illinois to determine how much the BOD of dairy cattle wastes could be decreased, and what percent of the volatile solids could be broken down, by extended aeration. The results indicated that a reduction in BOD of 95 - 98% was possible, that temperature directly influenced decomposition of volatile solids, that decomposition of volatile solids was only slightly affected by loading rate, and that straining of raw manure increased decomposition.

C-080 Hazen, T.E. and J.R. Miner. 1969. Waste-environment complex in confinement production of swine. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 197-203. 6 ref. 2 tab. 1 fig.
Preliminary report on research at Iowa State University being directed to the odorous compounds and their effects upon swine and equipment, and to the techniques that will better handle the manure without physical labor and with minimum pollution potential. Further details of the project are available within the listed references.

C-081 Jones, D.D., J.C. Converse and D.L. Day. 1969. Aerobic digestion of swine waste. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 204-211. 2 ref. 7 fig.
Report on laboratory and field trials at the University of Illinois to determine the performance of oxidation ditches while treating hog wastes. Reductions in BOD from 40,000 mg/l to less than 10,000 mg/l have been experienced. It was concluded that the in-the-building oxidation ditch works well for the treatment of hog wastes and prevents the build-up of objectionable gases and odors.

C-082 Lipper, R.I. and G.H. Larson. 1969. Control of water pollution from beef animal large feedlots. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 212-217. 10 ref.
Review of literature which has demonstrated that significant water pollution occurs from feedlots. A report is given on a research project which has shown that suspended solids concentrations in runoff from unsurfaced lots may be as high as 45,200 mg/l and COD as high as 19,000 mg/l. An estimation of the annual feedlot pollutional load in Kansas was given. New systems for pollution control from feedlots were discussed.

C-083 Myers, E.A. and R. Bodman. 1969. Sprinkler distribution of wastewater under freezing conditions. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 218-224. 6 ref. 1 fig.
Report on four years of study at Penn State University to determine: (1) the feasibility of year-round disposal of effluent on the land; (2) the degree of renovation of sewage by means of the soil, (3) the extent of water conservation by returning water to the groundwater supply; and (4) the effects of the application of effluent on soils, crops, trees, and wildlife. Winter disposal of effluent onto land was dealt with in detail. Results have indicated that wastewater can be distributed satisfactorily under freezing conditions when reasonable precautions are taken.

C-084 Poelma, H.R. 1969. Disposal and handling of dung. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 231-235.
Review of farm waste disposal research activity in Holland. Manure disposal methods in use or presently being tested were discussed. Some costing figures were given.

C-085 Riley, C.T. 1969. Farm waste disposal in the United Kingdom. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 236-246.
Discussion of several aspects of animal waste disposal in Great Britain. In Britain, a strong move back to solid handling of manure has been evidenced.

It was demonstrated that by pushing the pH of manure up to 12 or 12.5, odors were inhibited. Some interest is presently being directed toward wet oxidation and final incineration of wastes.

C-086 Taiganides, E.P. 1969. Recent developments in farm waste management in the United States. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 262-268. 17 ref. 1 tab.
"The primary effects of recent advancements in environmental control engineering and in animal sciences has been the 'industrialization' of animal production operations; the secondary effect is 'pollution'. This created the need for redirecting engineering research and development programs from the 'front end' to the 'back end' of the animal. These developments are traced chronologically and technologically."

C-087 Willrich, T.L. and J.R. Miner. 1969. Anaerobic lagooning of swine wastes. Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 287-291. 7 ref.
Discussion on the use of anaerobic lagoons in the U.S.A., and on the biological processes involved and some design and operational recommendations. Used in series with aerobic lagoons, anaerobic lagooning provides good treatment of livestock wastes. Odor production is the most serious factor limiting the use of anaerobic lagoons.

C-088 Parrakova, E. and D. Strauch. 1969. (The influence of intensive animal husbandry on the tenacity and the resistance to antibiotics of fecal micro-organisms.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 225-230. 4 tab. 3 fig.
Report on experiments with different varieties of salmonella in liquid manures of different composition. Results indicated that several salmonella species remain alive in summer for up to six months and survive at winter temperatures for up to one year. Salmonella in the excrement of poultry maintained in laying batteries were inactivated within 3 to 4 weeks. The studies proved that antibiotic resistance of coliforms will be transferred to sensitive salmonella by conjugation within the environmental conditions of these bacteria. Implications of these findings to the therapeutic application of antibiotics for man and animals were discussed.

C-089 Scholz, H.G. 1969. (Production of humus fertilizers from the sewage of a pig-fattening operation.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 247-255. 4 fig.
Report on one year of continuous operation of a 2-stage dehydration plant accepting wastes from a 3,000-head capacity hog operation. Most of the wastewater is removed in an odorless 'evaporation plant' and the rest in a drying oven. Waste gas from the drying oven serves for heating the 'evaporation plant'. Data were given on the fertilizer value of the manure powder produced by the operation. It was concluded that the economic returns that could be realized from using the fertilizer powder as a humus-type manure for vegetable crops were twice the costs of producing the product.

C-090 Seufert, H. 1969. (Structural and technical requirements for the removal of manure from bull-fattening, loose-housing stalls using little or no litter.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 256-261.

Report on a bull-fattening facility with emphasis on the design of the manure storage channels and on the mucking-out operation. Animal health was considered, as well as the economics of the system. Structural design of various components of the system was considered, including concrete specifications for waterproof channels.

C-091 Tietjen, C. 1969. (The basis and the requirements for the utilization of liquid manure from the viewpoint of manure economics.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 269-275. 7 ref. 4 tab. 2 fig.
Data are presented on the quantity and plant nutrient contents of feces and urine of dairy cows, pigs and poultry. Variations in both quantity and composition of manure were noted. It was indicated that liquid manure has a higher fertilizer value than solid manure. The relative value of the nitrogen in manures as compared to inorganic fertilizer was estimated. An economic utilization of manure depends on a balanced ratio of livestock production and farmland; if livestock production gets too large compared to the supply of arable land, then manure becomes a problem. The concepts of 'sheet composting' and 'compost fallow' were mentioned.

C-092 Velebil, M. 1969. (Technico-economical analysis of the possibility of constructing of stalls using no litter within Czechoslovakia.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 3: 276-286. 5 tab. 5 fig.
Laboratory and field trials were conducted to determine the characteristics of liquid manure and the effects of application of liquid manure to cropland on sugar beet yields. The use of radioactive tracers for the characterization of manure was reported. Data were presented on labour and investment requirements of litter-less systems of management. On the basis of these studies, it was concluded that liquid manure systems are feasible for Czechoslovakian livestock production operations.

C-093 Sällvik, K. 1969. (Investigations to compare different ventilation systems in order to avoid liquid manure gas poisoning of animals.) Proc. 7th Congress, Commission Internationale de Génie Rural, Baden-Baden, 8: 346. (Summary only)
Report of three years' investigation of liquid manure gas problems by the State Research Institute for Farm Buildings in Sweden. Data has been collected on air patterns, gas concentrations (H_2S, NH_3, CO_2), relative humidity, temperature, breathing rate of animals, and animal health in three types of barns - tie barns for cows, cubicle barns for cattle, and piggeries with slatted dunging passages. The results indicate the difficulty in predicting gas distribution within a building due to the large influence of the animals. Ventilation of piggeries via an air channel parallel with the dung channel prevented the release of H_2S into the atmosphere above the slats; similar results were noted for the cow barns. In cubicle barns with slatted floors, it is absolutely necessary to have ventilation air evacuated from under the slatted floor to prevent injuries to the cows.

C-094 Weinberger, L.W. 1969. Reflections on pollution control. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 1-3.
Discussion on U.S. national policy on water pollution control, cost-benefit

analyses in water pollution control, and the misconceptions in water pollution control. Opinions based on personal experiences are expressed on our ability to solve pollution problems.

C-095 King, D.R. 1969. Environmental pollution - now and in the years ahead. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 4-8.
Review of the total environmental pollution problem and legislation enacted to regulate against such pollution. The problem of animal waste disposal was analyzed and subject areas needing research were pointed out, including: (1) the potential benefits to control which may result from changing the character of animal wastes; (2) present control practices; (3) the application of new and more effective treatment and disposal methods; (4) potential uses for animal wastes; (5) land use planning; and (6) relationships of waste to agricultural production which can be used to assist in establishing standards.

C-096 Bernard, H. 1969. Effects of water quality standards on the requirements for treatment of animal wastes. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 9-16. 5 ref. 1 tab. 2 fig.
Review of water quality criteria in effect in Nebraska. Some cost analyses were presented to indicate the magnitude of the agricultural waste disposal problem. It was suggested that only with the cooperation and leadership of the industry itself can techniques be developed to meet the existing water quality standards and enable the industry to grow unimpeded by environmental backlash.

C-097 Loehr, R.C. 1969. The challenge of animal waste management. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 17-22. 5 ref.
Discussion of several interrelationships between various aspects of animal production and waste management. It is not acceptable to consider waste management by itself; an overview of the entire production operation and its interrelationships with feasible waste management systems is necessary.

C-098 Jones, P.H. 1969. Theory and future outlook of animal waste treatment in Canada and the United States. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 23-26. 27 ref. 2 tab.
Review of the problems posed by animal wastes, and of present day treatment methods. Proposed alternatives to present systems of production used in the livestock industry were given. A form for reporting operational data of a waste management facility was appended.

C-099 Vickers, A.F. and E.J. Genetelli. 1969. Design parameters for the stabilization of highly organic manure slurries by aeration. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 37-49. 11 ref. 6 tab. 7 fig.
Report on investigations to determine if aerobic oxidation systems are capable of achieving either complete treatment of poultry manure slurries or satisfactory partial treatment prior to nuisance-free ultimate disposal, and to

determine the conventional loading parameters that are significant in the design of completely mixed, aerated, stabilization basins for the treatment of manure slurries. It was demonstrated that, whereas aerobic stabilization basins are unsuitable for complete treatment of poultry manure slurries, they can be used successfully to reduce odor production, reduce the solids load on ultimate disposal facilities, enhance the liquid-solids separation of the slurry, and substantially reduce the BOD loading of the slurry. Volume loading rate was the most significant parameter affecting the performance of the stabilization basin.

C-100 Schmid, L.A. and R.I. Lipper. 1969. Swine wastes, characterization and anaerobic digestion. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 50-57. 3 ref. 5 tab. 2 fig.
Report on research conducted in Kansas on the characterization of swine wastes during the finishing period and on the digestion of such wastes in laboratory and field scale treatment facilities. It was concluded that swine waste characteristics can be related to pounds of waste per unit pound of liveweight. Solids removal from raw hog wastes would result in COD reductions of 90%. Operational parameters for the anaerobic digestors were presented and discussed. Acid fermentation rather than methane fermentation will occur during anaerobic digestion of undiluted swine feces plus urine, resulting in liquification but no stabilization.

C-101 Wells, D.M., R.C. Albin, W. Grub and R.Z. Wheaton. 1969. Aerobic decomposition of solid wastes from cattle feedlots. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 58-62. 4 fig.
Progress report on research being conducted at Texas Technological College on the aerobic stabilization of beef feedlot wastes. Composting in open air piles and in specially built drum-type digestors was reported. The studies have suggested that feedlot manure can be stabilized in less than 10 days to a point where the manure is less objectionable, does not attract insects and does not support the growth of pathogens or bacteria of putrefication. The length of stabilization required should be based on the planned use or disposal of the composted waste.

C-102 Kolega, J J., G.L. Nelson and Q.B. Graves. 1969. Analyses for oxygen transfer coefficients in rotor aeration systems. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 63-75. 13 ref. 4 tab. 9 fig.
Report on studies initiated to identify the physical parameters that characterize oxygen transfer in a rotor-aerated liquid waste system, and to develop a prediction equation for oxygen transfer for a given type of rotor. Several relationships were presented to characterize rotor performance.

C-103 Bloodgood, D.E. and C.M. Robson. 1969. Aerobic storage of dairy cattle manure. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 76-80. 4 ref. 2 tab. 1 fig.
Report on laboratory trials on the aerobic storage of dairy cattle manure at two different temperatures and four different loading rates. Volatile solids

reductions of 20% and 42% were recorded at 4°C and 24°C, respectively. Loading rate had no effect on the degree of degradation. Aerobic storage concentrated the Kjeldahl nitrogen content of the material. Foaming was a major problem with the system. It was concluded that the system has promise of minimizing odor problems encountered during field spreading of stored manure.

C-104 Clayton, J.T. and T.H. Feng. 1969. Aerobic digestion of diluted animal manure in closed systems - temporary expedient or long range solution? Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 81-87. 1 ref. 6 fig.
The question of diluting animal wastes before treatment versus the separation of liquid and solid portions with subsequent individual treatment was raised. A pilot study was performed using an aerobic-anaerobic system designed in part by one of the authors. Operational experiences during 78 weeks with the system were discussed. The practice of recirculating effluent as washing water was discussed and the need for long term experiments to determine the effects of such recirculation was noted.

C-105 Smith, L.W., H.K. Goering and C.H. Gordon. 1969. Influence of chemical treatments upon digestibility of ruminant feces. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 88-97. 11 ref. 10 tab.
Report on studies in Maryland to determine the effects of several chemical treatments upon feces from cattle fed a complete roughage ration, as measured by changes in cell wall digestibility ascertained by in-vitro fermentation and by changes in the chemical composition of the feces. The effects of sodium peroxide treatment on the in-vivo digestibility of roughage feces from cattle fed to sheep were also investigated. Results were reported in detail in tabular form.

C-106 Long, T.A., J.W. Bratzler and D.E.H. Frear. 1969. The value of hydrolyzed and dried poultry waste as a feed for ruminant animals. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 98-104. 12 tab.
Report on metabolism trials with sheep and feeding trials with steers to determine the value of heat treated poultry wastes as a source of nutrients for ruminants. Crude protein digestion of the sheep rations was significantly reduced by inclusion of poultry waste: nitrogen excreted in the feces was significantly lower for the soybean oil meal ration than for the poultry waste rations. The fattening trials with steers indicated no significant effects of poultry waste in the ration on rate of gain, feed intake, feed efficiency or carcass grade.

C-107 Anthony, W.B. 1969. Cattle manure: reuse through wastelage feeding. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 105-113. 10 ref. 9 tab. 1 fig.
Review of the use of wastelage (fresh manure and ground grass hay in the ratio of 57:43 stored in a silo) as a feed for ruminants. The system provides an economical, pollution free and flexible method for removing manure from feedlots. The possibility of growing yeast in fluidized and aerated waste,

hydrolyzing the fibre, discarding the lignified residue and concentrating the solubilized and yeast fermented products for feed usage was explored. Values were given for the concentration of various amino acids in manure from steers fed various rations.

C-108 Reed, C.H. 1969. Specifications for equipment for liquid manure disposal by the plow-furrow-cover method. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 114-119. 4 fig.
Review of the system and of the equipment used. Disposing of poultry manure by the plow-furrow-cover method appears to be an excellent conservation method and provides for application rates of 170 to 225 tons per acre. Further research is being conducted on the method with emphasis on modification of the equipment involved to meet different conditions.

C-109 Miller, B.F., W.L. Lindsay and A.A. Parsa. 1969. Use of poultry manure for correction of Zn and Fe deficiencies in plants. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 120-123. 6 ref. 2 tab.
Report on a greenhouse study to evaluate the effectiveness of poultry manure for the correction of Zn and Fe deficiencies and to determine if the organic fraction contributes significantly. The study confirmed that poultry manure is beneficial for the correction of Zn and Fe deficiencies in addition to its value as an NPK fertilizer. The results indicated that manure and other organic wastes may either supply or give rise to natural chelating agents that aid in the solubilization of insoluble micronutrient elements in soil, thereby rendering them more available to plants.

C-110 Webber, L.R. and T.H. Lane. 1969. The nitrogen problem in the land disposal of liquid manure. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 124-130. 13 ref. 3 tab. 1 fig.
Report on research leading to the preparation of guidelines outlining the crop-land requirements for the utilization and disposal of the nitrogenous compounds in liquid manures. A nitrogen balance was attempted for a growing corn crop on an Ontario soil. The amounts of and forms of nitrogen in animal manures were presented. Using this information, pollution control levels for manure disposal were arbitrarily chosen as double the rate of the crop utilization level. Research needs were outlined, including (1) quantitative characterization of the nitrogen cycle, and (2) extension of present knowledge of the process of volatilization of nitrogen as ammonia from liquid manure.

C-111 Townshend, A.R., K.A. Reichert and J.H. Nodwell. 1969. Status report on water pollution control facilities for farm animal wastes in the Province of Ontario. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 131-149. 9 ref. 14 tab. 5 fig.
Review of present pollution control facilities serving swine, beef cattle, dairy cattle, and poultry confinement housing operations. Operating problems encountered at the various water pollution control facilities were given and guidance was offered on the selection and design of new systems. The pollution

potential of farm animal wastes was estimated and data were presented on animal waste characteristics, loadings and population equivalents. The paper concludes that, based on our present technology and economics, the approach to animal waste disposal in Ontario should continue to be one of storage and land disposal rather than treatment and effluent discharge to watercourses. Odor control requires further attention, the use of mechanically aerated systems for conditioning and odor control being recommended.

C-112 Dale, A.C., J.R. Ogilvie, A.C. Chang, M.P. Douglass and J.A. Lindley. 1969. Disposal of dairy cattle wastes by aerated lagoons and irrigation. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 150-159. 11 fig.
Report on an 88-day field trial at Purdue University with a dairy waste disposal system consisting of an aerobic lagoon for storage and treatment, and an overhead sprinkler irrigation system for effluent discharge to grassland. Oxygen was provided by algae and sunlight: a mechanical aerator was used to supply additional oxygen and for mixing. Operational parameters and problems were discussed. The trial indicated that the system is odorless, results in little or no pollution and saves nutrients by providing a suitable place to dispose of wastes at all times, is relatively economical to install and operate and requires relatively little labor. Recommendations for further study were outlined.

C-113 Jones, D.D., D.L. Day and J.C. Converse. 1969. Field tests of oxidation ditches in confinement swine buildings. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 160-171. 1 ref. 15 fig. 1 tab.
Report on research conducted at the University of Illinois to determine design criteria and operational procedures for oxidation ditches receiving raw hog wastes. Five trials were presented, differing from each other in one or more of the following variables: rotor speed, rotor immersion depth, rotor type, fixedness of rotor, detention time, and loading rate. Data were presented for BOD and solids concentration of the ditch contents. Recommendations on design and operation of similar systems were forwarded.

C-114 Moore, J.A., R.E. Larson and E.R. Allred. 1969. Study of the use of the oxidation ditch to stabilize beef animal manures in cold climates. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 172-177. 3 fig.
Report on field trials with an oxidation ditch to determine its ability to contain and reduce large volumes of wastes, reduce the pollutional burden of these wastes and maintain an acceptable nuisance level. The results of three trials indicated that the oxidation ditch does not provide complete treatment for the loading rates tested. Foam production was a problem but odor control was satisfactory. Suggestions were given as to suitable loading rates and expected BOD reductions for oxidation ditches operated in cold climates.

C-115 Edwards, J.B. and J.B. Robinson. 1969. Changes in composition of continuously aerated poultry manure with special reference to nitrogen. Animal Waste Management, Proc. Cornell University Conference on

Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 178-184. 8 ref. 2 tab. 5 fig.
Report on laboratory and field research conducted in Ontario to study the nitrogen transformations in continuously aerated liquid manure and to determine the most efficient means of eliminating nitrogen from the wastes or of preventing losses of nitrogen from liquid manure, depending on whether or not sufficient cropland is available. Data were presented on organic N and ammonia N in the waste after various lengths of treatment. It was concluded that the oxidation ditch can be a useful device for controlling the ultimate nitrogen content of wastes before land disposal. Nitrogen can be removed by encouraging the nitrification-denitrification sequence and presumably could be conserved by inhibiting nitrification.

C-116 Foree, G.R. and R.A. O'Dell. 1969. Farm waste disposal field studies utilizing a modified Pasveer oxidation ditch, settling tank, lagoon system. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 185-192. 8 ref. 7 tab. 6 fig.
Report on two field studies with such a system receiving waste from a swine farrowing barn. The ditch contents were monitored for BOD, COD, dissolved oxygen, temperature, pH, total, fixed and volatile solids, total bacteria counts, and total, ammonia, and organic nitrogen content. The results suggested that the treatment efficiency of the oxidation ditch and of the total system were 50% and 70 - 90%, respectively.

C-117 Rademacher, J.M. and A.V. Resnick. 1969. Feedlot pollution control - a profile for action. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 193-202. 17 ref.
Review of the extent of the feedlot pollution problem, what has been done to resuscitate streams and to prevent stream pollution by feedlot drainage, and some approaches to solve the animal waste problem. It was suggested that there should be an interdisciplinary approach to solving the problem, involving sanitary and agricultural engineers, economists, planners, information specialists, and agronomists. National and advisory committees are needed to draw together all existing data and point out an action program.

C-118 Norton, T.E. and R.W. Hansen. 1969. Cattle feedlot water quality hydrology. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 203-216. 14 ref. 2 tab. 14 fig.
Results of field studies using portions of established feedlots in Colorado and simulated rainfall equipment to determine if the hydrology characteristics of feedlot runoff could be correlated with the quality characteristics through a modification of the flat plate model of overland flow. Equations were developed to predict the quantity and quality of the runoff from existing feedlots. Further studies should be conducted on full-scale feedlots to determine the validity of the extrapolations.

C-119 Grub, W., R.C. Albin, D.M. Wells and R.Z. Wheaton. 1969. The effect of feed, design and management on the control of pollution from beef cattle feedlots. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca,

New York. pp. 217-224. 2 tab. 5 fig.
Review of existing data. Management practices and design concepts which could materially reduce the pollution contributed by feedlots were suggested. The effects of precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout and ration composition on the composition of feedlot runoff were discussed. Organic matter, nitrogen and phosphorus were the three major pollutants considered.

C-120 Loehr, R.C. 1969. Treatment of wastes from beef cattle feedlots—field results. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 225-241. 4 ref. 8 fig.
Results of a field demonstration study in Kansas to investigate an anaerobic-aerobic treatment system for beef cattle feedlot wastewater. Management aspects of the system were discussed and data were presented on the quality of runoff from beef cattle feedlots. It was shown that the system substantially reduced the pollution potential of runoff, and was able to absorb shock loading into the anaerobic unit. Effluent from the system would require further treatment before discharge to streams.

C-121 Ostrander, C.E. 1969. Waste disposal management. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 242-244.
Discussion of the problems in the handling of vast amounts of waste from agriculture. Solutions and management procedures were suggested. Emphasis was placed on utilization rather than disposal.

C-122 Lasalle, R.M., Jr. and M. Launder. 1969. Manure conservation. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 245-248. 1 fig.
Report by the HUPSI Corporation of Wabash, Indiana on a proposed revolutionary new method of "manure conservation". The process, as applied to poultry laying houses, was expounded upon. Basically, it calls for immediate stabilization, denaturing and deodorizing in a weak phosphoric acid solution, and a final buffering treatment to reduce the acidity. Dehydration may also be used. A gross profit of $14.50 per ton was expected. Added advantages of the system are that it provides an enclosed environment which is odor-free, dust-free, vermin-free, and offers a complete solution to the waste disposal problem.

C-123 Walker, J.P. and J. Pos. 1969. Caged layer performance in pens with oxidation ditches and liquid manure storage tanks. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 249-253. 4 ref. 1 tab. 3 fig.
Report on a project at the University of Guelph, Ontario, to evaluate the performance of caged layers housed in a pen utilizing oxidation ditches in contrast to a pen with anaerobic storage tanks. Hen housed egg production, feed conversion; and mortality performance were slightly better for layers in a pen with oxidation ditches. Odors were also less offensive in the pen with oxidation ditches. It was suggested that cage systems that do not need dropping boards should be used, thereby eliminating shock loading and reducing odor and labor requirements. The practical application of aeration for

poultry manure is limited by the foaming problem. iv., Ithaca, New York. pp. 178-184. 8 ref. 2 tab. 5 fig.

Gel24t Meek, A.M., W. G. Merrill and R. A. Rirenced 1969. Current problems and practices nitrogen tsomesfsystems of manure handling in Northern Europe. re Animal Waste termine the mos Management, Proc. Cornell University Conference on Agricultural Waste venting Management, Cornell Univ., Ithaca, New York. pp. 254-259. the 6 ref. ot 4 sufficient cropland is available. Data were presented on organic N and ammonia Systems of manure management are described for animal operations in England, the Scotland and the Scandinavian countries. For Fifteen safety points for prevention of gas problems prepared in Sweden, were presented. Symptoms of chronic ging gas poisoning were given. ification sequence and presumably could be conserved by inhibiting nitrification.

C-125 Sobel, A.T. 1969. Measurement of the odor strength of animal manures.

C-116 Animal Waste Management, Proc. Cornell University Conference on studies Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 260-270. 10 ref. 4 tab. 6 fig., Proc. Cornell University Conference

Report on investigations at Cornell University on two methods of measuring or estimating the odor strength of animal manures. The vapor dilution method considers odor factually arising from the manure, whereas the liquid dilution method measures odor potential. Practical limitations of both methods were discussed. Some significant observations regarding manure, conditions and related odor strength were noted. ganic nitrogen content. The results suggested that the treatment efficiency of the oxidation ditch and of the total system

C-126 Burnett, W. E. and N. C. Dondero. 1969. Microbiological and chemical changes in poultry manure associated with decomposition and odor

C-117 generation. Animal Waste Management, Proc. Cornell University control - Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 271-291. 53 ref. 2 tab. 8 fig. Cornell Univ., Ithaca, New

"Changes in the microbial and chemical composition of batch lots of 'dry' and liquid poultry manure during decomposition were related to the production of offensive odors. The decomposition of uric acid by both aerobic and anaerobic uricolytic bacteria appeared to be related to the formation of significant quantities of ammonia. The number of sulfate-reducing bacteria, including Desulfovibrio species, increased during the course of decomposition of liquid poultry manure. These organisms were implicated as producers of some of the hydrogen sulfide in liquid poultry waste. There were apparent correlations between an increase in odor intensity of liquid manure with increased storage time and the concentrations of volatile organic acids, ammonia, and sulfides."

hydrology. Animal Waste Management, Proc. Cornell University Conference

C-127 Gumerman, R. C. and D. A. Carlson. 1969. Chemical aspects of odor removal in soil systems. Animal Waste Management, Proc. Cornell

Results University Conference on Agricultural Waste Management, Cornell Univ., and simul Ithaca, New York. pp. 292-302. 7 ref. 1 tab. 6 fig. characteristics of Report on an odor control system involving stabilization of gases in soil. gh a The gas selected for the studies was hydrogen sulfide. Chemical and biological mechanisms involved in gas stabilization by soil were discussed and evaluated for their relative effectiveness in wet and dry soil. Chemical mechanisms mentioned included ion exchange, water solution, adsorption and contact catalysis. It was found that a mixed population of aerobic and facultative aerobic microorganisms could sustain growth under hydrogen sulfide exposures of 600 mg/l H_2S in a stream of 600 ml/min total air. Autotrophs decreased and actinomycetes increased when the soil was dried to a low moisture content. rence on Agricultural Waste Management, Cornell Univ., Ithaca,

C-128 Eby, H.J. and G.B. Willson. 1969. Poultry house dust, odor and their mechanical removal. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 303-309. 6 ref. 1 tab. 5 fig.
Report on tests to evaluate the effectiveness and practicability of various filters in an attempt to reduce the odor carrying, proteinaceous dust that is released into the atmosphere from buildings for poultry. Plastic foam pad filters were found impractical due to high initial cost and ineffective washing methods. Filter devices involving the passage of exhaust air tangentially across a ½ inch mesh screen were deemed impractical since the filters were least effective at low relative humidities, while the dust problem is greatest at low humidities.

C-129 Ward, J.C. and E.M. Jex. 1969. Characteristics of aqueous solutions of cattle manure. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 310-326. 25 ref. 4 tab. 5 fig.
Report on previous research to investigate the aqueous characteristics of solutions of beef cattle feedlot manure. Characteristics studied were BOD, conductivity, pH, oxidation-reduction potential, coagulation and colloidal properties, dissolved solids, volatile solids, and foaming. The results were used to develop several mathematical relationships which may be used in the design of treatment facilities for cattle feedlot runoff.

C-130 Taiganides, E.P. and R.K. White. 1969. Typical variations encountered in the measurement of oxygen demand of animal wastes. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 327-335. 9 ref. 2 tab. 7 fig.
Large variations in the parameters used in measuring oxygen demand result in variations of the final value determined for BOD. Three methods of oxygen demand determination were investigated and evaluated. Values are given for the oxygen demand of various wastes as determined by the three methods tested. Further studies are being performed to determine a reliable range of values for the various oxygen demand parameters.

C-131 Morrison, S.M., D.W. Grant, M.P. Nevins and K. Elmund. 1969. Role of excreted antibiotic in modifying microbial decomposition of feedlot waste. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 336-339. 2 ref. 1 tab.
Report on a study of some microbial inhibitions which may be playing a role in the biodegradation of feedlot wastes. Isolates of 14 genera were isolated from manure samples. Growth studies with these isolates suggested that excreted antibiotic residues directly affect the decomposition of feedlot wastes, either by decreasing the conversion efficiency of the flora participating in manure decomposition, or by selecting for resistant microorganisms which do not participate in the stabilization process but which become involved in the production of metabolic end products contributing to the nuisance of feedlot odor. Further studies are being conducted on selected aspects of the problem which will ultimately allow a definition of the role of excreted antibiotic in modifying the complex process of biological stabilization of feedlot manure.

C-132 El-Sabban, F.F., T.A. Long, R.F. Gentry and D.E.H. Frear. 1969. The influence of various factors on poultry litter composition. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 340-346. 18 ref. 4 tab.
Results of analysis of litter samples from 55 different poultry farms in Pennsylvania in an attempt to (1) determine the chemical composition of poultry litter, and (2) study the effects of several factors on the proximate components of the litter, as well as the interrelationships among these components. Samples were analyzed for dry matter content, crude protein, true protein, crude fibre, ether extract and total ash. Furthermore twelve mineral elements were determined, these being Ca, P, K, Mg, Na, Fe, Cu, B, Al, Zn, and Ar. Various factors such as type of birds, bird density, kind of base litter material, litter depth and poultry house conditions were found to affect the proximate components of poultry litter, such that it is difficult to accurately predict the nutritive value of litter or manure.

C-133 Sobel, A.T. 1969. Removal of water from animal manures. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 347-362. 12 ref. 2 tab. 8 fig.
"The removal of water from animal manures changes the handling characteristics of the manure, reduces the weight and volume to be handled, and reduces the offensive odor of the manure. Water can be removed from manure by mechanical, thermal, and absorptive means. Mechanical methods such as direct pressing present the difficulty of the removed water containing considerable volatile solids. Thermal removal was investigated from the standpoint of utilizing a thin layer, unheated air, and very low or 'static' air velocity. The equilibrium moisture content of chicken manure is comparable with other agricultural hygroscopic materials. Equilibrium moisture content values are presented for temperatures of 70, 90, 110°F. Drying times for chicken manure under these conditions are in terms of days. Drying times are greatly influenced by sample variation. Effects of humidity on drying time are significant but sample variation has effect similar to a $\pm$15% relative humidity change. Moisture loss from a 'deep' layer of manure is less than that from a free water surface."

C-134 Biniek, J.P. 1969. Livestock production vs. environmental quality - an impasse? Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 363-368. 14 ref.
Discussion of environmental quality, quality standards, public concern, and changing economic concepts with the aim of demonstrating that an impasse between environmental quality and production efficiency can be averted.

C-135 Okey, R.W., R.N. Rickles and R.B. Taylor. 1969. Relative economics of animal waste disposal by selected wet and dry techniques. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. 11 ref. 17 tab. 5 fig.
Systems analysis of two basic waste treatment facilities to handle the wastes from feedlots carrying 500, 1,000, 5,000, 10,000 and 25,000 animals. Both plants were designed to meet effluent standards presently required. One system employed conventional liquid waste treatment procedures, whereas the

other system employed incineration and treated the undiluted animal wastes as delivered as a solid waste. Costs of waste treatment for the two systems were computed and ranged from 1 cent to 10 cents per pound gained. It was concluded that, when properly employed, wet systems of manure disposal are more expensive to own and operate than systems designed to handle solid wastes. It was suggested that continued research is necessary to solve both technical and economic problems associated with wastes collection, treatment, storm water exclusion, and nutrient losses.

C-136 Linton, R.E. 1969. The economics of poultry manure disposal. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 388-392.
Resume of a more extensive report published elsewhere. The study on which the report is based dealt with the conflict between poultry and alternative land uses in New York State. The poultry industry in the study area was described, and extreme points of view which were expressed by public officials, poultrymen, non-farm residents, resort operators, etc. were presented. As a result of the study, a pattern of manure disposal incorporating land spreading was singled out for further cost calculations. It was concluded that the continued expansion and viability of concentrated and specialized farm industries in the study area depends on how well they fit into a land use plan designed to prevent incompatible mixtures.

C-137 Mceachron, L.W., P.J. Zwerman, C.D. Kearl and R.B. Musgrave. 1969. Economic return from various land disposal systems for dairy cattle manure. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 393-400. 13 ref. 11 tab.
Report on field trials with various crop rotations to determine yield responses with and without dairy manures. Results of the trials were presented in detail in tabular form. Agricultural statistics were presented for Northeastern and Northcentral U.S.A. to show that dairy cattle manure could well be spread on the land. Farm cost accounting data indicated that manure crop yield returns ranged from $1.42 per ton to a deficit of $.26 per ton, without including a charge for hauling and spreading which could amount to over $3.00 per ton.

C-138 Casler, G.L. 1969. Economic evaluation of liquid manure systems for free stall dairy barns. Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 401-406. 3 tab.
Economic evaluation of liquid manure systems for free-stall dairy barns based on the viewpoint of getting rid of the waste materials at least cost, without really considering the potential for pollution. Reasons for installing liquid manure systems were reviewed and included (1) lower labor requirements, (2) elimination of a disagreeable daily chore, (3) change in labor distribution, (4) elimination of the need for a separate system to handle manure and milking parlor wastewater, (5) increased manure value, and (6) decreased manure handling costs. Results of the study indicated that justification for a liquid manure system must be based on other advantages in addition to increased manure value and reduced labor requirements. Furthermore, the pollution potential of liquid manure systems was judged to be more serious than that of a solid handling system.

C-139 Allee, D.J. and P. Clavel. 1969. Who should regulate poultry conflict problems? Animal Waste Management, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 407-414. 5 ref.
Appraisal of the outlook for regulatory devices based on economic and social theory, related research and a case study. An informal voluntary industry committee approach was recommended. It was suggested that because of a shortage of administrative and political resources, many rural areas will resist effective resolution of waste conflict problems until finally controls will be imposed by essentially urban orientated units of government.

C-140 Bernard, H. 1970. Effects of agriculture on water quality. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 6-10. 3 ref. 1 tab.
Discussion of the potential pollution problems rising from agricultural activities with a section dealing specifically with animal wastes. Problems with animal waste stem primarily from a combination of a lack of consideration of the degree of insult to the environment, the displacement of manure as an economic fertilizer by commercial fertilizers, and a tardiness in developing both animal management and treatment systems to minimize the pollution aspects of the animal industry.

C-141 Garman, W.H. 1970. Agriculture and nature's nutrient cycles. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 11-20. 12 ref. 2 tab.
Review of the natural cycles of nitrogen and phosphorus and an attempt to determine the influence of agriculture on these cycles. It is difficult to determine the pollution load on a stream from a farming area because of the large number of variables and unknown factors involved. One of the major problems for the immediate future was seen to be financing the cost of livestock and human waste disposal systems. The author emphasized that agriculture has been receiving more than its share of the blame for pollution of surface waters.

C-142 Luthin, J.N. 1970. Movement of water through soils. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 21-28. 11 fig.
General review of the movement of water through soil. The basic laws governing the movement are presented and illustrated using some agricultural examples. It was noted that phosphates come into solution under reducing conditions, such that all drainage waters can be expected to contain a certain amount of phosphate. Nitrates are reduced to elemental nitrogen which lowers the quantities of nitrates present in some drainage waters.

C-143 Peech, M. 1970. Reactions of fertilizers in soils. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. p. 29. (abstract only)
Anhydrous ammonia nitrogen is strongly retained in the soil but NH_4^+ is only weakly adsorbed by acid soils. Fertilizer phosphate is strongly retained by all soils; any residual effect is due largely to the slow transformation rate

in soils. Trace metals (Mn^{++}, Cu^{++}, Zn^{++}) are strongly chelated by soil organic matter. Exchange reactions of the K^+ ion are similar to those for the NH_4^+ ion.

C-144 Steckel, J.E. 1970. Movements of nutrients from poultry manure in soil. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. p. 30. (abstract only)
Report on field trials with the plow-furrow-cover method of land disposal of poultry manure in a sandy loam soil. Soil water samples were collected after several inches of rainfall and analyzed for K, Ca, Mg, Na, NH_4-N, NO_3-N, Cl, SO_4, and PO_4. Element concentrations were increased in the soil water by the manure application.

C-145 Mielke, L.N., J.R. Ellis, N.P. Swanson, J.C. Lorimor and T.M. McCalla. 1970. Groundwater quality and fluctuation in a shallow unconfined aquifer under a level feedlot. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 31-40. 13 ref. 2 tab. 4 fig.
Report on a study conducted in Nebraska to investigate the quality of the groundwater in the proximity of a level feedlot on a permeable soil with a fluctuating high water table. Despite the close proximity of contaminants on the lot surface to the groundwater, there was little evidence of pollution in the aquifer. The observations made indicated that the manure pack and the soil surface interface provides an effective barrier to water movement. It was suggested that evaporation accounts for most of the water losses from the lot surface. A hypothetical potential for nitrate pollution of groundwater was computed and used to show that widespread nitrate pollution from flat feedlots in Nebraska is improbable.

C-146 Hileman, L.H. 1970. Pollution factors associated with excessive poultry litter (manure) application in Arkansas. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 41-47. 5 ref. 9 tab. 1 fig.
Preliminary report on greenhouse studies. Soil pollution and related problems may occur from the practice of applying large quantities of broiler litter to soil, these being (1) excess soluble salt, (2) chemical imbalance with particular reference to K and the mono-valent to di-valent ratio, (3) nitrate accumulation to toxic levels in forage and water supplies, and (4) forages deficient in magnesium. Further study is needed to fully understand the mechanisms by which these conditions exist.

C-147 Kunkle, S.H. 1970. Concentrations and cycles of bacterial indicators in farm surface runoff. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 49-60. 27 ref. 2 tab. 7 fig.
Report of initial results from a study of bacterial pollution indicators on the Sleepers River Watershed, Danville, Vermont. Storm runoff was sampled below a watershed containing hayfields and grazed pastures. It was shown that concentrations of total and fecal coliforms in the streams were directly

related to levels of stream discharge, a full day of storm runoff producing higher coliform yields than a hundred non-storm days. Results of the study suggested that the fecal coliform group is a much better indicator of pollution than the less specific total coliform group.

C-148 Gburek, W.J. and W.R. Heald. 1970. Effects of direct runoff from agricultural land on the water quality of small streams. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 61-68. 4 ref. 4 fig.
Results of some intensive water quality sampling at the outlet of a 42 hectare agricultural watershed in Pennsylvania following a number of storms. Possible implications of the water quality changes observed were discussed. It was shown that water quality of the stream was directly affected by changes in hydrology, the stream chemistry responding quickly to changes within the storm hydrograph. It was suggested that the chemical variations in the watershed outflow are a direct reflection of the physical and chemical processes involved in the transformation of precipitation into direct runoff.

C-149 Day, D.L. 1970. Reducing the pollution potential of livestock wastes with in-the-building oxidation ditches. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 77-84. 3 ref. 11 fig.
Report on a low-odor, low-labor, low-stream pollution potential and convenient system of managing livestock wastes from animal to field consisting of a confinement building for livestock with self-cleaning slotted floors, an oxidation ditch below the floor, a non-overflow aerobic lagoon to receive overflow from the oxidation ditch, and irrigating equipment for removal of surplus wastes from the lagoon to the field. Possible refinements of the system were proposed to remove nitrates, phosphates and color from the final lagoon effluent. Means of reducing aeration costs were also considered.

C-150 Okey, R.W. and R.N. Rickles. 1970. The conceptual design of an economically feasible animal waste disposal scheme. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 85-97. 11 ref. 11 tab. 4 fig.
Report on development of a complete system for capture, treatment, and transport of wastes from a 25,000 animal feedlot. Included in the system were provisions for BOD, nitrogen, and phosphorus removal from the waste before final discharge of the effluent. The cost for the scheme was estimated at less than a cent per pound gained. It was suggested that treatment costs for feedlot wastes represent roughly the same fraction of total costs as for other industries.

C-151 McKenna, M.F. and J.H. Clark. 1970. The economics of storing, handling and spreading of liquid hog manure for confined feeder hog enterprises. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 98-110. 9 ref. 12 tab.
Report on a study performed at Guelph, Ontario, to determine the optimum size of storage capacity for feeder hog enterprises and the net value of manure as a fertilizer. A linear programming model was used in which the economically

optimum storage capacity was considered to be a function of the density of hogs per acre of land that is available for spreading and the crops that are under cultivation. Results were presented in detail. It was concluded that, for Ontario conditions, a land utilization program for hog waste disposal is economically feasible. The need for research to evaluate losses occurring under Ontario conditions for application of manure at different seasons of the year was emphasised.

C-152 Overman, A.R., C.C. Hortenstine and J.M. Wing. 1970. Land disposal of dairy farm waste. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 123-126. 2 ref. 3 fig.
Report on study of the chemical, physical and biological processes occurring in soils under Florida conditions when large quantities of dairy wastewaters are applied. Graphs were given of pH and nitrate and orthophosphate concentrations in the soil to a depth of 60 cm. Applications of up to 1 inch per week of effluent with a solids content of 0.15% were adequately handled by crops. It was concluded that soil-plant systems are effective in renovation of wastewater from animal operations.

C-153 Frink, C.R. 1970. The nitrogen cycle of a dairy farm. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 127-133. 11 ref. 1 tab. 4 fig.
Report on an examination of the dairy farm nitrogen cycle with special emphasis on the points in that cycle where man may intervene to reduce losses to the environment. Calculations of the efficiency of nitrogen conversion on farms revealed that losses to the environment increased as farm size decreased. Consideration was given to reduction of losses by foliar applications to growing crops, selection of crops with high yield and high nitrogen content, increased plant populations and more extensive use of cover crops.

C-154 Jaworski, N.A. and L.J. Hetling. 1970. Relative contributions of nutrients to the Potomac River Basin from various sources. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 134-146. 8 ref. 6 tab. 8 fig.
Report on investigations conducted in the Potomac River System to determine nutrient sources. Nutrient yields were twofold greater from agricultural areas than from forested areas. The major source of nutrients to the aquatic ecosystem was wastewater discharges.

C-155 Mathers, A.C. and B.A. Stewart. 1970. Nitrogen transformations and plant growth as affected by applying large amounts of cattle feedlot wastes to soil. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 207-214. 3 ref. 2 tab. 8 fig.
Report on studies in Texas to determine the decomposition rates and nitrogen transformations of animal wastes when applied to soil at various rates and to determine the effects on plant growth of applying large amounts of animal wastes to soil. Results of the studies indicated that evolution of C and transformation of nitrogen were rapid, nitrification was influenced by

application rate of manure and moisture content of the soil during incubation, and one unit of N from ammonia nitrate was equal to 2.4 units of N supplied in feedlot waste.

C-156 Nelson, D.W. and M.J.M. Romkens. 1970. Transport of phosphorus in surface runoff. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 215-225. 16 ref. 1 tab. 8 fig.
Report on field plot tests to study the amounts and forms of phosphorus removed by surface runoff from fertilized and unfertilized plots. It was concluded that phosphate concentration in the runoff is related to the rate of phosphorus application and to the amount and forms of phosphorus in the sediment; varies during the initial portion of runoff in successive storms but reaches an equilibrium value later during the rainstorm; represents over 1% of that applied. Organic phosphorus appeared to be removed in the first flush of runoff.

C-157 Swanson, N.P., L.N. Mielke and J.C. Lorimor. 1970. Hydrologic studies for evaluation of the pollution potential of feedlots in Eastern Nebraska. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 226-232. 15 ref.
Interim report on investigations to study the water balance of feedlots on both sloping and level sites in Nebraska, and to physically, chemically and microbiologically characterize the water leaving feedlots in overland flow or by percolation through the profile. Information collected was used to quantify the existing pollution potential of feedlots in Nebraska. Generation of runoff carrying solids from a sloping feedlot is a function of rainfall intensity and duration, and of slope steepness and length. Short term detention of runoff from sloping feedlots was recommended. The concept of a broad basin terrace has been adapted for controlling water erosion and for intercepting and storing surface runoff from cattle feedlots.

C-158 Walker, W.R. 1970. Legal restraints on agricultural pollution. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 233-241.
Review of existing legislation in the U.S.A. concerning agricultural pollution and discussion on new forms of regulations including land zoning, quotas and incentives. Common law was discussed under the headings of trespass, private and public nuisance, negligence, strict liability, joint and independent tortfeasors, defenses and limitations of advocatory process. State and Federal regulations were reviewed and interpreted. It was concluded that agricultural pollution will not likely be effectively controlled with private litigation, making necessary some form of Federal and State legislation.

C-159 Hunt, C.S.. 1970. Estimation of water pollution from farming activities. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 242-250. 5 ref. 11 tab.
Pollution arising from pesticides, fertilizers and soil erosion was estimated. One table was presented showing the estimated number of pounds of nitrogen, phosphate and potash produced by livestock in the Genesee River Basin, New York.

C-160 Schultz, D.A. 1970. A balance sheet method of determining the contribution of agricultural wastes to surface water pollution. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 251-262. 9 ref. 8 tab.
Report on application of the Balance Sheet Method to show the quantity of nutrients contributed by agricultural activities to a stream. The applicability of the method was demonstrated by an empirical example based on some assumptions and some secondary data for the Genessee River in Central New York State. It was concluded that the method is useful to the extent that the data are accurate. The method should aid the analyst in isolating those activities that adversely affect water quality.

C-161 Zwerman, P.J., A.B. Drielsma, G.D. Jones, S.D. Klausner and D. Ellis. 1970. Rates of water infiltration resulting from applications of dairy manure. Relationship of Agriculture to Soil and Water Pollution, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 263-270. 17 ref. 6 tab.
Report on field plot tests at Cornell University. Data were presented on rates and quantities of water entry into the soil surface, with special attention given to the effects of dairy manure and crop sequence on such rates and quantities. In trials comparing 6 tons of dairy manure plowed down versus no manure on continuous corn at two rates of mineral fertilization, manure increased infiltration by 27% whereas heavy mineral fertilization without manure decreased infiltration by 60% as compared to manure with moderate mineral fertilization. In another experiment involving manure with various crop rotations, manure did not significantly increase rates of infiltration.

C-162 Denit, J.D. 1971. Environmental quality and productivity - a challenge of the seventies. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 6-11. 5 ref. 2 tab.
Discussion of manure runoff and malfunctioning lagoons as two of the principal problems facing animal production operators. Twenty-four fish kills in 1969 which were directly attributed to manure drainage were documented. The responsibilities of livestock producers, farm advisors and research professionals in environmental quality were discussed.

C-163 Oglesby, R.T. 1971. Farm land runoff. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 15-19. 11 ref.
Discussion of the environmental significance of phosphorus and nitrogen in water, and of the contribution made by agriculture to the total nutrient load on the environment. Phosphorus and nitrogen in runoff may be measured directly or estimated by using nutrient budgets. Improperly managed or designed animal waste management facilities and operations contribute significant amounts of nitrogen and phosphorus to surface and ground water.

C-164 Downing, D.L. 1971. Environmental problems in the food processing industry. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste

Management, Cornell Univ., Ithaca, New York. pp. 20-24. 6 tab.
Review of the extent of the food processing waste disposal problem, the pollution potential of vegetable processing plant effluents, and total volumes of wastes which must be handled. In addition to water and air pollution by waste portions of the food products themselves, noise pollution and disposal of packaging materials are also of concern.

C-165 Klausner, S.D., P.J. Zwerman and T.W. Scott. 1971. Land disposal of manure in relation to water quality. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 36-46. 10 ref. 8 tab.
Discussion of the chemical characteristics of manure, land disposal methods, and soil and water conservation practices as they relate to handling of animal wastes to avoid pollution of water by runoff, seepage and erosion. The effects of manure applications at various times throughout the year were discussed The need for continuing research on development of economic means of manure handling and on establishing maximum land disposal rates was indicated.

C-166 Ostrander, C.E. 1971. Animal waste handling in the United Kingdom. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 52-53.
Review of the waste handling situation in England, Scotland and Holland. Several waste management practices being used were discussed. Odor was considered to be one of the biggest problems. Differences in livestock management as related to waste handling between the U.S.A. and U.K. were noted.

C-167 Loehr, R.C. 1971. Liquid waste treatment. I. Fundamentals. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 54-62. 1 tab. 1 fig.
Discussion of: (1) biochemical reactions; (2) basic biological systems; (3) basic metabolism of bacteria, fungi, algae and protozoa; (4) transformation of carbon, nitrogen, phosphorus in biological systems; and (5) temperature effects on waste treatment processes. Since waste treatment is a biological process, an understanding of the above concepts is necessary for the proper design and operation of agricultural waste treatment systems.

C-168 Loehr, R.C. 1971. Liquid waste treatment. II. Oxidation ponds and aerated lagoons. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 63-71. 2 ref. 1 tab. 3 fig.
Discussion on the application of oxidation ponds and aerated lagoons to the treatment of liquid manure. The design and operation of both types of treatment facilities were considered. Detailed information was given on the microbial reactions (bacteria/algae symbiosis), nutrient cycling, oxygen relationships, and temperature and loading effects in oxidation ponds. The design and efficiency of aeration systems for aerated lagoons were also considered in detail. It was concluded that both oxidation ponds and aerated lagoons can be successfully utilized for agricultural wastes if the fundamental concepts of each process are understood and incorporated into design and operation.

C-169 Loehr, R.C. 1971. Liquid waste treatment. III. The oxidation ditch. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 72-78. 1 ref. 1 tab. 2 fig.
Review of the application of oxidation ditches to livestock waste treatment. Oxidation ditches have been used successfully in livestock confinement operations for odor prevention and control, labor saving and waste purification. The oxidation ditch process and operational characteristics and problems were discussed. Data were given to illustrate loading rates, treatment efficiencies and power requirements.

C-170 Lawrence, A.W. 1971. Anaerobic biological waste treatment systems. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 79-92. 18 ref. 3 tab. 6 fig.
Review of anaerobic waste treatment with emphasis on the microbial processes involved, and on the design, operation and control of the process. The effects of selected inorganic materials on anaerobic treatment processes were discussed. Agricultural applications of the process were cited, with indications of some success. It was concluded that, at the present time, anaerobic lagoons are the most attractive anaerobic process configuration for agricultural applications because of the low capital and operating expense.

C-171 Lawrence, A.W. 1971. Chlorination of wastewater effluents. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 93-101. 11 ref. 1 tab. 3 fig.
Review of the process of chlorination for disinfection of wastewaters being discharged to a public watercourse. The reactions of aqueous chlorine, measurement of chlorine residuals, measure of success of disinfection, and factors affecting disinfection by chlorination were discussed. Some agricultural applications of chlorination were cited. It was concluded that chlorination is an effective and relatively economical process for wastewater treatment to protect against transmission of enteric disease via the water route.

C-172 Ludington, D.C. 1971. Solids destruction or severe treatment. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 102-106. 3 ref. 1 tab. 1 fig.
Description of biological, chemical and thermal processes for solids destruction. Examples were given of each type of treatment, probable solids reduction and the products of destruction. Agricultural applications were mentioned. It was suggested that solids destruction should be seriously considered only after all possibilities for reuse and recycle have been exhausted. The type of solids destruction process chosen should be based on the composition of the material to be degraded.

C-173 Sobel, A.T. 1971. Moisture removal. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 107-114. 4 ref. 1 tab. 7 fig.
Review of the benefits of poultry manure dehydration, including reduction in

offensive odor, reduction in weight and volume to be handled, and change in the handling characteristics. Odor offensiveness and weight and volume changes were given as functions of moisture content. Mechanical, absorption and thermal processes for moisture removal were discussed with references to factors affecting the efficiency and applicability of each process. It was recommended that, because dehydration is expensive, it should be considered only if a ready market is available and the cost of dehydration is considered as a treatment.

C-174 Toth, S.J. and B. Gold. 1971. Composting. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 115-120. 11 ref. 2 tab.
Description of the composting process involving the conversion into humus of organic residues via thermophilic organisms, with the evolution of CO_2. Moisture, air, nitrogen, potassium and phosphorus were discussed as they affect the composting process. A long list of various organic wastes, and their N, P and K contents was presented as a guide to their possible use in composting. Methods of composting, characteristics of an ideal compost, composting municipal garbage, and the agricultural value of composts were discussed briefly.

C-175 Heald, W.R. and R.C. Loehr. 1971. Utilization of agricultural wastes. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 121-129. 49 ref.
Review of waste recovery techniques which have been used or investigated and discussion of what techniques might be developed or refined in the future. Animal wastes may be field spread for their value as a fertilizer and/or soil conditioner, composted for specialty crops and urban gardens, dehydrated and used as feed supplements, or anaerobically digested for energy (methane) production. More information is required on the costs of the various methods before they can be evaluated. The techniques must be examined for their social, economic, legal and political effects.

C-176 Ludington, D.C. 1971. Odors and their control. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 130-136. 12 ref. 1 tab. 1 fig.
Review of previous research conducted at Cornell University on the control of odor from poultry manure. Methods investigated have been soil filtration, chemical treatment, plow-furrow-cover and soil injection, and prevention of odor production by frequent removal and spreading, moisture removal and aeration. Costs of controlling odor production by the various methods were reviewed. A list and evaluation were given of methods for control of odors from ventilation air, loading and outside storage areas, and land after spreading. Adequate aeration of liquid manure was considered to be the most effective overall odor control method.

C-177 Guest, R.W. 1971. Waste handling alternatives. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 137-141. 2 fig.

Discussion of three basic forms of all animal manures, based on moisture content, and some treatment processes which will affect future handling methods and utilization of these animal by-products. Selected aspects of storage and treatment of manure were considered. A flow sheet was presented to illustrate alternative methods of handling farm manures.

C-178 Young, R.J. 1971. Integration of components into a system. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 142-149. 7 fig.
Discussion on waste management systems for gaseous wastes, solid wastes, and liquid wastes. Flow charts were given to illustrate the alternatives available and to give a more detailed description of some selected treatment processes. It was suggested that pollution control regulations are a constraint on all waste management systems.

C-179 Crowley, J.W. 1971. Advisory groups for environmental protection and agricultural cooperation. Agricultural Wastes: Principles and Guidelines for Practical Solutions. Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 150-154.
Review of the advisory group approach to problem solving and discussion on the application of such an approach to the present dairy waste problem. Suggestions were made as to which people might best form a dairy waste management advisory group and how they might best perform their job.

C-180 Everingham, R. 1971. Waste management on a modern dairy farm. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 157-160.
Report by the owner of a 100 cow free-stall barn with a liquid manure system. The biggest problems with the system in 3 years of operation have been: (1) storage pits are not large enough, even though they were designed according to recommendations; (2) agitation of material in the pits; (3) runoff on frozen ground; and (4) odor from field spread manure. The farmer would like to increase the number of cleanout holes, increase the width of slots in the floor over the storage pits, increase the storage capacity to 4 months from the present 6 weeks, and would consider soil injection for disposal of the wastes.

C-181 Johanson, K.J. 1971. Performance of duck wastewater treatment facilities. Agricultural Wastes: Principles and Guidelines for Practical Solutions, Proc. Cornell University Conference on Agricultural Waste Management, Cornell Univ., Ithaca, New York. pp. 161-166. 3 ref. 3 fig.
Report on the Long Island duck industry waste problems, the present waste management systems and legal actions which led up to the introduction of the present systems. Very large volumes of wastewater must be handled on a continuous basis and, in many cases, on a year round basis, despite freezing winter temperatures. The State laws now require aeration of the wastewater for nutrient removal, some sort of solids removal, and disinfection (chlorination) before release back into public watercourses. Problems yet to be solved were outlined.

C-182 Brevik, T.J. and M.T. Beatty (ed.). 1971. Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis.

Several aspects of nitrogen and phosphorus in rural ecosystems were discussed which relate indirectly to animal waste management. These (with the appropriate page numbers in the published proceedings) included: movement of ground water (pp. 48-52); nitrates in groundwater (pp. 53-68) and plants (pp. 69-87) and their relationship to the health of animals (pp. 91-112) and humans (pp. 113-118); phosphorus in the environment (pp. 134-137); chemical characteristics of phosphorus in soils and water (pp. 138-143) and the relation of such phosphorus to eutrophication and surface water quality (pp. 144-155); phosphorus in rural ecosystems (pp. 156-175); phosphorus in effluent from processing plants (pp. 176-180); phosphorus removal in municipal, industrial and private wastewater treatment systems (pp. 181-200); and Wisconsin water quality standards (pp. 201-204).

C-183 Keeney, D.R. and L.M. Walsh. 1971. Sources and fate of "available" nitrogen in rural ecosystems. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 22-40. 8 tab. 4 fig.

Discussion of the nitrogen cycle and agricultural inputs to the available nitrogen pool. Statistics were given on the contribution made by several sources including farmyard manure. A nitrogen budget was drawn up for Wisconsin.

C-184 Martin, W.P. 1971. Soil pollutants and their effects on clean water. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 125-133.

Discussion of the effects of several agricultural pollutants on water supplies, including a section dealing specifically with animal wastes. It was concluded that agricultural pollution can be moderated but that it must be paid for through higher food prices.

C-185 Powell, R. and J. Densmore. 1971. Phosphorus in the rural ecosystem - runoff from agricultural land. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 156-166. 9 tab.

Review of the sources of phosphorus in the rural ecosystem including the three major sources of soil erosion, animal wastes, and fertilizers. Guidelines were given on the phosphorus concentrations of animal manures and on possible methods to control such phosphorus from entering water supplies.

C-186 Kirschbaum, N.E. 1971. Farm animal waste management - what our milk

market requires. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 208-210.
Interpretation and discussion of legal statutes (Wisconsin) and regulations which concern waste disposal from dairy facilities. These provisions are concerned with the general cleanliness of the cows, the breeding of flies, and the pollution of water used for drinking or for cleaning equipment, with no real concern as to the proper disposal of the wastes. In general, it appears that the daily removal and spreading of manure which was previously recommended is now being discouraged in Wisconsin.

C-187 Densmore, J. 1971. Controlling barnyard runoff. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 211-214.
Progress report on the experiences of the Soil Conservation Service in working with farmers on practices for pollution abatement in feedlots and barnyards. Three steps which might be recommended for runoff control from feedlots include (1) interception and diversion of all surface runoff not originating on the yard, (2) reshaping the lot to provide good drainage, and (3) collection, detention and disposal of runoff from the yard. Runoff holding facilities were discussed. Some observations were made on the present and expected situation in Wisconsin with regard to feedlots.

C-188 Massie, L.R. 1971. Planning land application of manure. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 215-222. 2 ref. 6 tab.
Discussion of land spreading practices for manure disposal in Wisconsin. Systems for application of manure to land will depend on soil and land conditions, including internal drainage of the soil profile, infiltration rates, rooting restrictions and bedrock conditions, erosion potential, and geological location. Some Wisconsin soils were classified as to problems which might arise from their use as a waste disposal media.

C-189 Gojmerac, W.L. 1971. Flies in relation to manure handling. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 223-226. 1 tab.
Report on a study to objectively evaluate the fly problem on dairy farms where manure was stored over summer and to compare this to the problem on nearby farms where manure was regularly removed. Calf pens, gutters and mangers were the areas with significant fly breeding. Fly breeding was significantly greater in gutters on those farms hauling than on those farms storing manure. It was concluded that those farms storing manure do not have a more serious

fly breeding problem than those farms regularly removing the manure, perhaps because of the greater effort to reduce fly problems on the former.

C-190 Bruns, E.G. 1971. A procedure for design of a manure stacking facility. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 227-232.
Design data and calculations used to estimate the waste storage requirements for two dairy operations were presented. Final estimates were given for solid manure storage requirements and liquid storage capacity of detention ponds handling yard runoff.

C-191 Brevik, T.J. 1971. Liquid manure handling. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 233-239.
Discussion on storage of animal manures, both solid and liquid, and of some terminology relating to liquid manure storage and handling. Considerations and problems associated with underground holding tanks were examined in detail with references being made to sizing of such tanks, odor and gases produced, construction, location, labor requirements, agitation, floors, irrigation, automation and safety. A list of publications detailing manure storage was appended.

C-192 Converse, J.C. 1971. Research progress in manure handling and treatment systems for livestock. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 240-264. 16 ref. 3 tab. 8 fig.
Report on recent research on manure handling and treatment systems for livestock wastes. Results of specific research on oxidation ditches, aerated lagoon irrigation systems, flushing systems using renovated wastewater and odor control methods were discussed in detail.

C-193 Cramer, C.O., R.F. Johannes and G.H. Tenpas. 1971. University of Wisconsin research on manure handling. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 265-269. 4 ref.
Review of past, present and proposed research on animal waste management at the University of Wisconsin.

C-194 Gilbertson, C.B. 1971. Large commercial feedlots - how wastes are handled in the West. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire,

Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 270-279. 1 tab. 2 fig.
Discussion of waste management for beef cattle operations in Nebraska. The feedlot situation was reviewed with reference to solid waste management, runoff management, groundwater contamination and air pollution. Legislation relating to feedlots was discussed. The results of past research and the objectives of present research by various agencies were outlined and recommendations were given on selected aspects of the problem.

C-195 Anon. 1971. The Lake Mendota pilot project. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 280-291.
Report on a pilot program to stimulate greater use of traditional soil conservation practices, to promote better management of farmyard and feedlot runoff and to encourage the construction of facilities for winter storage of farm animal wastes. Since initiation of the project, seven storage units have been placed into operation. Problems encountered to date and plans for the future were discussed.

C-196 Skinner, J.L. and J.W. Crowley. 1971. Action programs for manure handling. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 295-300.
Demonstration of the initiation and expected results of a waste management action program. Using the dairy industry of Wisconsin as an example, persons and agencies involved and considerations pertinent to the animal waste management problem were listed and explained. The ultimate requirement that wastes be recycled was emphasized.

C-197 Anon. 1971. Summaries of small group discussions. In T.J. Brevik and M.T. Beatty (ed.). Proceedings of Conferences on Farm Animal Wastes, Nitrates and Phosphates in Rural Wisconsin Ecosystems, Madison, Green Bay and Eau Claire, Wisconsin. Division of Economic and Environmental Development, University Extension, Univ. Wis., Madison, Wis. pp. 304-307.
Topics discussed included liquid manure systems on dairy farms (storage tank design and operation, gas production), free stalls for dairy cattle housing (manure management), needed publications for dairy manure management, adaption of soil and water conservation techniques to new problems, and guidelines and regulations.

C-198 Black, R.J. and W.Q. Kehr. 1969. Quantities and characteristics of farm animal wastes. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 17-21. 6 ref. 3 tab.
Presentation of average values for the weight of manure generated by various classes of livestock and poultry and for the composition of that manure.

C-199 McCoy, E. 1969. Health problems. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 22-24.
Review of previous research showing that manure contains large numbers of pollution bacteria (coliform, enterococci) but that there is a rapid die-off of these organisms when manure is applied to the land. It was concluded that the bacteria are removed by adsorption in percolation through soil and by their own die-off because of their inability to compete against the established soil and manure flora. The possibility that pollution bacteria originating in manure might move considerable distances in direct surface runoff or in seepage water through sandy or rocky soils, creviced bedrock, or earthworm holes was noted.

C-200 Evans, D. 1969. Aesthetics and odors. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 25-26.
Discussion of the odor problem with animal wastes. Threshold odor levels were given for several odorous gases and methods for measuring odor levels were discussed briefly. It was concluded that, before odor from animal wastes can be controlled, more needs to be known about the type, quantity and odor threshold of the various compounds involved.

C-201 Erdmann, A.A. 1969. Dead animals and how they contribute to pollution of the environment. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 27-29.
Discussion of the problem of dead animal disposal. The problems of the rendering industry, such as added labor costs, collection costs and the inferior product resulting from such operations (as compared to packing plant wastes), will probably make it necessary to use a different method of disposal of dead animals than is now followed.

C-202 Schraufnagel, F.H. 1969. Water quality problems. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 30-32. 7 ref.
Discussion of the potential water contaminants from livestock operations, including organic matter, plant nutrients and bacteria. The biggest threat to water quality in Wisconsin now appears to be the use of manure on frozen ground.

C-203 Bray, R.W. 1969. Future trends in livestock production. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 33-35.
General paper on the animal industry in Wisconsin. Livestock production and the percentage of large confinement units will increase in the future, such that the solid waste problems will become more complex.

C-204 Beatty, M.T., J.E. Kerrigan and W.K. Porter. 1969. What and where are the critical situations with farm animal wastes and by-products in Wisconsin? Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 36-57. 4 tab. 12 fig.
Discussion of potential pollutant situations in Wisconsin and some of the background factors which determine whether or not a critical situation exists

with respect to animal waste production. Maps and statistics were given to illustrate the kinds and amounts of wastes and by-products produced, the spacial distribution of the sources, the proximity to people, the physical environment and the uses and demands on water and land resources. Some data were presented to show the effect of land use on nitrate and ammonia in soil profiles and the losses of nitrogen and phosphorus from manure spread on frozen ground.

C-205 Berge, O.I., E.G. Bruns, T.J. Brevik and L.A. Brooks. 1969. Considerations in selecting dairy manure disposal systems. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 68-69. 8 tab.
Comparison of manure handling alternatives (daily hauling, stacking, liquid) under various housing conditions (stanchion barns, free-stalls with solid floors, free-stalls with slatted floors). Advantages and disadvantages of each alternative system were given and data were presented on investment and operating costs for each system. Approximate daily manure production for various classes of livestock were reported. Discussion was included on the value of dairy cattle manure and the importance of urine in this regard, and on equipment and methods for handling both solid and liquid manure.

C-206 Barth, C. 1969. Engineering research on farm animal manure. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 70-79. 6 ref. 2 tab.
General review of past research on characterization of animal wastes, biological treatment (anaerobic and aerobic lagoons, oxidation ditches, composting, land application), chemical treatment (liming, chlorination, pH adjustment, odor control), physical treatment (incineration, dehydration), coprophagy, gases and odors, and solid manure wastes. Several conclusions regarding the state-of-the-art were presented.

C-207 Dumelle, J.O. 1969. Nation-wide research on animal waste disposal. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 80-81.
Report on research projects being financed in whole or in part by the U.S. Federal Water Pollution Control Administration.

C-208 Kerrigan, J.E. 1969. Water Resources Center research on animal wastes and water quality. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 82-85.
Report on development of the Water Resources Center at the University of Wisconsin, current programs and objectives for the future.

C-209 Hall, F.E. 1969. The role of the Federal Water Pollution Control Administration in farm animal waste and the by-product management. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 92-95.
Discussion on how the U.S. Federal Water Pollution Control Administration programs relate to farm animal wastes and by-product management.

C-210 Densmore, J. 1969. Technical assistance available from the Soil

Conservation Service. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 96-97.
Discussion on the role of the U.S. Soil Conservation Service in providing technical assistance to help solve farm waste disposal problems.

C-211 Frangos, T.G. 1969. The regulatory role of the Department of Natural Resources. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 101-104.
Discussion of pollution regulations in Wisconsin pertaining to animal operations and on the role of the Wisconsin Department of Natural Resources in administering these regulations. It was pointed out that, unless there is general public acceptance of legal requirements, the policing of such requirements would be an awesome task.

C-212 Tuss, J. 1969. Columbia County program. Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 105-107.
Discussion of programs initiated in Columbia County, Wisconsin to avoid further urban-rural conflicts resulting from odors and potential pollution arising within livestock operations and from rezoning of agricultural land for urban use.

C-213 Johnson, J. 1969. What are the problems in Wallworth County? Proceedings of Farm Animal Waste and By-Product Management Conference. University Extension, Univ. Wisconsin, Madison, Wis. pp. 108-110.
Discussion of pollution control programs and zoning regulations affecting livestock producers in Wallworth County, Wisconsin.

C-214 Bayley, N.D. 1971. Animal wastes and America the beautiful. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 6-7.
This general report discusses some aspects of the American environment with special emphasis on the development of the present animal waste problem. Returning wastes to the land, control of odors, and a systems approach to waste management were seen as the immediate research priorities.

C-215 Kottman, R.M. and R.E. Geyer. 1971. Future prospects for animal agriculture. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 9-18. 18 tab.
Outline of current trends and future prospects for meat animals, dairy and poultry in the U.S.A. Tables were given to illustrate the efficiency of beef cattle, swine, sheep and poultry in each of the three periods 1955, 1970, and 2000. Recycling was seen as the ultimate answer to the waste management problem.

C-216 Whorton, W.J. 1971. The missing link. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 19-20.
Discussion of the role of communications in closing the gap between existing

technology and the practical application of that technology. Four areas of concern were (1) delays in getting knowledge to those who can apply it; (2) the high drop-out rate of knowledge before it reaches the user; (3) communications which are less than optimum; and (4) the responsibility of the individual in the communication process.

C-217 Cath, S. 1971. Role of State Departments of Agriculture in problems of animal waste management. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 21-22.
General discussion on the role of Government in forming anti-pollution legislation with regard to livestock operations. The author stressed that good regulatory enforcement of livestock waste disposal can, and should, only proceed at a pace commensurate with the results of good research. There is an urgent demand to provide livestock farmers with information on how to abate livestock waste problems.

C-218 Stewart, R.E. 1971. Responsibilities of a professional society toward urgent social problems. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 23-24.
Discussion of the true nature and role of engineers in solving problems of urbanization and environmental quality. Engineering societies are not truly professional until they change to be socially-orientated technical societies. Americans will have a clean environment if and when they are ready to pay the costs for that clean environment. The problem of urbanization is more difficult to solve.

C-219 Scholz, H.G. 1971. Systems for the dehydration of livestock wastes: a technical and economical review. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 27-29. 2 tab. 5 fig.
Report on investigations. The properties of excreta from various classes of livestock were discussed as they relate to dehydration of that excreta. Dehydration techniques and equipment were illustrated. Except for minor reductions in the nitrogen content, all ingredients from the excreta, including phosphorus, nitrogen, potassium, lime and organic compounds, are transferred into the dried humus manure. An economic analysis of the process and an evaluation of the potential market for the product (West Germany) indicated that the system has good potential.

C-220 Nordstedt, R.A., H.J. Barre and E.P. Taiganides. 1971. A computer model for storage and land disposal of animal wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 30-33. 4 ref. 6 fig.
Report on development of a scheduling model for a liquid manure system. The model developed was effective for comparing alternatives within the storage and land disposal system despite the large number of time and non-time dependent variables involved. The model was also useful for its ability to consider the effect of storage on the fertilizer value of wastes. Investment for the storage facility was one of the prime factors affecting the net cost of the system being modeled.

C-221 Fogg, C.E. 1971. Livestock waste management and the conservation plan. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 34-35. 8 ref. 2 tab.
Discussion of the role of the Soil Conservation Service in livestock and poultry waste management, and a review of current practices. The results of current and future research will help to further refine the design of waste management systems.

C-222 Velebil, M. 1971. Technological and technical conceptions of manure handling in Czechoslovakia. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 36-38. 2 tab. 4 fig.
Review of the fundamental physical characteristics of manure and investigation of the technological and technical problems that might be expected in the next decade with respect to collection and transport of manure in dairy and hog barns. An ionization detector was used to determine several properties of slurries. Cattle barn waste management systems used in Czechoslovakia were examined and information was provided on equipment used and labor and energy inputs to the various systems.

C-223 Turnbull, J.E., F.R. Hore and M. Feldman. 1971. A land recycling liquid manure system for a large-scale confinement operation in a cold climate. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 39-43. 5 ref. 1 tab. 7 fig.
Report on a full-scale liquid manure system at a Greenbelt farm in Ontario which is based on the established practice of recycling manure to cropland. Storage is accomplished by a combined system of short-term storage pits within the confinement units and large concrete storage tanks outside the buildings. Several aspects of the storage facilities were examined and field disposal techniques by the plow-cover method were discussed in detail.

C-224 Madden, J.M. and J.N. Dornbush. 1971. Measurement of runoff and runoff carried waste from commercial feedlots. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 44-47. 4 ref. 5 tab. 2 fig.
Report on the quantity and quality of runoff from six feedlots in South Dakota. It was observed that 30% of the total annual runoff may be attributed to snow-melt. In a typical feedlot operation, the potential quantity of waste leaving the feedlot as surface runoff is 5% of the total waste generated. It was concluded that minimum detention facilities, diversion of foreign drainage and reduction of runoff velocities will reduce the pollution potential of feedlot runoff to less than 2% of the total waste produced.

C-225 Edwards, W.M., F.W. Chichester and L.L. Harrold. 1971. Management of barnlot runoff to improve downstream water quality. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 48-50. 8 ref. 5 fig.
Report on studies. Runoff from a small barnlot in Ohio was highly enriched

by nutrients. By directing the runoff through a 500 m, heavily grassed waterway before releasing it into an open stream, nutrient concentrations were greatly reduced. Deposition of highly enriched organic and mineral solids in the waterway and dilution of the barnlot runoff by water of lower nutrient concentration from surrounding areas were considered to be the major mechanisms by which the runoff quality was improved in the waterway. Further research topics were given.

C-226 Swanson, N.P., L.N. Mielke, J.C. Lorimor, T.M. McCalla and J.R. Ellis. 1971. Transport of pollutants from sloping cattle feedlots as affected by rainfall intensity, duration and recurrence. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 51-55. 9 ref. 4 tab. 4 fig.
Results of simulated rainfall experiments on an unpaved, old established feedlot in Eastern Nebraska. Data were presented on COD values, phosphorus, ammonia-nitrogen and nitrate-nitrogen contents of the runoff for different rainfall intensities, duration and frequency; the two-factor interactions were noted. Runoff from the feedlot was compared to that from nearby fallow land.

C-227 Gilbertson, C.B., T.M. McCalla, J.R. Ellis and W.R. Woods. 1971. Characteristics of manure accumulations removed from outdoor, unpaved, beef cattle feedlots. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 56-59. 8 ref. 4 tab. 6 fig.
Results of studies to determine the characteristics of beef cattle wastes removed from new soil-surfaced feedlots of varying slopes located in Nebraska. Data were presented on the moisture content, volatile and non-volatile solids content, N and P content, pH and electrical conductivity of the waste removed at varying times of the year. The results were analyzed for interactions between manure characteristics and slope, animal density and climate. Information obtained by these studies was regarded as useful in evaluating land-loading and disposal practices.

C-228 Morrison, S.R., G.P. Lofgreen and T.E. Bond. 1971. Feedlot manure management in a desert climate. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 60-61. 8 ref. 2 tab. 2 fig.
Report on a slatted-floor system for outdoor feedlots located in Imperial Valley, California. The aim was to have a system that produced no outflow, no seepage to groundwater, minimum sludge to dispose of, and no nuisance to neighbors. Results of tests with an aerobic-anaerobic treatment system involving lagoons to determine the effect of loading rate on decomposition of organic matter and nitrogen and the surface area required for evaporation of the liquid load were presented. Further research is required on manure movement, other aeration systems and sludge handling for future development of a suitable manure management system for a desert climate.

C-229 Manges, H.L., L.A. Schmid and L.S. Murphy. 1971. Land disposal of cattle feedlot wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus,

Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 62-65. 4 ref. 1 tab. 4 fig.
Interim results from the first year of a two-year study to (1) characterize stormwater runoff from a feedlot, (2) characterize manure generated in a feedlot and (3) determine the influence of feedlot runoff and manure loading rates on soil characteristics, stormwater and irrigation runoff composition from the treated soil, and corn forage yields. The success of land disposal of feedlot wastes depends on the maintenance of high crop yields so that nitrogen contamination of groundwater does not become a problem. Maximum manure disposal rates will ultimately be determined by the permissible accumulation of nitrogen and salts in the soil profile.

C-230 Butchbaker, A.F., J.E. Garton, G.W.A. Mahoney and M.D. Paine. 1971. Evaluation of beef feedlot waste management alternatives. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 66-69. 6 ref. 2 tab. 6 fig.
Report on research conducted in Oklahoma to obtain design information and associated costs for alternative waste management systems. Equations and procedures were developed to calculate the sizes of equipment and facilities needed for the various systems. A computer program was developed to analyze the various alternatives. Several conclusions were presented as a result of the studies.

C-231 Hegg, R.O. and R.E. Larson. 1971. The waste pattern of beef cattle on slatted floors. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 70-72. 8 ref. 4 tab. 2 fig.
Report on studies to determine the quantity and spatial distribution of wastes produced by beef cattle fed a high energy ration in a slatted-floor confinement housing unit. Rates of production and composition of urine and feces were discussed. Information obtained on the waste pattern in relation to solids accumulation in the bottom of oxidation ditches may help in the design of systems for efficient solids removal.

C-232 Schulte, D.D. and R.C. Loehr. 1971. Analysis of duck farm waste treatment systems. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 73-76, 80. 8 ref. 9 fig.
Report on development of a mathematical model which, combined with bench scale tests, published information and dynamic programming techniques, allowed an evaluation of alternative duck farm wastewater treatment systems. The feasibility of systems analyses techniques in waste management studies was demonstrated.

C-233 Nordstedt, R.A., L.B. Baldwin and C.C. Hortenstine. 1971. Multistage lagoon system for treatment of dairy farm waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 77-80. 8 ref. 7 tab.
Interim report on studies conducted in Florida to determine the feasibility of

using a multistage lagoon system for treatment of dairy farm wastes. Data for the first eight months of operation were presented, including BOD and nutrient reductions. The potential for groundwater pollution by seepage from the lagoons was investigated in view of the warm climate, sandy soils and high water table elevation. Further monitoring of the three-stage, aerobic/anaerobic lagoon system is contemplated, including a microbiological study. Recommendations for lagoon design were given.

C-234 Bressler, G.O. and E.L. Bergman. 1971. Solving the poultry manure problem economically through dehydration. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 81-84. 5 tab. 3 fig.
Report on development of an automatic, two-stage dehydration system at Penn. State University. Manure is first dried to 30% inside the house by stirring and aerating with strategically placed fans; the material can then be field spread or further dried to 9% by a commercial drier unit. Application along highway embankments and land reclamation of unsightly spoil banks were proposed as two practical uses for dehydrated poultry manure.

C-235 Turner, D.O. and D.E. Proctor. 1971. A farm-scale dairy waste disposal system. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 85-88. 6 ref. 4 tab. 4 fig.
Report on development of confinement areas and manure distribution facilities for a 378-head dairy herd. The facility was constructed to demonstrate a practical solution to the problems of dairy waste management on an alluvial plain area which is subject to severe winter flooding. The manure handling system utilizes a covered confinement barn, lagoons for winter detention of manure, and a pump-pipe distribution system. Recommendations on the design and operation of such a system and on maximum field application rates were given.

C-236 Carlson, L.G. 1971. A total biochemical recycle process for cattle wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 89-91. 5 ref. 3 fig.
Report on development of a system which includes both the method and the apparatus for treating animal wastes into useful by-products and recycling them, the solids in the form of nutrients, bedding and fertilizer, and the liquid in the form of purified water. The entire system is illustrated in the form of diagrams and flowsheets. Some costs are given.

C-237 Jones, K.B.C. 1971. The UK reconciliation of modern intensive livestock farming with a basically urban society. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 92-94. 6 ref. 5 tab.
"The UK already has a basic reconciliation of interests between town and country, and new developments require the interests of veterinary surgeons, neighbors, planning authorities, river authorities and public health inspectors to be considered. By making the necessary consultations in his own interest,

the farmer is achieving a better understanding of urban needs and the city worker is more tolerant of farming methods that keep his food bills down yet permit him to enjoy the amenities of the British countryside."

C-238 Taiganides, E.P. and R.L. Stroshine. 1971. Impact of farm animal production and processing on the total environment. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 95-98. 13 ref. 7 tab. 1 fig.

Preliminary report of a long-term study at Ohio State University to delineate the impact of the farm animal industry on environmental quality and to delineate alternative systems of waste management which are technologically, economically and ecologically feasible. This paper reports the available statistics and data on numbers of various classes of livestock in the U.S.A. and daily production and composition of manure from each as they relate to the design of treatment systems. Some concepts are defined which might be used as a basis for subsequent analyses.

C-239 Willrich, T.L. and J.R. Miner. 1971. Litigation experiences of five livestock and poultry producers. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 99-101. 7 ref.

Report on five selected cases involving civil proceedings against livestock operators. Causes for the proceedings were: (1) noncompliance with zoning regulations; (2) offensive odors exhausted from totally enclosed, mechanically ventilated buildings within which manure and wasted feed were decomposing anaerobically; (3) offensive odors from anaerobic lagoons; (4) offensive odors from manure decomposing on open lot surfaces; (5) surface water pollution by runoff-transported manure from open lots. Other causes of complaints have been objectionable noises, excessive flies and rodents, manure spillage on public highways and suspected groundwater pollution. Suggestions were given to livestock and poultry producers to minimize the probability of becoming involved in court litigations over waste disposal methods.

C-240 Johnson, J.B. and L.J. Connor. 1971. Origins and implications of environmental quality standards for animal production firms. Livestock Waste Management and Pollution Abatement, Proc. International Symposium Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 102-104. 14 ref.

Discussion of four types of actions which could result in environmental quality standards being applied to livestock production operations, and the types of adjustments by the livestock producer which would be necessitated by such actions. Economic aspects of pollution control measures were discussed.

C-241 Hartung, L.D., E.G. Hammond and J.R. Miner. 1971. Identification of carbonyl compounds in a swine-building atmosphere. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 105-106. 10 ref. 1 tab.

Results of quantitative measurements of carbonyls present in swine-building atmospheres. Concentrations of those present in largest amounts were compared with odor thresholds to determine which of the carbonyls were present at odorous levels. Only ethanal was present in amounts above its threshold. Propanal, acetone and 2-butanone were present in concentrations an order of magnitude below their thresholds; however, it is probable that they may give a detectable effect through their additive interactions. No unsaturated carbonyls were found in the gases analyzed.

C-242 Nordstedt, R.A. and E.P. Taiganides. 1971. Meteorological control of malodors from land spreading of livestock wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 107-109, 116. 8 ref. 1 fig.
Report on an investigation of meteorological control as an effective concept for reducing and dispersing odors from land spreading of animal wastes. An air quality model was developed and may be used successfully to quantitatively evaluate the odor nuisance potential of animal wastes as a constraint on land spreading operations. Information is required on human response to odors from animal wastes and on the identification, emission rates and the parameters which affect the production of odors from animal wastes. It was suggested that daily manure spreading decisions should be made with special attention to diffusion conditions and wind speed.

C-243 White, R.K., E.P. Taiganides and G.D. Cole. 1971. Chromatographic identification of malodors from dairy animal waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 110-113. 8 ref. 2 tab. 5 fig.
Report on an investigation of the separation and identification of the principal odorous compounds emanating from dairy cattle wastes using the equilibrium sampling technique, gas chromatography, the Kovat indices of known odorous compounds, and a sensory evaluation of odors. Compounds identified were hydrogen sulfide, methanethiol, dimethyl sulfide, diethyl sulfide, propyl acetate, n-butyl acetate, trimethylamine and ethylamine; dimethyl sulfide was considered the principal component of anaerobic dairy waste odor. Aeration significantly reduced or eliminated all of the sulfur compounds identified.

C-244 Willson, G.B. 1971. Control of odors from poultry houses. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 114-116. 4 ref. 1 tab. 2 fig.
Report on study to develop an economical method for reducing odors in the exhaust air from poultry houses. Baffle imprringement filters utilizing the natural stickiness of the dust were evaluated for dust and odor control. The effects of a water spray ahead of the baffle to remove ammonia and other gases were determined. It was concluded that removal of dust from poultry house exhaust air can reduce the strength and change the quality of the odor but that there is not a direct relationship between dust and odor. Economics and practicality of the system were discussed.

C-245 Hashimoto, A.G. and D.C. Ludington. 1971. Ammonia desorption from concentrated chicken manure slurries. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 117-121. 7 ref. 5 tab. 3 fig.

Report on research to determine the parameters affecting ammonia desorption from concentrated chicken manure slurries, and to develop an equation to predict the rate of ammonia desorption. Under experimental conditions, it was determined that almost all nitrogen could be removed from chicken manure slurries by ammonia desorption if sufficient detention times were used. A complete description of the process was given as well as some operational data.

C-246 Bromel, M., Y.N. Lee and B. Baldwin. 1971. Antibiotic resistance and resistance transfer between bacterial isolates in a waste lagoon. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 122-125. 11 ref. 6 tab. 2 fig.
Report on studies to determine the incidence and patterns of antibiotic resistance and R factors in 350 gram-negative bacterial isolates from solid bovine wastes, from farm animal waste lagoons and from the Red River which serves as a water source for domestic, agricultural and industrial purposes. Of 21 human urinary tract isolates, only four did not show multiple resistance and hence could be used as recipients in conjugation experiments; such conjugation experiments were successful in demonstrating the transferability of R factors carrying multiple antibiotic resistance. The transfer of drug resistance resulting from the use of antibiotics in feed was considered to be a serious threat.

C-247 Middaugh, P.R., L.R. Koupal, R.L. Pierce, Jr., J.E. Tiede and J.W. Zerfas. 1971. Differentiation of ruminant from non-ruminant fecal sources of water pollution by use of enteric bacteria. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 126-128. 35 ref. 1 fig.
Review of the problem of identification of sources of fecal pollution in water. More elaborate methods than those described in "Standard Methods for the Examination of Water and Wastewater (1971)" are necessary to differentiate between human and non-human sources. Improvements in bacteriological methods may now permit the isolation from water and identification of more specific indicator organisms such as certain of the enteric bacteria (Streptococci, Salmonellae). Further laboratory studies are being conducted to develop methods for rapid isolation, enumeration and characterization of selected indicator and pathogenic organisms from surface water.

C-248 Hamilton, H.E., I.J. Ross, J.J. Begin and S.W. Jackson. 1971. Growth kinetics of rumen bacteria in solutions of poultry excreta. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 129-131. 12 ref. 8 fig.
Report on study to determine the kinetics of rumen microbial growth in poultry excreta during batch cultivation as affected by pH and excreta solids concentration. Results were reported in detail. Implications of these results with respect to improvement of the quality of manure as feed for ruminants were discussed.

C-249 McCalla, T.M. and L.F. Elliott. 1971. The role of microorganisms in the management of animal wastes on beef cattle feedlots. Livestock Waste Management and Pollution Abatement, Proc. International Symposium

on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 132-134. 28 ref. 3 tab. 2 fig.
Discussion of some of the microbial decomposition alternatives of animal wastes from a feedlot management standpoint, with special reference to a Nebraska feedlot. Manure removal does not solve odor problems. If a feedlot surface is maintained aerobically, odor production will be at a minimum and pathogens, such as Salmonellae, should be of little concern. If the feedlot has an organic matter layer maintained over the soil surface, limited amounts of pollutants will move downward. If manure disposal is a problem, manure can be mounded on-site for many years without groundwater pollution and with a minimal amount of feedlot cleaning.

C-250 Sewell, J.I. 1971. Agitation in liquid manure tanks. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 135-137. 5 ref. 1 tab. 4 fig.
Report on work in Tennessee using model and field studies to obtain information about optimal agitation conditions and procedures on which to base designs for liquid manure holding tanks. The theory of turbulent mixing of solids and liquids was used to develop an expression for the solid material that will settle to the bottom of a tank after agitation. Dimensional analysis was applied to the variables in the expression to develop prediction factors for model studies. Agitation efficiencies, operational problems and management data were recorded for two liquid manure holding tanks constructed at two experimental dairies.

C-251 Grimm, K. and G. Langenegger. 1971. Measuring method for evaluating the ability to pump semi-liquid and liquid manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 138-141, 145. 10 ref. 9 fig.
Report on the development of a modified falling body viscometer which enables a relatively simple rating of manure slurries with respect to pumpability. This measuring method creates uniform conditions for pump tests and allows a classification of pumps for thick media. Other measurements previously used to classify slurries were discussed and the inadequacy of such measurements was noted.

C-252 Staley, L.M., N.R. Bulley and T.A. Windt. 1971. Pumping characteristics, biological and chemical properties of dairy manure slurries. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 142-145. 2 tab. 6 fig.
Report on a waste handling system for a 150-head dairy farm of 120 acres located on a high water table, high winter rainfall area of the Lower Fraser Valley in British Columbia. Field spreading of manure by wheel transport from November to February was not feasible; above ground slurry storage and pumping through an irrigation pumpline was found to be feasible. On-site pumping tests were conducted to study the influence of dilution on pressure drops and pumping characteristics of dairy wastes. A positive displacement helical type pump with a pressure relief valve incorporated into the system to reduce pump wear proved to be the most satisfactory. Some physical, chemical and hydraulic characteristics of dairy manure slurries were shown.

C-253 Taiganides, E.P. and R.K. White. 1971. Automated handling, treatment and recycling of waste water from an animal confinement production unit. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 146-148. 3 ref. 4 fig.
Report on the design procedures and parameters used in the construction of the waste treatment units for a 500-pig confinement unit in Ohio. The system involves flushing of manure from the hog house and screening of the flushed washwater to separate solids from liquids. The solids are aerobically digested, deodorized and stored prior to field spreading. The liquids are discharged into an oxidation ditch. Effluent from the ditch is passed through a settling tank and the supernatant reused as flushing water. Provisions for disinfection of recycled water were included in the design. Data are now being collected on the operation of the system.

C-254 Smith, R.J., T.E. Hazen and J.R. Miner. 1971. Manure management in a 700-head swine-finishing building; two approaches using renovated waste water. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 149-153. 14 ref. 2 tab. 7 fig.
Report on waste management in a 700-head swine-finishing building at the Iowa State University. The system used incorporated intermittent flushing with flushing water coming from other parts of the system. In the first phase, manure was flushed into an anaerobic lagoon from which the supernatant was pumped into an oxidation ditch. Effluent from the ditch was settled and the purified water was recycled. In a second phase, the anaerobic lagoon was bypassed. In a third arrangement, supernatant from the lagoon was directly recycled. Equipment design, operating experiences, loading and treatment efficiencies for phases one and two were discussed and compared. Phase 3 did not cause any health problems in the short time it has been used. The merits and problems of the overall system were discussed.

C-255 Jones, E.E., Jr., G.B. Willson and W.F. Schwiesow. 1971. Improving water utilization efficiency in automatic hydraulic waste removal. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 154-158. 8 ref. 11 fig.
Review of the literature on hydraulic waste removal and description of a hydraulic waste removal system installed in a swine building. Operation experiences, reported in detail, indicated that, with improved design, improvements in water utilization efficiency are possible. The critical need is for a better matching scour and transport capacity with waste deposition patterns to increase the maximum solids concentration and reduce the volume of clean water discharged. Increased knowledge of animal behavior is also required, especially regarding those environmental factors causing a seasonal variation in response to a given facility. It was concluded that hydraulic waste removal has potential worth developing.

C-256 Galler, W.S. and C.B. Davey. 1971. High rate poultry manure composting with sawdust. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 159-162. 2 ref. 2 tab. 9 fig.
Report on research to investigate the aerobic thermophilic composting of animal wastes mixed with a carbonaceous material (sawdust) and the effect on

plant growth of compost so produced. The method of composting and analyses of the compost were reported. Results were presented of studies on aeration and agitation requirements, C/N ratio and C.E.C. of the compost, moisture content, nitrogen conservation, and storage effects. Interim results of greenhouse and plot experiments using the compost as a soil conditioner were also given.

C-257 Willson, G.B. 1971. Composting dairy cow wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 163-165. 4 ref. 2 tab. 4 fig.
Report on pilot and bench experiments to evaluate the effectiveness of aerobic composting for stabilization of dairy cow manure. The effects of some environmental factors and means of controlling them were studied. The absence of offensive odors during storage and subsequent handling of the compost was noted.

C-258 Robbins, J.W.D., G.J. Kriz and D.H. Howells. 1971. Quality of effluent from farm animal production sites. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 166-169, 173. 4 ref. 4 tab. 5 fig.
Summary of the findings of a 2-year study to investigate the importance of animal wastes in agricultural land runoff. The study included: (1) measurement of pollutants reaching streams from 12 typical agricultural sites in the Piedmont region of North Carolina; (2) development of data and relationships for estimating the effects of animal waste production under similar conditions at other locations; (3) assessment of present animal waste management practices; (4) development of recommendations for corrective actions; and (5) identification of researchable problem areas.

C-259 Miner, J.R., J.W. Wooten and J.D. Dodd. 1971. Water hyacinths to further treat anaerobic lagoon effluent. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 170-173. 10 ref. 7 tab. 4 fig.
Report on study to evaluate the use of water hyacinths in wastewater treatment systems to transform anaerobic lagoon effluent into water suitable for discharge to a surface watercourse. Results showed that the effluent from the pools of water hyacinth was colorless and sufficiently lowered in organic matter and nutrients to allow discharge into many receiving streams. It was proposed that reduction of nitrogen concentration by water hyacinths will allow more intense application of lagoon effluent to cropland without the danger of groundwater pollution. The economic feasibility and attractiveness of this system demands that uses for the harvested plants be devised. Although limited use has been made of the plants as livestock roughage, there are insufficient data to establish this as an economical practice.

C-260 Elmund, G.K., S.M. Morrison and D.W. Grant. 1971. Enzyme-facilitated microbial decomposition of cattle feedlot manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 174-175. 7 ref. 4 fig.
Report on studies conducted to evaluate the use of various hydrolytic enzymes

to hasten microbial decomposition of feedlot manure. Methods to evaluate and optimize conditions for enzymatic hydrolysis and bioassay techniques to measure increased rates of microbial activity were discussed. Further research is being done to evaluate the efficiency of such processes in the treatment of feedlot wastes.

C-261 Taiganides, E.P., R.K. White and R.L. Stroshine. 1971. Water and soil oxygen demand of livestock wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 176-179. 7 ref. 4 tab. 7 fig.
Review of previous research. Values for the oxygen demand of organic wastes in a water medium as determined by BOD tests have been used in the design of waste stabilization and pollution abatement systems. Because animal wastes exert an oxygen demand in air and soil media, procedures to measure this oxygen demand were tested and results were compared between various animal wastes. Oxygen demand per unit of waste appeared to be the same in either soil or water.

C-262 Ariail, J.D., F.J. Humenik and G.J. Kriz. 1971. BOD analysis of swine waste as affected by feed additives. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 180-182, 189. 11 ref. 8 fig.
Report on investigation of the interference of excreted feed additives in determining BOD values of swine wastes. Tests were run with domestic sewage to determine the minimum amount of copper, zinc and chlorotetracycline that would affect the BOD analysis. Copper was the only feed additive found in swine waste in concentrations large enough to measurably affect the BOD determination. BOD data for swine wastes are reliable only if less than inhibitory amounts of excreted feed additives exist in the waste.

C-263 Meyer, R.C., F.C. Hinds, H.R. Isaacson and T.D. Hinesly. 1971. Porcine enterovirus survival and anaerobic sludge digestion. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 183-184. 6 ref. 1 tab. 2 fig.
Report on a study investigating the fate of a known swine enterovirus when exposed to anaerobic digestion. Preliminary results indicated that a reduction and loss of infectivity can be expected upon suitable exposure, but more work is required on a wide variety of animal viruses to tell how well anaerobic digestion can inactivate viruses.

C-264 Thygeson, J.R., E.D. Grossmann and J. MacArthur. 1971. Through-circulation drying of manure in superheated steam. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 185-189. 6 ref. 1 tab. 7 fig.
Description of a new drying system for treating undiluted, wet manure. The system was claimed to minimize many of the disadvantages of drying as noted in other research attempts. The basic features of the new method are (1) high velocity flow of drying medium through a bed of wet preformed manure particles and (2) the application of superheated steam as the drying agent. The system advantages include: (1) high production rates; (2) no air or water pollution

hazard; (3) recovery of a stable, odor-free product; (4) high thermal efficiency; (5) accurate control of particle size; and (6) operation of the system independent of environmental conditions.

C-265 White, R.K. and E.P. Taiganides. 1971. Pyrolysis of livestock wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 190-191, 194. 5 ref. 3 tab. 3 fig.

Report on research to determine the heating values for the gaseous products of pyrolysis of animal wastes. Results indicated that the heat of pyrolysis products of both beef and poultry wastes would produce enough heat to vaporize the moisture in the waste. The pyrolysis products of swine wastes had the lowest heating value of the wastes tested and would not produce enough heat to vaporize the moisture in the waste; pre-drying of the waste would enable the products to sustain pyrolysis. Further research on pyrolysis of animal wastes was considered to be desirable. A note was made of the possible use of char, a product of pyrolysis of bovine wastes, as an absorbent for the tertiary treatment of wastewater.

C-266 Surbrook, T.C., C.C. Sheppard, J.S. Boyd, H.C. Zindel and C.J. Flegal. 1971. Drying poultry waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 192-194. 6 ref. 4 tab. 4 fig.

Report from Michigan State University on the operation and performance of one commercial pneumatic drier. Properties of the dried manure, and costs of drying were given. Results indicated that poultry, dairy, beef and swine manure can be dried successfully on the farm. The two most important parameters in the pneumatic drying process were temperature and particle diameter. Nutrient analysis of the dried product showed that protein and nitrogen losses as high as 25% might result with high drying temperatures. The process described provided an easily handled and stored product, prevented air and water pollution, and was economically feasible.

C-267 Morris, W.H.M. 1971. Economics of waste disposal from confined livestock. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 195-196, 198. 3 ref. 4 tab.

Economic analyses of livestock waste management systems. The fertilizer value of manure, costs of storing liquid manure, costs of operating oxidation ditches, dehydration costs and potential for recycling by feeding were considered in the analyses. It was concluded that land spreading, anaerobic and aerobic treatment, and feeding are practical alternatives. The economic choice depends on the species, the environment, and several other factors which are given.

C-268 Jordan, H.C. 1971. Marketing converted poultry manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 197-198.

Results of a survey of poultry waste marketing in the U.S.A. Questions and answers dealt with composition of the product marekted, bagging operations, supplements used, and marketing aspects such as price and advertising.

C-269 Okey, R.W. and S. Balakrishnan. 1971. The economics of swine waste disposal. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 199-203. 26 ref. 8 tab. 5 fig.

Review of several waste treatment techniques employed by the swine industry. Costs of construction and operation were given for a series of systems designed to handle wastes from 500, 2,000 and 5,000 animals. It was concluded that most pollutants contained in swine wastes are associated with the solid phase. Those pollutants associated with the liuqid phase are predominantly nitrogenous. Microbiological conversion of waste organic materials as a basic treatment process was considered questionable. It was recommended that solids separation techniques be used prior to waste stabilization and treatment, and that the value of swine manure as a fertilizer or conditioner must include all significant differences in treatment costs.

C-270 Badger, D.D. and G.R. Cross. 1971. Economic implications of environmental quality legislation for confined animal feeding operations. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 204-206. 5 ref. 5 fig.

Report on a study in Oklahoma to examine new legal standards under which livestock producers must operate, to analyze the effects of such standards on the control of wastes and runoff from confinement operations, and to determine the resulting economic consequences. Average total waste handling costs for beef operations now range from $0.01 to $0.0015 per pound gain depending on the size of operation; costs decrease up to a size of 15,000 head one-time capacity and thereafter begin to increase. It was concluded that site selection will be more critical in the future and that zoning regulations are inevitable.

C-271 Lee, H.Y. and T.R. Owens. 1971. Cost of maintaining specified levels of water pollution control for confined cattle feeding operations for the Southern High Plains. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 207-208, 216. 5 ref. 1 fig.

Review of confined cattle feeding operations in the Southern High Plains region of the U.S.A. Costs associated with meeting specified runoff controls are analyzed and implications are drawn of the effects of improved waste management systems on the future of the region as a cattle producing area and on the consuming public. Present systems fail to provide for pollution control originating in solid animal waste once it leaves the feedlot; modified environment systems would provide such control but cannot be presently recommended for economic and technological reasons. Research is needed on feed conversion efficiency in modified environment systems, land requirements for manure disposal, and the pollution potential of collection basins due to seepage.

C-272 Loehr, R.C., D.F. Anderson and A.C. Anthonisen. 1971. An oxidation ditch for the handling and treatment of poultry wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 209-212. 5 ref. 3 tab. 5 fig.

Report on studies to illustrate the application of the oxidation ditch to the handling and treatment of wastes from laying hens and to determine factors affecting its performance. The results of 9 months of continuous operation have indicated that the oxidation ditch is a reasonable alternative for the handling, treatment, and disposal of poultry wastes where odor control, liquid waste handling and reduction of oxygen demand are desired. Minimal maintenance was necessary for consistent operation. Material from the ditch can not be directly discharged to surface waters. Oxidation ditches should be designed for a holding period of 6 months. Data collected so far will enable the design of a similar treatment system for a larger operation.

C-273 Windt, T.A., N.R. Bulley and L.M. Staley. 1971. Design, installation and biological assessment of a Pasveer oxidation ditch on a large British Columbia swine farm. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 213-216. 11 ref. 1 tab. 7 fig.

Report on the basis of design, the installation and the assessment of an oxidation ditch for the treatment of wastes from a 330-hog finishing barn. Operational data are presented for the first few months of operation. The system has given complete odor control, settling of solids has been minimal, and the effluent has been easily handled by most pumps. Costs of aeration have been about 66 cents per day or 25 cents per finished hog. The contents of the ditch have shown a cycling nature which suggests a possible variable by which good management might produce the maximum biological breakdown. Further data are being collected including data on effluent volumes.

C-274 Larson, R.E. and J.A. Moore. 1971. Beef wastes and the oxidation ditch today and tomorrow. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 217-219. 4 ref.

Report on studies conducted in Minnesota with an oxidation ditch to treat beef cattle wastes on a batch basis. Only a summary of results which affect the future application and limitations of the system for treatment of beef cattle wastes in cold climates are presented. It was concluded that the oxidation ditch can be operated as a batch system in cold climates; its role is limited to that of collection, odorless temporary storage and partial treatment. Further treatment of the ditch effluent, such as is accomplished by land disposal, is necessary. It was also concluded that the oxidation ditch for use in cold climates is limited to the treatment of wastes in warm confinement units. Research areas were identified.

C-275 Pos, J., R.G. Bell and J.B. Robinson. 1971. Aerobic treatment of liquid and solid poultry manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 220-224. 11 ref. 7 tab. 6 fig.

Report on a series of pilot and field studies conducted at Guelph, Ontario, on stored poultry manure to evaluate various effects of aeration. Results indicated that short term aerated storage can reduce the nitrogen content by more than 50%. Aeration was a satisfactory way to control the odor of liquid poultry manure. Mechanical and surface aerators did not give reliable service in cold periods in winter; the possibilities of using a pneumatic aerator were noted. It was concluded that composting could be a practical year-round solid waste treatment process.

C-276 Robinson, K., J.R. Saxon and S.H. Baxter. 1971. Microbiological aspects of aerobically treated swine wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 225-228. 6 ref. 1 tab. 7 fig.
Report on trials in Scotland aimed at determining the behavior of micro-organisms as related to laboratory and field oxidation ditch experiments. It was concluded that: (1) pH declines as substrate additions decline and microfloral activity declines; (2) substrate utilization is related to oxygen consumption; (3) Acinetobacter are the dominant flora, their development being correlated to a high pH, foam formation and rapid COD reduction, and (4) pathogenic bacteria can survive aeration for prolonged periods.

C-277 Mathers, A.C. and B.A. Stewart. 1971. Crop production and soil analyses as affected by applications of cattle feedlot waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 229-231, 234. 3 tab. 6 fig.
Report on trials in Texas to study the effects of high rates of manure applications to soil on plant and soil characteristics. It was concluded that (1) grain sorghum yields were reduced for rates of manure application greater than 269 tons/ha; (2) nitrate pollution was reduced only if growing crops utilized most of the applied nitrogen, with excess nitrogen accumulating in plants and/or in the soil profile; and (3) high rates of manure application under poorly drained conditions can create salinity problems.

C-278 Erickson, A.E., J.M. Tiedje, B.G. Ellis and C.M. Hansen. 1971. A barriered landscape water renovation system for removing phosphate and nitrogen from liquid feedlot waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 232-234. 2 tab. 2 fig.
Report on a pilot plant at Michigan State University which incorporated a barriered landscape water renovation system (BLWRS) for treating liquid swine wastes. The system has been very effective and has provided good quality renovated water suitable for recycling. The BLWRS could reduce nitrogen at the rate of one ton per acre per 3-month cycle.

C-279 Reddell, D.L., W.H. Johnson, P.J. Lyerly and P. Hobgood. 1971. Disposal of beef manure by deep plowing. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 235-238. 6 ref. 4 tab. 4 fig.
Report on trials in Texas with four different types of deep plowing equipment and attempts to dispose of up to 900 tons/acre of feedlot manure (50% moisture). Rates of 900 tons/acre could be disposed of at a cost of 4.5 cents/ton. Applications greater than 900 tons/acre are mechanically possible. No serious water quality problems were observed but ammonia-nitrogen levels in runoff were increased with some treatments and Cl was observed to increase with depth on heavily manured plots. Crop growth was inhibited by heavy manure applications.

C-280 McCaskey, T.A., G.H. Rollins and J.A. Little. 1971. Water quality of runoff from grassland applied with liquid, semi-liquid and 'dry' dairy waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 239-242. 4 ref. 5 tab. 1 fig.
Report on runoff trials from plots receiving liquid manure via irrigation equipment, liquid manure via a tank spreader, and solid manure via a conventional manure spreader. No significant odor or fly problems were encountered with any of the systems, but manure solids accumulation was a problem with the latter method when rates of application greater than 7.16 metric tons per 3-week cycle were attempted.

C-281 Adriano, D.C., P.F. Pratt and S.E. Bishop. 1971. Fate of inorganic forms of N and salt from land-disposed manures from dairies. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 243-246. 8 ref. 7 tab. 1 fig.
Report on research in California in which ammonia-, nitrate- and nitrite-nitrogen, chlorine and electrical conductivity were used as tracers of contamination by dairy wastes. It was concluded that nitrate-nitrogen concentrations of the magnitude measured (92 ppm at 10 to 19 ft. under corrals) could cause nitrate pollution of groundwater at a depth of 46 feet, that the buildup of the nitrate-nitrogen pool in the soil can be minimized by maximizing ammonia volatilization before incorporation of the wastes into the soil, and that an allowance of one acre per 3 cows be the maximum rate of waste application to keep nitrate-nitrogen concentrations at less than 10 ppm in the soil solution beyond the root zone.

C-282 Hileman, L.H. 1971. Effect of poultry manure application on selected soil chemical properties. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 247-248. 5 fig.
Report on trials with poultry manure applications on different soils. It was concluded that incorporation into the soil of poultry manure creates an unbalanced soil chemistry which adversely affects plant growth. The value of poultry manure as a source of potassium was shown. Results of the trials also showed that different soils react differently to manure, that salt problems can be effectively analyzed by soil conductivity measurements, and that an incubation period is required between manure application and seeding.

C-283 Concannon, T.J., Jr. and E.J. Genetelli. 1971. Groundwater pollution due to high organic manure loadings. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 249-253. 15 ref. 5 tab. 4 fig.
Report on experiment utilizing field plots and laboratory soil profiles to determine the effect of the plow-furrow-cover method of manure disposal on TOC, N, SO_4, PO_4, Cl, Mg, Na, Ca and K concentrations at a depth of 4 feet. Field results did not correlate with laboratory results, but laboratory soil columns were considered to be invaluable research tools. No significant differences were noted in concentrations of any of the parameters listed above in unmanured and manured plots or profiles. Contamination of groundwater must be evaluated on the basis of the predicted future flow net of the area.

C-284 Hensler, R.F., W.H. Erhardt and L.M. Walsh. 1971. Effect of manure handling systems on plant nutrient cycling. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 254-257. 7 ref. 6 tab. 4 fig.
Report on greenhouse and field trials in which corn was used to study nutrient recovery and use after applications of fresh, fermented, aerobic liquid, and anaerobic liquid manure. It was concluded that heavy applications of manure (270 tons/acre) can be used without danger of toxicity to plants. Less plant response was noted from aerobic liquid manure than from any of the other forms. Summer applications of manure were most effective. An increase in grass and weed species was noted when manure was applied to alfalfa-grass meadows. Run-off losses were greater on sod than on fallow. A number of high nitrate wells where animal wastes were the most likely source of contamination were reported in the study area (Wisconsin).

C-285 Bartlett, H.D. and L.F. Marriott. 1971. Subsurface disposal of liquid manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 258-260. 2 tab. 3 fig.
Report on research at Penn. State University to develop equipment for applying dairy manure slurries about 4 inches below the soil surface with a forage crop cover. Maximum application rates without danger of groundwater pollution from nitrates were studied. Equipment used and field operations were described. The method controlled odors, flies and runoff. The optimum rate of manure application is not substantially greater than that which will supply the maximum nitrogen required by any crop, plus some allowance for losses other than leaching.

C-286 Stewart, T.A. and R. McIlwain. 1971. Aerobic storage of poultry manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 261-262, 266. 2 tab.
Report on field studies to determine the value of aerobic storage to control poultry manure odors and to obtain some breakdown of manure solids. An oxidation ditch situated directly underneath stepped type cages provided satisfactory storage, improved the poultry house atmosphere, and did not present any major management problems. The ditch should be emptied before much sedimentation occurs to ensure an odor-free slurry for disposal. Decomposition during storage accounted for about 42% of the TS, 64% of the total N, and from 60 - 80% of the BOD_5. Major problems encountered were foaming, floating feathers and mechanical failure of rotor bearings. Aerobic storage by oxidation ditches is feasible but the economics of the system must be assessed in light of each individual circumstance.

C-287 Diesch, S.L., B.S. Pomeroy and E.R. Allred 1971. Survival and detection of leptospires in aerated beef cattle manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 263-266. 16 ref. 1 tab. 2 fig.
Report on research conducted to determine the public health significance of leptospires in animal manure disposal, during Minnesota winter conditions, using the extended aeration system. An oxidation ditch model was operated

under simulated environmental conditions. Methods were developed for detecting and measuring the survival of Leptospira pomona, a pathogenic spirochaete capable of infecting both animals and man. Results indicated that pathogenic leptospires are capable of survival for up to 18 days in an aerated model oxidation ditch, and 11 days in effluent and sludge. It was concluded that chlorination or other disinfection of sludge and effluent is required before discharge for immediate control and prevention of diseases caused by pathogens transmitted by manure of domestic animals.

C-288 Converse, J.C., D.L. Day, J.T. Pfeffer and B.A. Jones, Jr. 1971. Aeration with ORP control to suppress odors emitted from liquid swine manure systems. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 267-271. 10 ref. 6 tab. 4 fig.

Report on laboratory studies in Illinois to determine if a liquid manure system can be operated with no residue of dissolved oxygen present (less aeration) and still maintain odorless conditions and to determine the amount of degradation of swine manure under such conditions. Data and results were reported in detail. The results indicated that the ORP in liquid manure must be maintained by aeration in the range from -300 to -340 mv and the pH in the range from 7.7 to 8.5 to maintain relatively odorless conditions as compared to anaerobic degradation.

C-289 Chang, A.C., A.C. Dale and J.M. Bell. 1971. Nitrogen transformation during aerobic digestion and denitrification of dairy cattle wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 272-274, 278. 6 ref. 1 tab. 7 fig.

Report on laboratory and bench scale experiments to determine the nitrogen transformations during aerobic digestion of dairy cattle manure and to study the feasibility of removing nitrogen before field disposal of the wastes by biological denitrification of the digested effluent. Results were presented in detail, including a discussion of the nitrogen cycle of wastewater treatment and the effects of temperature and organic carbon on nitrogen transformations. It was concluded that for complete denitrification of digested dairy cattle wastes, acclimated sludge and a sufficient supply of organic carbon are needed; under such conditions, a rate of denitrification close to 13.26 mg of nitrogen per hour can be expected.

C-290 ten Have, P. 1971. Aerobic biological breakdown of farm waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 275-278. 1 ref. 7 tab. 1 fig.

Report on field investigations in the Netherlands of operational activated sludge plants treating pig slurry, veal calf slurry, pig urine and fresh poultry manure. Laboratory experiments were also conducted to determine the feasibility of further treating plant effluents by extended aeration. Plant efficiencies and nutrient removals were discussed. Some investment and operational costs were given.

C-291 Barth, C.L. and L.B. Polkowski. 1971. Low-volume, surface-layer aeration conditioned manure storage. Livestock Waste Management and

Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 279-282. 10 ref. 3 tab. 5 fig.

Report on research which developed the concept of a manure storage lagoon which could serve as an alternative to an underground storage tank. Laboratory scale studies were carried out to test the design concepts and aeration procedures. Results of the tests indicate that low-volume, surface-layer aeration effectively reduced odor intensity, and produced a scum-free surface and a concentrated sludge storage zone. Favourable storage conditions were associated with supernatant conditions of dissolved oxygen greater than 1.0 mg/l and pH greater than 8. After 2 months of storage, COD and volume recovery were 85% and nitrogen recovery 79%. Total storage volume required was about twice the volume of manure to be stored to allow for adequate dilution water.

C-292 Ogilvie, J.R. and A.C. Dale. 1971. Short term aeration of dairy cattle manure for irrigation. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 283-285, 287. 12 ref. 4 fig.

Report of a preliminary field study and two laboratory studies to investigate the concept of short term aeration of animal wastes. In the system proposed, wastes were aerated for less than 24 hours in a small aeration tank with mixed liquor being removed from the tank by an irrigation system. It was shown that such a system does reduce odors from dairy cattle wastes, both at the time of initial handling and during irrigation. There was a conversion of soluble organics to cell material, with 80% of the soluble COD being removed. The process is especially adaptable to year round use in areas of light snowfall and unfrozen ground.

C-293 Wesley, R.L., E.B. Hale and H.C. Porter. 1971. The use of oxidation ponds for poultry processing waste disposal. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 286-287.

Report on the design of a series of lagoons for treatment and disposal of the wastewater from a Virginia poultry processing plant. The multilagoon system has secured 97% BOD removal and 85% solids reduction. The microflora of the lagoons were shown to be very temperature dependent. To date, chlorination of the final effluent has not been required.

C-294 Hill, D.T. and R.E. Smith. 1971. Acclimatization response time for aerobic digestors. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 288-290, 296. 5 ref. 2 tab. 5 fig.

Report on laboratory research with bench scale aerobic digestors to determine and predict acclimatization response time and how this time period might be reduced for periodically operated activated sludge units. It was concluded that, following down time, an activated sludge treatment unit with no maintenance aeration will acclimate as fast as a unit with maintenance aeration. The acclimatization time for aerobic reactors treating aperiodic anaerobic lagoon effluents ranged from 5.69 to 15.21 hours depending on length of the down period. Results of this study were considered useful in the time-volume-flow rate relationships for the design of aerobic treatment units for anaerobic lagoon effluents.

C-295 Taylor, J.C. 1971. Regulatory aspects of recycled livestock and poultry wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 291-292. 15 ref.
Review of previous research using livestock and poultry wastes as animal feed. Section 3.59 of the code of Federal Regulations (U.S.) states that the Food and Drug Administration does not and has not sanctioned the use of poultry litter as a feedstuff for animals; poultry litter could contain drugs and antibiotics or their metabolites and disease organisms which may be transmitted from poultry to other animals by using the litter in animal feed. There is a great need for information on aspects of human and animal safety when animal wastes are proposed for use in the rations of livestock.

C-296 Anthony, W.B. 1971. Cattle manure as feed for cattle. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 293-296. 10 ref. 11 tab. 2 fig.
Results of three steer feeding trials conducted at Auburn University to ascertain the relative value of manure-containing diets for fattening yearling steers, to determine the effect of using a protein supplement in rations consisting of 60% corn and 40% wastelage, and to compare a corn-wastelage ration to a corn-manure ration. Nutrient analysis of all rations are presented. A flow sheet is presented to illustrate the production, collection and feeding of manure. Manure rations for steers and cows should be supplemented with Vitamin A, deflorinated phosphate and trace mineralized salt. Brood cows should receive supplemental protein for a period before and after calving. The advantages of using manure as feed for cattle are the enhancement of sanitation for confinement reared cattle and an improvement in beef production efficiency.

C-297 Bull, L.S. and J.T. Reid. 1971. Nutritive value of chicken manure for cattle. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 297-300. 14 ref. 7 tab.
Report on a series of trials conducted to study the acceptability, intake and use of air dried chicken manure as a source of N, Ca and P for producing dairy cattle and steers. Results indicated that air-dried chicken manure could be used as the sole source of supplemental protein for steers and dairy cows fed low-protein basal diets. N, Ca and P were readily available and well utilized by the animals. Air dried chicken manure to be used as a feed additive should contain less than 20% moisture to avoid storage and intake problems.

C-298 Fontenot, J.P., K.E. Webb, Jr., B.W. Harmon, R.E. Tucker and W.E.C. Moore. 1971. Studies of processing, nutritional value and palatability of broiler litter for ruminants. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 301-304. 16 ref. 5 tab. 1 fig.
Report on experiments conducted: (1) to develop processing methods to destroy

pathogenic organisms in broiler litter; (2) to study the effect of sterilizing methods on the nutritional value of litter; (3) to study the variations in composition of litter; (4) to determine the palatability of rations containing different proportions of broiler litter; and (5) to assess the magnitude of pesticide residues in broiler litter. Results of trials indicated that broiler litter can be sterilized by dry heat treatment and that the pesticide residues pose no serious problem. Research is required on the problem of medicinal drug residues.

C-299 Flegal, C.J. and H.C. Zindel. 1971. Dehydrated poultry waste (DPW) as a feedstuff in poultry rations. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 305-307. 9 ref. 7 tab.

Report on experiments with poultry to evaluate the use of DPW as a feed additive. Body weight of Leghorn chicks was not influenced by up to 20% DPW but diets of 10 or 20% DPW depressed body weights of broiler types at 4 weeks of age. Egg production and feed efficiency by laying hens were not affected by up to 20% DPW in the ration. Egg quality factors were not adversely affected by adding up to 40% DPW in the laying ration; neither was taste affected by the DPW rations.

C-300 Bucholtz, H.F., H.E. Henderson, J.W. Thomas and H.C. Zindel. 1971. Dried animal waste as a protein supplement for ruminants. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 308-310. 4 ref. 6 tab.

Results of feeding trials to determine the value of dried poultry waste as a supplemental protein source to feedlot cattle, growing sheep, lactating cows and young calves. Sheep were also fed dehydrated feces from pigs and cattle. Results were presented in tabular form and animal responses were discussed. Beef animals responded poorly, probably because of improper ration proportions, trials with sheep were more successful. Milk production by cows was not adversely affected by including dried poultry waste in their diet. From management and nutritional considerations, it was concluded that dehydrated animal wastes must contain more than 25% crude protein to economically compete with other supplemental nitrogen sources for ruminants.

C-301 Hodgetts, B. 1971. The effects of including dried poultry waste in the feed of laying hens. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 311-313. 12 ref. 9 tab. 2 fig.

Report on feeding trials in England, incorporating about 10% dehydrated poultry waste in the ration of laying hens. Both nutritional and bacteriological aspects were considered. Results indicated that egg production and flock health were not adversely affected, and that feed costs were reduced by £2/ton. Dehydrated poultry waste appeared to have little nutritional value but improved the efficiency of feed consumption. The importance of using only fresh wastes in recycling work and of careful handling of this waste was emphasized. More detailed work is needed on the recycling of poultry waste through poultry.

C-302 Smith, L.W., H.K. Goering and C.H. Gordon. 1971. Nutritive evaluations of untreated and chemically treated dairy cattle wastes. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 314-318. 5 ref. 8 tab.

Report on feeding trials to determine (1) the in-vivo nutritive value of dairy cattle waste with and without sawdust bedding, (2) the effects of several chemicals on these materials, and (3) the effects of physical preparations and conventional feed additives on acceptability and utilization of the waste. It was shown that sheep will consume untreated dehydrated and pelleted dairy cattle manure at levels adequate for maintenance. Chemical treatment of manure increased its fibre digestibility. The effects of treatments and pelleting on dry matter consumption were discussed. Further research effort on this subject is warranted.

C-303 Calvert, C.C., N.O. Morgan and H.J. Eby. 1971. Biodegraded hen manure and adult house flies: their nutritional value to the growing chick. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 319-320. 4 ref. 6 tab.

Review of previous research. Results of trials have shown that house fly larvae can be used to biodegrade hen manure while, at the same time, removing obnoxious odors and reducing the moisture content and volume of the manure. The larvae can be used as a protein supplement for growing chicks. The stabilized manure can be further dried for use as a fertilizer and/or soil conditioner. The processed manure does not seem to have any value when substituted for soybean meal in the chick diet.

C-304 Wilkinson, S.R., J.A. Stuedemann, D.J. Williams, J.B. Jones, Jr., R.N. Dawson and W.A. Jackson. 1971. Recycling broiler house litter on tall fescue pastures at disposal rates and evidence of beef cow health problems. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 321-324, 328. 17 ref. 5 tab. 3 fig.

Report on studies to determine the effects of heavy broiler litter fertilization on the soil, plant, and cow parameters of a Kentucky-31 tall fescue pasture ecosystem. The development of nitrate toxicity, grass tetany, fescue toxicity and fat necrosis were investigated in cattle pastured on grassland to which 24 MT per ha of broiler house litter had been applied each year for 2½ years. Cases in which these conditions developed were discussed. There was a strong indication of a fescue toxicity and/or a parasite problem associated with the littered pasture. Changes in the chemical composition (K/(Ca+Mg), NO_3-N and perloline contents) of the grass were reported. On the basis of these studies, it was recommended that broiler litter disposal rates should be less than 9 MT/ha per year on tall fescue pastures.

C-305 Goodrich, P.R. and E.J. Monke. 1971. Movement of pollutant phosphorus in saturated soils. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 325-328. 8 ref. 8 fig.

Report on a laboratory experiment concerning phosphorus movement in saturated soil. Uniform soil columns and radioactive tracer solutions were used in the experiment. Monitoring equipment and data acquisition system developed were useful in predicting the movement of phosphorus under waste irrigation conditions without field trials at each disposal site. It was emphasized that clay minerals are important in the adsorption of phosphate in soils, and that no soils have an infinite capacity to adsorb phosphate from solution. Contamination of subsurface waters with phosphorus could result from improperly designed soil systems for waste treatment.

C-306 Koelliker, J.K., J.R. Miner, C.E. Beer and T.E. Hazen. 1971. Treatment of livestock-lagoon effluent by soil filtration. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 329-333. 5 ref. 2 tab. 6 fig.

Results of the past two years of a long-term field experiment to study the use of soil systems for the final treatment and disposal of anaerobic, swine-lagoon effluent. Observations were concerned primarily with the long-term operation of the system and with trying to gain further understanding of the nitrogen transformations within the soil system. Data were reported on COD, total phosphorus, and nitrogen reductions. To minimize the possibility of runoff, it was recommended that application rates of lagoon effluent should be less than half the suggested infiltration rate for clean water on the same soil. Nitrogen will likely be the limiting factor in most systems.

C-307 Overman, A.R., C.C. Hortenstine and J.M. Wing. 1971. Growth response of plants under sprinkler irrigation with dairy waste. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 334-337. 8 ref. 6 tab. 9 fig.

Report on field experiment to determine the interrelationships between application rates of nutrients, crop production, and losses of nutrients from the root zone for various application rates of manure. Results indicated that, as the quantity of nutrients applied to a crop was increased, the percentage uptake by the vegetation decreased and the percentage lost from the root zone increased. Maximum yield for oats and sorghum-sudangrass did not occur at the same levels of fertilization. It was also shown that oats grown with dairy manure were satisfactory in chemical composition, palatability and digestibility.

C-308 Larsen, V. and J.H. Axley. 1971. Nitrogen removal from sewage waters by plants and soil. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 338-340, 347. 17 ref. 6 tab.

Results of a study of the nitrogen removal by plants and soils from sewage waters of a poultry processing plant. Soil used in the treatment system was a sandy loam (C.E.C. = 4.5 me/100g of soil; pH = 6.5; infiltration capacity = 6 cm/hr.). The soil-plant system satisfactorily removed large quantities of nitrogen. At application rates greater than 11.7 cm/week, removal of nitrogen was largely by denitrification and immobilization; at rates of application less than 9.7 cm/week, crop removals, ammonia volatilization and dilution by rainwater and groundwater were especially important. For an application rate of 200 in/year, nitrogen concentrations in the sewage of 65 ppm were reduced to 11 ppm after passage through 3 m of water unsaturated soil and 6 m of water saturated soil.

C-309 Graves, R.E., J.T. Clayton and R.G. Light. 1971. Renovation and reuse of water for dilution and hydraulic transport of dairy cattle manure. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 341-344. 8 ref. 3 tab. 5 fig.
Report on studies to determine the effectiveness of screening for removal of solids from dairy cow slurries, to measure the effect of such screening, and to establish design parameters for systems to renovate screen effluent for reuse in the transport system. The results of trials with two screening systems were reported including a description of the problems encountered. No adverse effects could be attributed to recirculation. The system was considered feasible for feedlot runoff, duck ranges, and any other areas requiring disposal of large volumes of polluted water.

C-310 Glerum, J.C., G. Klomp and H.R. Poelma. 1971. The separation of solid and liquid parts of pig slurry. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 345-347. 2 tab. 5 fig.
Results of experiments in the Netherlands to develop methods to separate solid and liquid portions of pig slurry prior to disposal of the solid fractions and discharge of the liquid fraction, after treatment, into public watercourses. Trials were performed with a centrisieve, two decanter centrifuges, a rotary vacuum filter, a vibroscreen and a sedimentation silo. On the basis of strength of results, capacity, and initial expense, the centrisieve was selected as the best. The sedimentation silo also deserves attention because of the greater reduction in BOD.

C-311 Ross, I.J., J.J. Begin and T.M. Midden. 1971. Dewatering poultry manure by centrifugation. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 348-350. 4 ref. 1 tab. 2 fig.
Report on trials at the University of Kentucky with fermentation and processing techniques intended to make a usable feed material from poultry wastes. Tests were conducted to determine the dewatering characteristics of solutions of poultry manure and to determine the amount of solids separation that could be expected by centrifugation. The effects of several variables were evaluated, including the initial percent solids in the waste, the relative centrifugal force, time of centrifugation, temperature and amount of washwater used.

C-312 Holmes, L.W.J., D.L. Day and J.T. Pfeffer. 1971. Concentration of proteinaceous solids from oxidation ditch mixed-liquor. Livestock Waste Management and Pollution Abatement, Proc. International Symposium on Livestock Wastes, Columbus, Ohio. Amer. Soc. Agr. Eng., St. Joseph, Michigan. pp. 351-354. 4 ref. 8 fig.
Report on a series of centrifugation trials with swine oxidation ditch mixed-liquor to determine the feasibility of proteinaceous solids recovery and concentration from mixed-liquor. The effects of feed flow rate and centrifugal force on solids recovery and desired levels of concentration were discussed. Data on the nutritive value of the centrifuged product were given.

C-313 Taiganides, E.P. 1964. Disposal of animal wastes. Proc. 19th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 117. Purdue Univ., Lafayette, Indiana. pp. 281-290. 19 ref. 5 tab.
Properties, handling, treatment, and final disposal of farm animal wastes were considered as they relate to each other. Tables of animal waste properties were given. The author indicated that farmers are willing to accept new ideas on waste management, but new ideas are slow in coming from the engineers and scientists in the field.

C-314 Dornbush, J.N. and J.R. Andersen. 1964. Lagooning of livestock wastes in South Dakota. Proc. 19th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 117. Purdue Univ., Lafayette, Indiana. pp. 317-325. 8 ref. 2 tab. 2 fig.
Some of the basic factors influencing the design and operation of farm manure lagoons in northern climates were indicated. A loading rate of 10 lbs volatile solids per cu. ft. of lagoon volume was recommended. Lagoon depths of 5 to 8 ft. warrant further consideration. Some mixing of the upper layers and of the sludge is necessary for odor control, but essentially anaerobic conditions should be maintained.

C-315 Cooper, R.C., W.J. Oswald and J.C. Bronson. 1965. Treatment of organic industrial wastes by lagooning. Proc. 20th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 118. Purdue Univ., Lafayette, Indiana. pp. 351-364. 8 ref. 2 tab. 6 fig.
Discussion of the operation of anaerobic, facultative, and aerobic lagoons in California and description of some successful applications of lagoons for the treatment of wastewaters from animal rendering and hide-curing plants, oil refineries, and poultry farms. Factors affecting the choice of type of lagoon were indicated and it was recommended that pilot plant studies should be carried out to study the applicability of lagooning for a particular wastewater.

C-316 Davis, R.V., C.E. Cooley and A.W. Hadder. 1965. Treatment of duck wastes and their effects on the water quality in the Rappahannock River, Urbanna, Virginia. Proc. 20th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 118. Purdue Univ., Lafayette, Indiana. pp. 626-646. 10 tab. 7 fig.
Report on the facilities for treatment of wastewaters from two large duck farms, on developments leading to the present facilities, and on the effect of the treatment on quality of the effluent released into the Rappahannock River. A system of lagoons provides primary settlement and final clarification of the effluent before release into the river. The quality of the river has improved since incorporation of the new treatment facilities. It was suggested that the high salt and chloride concentrations of the river water probably account for some of the coliform reduction.

C-317 Bloodgood, T.W. 1966. Treatment of animal wastes at the Greenfield Laboratories of Eli Lilly and Company. Proc. 21st Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 121. Purdue Univ., Lafayette, Indiana. pp. 56-61. 1 ref. 1 tab.
Information was presented on the facilities used at Greenfield Laboratories in Indiana to treat wastes from the thousands of animals used in the various production and research programs. A description of five plants treating different animal wastes in five different ways was given. Costing figures

and operational procedures and problems were discussed.

C-318 Stanley, D.R. 1966. Anaerobic and aerobic lagoon treatment of packing plant wastes. Proc. 21st Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 121. Purdue Univ., Lafayette, Indiana. pp. 275-283. 3 ref. 2 fig.
Report on the waste treatment facilities of meat packing plants and slaughter-houses in Edmonton, Alberta. Anaerobic lagoons have been used to provide economical and efficient treatment of the wastes under sub-zero weather conditions. Odor nuisance due to hydrogen sulfide production has been controlled by raising the pH to neutrality using hydrated lime. Effluent from the anaerobic lagoons is stored during winter months and discharged to the North Saskatchewan River in the spring.

C-319 Miner, J.R., L.R. Bernard, L.R. Fina, G.H. Larson and R.I. Lipper. 1966. Cattle feedlots runoff nature and behavior. Proc. 21st Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 121. Purdue Univ., Lafayette, Indiana. pp. 834-847. 10 ref. 9 tab. 9 fig.
"Cattle feedlot runoff was found to be a high strength organic waste containing considerable quantities of nitrogen. Concentrations of organic matter and nitrogen increased with (1) low rainfall intensities, (2) warm weather, and (3) moist lot conditions. Runoff from the concrete lot was approximately twice as heavily polluted as runoff from the non-surfaced lot. Runoff from both was heavily laden with bacteria normally used to evaluate water quality. The bacterial nature of stored feedlot runoff and litter changed continuously. The changes were a function of temperature as well as storage time. As a result, the fecal coliform:fecal streptococcus ratio does not appear to be an entirely reliable tool to identify the cause of an observed water pollution problem."

C-320 Enders, K.E., M.J. Hammer and C.L. Weber. 1967. Field studies on an anaerobic lagoon treating slaughterhouse waste. Proc. 22nd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 129. Purdue Univ., Lafayette, Indiana. pp. 126-137. 6 tab. 5 fig.
Wastes originating from the holding yard, the slaughtering floor, the gut and hide processing units, the plant domestic facilities, the clean-up operations, and the cooling water are treated in an anaerobic-aerobic lagooning system. Average detention time in the lagoons is 4.3 days. Average BOD loading is 31.4 lb BOD/1000 cu. ft. of lagoon volume with a resulting efficiency of 87% BOD removal.

C-321 Niles, C.F., Jr. 1969. Egg laying house wastes. Proc. 22nd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 129. Purdue Univ., Lafayette, Indiana. pp. 334-341. 2 tab. 1 fig.
Discussion of the treatment of wastes from a large poultry operation in Indiana. Wastes include the manure from 205,000 laying hens, waste drinking water and feed, and an average of 50 dead birds per day. At one time all the wastes were treated in 2 lagoons, 3 ft. deep and having a combined surface area of 2.5 acres. Odor problems and the possibility of dam failures led to the consideration of a drying process. Production rates of 2,800 lbs per day per drier have been achieved with the new drier installation. The dried material is all marketed. Wastewater is being disposed of on the land by irrigation.

C-322 Loehr, R.C. 1968. Technical and legal controls for the disposal of animal wastes. Proc. 23rd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 132. Purdue Univ., Lafayette, Indiana. pp. 507-519. 21 ref. 5 tab. 2 fig.
Report on the feedlot situation in Kansas. Technical limitations and legal controls were considered. Data were presented on the quality of untreated animal wastes and on the quality of treated wastewaters required to meet stream standards. Various treatment processes were considered and evaluated on the basis of their ability to meet expected effluent standards. Comments were given on the alternatives of handling and treating animal wastes in solid or liquid form.

C-323 Proctor, D.F. 1968. The management and disposal of dairy manure. Proc. 23rd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 132. Purdue Univ., Lafayette, Indiana. pp. 554-566. 8 fig.
Report on the management of wastes from dairy operations in Washington. Climatic considerations affecting the manure disposal problem were discussed. Four criteria were given for evaluating the success of a dairy manure management program: comparative costs, effectiveness, year round adequacy, and environmental protection. Two dairy waste management projects were illustrated.

C-324 Wymore, A.H. and J.E. White. 1968. Treatment of a slaughterhouse waste using anaerobic and aerated lagoons. Proc. 23rd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 132. Purdue Univ., Lafayette, Indiana. pp. 601-618. 14 tab. 3 fig.
Report on the waste treatment facilities at a hog slaughterhouse in Iowa. Wastes to the facility come from the hog pens, the kill floor, rendering, and sanitary sewage. The treatment consists of anaerobic lagooning followed by aerobic treatment in large aerated lagoons. Design data were reported in detail, as well as data on wastewater quality. An evaluation of the treatment plant facility was given and some operating and investment costs were reported.

C-325 Horasawa, I. 1968. Stabilization pond treatment of slaughter-house wastes. Proc. 23rd Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 132. Purdue Univ., Lafayette, Indiana. pp. 1178-1185. 9 ref. 5 tab. 3 fig.
900 slaughterhouses in Japan kill 6 million animals per year: about 130 of these kill only 1 to 5 animals per day which makes the construction and operation of complex waste treatment facilities prohibitive for them. This paper reports on an experimental study of the use of the stabilization pond process by small slaughterhouses.

C-326 Antonie, R.L. and F.M. Welch. 1969. Preliminary results of a novel biological process for treating dairy wastes. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue Univ., Lafayette, Indiana. pp. 115-126. 11 fig. 3 tab.
Results of some extensive field testing of the "Rotating Biological Contactor" (RBC) as designed by the Allis-Chalmers Mfg. Co. Combined waste from several sources in a milk plant, including wastewater from cleaning of equipment and from cottage cheese processing, and whey from cottage cheese processing, were effectively treated. Weather conditions had no apparent effect on RBC effectiveness. Attractive RBC characteristics include a large microbial

population, flexible aeration capacity, little maintenance, low power requirements, and predictable performance.

C-327 Jones, D.D., D.L. Day and J.C. Converse. 1969. Oxygenation capacities of oxidation ditch rotors for confinement livestock buildings. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue Univ., Lafayette, Indiana. pp. 191-208. 5 ref. 13 fig. 2 tab.
Oxygenation capacities of five aeration rotors tested at the University of Illinois were reported. Parameters studied were blade immersion, blade design, rotor speed, and gross power requirements. Both angle iron bladed rotors and rectangular plate rotors added about 1.6 lb oxygen per foot of rotor operating at 200 rpm. The scoop-bladed rotor added 1.47 lb oxygen per hour per foot of rotor operating at four inches immersion and at 200 rpm. Oxygenation capacity of an individual rotor varied directly and almost linearly as immersion or rotor speed. Oxygenation took place almost entirely in the immediate vicinity of the rotor.

C-328 Saucier, J.W. 1969. Anaerobic lagoons versus aerated lagoons in the treatment of packing-house wastes. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue Univ., Lafayette, Indiana. pp. 534-541. 1 ref. 3 tab. 2 fig.
The costs and end results of anaerobic and aerobic lagooning of packing-house wastes were compared. Characteristic of packing plant wastes are slug loads of very high concentrations of BOD, suspended solids and grease. The anaerobic lagoon holds an economic advantage over the aerated lagoon. Odors are present and further treatment of the effluent is necessary. Aerated lagoons may be more heavily loaded and provide final treatment without odor problems, although operating expenses are higher than for anaerobic lagoons.

C-329 Taiganides, E.P. 1969. Mission impossible - dispose animal wastes. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue University, Lafayette, Indiana. pp. 542-549. 10 ref. 4 tab. 1 fig.
Discussion of the animal waste disposal problem on the basis of observed trends: (1) from diffused to point generation of wastes; (2) from solid to liquid form for transport; (3) from storage to treatment; (4) from utilization as fertilizer to utilization as a conditioner; and (5) from viewing disposal as a chore to viewing it as a problem. The only logical sink for the disposal of animal wastes is the land.

C-330 Griffith, C.C. and M.L. Rodevick. 1969. BOD from poultry processing plants. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue Univ., Lafayette, Indiana. pp. 713-724. 3 ref. 3 tab. 1 fig.
Report on studies. It was substantiated that the BOD load from poultry processing plants cannot be expressed accurately in terms of production units, either head count or gross liveweight, unless the average liveweight per bird processed is considered. The data presented indicated that the BOD of wastes produced per 1,000 pounds of liveweight of birds processed increased greatly as the liveweight of birds increased. Discussion was included on the validity of specific correlations made by the authors.

C-331 Dague, R.R., W.L. Paulson and K.J. Kline. 1969. Hydrologic aspects of feedlot waste control. Proc. 24th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 135. Purdue Univ., Lafayette, Indiana. pp. 998-1016. 7 ref. 10 tab. 13 fig.
Review of the hydrologic factors that require consideration when designing systems for the control of cattle feedlot runoff. A discussion of several methods of cattle feedlot runoff control was presented. Caution was forwarded on the application of the term "population equivalent" to feedlot wastes.

C-332 Dague, R.R. 1970. Alternatives in cattle feedlot waste management. Proc. 25th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 137. Purdue Univ., Lafayette, Indiana. pp. 258-265. 17 ref. 1 fig.
General review of the problems presented by the large volumes of high strength wastes produced in cattle feedlots, and of some of the alternatives which now exist for controlling those wastes to avoid pollution. The characteristics of feedlot wastes and the water pollution potential of feedlots were discussed. Control, treatment, disposal and/or utilization of solid wastes and runoff were considered.

C-333 Koelliker, J.K. and J.R. Miner. 1970. Reduction of nitrogen concentrations in swine lagoon effluent by biological denitrification. Proc. 25th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 137. Purdue Univ., Lafayette, Indiana. pp. 472-480. 11 ref. 6 tab.
Report on laboratory trials to reduce the nitrogen concentration of anaerobic swine lagoon effluent by biological denitrification prior to disposal of the purified effluent. Several preliminary tests were made to test the possibility that the organic material in the nitrified effluent from an oxidation ditch could serve as a carbon source for denitrification; results were negative. Nitrified swine wastes were successfully denitrified (91% nitrogen removal) by adding raw swine manure to nitrified effluent at a feed rate of $BOD_5=3.26NO_3$-N for a detention time of 1 day at 20^oC. Organic and ammonia-nitrogen were not removed by denitrification. About 1 gm of COD was added to the denitrified liquid for each one gm of NO_3-N removed. No offensive odors were produced by the denitrification unit which was shown not to be operating completely anaerobically.

C-334 Rust, D.W. 1970. 15 years of progress in poultry waste disposal. Proc. 25th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 137. Purdue Univ., Lafayette, Indiana. pp. 659-661.
Discussion of waste handling facilities at eight different poultry housing facilities. Most of the waste is handled by in-situ composting in pits beneath wire floors or suspended cages. Outside lagoons are used to dispose of egg wash water. Odor and stream pollution are not a problem with the system.

C-335 Scalf, M.R., W.R. Duffer and R.D. Kreis. 1970. Characteristics and effects of cattle feedlot runoff. Proc. 25th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 137. Purdue Univ., Lafayette, Indiana. pp. 855-864. 6 ref. 3 tab. 10 fig.
Report on a study designed to measure the quantity of rainfall runoff and its pollutional characteristics from a commercial 12,000-head cattle feedlot and to evaluate the effect of this wastewater on small impoundments. Direct runoff

from the feed pens contained variable concentrations of organic matter, solids and nutrients, one order of magnitude higher than raw municipal sewage. Two weeks of sedimentation in runoff collection ponds produced an effluent with pollutant concentrations of 10 to 30% of the direct runoff concentrations. When the feedlot operator pumped the collection pond effluent through an inadequate treatment system into a 45-acre flood control reservoir, an extensive fish kill occurred, emphasizing the need for more complete treatment of the pond effluent before discharge to streams or reservoirs.

C-336 Sheffield, C.W. and B. Beville. 1970. Feedlot waste in Florida. Proc. 25th Industrial Waste Conference, Purdue University, Eng. Ext. Ser. No. 137. Purdue Univ., Lafayette, Indiana. pp. 914-918. 1 fig.
Report on a study of waste treatment for 800 dairy cows on acid flatwood areas of Florida. The treatment method for the study included a grit chamber with one hour detention time followed by an anaerobic pond (18 days detention), then an aerobic pond (16 days detention) and a polishing pond (9 days detention). Then half of the 100,000 gpd flow was diverted to a three to five acre sub-surface drain and the other half to a five acre spray irrigation system. Estimated costs and design criteria were given.

C-337 Anon. 1971. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. 205 pp.
In addition to several papers on research and technology which are indexed separately in this bibliography, the published proceedings of this National Symposium on Animal Waste Management included papers submitted at the conference by various legislators, regulators, government and private researchers, farm and commodity organization representatives and farmers on (1) the state-of-the-art in animal waste management; (2) State activities in waste management research and legislation; (3) Government technical and financial assistance programs; (4) experiences with cooperative waste management projects; and (5) reports and recommendations of various working groups at the conference.

C-338 Bernard, H., J. Denit and D. Anderson. 1971. Effluent discharge guidelines and animal waste management technology. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 69-83. 10 ref. 7 tab. 7 fig.
Review of developments within the animal industry which have led to the present day waste problem, and of some of the waste management activities and treatment processes now employed to control air and water pollution from confined animal units. The aim of present research in waste management is to meet the ultimate objective of "zero discharge" or complete recycling. Increasingly stringent legal standards which are being imposed on feedlots in the U.S.A. were discussed."

C-339 Dale, A.C. 1971. Status of dairy cattle waste treatment and management research. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virgina. Council of State Governments, Washington, D.C. pp. 85-95. 6 tab. 3 fig.
Review of dairy production in the U.S.A. and of current waste management problems. In general, dairymen have done a good job of returning the wastes

to the soil. Other disposal methods were discussed, namely, anaerobic digestion, aerobic stabilization in oxidation ditches, lagooning, composting, dehydration, direct irrigation, incineration, and refeeding. The physical properties and chemical composition of dairy manure were noted, and research activities in dairy waste management were reviewed.

C-340 Viets, F.G. Jr. 1971. Cattle feedlot pollution. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 97-105. 13 ref. 2 tab.
Review of cattle feedlot pollution and of research which has been conducted in the United States to solve some of the problems associated with feedlot waste management. Surface water pollution (runoff), air pollution (odors, dust, ammonia), deep percolation and soil pollution (salts, metals) were discussed with references to the potential magnitudes of the problems posed by each, and to methods currently used to combat such pollution. Problems encountered in attempting a nitrogen balance of a cattle feedlot were discussed. It was concluded that zoning is one of the best solutions to the feedlot problem.

C-341 Loehr, R.C. 1971. Poultry waste management. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 107-110.
Discussion of the various alternatives available to poultry producers for manure handling, including in-house drying of droppings and aeration in oxidation ditches. It was emphasized that there are reasonable and feasible solutions now available for control of wastes from agricultural operations which should be put into practice as soon as possible. A systems approach to waste management was recommended.

C-342 Muehling, A.J. 1971. Swine waste management. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 111-119. 9 ref. 7 fig. 3 tab.
Discussion of the problems facing swine producers with respect to waste handling, and a review of the qualitative and quantitative properties of swine manure. Seven common manure handling systems used by swine producers to control pollution are described: (1) wastes from hogs on pasture; (2) handling solids; (3) slotted floors - store and haul; (4) waste lagoons; (5) combination hauling and lagooning; (6) oxidation ditch; and (7) hydraulic manure removal. Other methods are briefly discussed, namely dehydration, incineration, composting, and refeeding. Future trends in swine production were noted briefly.

C-343 Yeck, R.G. and P.E. Schleusener. 1971. Recycling of animal wastes. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 121-127. 18 ref. 3 tab.
Discussion of field application and refeeding (either directly or indirectly) of manure as methods for complete recycling of animal wastes. Theoretically, the return from recycling by refeeding would be greater than that from recycling by field application. Problems which must be overcome before refeeding becomes an acceptable process are discussed. Sixteen processes which

might be used to recycle wastes back through animals as feed include drying, cooking, fumigation, chemical treatment, washing, pyrolysis, ensiling, composting, lagooning, hydroponics, insects, earthworms, fish, algae, yeast, and single cell protein culture.

C-344 Taylor, J.C. 1971. Regulatory aspects of recycled livestock and poultry wastes. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 129-131. 4 ref.
Report on the present stand of the U.S. Food & Drug Administration on the practice of recycling livestock wastes as a feedstuff. Reasons for the ruling on refeeding, and other pertinent information regarding health and aesthetic aspects of refeeding are discussed.

C-345 Schwengel, F. 1971. Water pollution and the farmer. Animal Waste Management, Proc. National Symposium on Animal Waste Management, Warrenton, Virginia. Council of State Governments, Washington, D.C. pp. 133-135.
General discussion on pollution emanating from agricultural sources, with emphasis on the magnitude of the problem, and steps being taked by the Government of the U.S.A. to understand and alleviate the problem of agricultural pollution. Current findings of research projects were reviewed.

C-346 Turnbull, J.E. 1971. Confinement sheep housing. Proc. Fourth Annual Sheep Symposium, Banff, Alberta. Dept. of Extension, University of Alberta. pp. 89-102. 4 ref. 2 tab. 7 fig.
Discussion of alternative sheep housing facilities, including a description of manure handling facilities in total confinement units. Storing and handling sheep manure as a liquid was considered impractical because of its high dry matter content.

C-347 Hurley, C. 1965. Manure handling and farmyard drainage. Proc. Seminar on Farm Buildings and Agricultural Engineering, Agricultural Institute, Dublin. pp. 64-76. 4 tab. 4 fig.
Discussion on alternative systems for the collection, storage, and disposal of farm yard drainage and manure. Costs and labor requirements of the various systems are outlined. Data are given on the polluting properties of manure and silage effluent.

C-348 McAllister, J.S.V. 1971. Nutrient balance on livestock farms. Potassium and Systems of Grassland Farming, 1st Colloquium of the Potassium Institute, Ltd. pp. 113-121. 6 ref. 7 tab.
"The results presented show that on farms where there is intensive livestock production, large quantities of plant nutrients will be collected in the excreta. Where the excreta are disposed of by spreading on the land and where the bulk of the food fed to the stock is imported, there will be a total gain in some nutrient contents of the soil on the farm. The extent of this will depend upon the intensity of stocking but it may be as high as 100 kg phosphorus and 135 kg potassium per ha per annum. The large increases in the concentrations of extractable nutrients in the soil, especially in the upper layers, may have adverse effects on sward growth. Work should be undertaken to obtain information on the effects of high levels of exchangeable nutrients on the concentration of the soil solution and on plant growth."

C-349 Rantcheva, T. 1968. Contribution to the problem of the substitutes for horse manure in mushroom growing. Mushroom Science VII, Proc. of the Second Scientific Symposium and the Seventh International Congress on Mushroom Science, Hamburg, Germany. pp. 349-353.
"The development of mushroom growing in Bulgaria coincides in time with the enlargement and mechanization of the Cooperative and State farms, i.e. with the decrease in the number of working horses. The shortage of good horse manure is aggravated because the horses are fed on forage unsuitable for mushroom growing. The Complex Experimental Station Negovan, near Sofia, has published some formulae for semi-synthetic composts for Bulgarian mushroom growers. Wheat straw, crushed corn cobs, lavender straw, and poultry manure are the basic materials. The percentage of horse manure is 0-50% of the dry matter. We try to exclude fodder from mushroom composts, except for wheat or rye straw. The paper details some of the methods used in carrying out the experiments, and gives formulae and results obtained in primitive mushroom houses, i.e. without peak heating and air conditioning."

C-350 Ross, R.C. 1968. Experiments on the use of farm waste-products in mushroom composting. Mushroom Science VII, Proc. of the Second Scientific Symposium and the Seventh International Congress on Mushroom Science, Hamburg, Germany. pp. 365-371. 2 ref. 2 tab. 1 fig.
"The use of the materials, bullock manure, poultry manure, pig slurry and straw are being investigated in the preparation of mushroom compost in Northern Ireland. A 'synthetic' compost prepared from straw and pig slurry is being developed and useful commercial yields are being achieved (400 - 500 lb mushrooms per ton of compost spawned). Selected bullock manure has consistently given yields in excess of conventional horse manure composts without the need for expensive organic nitrogen supplements. Poultry litter manure and pig slurry are proving to be cheap and effective sources of nitrogen for the supplementation of horse manure composts."

C-351 Day, D.L., M.P. Bryant, A.H. Jensen, S.W. Melsted, A.J. Muehling, J.T. Pfeffer and G.T. Woods. 1971. Animal and human metabolic wastes. Proc. 1st Allerton Conference, Agriculture's Role in Environmental Quality, Univ. Illinois, Urbana-Champaign. pp. 23-25. 2 tab.
Report of a task group on animal and human metabolic wastes. Differences between livestock wastes and municipal sewage were cited. It was concluded that: (1) not all livestock producers have a disposal problem; (2) land should be the ultimate receptor for wastes; (3) soil contaminants should be selectively removed prior to disposal onto land; (4) zoning and land-use programs should be developed; (5) regulations should be based on facts and should be concerned with overall concepts of pollution control rather than individual equipment and facilities specifications; (6) financing and cost sharing of pollution control programs should be investigated; and (7) an information dissemination program is required. Research priorities were outlined.

SECTION D

No books or texts concerned solely with the subject of farm animal wastes appear to be available at this time. Nevertheless, material relating to specific and/or general aspects may be located in texts of widely differing subject-matter. Such material is included in this section of the bibliography. Where the association with farm animal wastes is somewhat tenuous - for example, laboratory techniques involved in water quality analysis - the references constitute a selective rather than an exhaustive list.

D-001 Smith, G.E. 1967. Fertilizer nutrients as contaminants in water supplies. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 173-186. 20 ref. 7 tab.

Soil core samples were taken to depths of 16-49 feet beneath livestock feedlots to study nitrate accumulations. Where livestock had been fed for more than 50 years, from 2000-4000 lbs/acre of nitrate-nitrogen were frequently found. Many layers of soil under the feeding areas in some soils contained 500 to 600 lbs/acre-foot of nitrate-nitrogen at depths of 5-10 ft. Lack of organic matter and evidence of few bacteria in the deeper horizons suggested that there was little reduction of nitrate and thus it accumulated. Investigations on lateral movement of nitrates indicated that nitrate concentrations usually diminished 200-300 ft. from the source of pollution. It was concluded from comparative sampling of feedlots and fertilized cropland that the nitrate in rural water supplies now comes mainly from waste disposal systems and livestock feeding operations.

D-002 Gates, C.D. 1967. The disposal of domestic wastes in rural areas. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 367-384. 16 ref. 5 tab. 1 fig.

General discussion of the problems of disposal of domestic wastes in rural areas. Systems analysis was proposed as an approach to consider all aspects of the problem and arrive at a low cost, total waste management system which meets environmental quality constraints. The septic tank system was described and factors influencing its operation and longevity were discussed.

D-003 Taiganides, E.P. 1967. The animal waste disposal problem. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 385-394. 7 ref.

General review of the animal waste disposal problem. Factors which cause and/or aggravate the waste disposal problem are (1) the properties of animal wastes themselves; (2) current methods of livestock production; (3) urbanization of rural areas and increased public awareness of the need for an aesthetically pleasant environment; and (4) inadequacy of present methods of handling and disposal of manure.

D-004 Deibel, R.H. 1967. Biological aspects of the animal waste disposal problem. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 395-399. 3 ref.

Report on studies to determine the source of odor from stored animal wastes and to develop odor control measures. Experiments with poultry manure indicated that bacteria, and not intestinal enzyme action, are responsible for odor production. It was suggested that chemical treatment for odor abatement is feasible. Attempts to isolate the bacteria responsible for odor production met with failure.

D-005 Ludington, D.C. 1967. Properties of chicken manures affecting their disposal. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 401-413. 15 ref. 4 tab. 3 fig.

Report on the characteristics of poultry manure which have a large influence on the treatment of the manure prior to disposal. Factors making chicken manure disposal and treatment most difficult are its high ammonia nitrogen content and a high K_1 factor (deoxygenation constant in the standard BOD exertion equation). The BOD_5 for chicken manure accounts for 95% of the ultimate BOD as compared to a corresponding figure of 68% for domestic wastes; thus chicken manure may undergo putrefaction or become septic more quickly than domestic waste. It was recommended that treatment of poultry manure be prompt, that aerobic conditions by maintained at all times for odor control and that ultimate disposal be on the land. The oxidation ditch method of treatment was considered impractical.

D-006 Willrich, T.L. 1967. Disposal of animal wastes. In N.C. Brady (ed.). Agriculture and the quality of our environment. Amer. Assoc. Advancement Sci. Publ. 85. pp. 415-428. 41 ref.
General discussion on (1) various processes for converting animal wastes into marketable products (stock piling, dehydration, composting); (2) disposal of wastes without salvage (incineration, land fill, plow-furrow-cover); (3) disposal of feedlot runoff (regulations, research, experience, evaluation); (4) primary treatment of diluted wastes (screening, settling, anaerobic lagooning, anaerobic digestion); (5) secondary treatment (field application, aerobic lagooning, activated sludge, oxidation ditch, trickling filter); (6) tertiary treatment processes (aerobic lagooning, soil filtration, hydroponics). Land application was considered to have merit whether the objective is utilization or disposal.

D-007 Marsh, H. (ed.). 1965. Newsom's sheep diseases. 3rd ed. The Williams & Wilkins Co., Baltimore, Maryland. 456 pp.
Compilation of research and personal knowledge on diseases of sheep caused by bacteria, rickettsia, viruses, fungi, protozoa and parasites with reference to the isolation of causative agents from the feces of infected and healthy sheep.

D-008 Dunne, H.W. (ed.). 1970. Diseases of swine. 3rd ed. The Iowa State University Press, Ames, Iowa. 1144 pp.
Collection of chapters written by several different authors on viral diseases, bacterial and mycotic infections, and parasitic infections with reference to isolation of the causative agents from swine manures.

D-009 Sojka, W.J. 1965. *Escherichia coli* in domestic animals and poultry. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England. 231 pp.
A very detailed account of: (1) the general characteristics of *Escherichia*, and the biochemical and serological behavior of *E. coli*; (2) the isolation of *E. coli* from cattle, sheep, pigs, poultry and other animals and the infections caused by *E. coli* in these animals; and (3) practical procedures used in the study of members of the genus *Escherichia*.

D-010 Hofstad, M.S. (ed.). 1972. Diseases of poultry. 6th ed. The Iowa State University Press, Ames, Iowa. 1176 pp.
Recognition of the role of feces and litter in disease transmission are made in many instances in specific discussions on diseases and disorders caused by bacteria, viruses, chlamydia, fungi, nematodes, protozoa, cestodes, trematodes, acanthocephalans and external parasites.

D-011 Jensen, R. and D.R. Mackey. 1971. Diseases of feedlot cattle. 2nd ed. Lea & Febiger, Philadelphia, Pennsylvania. 376 pp.
This book describes some of the health and management problems of the feedlot industry. One chapter deals specifically with the problem of pollution from cattle feedlots. Scattered references are made to the transmission of disease from animals to animals and/or humans via air, soil, or water transport mechanisms. Many illustrations are included and many references cited.

D-012 Graham-Jones, O. (ed.). 1968. Some disease of animals communicable to man in Britain. Pergamon Press Ltd., New York. 338 pp.
Proceedings of a symposium organized by The British Veterinary Association and The British Small Animal Veterinary Association and held in London in 1966. Diseases considered were salmonellosis, shigellosis, pasteurellosis, Toxocara infestations, cysticerosis, trichinosis, hydatidosis, fascioliasis, louping ill, Newcastle disease, catscratch fever, ornithosis, rabies, B-virus infection, ringworm, listeriosis, leptospirosis, Q fever and other rickettsioses, and brucellosis. Isolations of causative organisms in animal excrements were reported and some references were made to the effect of animal wastes in the transfer of zoonoses.

D-013 Kraggerud, H. 1965. Schweineställe. (Housing for pigs.) Verlag Paul Parey, Hamburg und Berlin. 82 pp. 9 tab. 161 fig.
Description, complete with several illustrations, of contemporary pig housing facilities which are adaptable to Norwegian farms. Various designs of buildings and equipment were considered as they relate to different management conditions. Some sections of this book refer specifically to manure handling and sanitation.

D-014 Steele, J.H. 1971. Zoonoses of domestic animals. CRC Critical Reviews in Environmental Health, Volume 2. Chemical Rubber Company, Cleveland, Ohio. pp. 243-292. 14 ref.
A valuable review on zoonoses of domestic animals, discussed in some detail with respect to symptoms, diagnosis, treatment, and causal agent (Virus, Rickettsia, Bedsonia, Chlamydia, Bacteria, Fungus, Protozoa, Helminth and Arthropod). Some of the diseases discussed may be transmitted via the feces of infected animals, and thus the importance of this paper to those interested in the health aspects of farm animal waste disposal and utilization.

D-015 Huber, W.G. 1971. Antibacterial drugs as environmental contaminants. In J.N. Pitts, Jr. and R.L. Metcalf (eds.). Advances in Environmental Science and Technology. Volume 2. Wiley Interscience, Toronto, Ontario. pp. 289-320. 47 ref.
A comprehensive review of antibacterial drugs, including discussion on classes of antibacterial drugs, their usage patterns, and the environmental hazards associated with their use. Of specific relevance to animal waste problems were discussions on antibiotic drug residues in livestock and poultry, and infectious or transferable drug resistance associated with some of the gastrointestinal bacteria.

D-016 Lunin, J. 1971. Agricultural wastes and environmental pollution. In J.N. Pitts, Jr. and R.L. Metcalf (eds.). Advances in Environmental Science and Technology. Volume 2. Wiley Interscience, Toronto, Ontario. pp. 215-261. 91 ref. 11 tab. 5 fig.
General discussion on the current status of thinking on environmental pollution

from agricultural wastes, including a section dealing specifically with animal wastes. Research effort to date has enabled neither an adequate assessment of the effect of agricultural wastes on overall environmental quality nor the efficient development or modification of technology to minimize pollution hazards.

D-017 Zwick, D. and M. Benstock. 1971. Water Wasteland. Grossman Publishers, New York, N.Y. pp. 92-106.
This book, a report from Ralph Nader's Study Group on Water Pollution, contains a section entitled "The Forgotten Polluters", in which livestock producers are indited, along with other agricultural operators, as the biggest polluters in the United States. Statistics are given to illustrate the role of agriculture in water pollution and the extent of research and expenditures in the United States to reduce the pollution potential of agricultural enterprises.

D-018 Smith, H.W. 1962. The effects of the use of antibiotics on the emergence of antibiotic-resistance disease-producing organisms in animals. In M. Woodbrine (ed.). Antibiotics in Agriculture, Proc. of the University of Nottingham Ninth Easter School in Agricultural Science. Butterworth & Co., Ltd., London, England. pp. 374-388. 32 ref. 9 tab.
The widespread use of antibiotics is giving rise to the emergence of antibiotic-resistant strains of potentially pathogenic bacteria. There is no evidence indicating that these resistant strains are any more, or any less, virulent than their sensitive counterparts. The development of antibiotic-resistant strains of Escherichia coli, Salmonella spp., Clostridium welchii, Staphylococcus aereus and Mycoplasma gallisepticum has been demonstrated by several researchers. The author suggests that the use of antibiotics as feed additives for growth promotion should be restricted, and that those used should be ones which are unsuitable for the therapy of systemic disease in animals and man.

D-019 Kononova, M.M. 1966. Soil Organic Matter - Its Nature, its Role in Soil Formation and in Soil Fertility. 2nd English ed. Pergamon Press, Ltd., Oxford, England. 544 pp.
This general text on soil organic matter contains references to (1) the value of farmyard manure (FYM) as a source of humus; (2) its growth promoting effect; (3) its effect on the free humic acid content of the soil, animal health, germination, humus composition and reserves in the soil, and the vitamin content of plants; (4) mineralization of organic compounds in FYM; (5) the role of invertebrates in incorporation of FYM into the soil; and (6) the overall role of FYM in soil fertility.

D-020 Vil'yams, V.R. 1968. Basic Soil Science for Agriculture. 6th (translated) ed. Israel Program for Scientific Translations, Jerusalem, Israel. 448 pp.
This general text on soil science includes sections dealing specifically with the use of farmyard manure for the control of soil fertility. The importance of applying organic manures for the maintenance of soil structure was emphasized. The effects of anaerobic and aerobic processing on the fertilizer value and physical properties of manure were noted. It was suggested that the major value of farmyard manure lies in its mineral and nitrogen content, and that to receive maximum benefit from manure, it should be aerobically

processed, should be uniformly distributed onto crop land, and should be immediately incorporated into the soil.

D-021 Canadian Industries Limited. 1970. A Digest of Environmental Pollution Legislation in Canada. Volume 1. Canadian Council of Resource Ministers, Montreal, Quebec.
This digest of water pollution legislation in Canada contains an account of Federal and International water pollution regulations followed by a detailed discussion of provincial legislation in each of Canada's ten provinces. Sections of many Acts are reproduced in this digest, and limited discussion is presented on the agencies and mechanisms involved in the enforcement of these Acts. An attempt also has been made in this book to interpret the scope and intent of some of the regulations in force in Canada.

D-022 Canadian Industries Limited. 1970. A Digest of Environmental Pollution Legislation in Canada. Volume 2. Canadian Council of Resource Ministers, Montreal, Quebec.
This digest of pollution legislation in Canada is divided into two parts; the first part dealing with air pollution and the second part with soil pollution and solid waste disposal. In each section, an account is given of Federal and International regulations, followed by a detailed discussion of provincial legislation. Sections of many Acts are reproduced in this digest, and limited discussion is presented on the agencies and mechanisms involved in the enforcement of these Acts. Some attempt has been made to interpret the scope and intent of air and soil pollution regulations in force in Canada.

D-023 Baldwin, M.F. and J.K. Page, Jr. (eds.). 1970. Law and the Environment. New York Walker and Company, New York. 432 pp.
This book covers some of the wider aspects of environmental law, as discussed at a 1969 Conference involving lawyers, law professors and conservation leaders. Topics discussed at the Conference which are indirectly relevant to farm animal wastes included those dealing with problems of litigation and needed developments in the law.

D-024 Lytle, R.J. 1969. Farm Builder's Handbook. Structures Publishing Co., Farmington, Michigan. 206 pp.
Design and construction details are given for various components of farm buildings. A separate chapter is included on waste management in which details are given on waste production volumes, lagoons, oxidation ditches, floor designs, storage structures, and dead animal disposal pits and incinerators.

D-025 American Society of Agricultural Engineers. ____. Agricultural Engineers Yearbook. Amer. Soc. Agr. Eng., St. Joseph, Michigan.
The Agricultural Engineers Yearbook is published annually by the American Society of Agricultural Engineers. Advisory and informational material is included in the form of ASAE Standards, Recommendations and Data. Some of this material is concerned directly with waste management, namely: (1) ASAE R317 - Improving safety on enclosed mobile tanks for transporting and spreading of agricultural liquids and slurry; (2) ASAE S238 - Volumetric capacity of forage wagons, wagon boxes, and forage handling adaptions of manure spreaders; (3) ASAE S324 - Volumetric capacity of box type manure spreaders - dual rating method; (4) ASAE S325 - Volumetric capacity of open tank type manure spreaders; (5) ASAE S326 - Volumetric capacity of closed

tank type manure spreaders; (6) ASAE R345 - Design of farm waste storage tanks; and (7) ASAE R292 - Uniform terminology for rural waste management.

D-026 Associate Committee of the National Building Code. 1970. Canadian Code for Farm Buildings (Farm Building Standards). National Research Council of Canada, Ottawa, Ontario.
This publication is intended as a guide for those interested in the design, construction, remodelling and evaluation of farm buildings. It provides general recommendations and detailed specifications to serve as references, with the intent of obtaining safe and efficient performance and economy within such buildings. Basic standards, recommended good practice and performance, and technical data and information are covered in three separate parts. Sections pertinent to farm animal wastes are those dealing with manure lagoons, manure storage, land disposal standards, dead animal disposal pits, incinerators, milk waste disposal, and design loads for slatted floors.

D-027 Elrick,D.E. (ed.). 1970. Environmental Challenge: Focus on Ontario. Science Research Associates (Canada) Ltd., Don Mills, Ontario.
This book is composed of a collection of readings first presented in a series of public discussions at the University of Guelph. Although none of the papers deal specifically with farm animal wastes, references were made to the problems of animal wastes and to the solutions being used by other industries to solve their waste management problems. The effects of various pollutants on the environment were discussed in all of the papers.

D-028 Canada Committee on Agricultural Engineering. ____. Canada Farm Building Plan Service. Engineering Research Service, Canada Department of Agriculture, Ottawa, Ontario.
The Canada Farm Building Plan Service Design Centre prepares detailed, large-scale plans for Canadian agriculture. Plans cover a wide range of buildings and facilities for livestock production, including facilities for handling and storage of farm animal wastes. Details of alternative waste systems appropriate to a particular layout are given. Plans are regularly updated in line with new developments and technology.

D-029 Midwest Plan Service. ____. Structures and Environment Handbook. Publ. No. MWPS-1, Midwest Plan Service, Ames, Iowa.
This publication of the Midwest Plan Service, which is periodically updated, contains data and information with regard to the design, construction, and operation of farm buildings and associated equipment. Of special application to farm animal wastes are fact sheets on handling liquid manure, handling swine manure, oxidation ditch for treating hog wastes, anaerobic manure lagoons, design of farm waste storage tanks and general aspects of waste disposal from cattle operations. Other papers with less direct bearing on animal wastes deal with such topics as ventilation and environmental control in animal facilities, and water quality, treatment and distribution.

D-030 Miner, J.R. and J.R. Jordan. 1971. Bibliography of Livestock Waste Management. Publ. No. MWPS-17, Midwest Plan Service, Ames, Iowa. 71 pp.
A bibliography of some 500 entries, concerned primarily with recent research conducted in the United States on the treatment, disposal and utilization of animal wastes. All references are cross-indexed by author and pertinent keywords.

D-031 Clark, J.W., W. Viessman, Jr. and M.J. Hammer. 1971. Water Supply and Pollution Control. 2nd. ed. International Textbook Company, Toronto, Ontario. 661 pp.
This book is concerned with the scientific principles underlying water and waste water management. Topics having direct application to present day problems and solutions in farm animal waste management include water requirements and waste volumes; hydraulic transport of wastewater; wastewater systems; water quality determination and standards; systems for treating water and wastes; physical, chemical and biological treatment processes; processing of sludge; tertiary wastewater treatment; and reuse of wastewaters. The book also concerns itself with some of the more general aspects of environmental quality, and with some legal considerations in water supply and pollution control.

D-032 Weber, W.J. Jr. 1972. Physicochemical Processes for Water Quality Control. John Wiley & Sons, Inc., New York, N.Y. 640 pp.
This book details the principles of wastewater treatment kinetics, reactions and reactors, and outlines the basic concepts of coagulation, flocculation, sedimentation, filtration, adsorption, ion exchange, reverse osmosis, ultra filtration, electrodialysis, chemical oxidation, disinfection corrosion and corrosion control, aeration and gas transfer, and sludge treatment.

D-033 Gloyna, E.F. and W.W. Eckenfelder, Jr. (eds.). 1968. Advances in Water Quality Improvement. Volume 1. University of Texas Press, Austin, Texas. 513 pp.
This textbook contains 39 papers on specific topics related to the effects of pollutants on streams, new concepts in biological waste treatment, and waste stabilization pond practices, including one paper entitled "Waste Stabilization Ponds for Agricultural Wastes". Other papers dealing with removal of nitrogen and phosphorus from wastewaters, eutrophication, dissolved oxygen sag in streams, the activated sludge system, biological oxidation, nitrogen removal by biological treatment, biological filtration, aeration, flocculation, aerated lagoons, anaerobic digestion, and treatment kinetics have indirect application to problems of farm animal waste treatment.

D-034 Pazar,C. 1971. Waste Water Cleanup Equipment. Noyes Data Corporation, Park Ridge, New Jersey. 551 pp.
This book describes commercial equipment used for water pollution control. Appropriate, detailed, technical information and illustrations are included. Equipment described which could have application in the handling and treatment of farm animal wastes includes screens, pumps, siphons, valves, flocculators, settling tanks, flotation units, sludge collectors, aerators and diffusers, nozzles and distributors, air compressors and filters, chemical mixers and feeders, sludge screens, sludge filters, centrifuges, and driers, and equipment for chlorination, ozononation, deodorization, adsorption, desorption, ion exchange, chemical treatment, mechanical treatment, thermal treatment, biological treatment, electrodialysis, reverse osmosis, and anaerobic processing.

D-035 Gloyna, E.F. 1971. Waste Stabilization Ponds. World Health Association, Geneva, Switzerland. 175 pp. 164 ref.
This monograph summarizes available information on waste stabilization ponds, defines acceptable design criteria based on public health considerations, suggests alternative approaches to design, provides data on pond design, and

deals with the operational problems that ultimately determine the success or failure of ponds as waste-water treatment facilities. The extent of waste stabilization pond usage in the world, costs, waste characteristics, algae-bacterial systems and disease transmission control were also considered.

D-036 Golueke, C.G. 1970. Solid Waste Management Abstracts and Exerpts from the Literature. Publ. No. 2038, Public Health Service, U.S. Dept. of Health, Education, and Welfare, Washington, D.C. 455 pp.
This report is a collection of abstracts and exerpts of the literature reviewed during the first three years of a comprehensive study of solid wastes management. Specific references were made to animal and other agricultural wastes.

D-037 Golueke, C.G. and P.H. McGauhey. 1970. Comprehensive Studies of Solid Waste Management. Publ. No. 2039, Public Health Service, U.S. Dept. of Health, Education, and Welfare, Washington, D.C. 447 pp.
Progress reports covering the first and second years of a comprehensive study of solid wastes management. These reports are intended to acquaint the reader with the underlying concepts of the solid wastes problem and with the details of the multidisciplined research program set up to study the problem. Progress and preliminary findings of a number of coordinated research teams are presented in detail in the first report. Further progress is outlined in the second report. Research topics considered in the program described include characteristics and amounts of solid wastes generated by industry, cities and agriculture, operations research and systems analysis, planning and economics, public health, anaerobic digestion, incineration-pyrolysis, composting, landfill, salvage operations, wet oxidation of organic wastes, and biological fractionation of organic wastes. Specific references were made to farm animal manures.

D-038 American Public Health Association. 1971. Standard Methods for the Examination of Water and Wastewater. 13th ed. American Public Health Association, Washington, D.C. 875 pp.
"Standard Methods" is prepared jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation, and is updated periodically. It covers a wide range of test procedures which are considered under six major headings: (1) Physical and chemical examination of natural and treated waters in the absence of gross pollution; (2) Physical, chemical and bioassay examination of polluted waters, wastewaters, effluents, bottom sediments, and sludges; (3) Examination of water and waste water for radioactivity; (4) Bacteriological examination of water to determine its sanitary quality; (5) Identification of iron and sulfur bacteria; and (6) Biological sampling and analysis.

D-039 Faust, S.J. and J.V. Hunter (eds.). 1971. Organic Compounds in Aquatic Environments. Marcel Dekker, Inc., New York, N.Y. 638 pp.
This text relates the chemistry of organic compounds to the occurence and effects of such compounds in natural and domestic water supplies. Specific references are made to industrial wastes, including silage. Sections dealing with organic-inorganic and organic-metal interactions, cycling of organic matter, and the kinetics of biologically mediated aerobic oxidation of organic compounds relate directly to farm animal wastes.

D-040 White, G.C. 1972. Handbook of Chlorination. Van Nostrand Reinhold

Co., New York, N.Y. 744 pp.
Chlorination is not a common process in the normal treatment of farm animal wastes. However, situations do exist where chlorine has been used, including disinfection of wastewater effluents prior to recirculation as washwater, disinfection of duck farm effluent, and odor control. This book provides a practical and easily understood approach to chlorination, illustrates some applications of chlorination in the treatment of industrial wastes, describes equipment used, and reviews other methods of disinfection.

D-041 Sawyer, C.N. and P.L. McCarty. 1967. Chemistry for Sanitary Engineers. 2nd ed. MacGraw-Hill Book Company, New York. 518 pp.
This book provides a useful guide to some fundamentals of chemistry and some methods for water and wastewater analysis. More specifically, it is concerned with (1) basic concepts from general, qualitative, quantitative, organic, physical, colloid, bio- and radio-chemistry; (2) examination of water and wastewaters for turbidity, color, pH, hardness, chlorides, dissolved oxygen, BOD, COD, nitrogen, solids, iron and manganese, fluoride, sulfate, phosphorus and phosphate, grease, volatile acids and gases; and (3) processes used in connection with water and wastewater treatment. The concepts developed apply equally well to sewage and to more concentrated inorganic and organic (animal wastes) industrial wastes.

D-042 CCM Information Corporation. 1971. Environmental Pollution - A Guide to Current Research. CCM Information Corporation, New York. 851 pp.
Compilation of data on research projects concerning the wider issues of environmental pollution, including a section dealing specifically with animal wastes. The objectives and experimental approach and/or progress were outlined for most of the projects indexed in this compilation. Only research activity in the United States has been considered. Subject, researcher, and supporting agency indexes were included.

D-043 Fair, G.M., J.C. Geyer and D.A. Okun. 1966. Water and Wastewater Engineering. Volume 1. Water Supply and Wastewater Removal. John Wiley & Sons, Inc., New York.
This book is concerned with water and wastewater collection and distribution. Sections which are relevant to problems and solutions of the livestock and poultry industries include those dealing with rainfall and runoff, storage and runoff control, wastewater flow and collection, and the machinery and equipment involved in wastewater collection and distribution. Also of some relevance are chapters concerning the broader aspects of wastewater systems, surface and groundwater hydrology, information analysis, and systems engineering or optimization techniques.

D-044 Fair, G.M., J.C. Geyer and D.A. Okun. 1968. Water and Wastewater Engineering. Volume 2. Water Purification and Wastewater Treatment and Disposal. John Wiley & Sons, Inc., New York.
This book is concerned primarily with physical, chemical and biological matters in the qualitative management of water resources. Topics discussed which have direct application to farm animal waste treatment include aeration and gas transfer; sedimentation; flocculation, flotation and adsorption; filtration; chemical precipitation, stabilization, and ion exchange; coagulation, and the mitigation of corrosion; disinfection; and biological treatment systems. Discussion on the physical and chemical properties of

industrial waters and wastewaters, water quality objectives and standards, and treatment kinetics may also bear some relationship to problems faced in animal waste management.

D-045 Thomann, R.V. 1972. Systems Analysis and Water Quality Management. Environmental Science Services Division, Environmental Research and Applications, Inc., New York, N.Y. 286 pp.
In this book, various principles involved in systems analysis are applied to water quality management. Models are developed to describe conservative and coupled non-conservative systems, such as represented by the dissolved oxygen concentration of streams. The practical application of these models is discussed and illustrated. Basic techniques of economic analysis are described and, incorporated with the water quality models, are used to develop a series of water quality management models.

D-046 Summer, W. 1971. Odor Pollution of Air - Causes and Control. The Chemical Rubber Company, Cleveland, Ohio. 310 pp.
This book provides both the theoretical and practical aspects of odor, its production, sensation and abatement. Information is given on the sense of smell in humans, thresholds of olfaction, pathogenic and social aspects of odor, methods of detection and measurement, and the effects of weather on odor production and sensation. Anentire section of the book is devoted to the legal aspects of odor and odor evaluation in court cases. Several techniques of deodorization are described including phase separation, wet and dry scrubbing, chemical cleaning, dilution, electrostatic precipitation, condensation, masking, combustion, ultraviolet irridation, and deodorization by change of process. Gaseous odorous constituents common to animal wastes and discussed in this book included ketones, aldehydes, acrolein, amines, carbon monoxide, carbonyls, hydrogen sulfide, indole, mercaptans, methane, phenols, and skatoles.

D-047 Leithe, W. 1971. The Analysis of Air Pollutants. Translated ed. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan. 304 pp.
This book provides a comprehensive guide to common air pollutants, including many which are common to livestock operations (dust, sulfur-, nitrogen- and carbon-containing air pollutants). Analytical methods used in identification and quantification of air pollutants are described in some detail. Information is also given on the more general aspects of air pollution, including legislation, meteorological effects on dispersion of air pollutants, public health aspects, and air pollution methodology.

D-048 Kittrell, F.W. 1969. A Practical Guide to Water Quality Studies of Streams. Federal Water Pollution Control Administration, U.S. Dept. of the Interior, Washington D.C. 135 pp.
This book describes and explains the fundamental aspects of stream pollution studies. It includes information on the objectives of stream surveys, sampling procedures and sample examination, interpretation of data, and report preparation. Its contents could be useful to those attempting stream surveys to collect information on the effects of farm animal wastes on surface waters.

D-049 Zajic, J.E. 1971. Water Pollution - Disposal and Reuse. Volume 1. Marcel Dekker, Inc., New York, N.Y. 389 pp.
This volume stresses the biological phemonena involved in water quality

management. Of particular applicability to farm animal wastes are chapters concerning eutrophication (phosphorus and nitrogen control), activated sludge, trickling filters, anaerobic digestion, oxidation ponds and lagoons, solid waste disposal and composting, shock loading, bio-filtration, odor sensation and control, color and taste removal, virus detection in water, and corrosion.

D-050 Zajic, J.E. 1971. Water Pollution - Disposal and Reuse. Volume 2. Marcel Dekker, Inc., New York, N.Y. 257 pp.
This volume concerns itself primarily with chemical and physical phenomena involved in water quality management. Of particular applicability to farm animal wastes are chapters concerning sedimentation, ion exchange, electrodialysis, reverse osmosis, thermal treatment, flotation, incineration, disinfection and sterilization, deep well disposal, corrosion and hydraulic equipment.

D-051 Oostenbrink, M. 1960. Population dynamics in relation to cropping, manuring and soil disinfection. In J.N. Sasser and W.R. Jenkins (eds.). Nematology. The University of North Carolina Press, Chapel Hill. pp. 439-446.
Whereas artificial fertilizers do not seem to directly influence nematode population of the soil, organic manures such as stable manure are known to promote saprozoic nematodes, thereby markedly affecting the total nematode population. Organic manuring suppresses the rate of infestation and reproduction of Heterodera, Meloidogyne and Pratylenchus and probably other phytophagous species. Stable manure does not decrease the numbers of H. rostochiensis cysts in the soil directly.

D-052 Sainsbury, D. 1967. Animal Health and Housing. Ballière, Tindall and Cassell, London, England. 329 pp.
In this book, the interrelated aspects of the environment, health and housing of livestock are discussed in detail. Specific references are made to the disposal of manure and to sanitation in general, and to the effects of these on animal health.

D-053 Odum, E.P. 1971. Fundamentals of Ecology. 3rd. ed. W.B. Saunders Co., Philadelphia, Pennsylvania. 574 pp.
A valuable overview of ecological principles and concepts, including energetics, nutrient cycles and ecological organization. Applications of these basic principles are described. A chapter on pollution and environmental health, and another on resources and resource management are especially applicable to problems in agriculture.

D-054 Salter, R.M. and C.J. Schollenberger. 1938. Farm manure. In Soils and Men. U.S. Dept. Agr. Yearbook of Agr. U.S. Government Printing Office, Washington, D.C. pp. 445-461. 5 tab. 1 fig.
"Manure to the amount of a billion tons a year is produced on American farms. Theoretically it is capable of producing $3,000,000,000 worth of increase in crops, but only a small part of its value is actually realized. Much of the loss is due to faulty handling. This article gives a thorough practical discussion of the whole problem of handling manure for maximum effectiveness with a realistic regard for American conditions."

D-055 Weller, J.B. 1965. Farm Buildings: Techniques - Design - Profit. Volume 1. Crosby Lockwood & Sons, Ltd., London, England. 270 pp.

This text on farm buildings includes discussion on the function of farm buildings, mechanical handling of materials to, within and from farm buildings, and the design requirements of specialized buildings. Of particular application to animal waste management problems are sections dealing with materials handling, manure storage structures and manure handling equipment.

D-056 U.S. Dept. of Agriculture. ____. Yearbook of Agriculture. U.S. Dept. of Agriculture, U.S. Government Printing Office, Washington, D.C.
Each annual addition of the "Yearbook of Agriculture" reports the results of recent Federal, State and Industry research in all areas of agriculture. Specific references are often made to problems of waste management.

D-057 Moncrieff, R.W. 1967. The Chemical Senses. 3rd. ed. Leonard Hill Books, London, England. 760 pp.
A valuable reference text on the structure of the human chemical sense organs, olfactory response in the human, classification of odors, chemical constituents of odors, physical properties of odorous materials, theories of odor, and perfumes and essences.

D-058 Sayce, R.B. 1966. Farm Buildings. The Estates Gazette Ltd., London, England. 510 pp.
A study of the long-term equipment of the farm, including layout, design and services, financial appraisal and control. One chapter is devoted entirely to a discussion on drainage of farm buildings and disposal of manure and effluent.

SECTION E

A considerable volume of literature pertaining to farm animal wastes has been published in a number of countries by government agencies, by research centres and stations and by universities. This material includes scientific, technical and extension type publications in various forms. This fifth section contains references obtained from such publications.

E-001 Quick, A.J. 1963. The slurry chore. Agriculture (London), 70: 580-583.
Reference is made to a N.A.A.S. Milk Group survey made during 1961 to examine the methods employed and the times involved in cleaning slurry on more than 100 dairy farms in England and Wales. Various cleaning methods were employed. Advisory recommendations are given.

E-002 Tetlaw, C. 1964. Indoor lagoons for poultry. Agriculture (London), 71: 10-12.
Report on successes in U.S.A. and U.K. with indoor lagoons for poultry manure. Despite slightly greater mortality in the lagoon-housed birds, the hen-house average was better with both total egg production and food conversion being better for birds housed on slats over lagoons as compared to control birds. One lagoon, which has been used for two years, has a buildup of only 14% solids in 16 inches of water and has never been cleaned out.

E-003 Soden, R.W. 1964. The ways and means of farmstead drainage. Agriculture (London), 71: 22-26.
Advisory paper on the problem of safely disposing of farm effluents. The daily urine and feces of 1 pig may be equal in polluting strength to that of 2 people; from 1 cow, 50 people. The effluent from one ton of grass silage ensiled at 17.8% dry matter is equivalent to 12,000 gallons of domestic sewage. Of the disposal systems considered, organic irrigation was the most expensive but the benefits must be weighed against the costs.

E-004 Sayce, R.B. 1964. Simple slurry collection. Agriculture (London), 71: 388-389.
Two inexpensive systems for collection followed by storage and/or disposal are explained. Both involve the use of tractor-powered scrapers to push the manure to the collection area. In one case, a large concrete storage apron with 4-ft. sides serves as the storage area; in the other case, slurry is pushed directly into a tractor-pulled trailer standing in a bay under a hanging ledge. Emphasis is given to controlling the liquid portion, including rain water, to avoid pollution.

E-005 Riley, C.T. 1964. De-watering poultry manure. Agriculture (London), 71: 527-529.
This general paper considers the problem of drying poultry manure. Industrial appliances have not been very successful in handling poultry manure. It is likely that drying by heat will be the best system. Estimates of the cost of producing the dried product and of the N.P.K. value are given.

E-006 Wood, N.B. 1964. Effluent tanks. Agriculture (London), 71: 534-535.
General advice on storage tanks for liquid manure, including recommendations on shape, size, materials and maintenance.

E-007 Riley, C.T. 1966. Poultry manure disposal - Is there a problem? Agriculture (London), 73: 110-112.
Environment (specifically odors and the type of people who notice them) defines the difference between a problem and a no-problem farm. Farmers should reconsider the policy of "throw it away" and look at ways to realize the economic value of poultry muck. Statistics are given on poultry waste disposal in Great Britain.

E-008 Gatehouse, H.C.E. 1967. Disposal of farm effluent - Introduction to a series. Agriculture (London), 74: 89-94.
The contribution of individual farmers to river pollution may be small but, together, they can add up to a very considerable problem. The potential polluting load on the River Severn from the cattle and pig population in the catchment area was estimated at the equivalent of 22 million gallons/day of domestic sewage. Figures for the BOD of silage liquor, whole milk, piggery drainage, and cowshed drainage were given as 60,000 ppm, 100,000 ppm, 14,000 ppm and 1,000 ppm, respectively, as compared to 350 ppm for crude domestic sewage. The upper limit on BOD of raw water abstracted for public supply has been stipulated by the World Health Organization as 6 ppm, indicating the potential problem created when and if farm effluents reach streams.

E-009 Gibson, E.A. 1967. Disposal of farm effluent - Animal health. Agriculture (London), 74: 183-192.
Review of the potential health hazards associated with slurry manure systems, including the spreading of infectious diseases (Johnes disease, anthrax, avian tuberculosis, salmonella infection and various viral infections), liberation of toxic gases, hypomagnesaemia in cattle due to high potassium applications on pastures by way of manure, high nitrate content of herbage and associated hazards, and copper poisoning in sheep pastured on land where pig slurries have been spread. Recommendations for reducing these hazards are given. A list of Salmonella species likely to be present in effluent from livestock is given in tabular form.

E-010 Gray, S.T.G. 1967. Disposal of farm effluent - Public health. Agriculture (London), 74: 241-244.
The developing conflict between the public and intensive animal housing units is discussed. Ways to avoid such conflict are suggested. Nuisance provisions of the Public Health Act of 1936 (Great Britain) are discussed and interpreted.

E-011 Quick, A.J. 1967. Disposal of farm effluent - The dairy farm. Agriculture (London), 74: 383-387. 3 ref. 3 tab. 1 fig.
A three point approach to the waste disposal problem which may be used on every dairy farm is described: (1) apply certain well-tried principles of materials handling; (2) identify on each farm the main factors which will influence the choice of system; and (3) select the most suitable system from the alternatives available. This approach is illustrated using, as an example, an 80-cow herd in a wet area managed on a loose-housing and parlour system. Some costing figures are given.

E-012 Soutar, D.S. and S.H. Baxter. 1968. Disposal of effluent from the piggery. Agriculture (London), 75: 165-170.
This article concerns the handling of pig effluent in sludge form. Areas considered are design and management of the pen, use or absence of bedding, sludge storage requirements and methods, sludge conveyance, toxic gas hazard, land disposal of sludge, and disposal via lagoons and/or oxidation ditches. In the authors' opinion, properly organized field distribution of sludge may offer the most satisfactory answer.

E-013 Jones, K.B.C. 1968. Farm waste management - Lessons from America. Agriculture (London), 75: 213-218.

A comparison is drawn between the waste disposal problems and disposal techniques in American countries and in Britain: American farmers are encouraged to try new methods, even before the methods are proven as sound practice; American farmers, with the exception of those in the North, have less of a slurry problem with dairy herds; the practice of foliar application of liquid wastes on to forest plantations has not been tried in Britain; Britain is leading in the field of extended aeration of wastes; ceiling-suspended battery laying cages for poultry have not been used in Britain; America has marginally better communications between professional disciplines.

E-014 Haines, M. and D.M. James. 1968. Slurry storage - under high rainfall conditions. Agriculture (London), 75: 281-284.
A 60 to 70-day storage pit constructed on a Towy Valley farm is illustrated and evaluated. Recommendations are given for the design of such storage facilities.

E-015 Riley, C.T. 1968. Wastes from the poultry industry. Agriculture (London), 75: 374-376.
The amounts of, and other pertinent information concerning, the various classes of poultry wastes are discussed under the headings of hatchery wastes, manure from layers on litter, deep litter from broilers, feathers and offal from broilers, and poultry packing station washings. The author indicates that the wastes may provide a worthwhile secondary return to the producer.

E-016 Hall, W.K. 1969. Disposal of farm waste - Mechanization. Agriculture (London), 76: 137-140.
In this report, the author classified slurry according to dry matter content and described suitable equipment for field spreading each of the classes of slurry so designated.

E-017 Hooper, H.J. 1969. The slurry problem on the farm. Agriculture (London), 76: 327-332. 4 ref. 2 fig.
This general report concerns itself briefly with the control of 5 categories of farm drainage: (1) drainage from the farm dwelling-houses; (2) surface and roof water; (3) silage effluent; (4) drainage from livestock buildings such as wash water from milking parlours; and (5) farmyard manure and slurry. The disposal of farmyard manure is elaborated upon, with references to handling it as a solid, a semi-solid or as liquid slurry. The choice of method of disposal depends upon the type of land available and the estimated installation and operating costs.

E-018 Harvey, N. 1969. Slatted floors for fattening cattle. Agriculture (London), 76: 364-367.
This article summarizes British research findings on such systems, including specific references to manure storage and handling. Some costing figures were given.

E-019 White, C. 1970. Broiler litter on Welsh coal tips. Agriculture (London), 77: 49-51.
Report on trials testing the potential use of poultry manure in the restoration of coal tips. Some useful properties of broiler litter in relation to the reclamation of derelict land include: (1) its N.P.K. value; (2) slow release of nutrients preventing quick wash-away in high rainfall areas;

(3) moisture holding capacity of the litter material; and (4) its contents of microorganisms and trace elements such as calcium (3%), manganese, cobalt and magnesium. Further trials are being conducted.

E-020 Jones, K.B.C. 1970. Farm waste disposal - amenity and good neighbourliness. Agriculture (London), 77: 165-167.
The author discusses some nuisances to city dwellers that can arise out of farming activities (odors, noise, aesthetics), and suggests how these nuisances can be minimized or abated. The rights and liabilities with regard to waste disposal in effect in Britain are summarized.

E-021 Rees, B. 1971. Industrial waste and agriculture in Glamorgan. Agriculture (London), 78: 126-128, 135.
Industrial wastes, including poultry and pig manure, are being used in the restoration of opencast mining sites. In Glamorgan, the disposal of manure from certain large scale units is undertaken by organized manure disposal groups. A considerable quantity of manure is used in the restoration of opencast coal land and derelict colliery tips with satisfactory results.

E-022 Hewgill, D. 1971. Fertilizer practice in England and Wales. Agriculture (London), 78: 282-285. 2 tab. 1 fig.
Presentation of some useful statistics on fertilizer use in Great Britain, including the percentage of cropland and grassland receiving farmyard manure.

E-023 Jones, K.B.C. 1971. Farm waste disposal - An international view. Agriculture (London), 78: 521-524. 1 fig.
General overview of livestock waste disposal, with references to opinions and experiences presented at an International Conference on the subject held in the U.S.A. in 1971. An oxidation ditch being used to treat wastes from 500 fattening pigs also was described.

E-024 McQuitty, J.B. 1964. Handling poultry manure in liquid form. Agr. N. Ire., 39: 87-89.
Description of the manure handling facilities used in a 1,500-bird 3-tier cage unit. The droppings are scraped into a cross-channel and diluted. The slurry is conveyed to a collection tank by periodic opening of sluice gates at the lower end of the channel. Design and management considerations are outlined. The merits of handling poultry manure as a slurry are discussed. The results of a trial using a chemical deodorant to reduce odor during clean-out and field spreading operations are also reported.

E-025 Bingham, A.N. 1965. Poultry manure disposal. Agr. N. Ire., 40: 112-115.
In one week, 1000 layers produce one ton of manure, containing the equivalent of 1½ cwt. sulfate of ammonia, 1 cwt. superphosphate and 1/6 cwt. muriate of potash. Possible disposal methods for poultry manure include field spreading solid manure at the rate of 2 to 2½ tons/acre, collection in pits or indoor lagoons followed by field spreading, use as a fuel, methane gas production, drying, incineration, and discharge to a public sewage plant.

E-026 McQuitty, J.B. and J.S.V. McAllister. 1965. Toxic gases from pig slurry. Agr. N. Ire., 40: 179-181.
The results of a survey of gas concentrations in slurry tanks and in piggeries

are reported. Three cases of gas poisoning are mentioned, and the concentrations of gases at those locations were measured. Concentrations of gases before agitation were low, but agitation caused marked increases in the concentrations of H_2S and CO_2, sometimes to levels above those known to be toxic. Good ventilation rapidly reduced gas concentrations after cessation of agitation. Safety recommendations are given.

E-027 Todd, W.D.M. 1967. Open slurry tanks. Agr. N. Ire., 42: 115-118.
This is a report on open-pits for pig slurry, dug into the ground and lined with concrete. Rain water (45 in./year) is allowed to fall into the pits to dilute the concentrated slurry. Slurry collected in the tanks is spread on grassland. The author considers the system to be suitable for cattle slurry as well. Safety regulations are discussed.

E-028 Ward, P.J. 1968. Pruning and manuring apple trees. Agr. N. Ire., 42: 343-347.
The two main plant foods needed by apples are nitrogen and potash. Humus is also needed, but phosphates do not appear to be important. FYM, containing nitrogen and some potash and phosphates as well as traces of elements such as manganese and magnesium, should be used on orchards where possible. A dressing of 'strawy' FYM is recommended for young orchards to conserve moisture and encourage quick rooting. FYM should be applied to established orchards each year at 15 - 20 tons/acre, the manure being supplemented with potash and nitrogen fertilizer where necessary.

E-029 Robinson, T.W. 1968. The problem of farm wastes. Agr. N. Ire., 43: 242-244.
Within the past few years, it has been realized that attention must be paid to the disposal of farm wastes to avoid pollution. The author describes two systems for collection of farm waste: (1) in a tank for liquid manure; and (2) in a pit or midden for semi-liquid manure. A system for separating contaminated farm waste water from rain water is illustrated. The problem with silage effluent is also considered and ways to avoid pollution by silage liquor are suggested.

E-030 Robinson, T.W. 1968. Disposal of farm wastes. Agr. N. Ire., 43: 277-279.
The author considers various alternatives to conventional land spreading of manure slurries and silage effluent. The idea of a sacrifice area devoted exclusively to the disposal of farm wastes is examined. Biological treatment by the activated sludge process in an oxidation ditch or aeration pit is briefly described.

E-031 Stewart, T.A. 1969. The manurial value of slurry. Agr. N. Ire., 43: 416-419.
Animal manures handled in liquid form vary widely in their manurial value. Some reasons for the variation are given and suggestions are made as to the likely levels of nitrogen, phosphate and potash to be found in cattle and pig slurries.

E-032 Stewart, T.A. 1969. Applying slurry to grassland. Agr. N. Ire., 44: 12-15.
Slurry disposal is costly, but much of the cost can be offset by its use as a

fertilizer. Some of the factors influencing the value of slurry as a fertilizer for grass are given. Slurry from 3 cows or 45 pigs can be applied on one acre.

E-033 Gordon, W.A.M. 1970. Marek's Disease. Agr. N. Ire., 44: 427-429.
The virus responsible for Marek's Disease in poultry was isolated in 1967. Poultry manure is highly infectious, the infectious agent surviving in litter for up to 16 weeks.

E-034 Stewart, T.A. 1970. Self-emptying dung channels. Agr. N. Ire., 45: 59-61.
The design and operation of self-emptying dung channels for handling the manure from beef animals fed silage and hay diets are considered. The channels worked better when handling manure from silage-fed animals as compared to hay-fed animals. Some data also are given on manure output and nutrient content of the manure produced. Phosphate levels were influenced by phosphate supplementation of the diet.

E-035 Stewart, T.A. 1970. Poultry manure as a fertilizer. Agr. N. Ire., 45: 210-212.
Most of the poultry manure produced in Northern Ireland is returned to the land. The value of poultry manure and its application to crops are discussed. Some problems with the use of poultry manure as a fertilizer are also examined.

E-036 Stewart, T.A. 1971. Manuring barley with slurry. Agr. N. Ire., 46: 193-195.
Experimental results suggest that animal slurries applied to the seed bed are an efficient source of nitrogen for barley. Some practical limitations are discussed including poor response to autumn applications, differences in response to pig, poultry and cow slurries, and the requirement for supplemental phosphate fertilizer in some cases.

E-037 Wright, D. 1971. The problem of dirty cattle and sheep. Agr. N. Ire., 46: 226-227.
Dirty cattle earn lower prices at sale time due to the extra weight loss in killing, danger of contamination during slaughtering and reduced hide and fleece value. Suggestions are made on over-wintering livestock in an effort to supply cleaner animals for market.

E-038 Ministry of Agriculture, N. Ireland. 1972. Silage effluent - An increasing problem. Agr. N. Ire., 46: 324.
Silage effluent, probably the most troublesome source of agricultural pollution, has a BOD of more than 30,000 ppm compared with a BOD of 15,000 ppm for pig slurry and 300 - 600 ppm for untreated domestic sewage. The greater proportion of silage is made during late spring and early summer when stream flow rates are low, thereby intensifying the problem.

E-039 Ministry of Agriculture, N. Ireland. 1972. Silage effluent - Collection and storage. Agr. N. Ire., 46: 360-361.
The quantities of effluent produced by grass ensiled at various moisture contents are given. Much silage made in Northern Ireland has a dry matter content of 18 - 20% and produces 20 - 40 gallons of effluent for each ton of

grass ensiled. Methods of collecting and storing silage effluent to avoid water pollution are suggested.

E-040 Ministry of Agriculture, N. Ireland. 1972. Silage effluent - Disposal. Agr. N. Ire., 46: 396.
Silage effluent is composed mostly of organic acids, minerals and sugar, but its fertilizer value is almost nil. If applied to crops at rates exceeding 2,000 gallons of diluted liquor (diluted 1:1 with water) per acre, there is danger of scorching, particularly to young leys. It was emphasized that silage effluent must not be allowed into lakes or rivers. The optimum method of disposal involves collection of the effluent in tanks along with other farm wastes for future spreading on the land.

E-041 U.S. Dept. of Agriculture. 1966. Hydroponic system for growing forage grasses with livestock wastes. Agr. Res., 15(1): 10-11.
A system of producing forages by hydroponic culture on animal waste lagoon effluents has been tried on a laboratory scale. For farm use, a hydroponic bed about 1½ ft. deep would be used. The bed would be lined with polyethylene to prevent seepage. For every 100,000 gallons of effluent, 2.2 acres of land would be required for the beds. Costs are estimated at $0.25 per 1,000 gallons of clarified liquid.

E-042 U.S. Dept. of Agriculture. 1969. Mulching poultry litter. Agr. Res., 17(11): 15-16.
Mulches of poultry litter applied to fallow lots of Cecil soil with 7% slope at rates of 10, 27, and 40 tons per acre delayed initial runoff by 20, 29, and 52 minutes, respectively. A practical application rate of 10 tons/acre resulted in no runoff and no surface water pollution from the first inch of test rain.

E-043 U.S. Dept. of Agriculture. 1969. Clear water from wastes. Agr. Res., 18(6): 10-14.
Grass-covered basins have been used successfully in Arizona to purify sewage effluent. Under proper soil and hydrogeologic conditions, plant-soil filters can cleanse 300 acre-feet or more of secondary sewage effluent per year per acre of filter. Basins seeded with common Bermuda-grass are more effective in nitrogen removal than ungrassed plots. A cycle of 14 days wet and 10 days dry is used to prevent soil pore clogging and to maintain sufficient oxygen for nitrification. Salt may be an ultimate problem.

E-044 U.S. Dept. of Agriculture. 1970. Airborne ammonia eutrophies lakes. Agr. Res., 19(2): 8-9.
ARS scientists have found that airborne ammonia from cattle feedlots near lakes and rivers may contribute more nitrogen enrichment to those bodies than runoff and deep percolation from the same sources. As much as 90% of the urinary nitrogen excreted in a feedlot can be released as ammonia directly into the air. Thirty pounds per acre of nitrogen is sufficient to eutrophy a lake 2 feet deep. Researchers found that ammonia volatilizes from feedyards and is absorbed by lakes even when both are covered with ice and snow.

E-045 U.S. Dept. of Agriculture. 1970. Litter for poultry forages. Agr. Res., 19(2): 15.
ARS scientists in Georgia undertook a project to find out how much broiler

litter could safely be disposed of on fescue and coastal Bermuda-grass without damaging the stand. Fescue was damaged by rates of poultry litter above 5 tons/acre/month. Some weedy species were more tolerant. Coastal Bermuda-grass yields increased with litter applications up to 20 tons/acre/month or one-time application of 40 tons/acre. Severe damage was noted for application of 60 tons/acre without irrigation but no severe damage occurred for 60 tons/acre with irrigation.

E-046 U.S. Dept. of Agriculture. 1970. Little pollution from flat feedlot. Agr. Res., 19(6): 10-11.
A flat feedlot with stocking rate of 400 ft^2 per animal, little manure removal, situated on highly permeable soil above a fluctuating high water table and with little surface drainage is being monitored by ARS scientists. There is little evidence of pollution in an aquifer 2 ft below the surface of the feedlot. Indications are that the 1 ft deep manure pack and the soil form a common interface that effectively bars water movement. Soil core samples were analyzed and results showed that downward movement of nitrates and other forms of nitrogen in the soil is negligible. Only twice in 2½ years did nitrate-nitrogen contents of wells next to the feedlots exceed 10 ppm. Most of the wastes have been decomposed as only 12 - 15 inches of organic matter has accumulated on the lot despite very little manure removal.

E-047 U.S. Dept. of Agriculture. 1970. Caissons aid feedlot research. Agr. Res., 19(6): 11.
Two caissons, 3½ ft in diameter by 7½ ft deep, were installed in a feedlot and in a cornfield. Under the feedlot, methane and carbon dioxide concentrations ranged from 0 to 55% and from 0 to 40%, respectively, and under the cornfield the corresponding concentrations were 0% and 0 to 1.6% respectively. Oxygen concentration in the feedlot profile ranged from 0 to 20% and stayed at 19 to 20% in the cornfield profile. High methane and carbon dioxide levels were accompanied by low oxygen and nitrogen gas concentrations, and occurred only when the feedlot surface was wet.

E-048 U.S. Dept. of Agriculture. 1971. Barn wastes for feeds. Agr. Res., 19(7): 3-4.
ARS scientists are experimenting with pelleted rations fed to sheep consisting of up to 85% barn wastes. Chemical treatments to make barn wastes, and other fibrous material, more digestible for ruminants have been tested. Untreated pellets (70% barn waste) were consumed as readily as alfalfa pellets. Digestibility increased by treating with sodium chlorite, sodium peroxide and sodium hydroxide. Ill-health has not been observed as a result of the feeding programs.

E-049 U.S. Dept. of Agriculture. 1971. Braking feedlot runoff. Agr. Res., 19(8): 5.
This article reports on two management systems that limit pollution of streams and groundwater from beef cattle feedlots which are currently under development in Nebraska. Collection basins are utilized to trap the runoff. Runoff recording equipment and groundwater sampling wells have been installed at two test feedlots. At one feedlot, steel cased wells (caissons) have been installed to a depth of 12 ft to allow a study of soil gases and pollutants moving downward under various conditions in the feedlot. Soil cores have been and are being taken for analysis.

E-050 U.S. Dept. of Agriculture. 1971. Phosphorus overrated as pollutant? Agr. Res., 19(9): 12.
Work conducted at the ARS Northeast Watershed Research Center, Univ. Park, Pa. has indicated no discernible relation between soluble inorganic phosphorus concentration and the presence or absence of algae in ponds. Of seven ponds investigated, algae grew in three and did not grow in four. The pond with the greatest algal growth had the highest average phosphorus concentration. Two ponds with concentrations greater than 15 ppb showed no algal growth but the average phosphorus concentration in a pond growing algae was about 8 ppb. All the algae-free ponds had greater average phosphorus concentrations than 8 ppb.

E-051 U.S. Dept. of Agriculture. 1971. Manure on millet. Agr. Res., 20(2): 16.
Application of 65 tons/acre of dry cattle manure in the surface 8 inches of soil had no harmful effects on root development of millet in Alabama tests; however, when the same amount of manure was applied as a continuous layer (laid as a subsurface layer to simulate plowing-in manure), millet roots were considerably restricted, probably due to inadequate oxygen supplies rather than ammonia toxicity. The nitrate content of percolating water was increased by the plowed-in layer of manure, but not by the incorporated manure. Top growth of millet was increased by both manure treatments, but the increase in growth was greater for the incorporated than for the plowed-in manure.

E-052 U.S. Dept. of Agriculture. 1971. On guard against pollution. Agr. Res., 20(3): 14.
Various sources of agricultural pollution from livestock operations are under careful investigation by ARS scientists. Dead animal disposal, anti-pollutant procedures at points-of-entry and quarantine stations, and pesticide and pesticide container disposal are considered.

E-053 U.S. Dept. of Agriculture. 1971. Poultry houses that make good neighbors. Agr. Res., 20(6): 12.
ARS scientists are experimenting with spray chambers for elimination of odor and dust emissions from poultry houses. In the spray chamber, which is located next to the exhaust fans, water combines with ammonia and other malodorous gases and carries them away in solution. Dust is also trapped by the water spray.

E-054 U.S. Dept. of Agriculture. 1972. Ventilation failure can kill birds. Agr. Res., 20(7): 15.
Birds were stressed and killed by build-up of temperature and high humidity. Ammonia and carbon dioxide levels did not appear to present a great hazard.

E-055 U.S. Dept. of Agriculture. 1972. Sugar fatal to house fly larvae. Agr. Res., 20(9): 16.
An ARS dairy scientist has tested three sugars (dextrose, lactose and sucrose), corn starch and ethyl alcohol to determine the larvicidal properties of each when mixed with manure at levels ranging from 0 to 10%. Sugar attracts house flies but will kill house fly larvae when placed in the manure where the flies breed. All the treatments except corn starch were effective against house fly larvae.

E-056 U.S. Dept. of Agriculture. 1972. Feedlot runoff on grass. Agr. Res., 20(10): 16.
Nebraska studies indicate that yearly variations in managing the runoff from beef cattle feedlots may cause differences in the response of grasses to this source of nutrients. Winter runoff in 1970 was stored in a settling basin; subsequent application of this runoff to grass seedlings promoted good forage growth and color. Winter runoff in 1969 was applied directly to grass without any attempt to remove solids from the runoff; crop growth was retarded by this treatment. It was suggested that the growth failure in 1969 was caused by ammonia toxicity and could have been averted by removing solids from the runoff, thereby allowing reduction of ammonia.

E-057 U.S. Dept. of Agriculture. 1972. Tracing feed additives in the environment. Agr. Res., 20(11): 8-9.
ARS scientists are conducting a two-phase study to examine the effects of diethylstilbestrol (growth promoting hormone), chlorotetracycline (antibiotic to prevent liver abscesses), and an organic phosphate (systemic insecticide) on cattle utilization of all-roughage diets and the fate of these additives when they leave the animal's body in the manure. The experiments are being designed to determine how much active chemical from the additives is present in the voided feces, how composting and bacterial action affect the additives, and after the wastes are spread on pasture, how the additives move through the soil profile and forage to possibly accumulate in grazing animals.

E-058 McDonald, R. 1968. Disposal of poultry manure. Scottish Agr., 47: 91-93.
Handling and disposal systems available to the poultry farmer were discussed briefly. These were: (1) the deep pit system; (2) fresh manure from layer battery cages; (3) hydraulic disposal; (4) poultry lagoons; (5) oxidation ditch; (6) anaerobic methane digestion; (7) drying; and (8) disposal to main sewers. The choice of system for a particular enterprise will depend upon various factors such as land use, site of farm, available capital, types of buildings and equipment available. Any system must not contravene regulations concerning the disposal of manure.

E-059 Herriott, J.B.D. 1969. Farm wastes. Scottish Agr., 48: 233-238.
Discussion of the waste disposal problem, including information on waste strength characteristics, and consideration of two approaches to waste management: (1) disposal without regard to the manurial value of manure; and (2) disposal for utilization of the inherent fertilizer value of manure. Recommendations were given on the handling of slurry destined for use as a grassland fertilizer. It was emphasized that waste management systems must be planned to be very effective.

E-060 Phillips, F.W. 1970. Effluent disposal. I. Sources of agricultural waste. N.Z. J. Agr., 120(3): 25-27. 3 tab. 1 fig.
General report on the total production of animal manure in New Zealand and on the rates of production of manure from hens, pigs and dairy cattle.

E-061 Phillips, F.W. 1970. Effluent disposal. II. Stream pollution. N.Z. J. Agr., 120(3): 28-29. 1 tab. 2 fig.
Review of the effects of discharging animal wastes to streams. The Manawatu River between Palmerston North and the sea has a dissolved oxygen content of

7 - 9 ppm with coliform counts ranging from 300 to 100,000/100 ml in contrast to a dissolved oxygen content of 12 ppm and coliform counts less than 300/100 ml in small unpolluted streams.

E-062 Phillips, F.W. 1970. Effluent disposal. III. Dairy wastes. N.Z. J. Agr., 120(3): 30-31, 33. 4 fig.
Discussion of various methods now practiced in New Zealand for disposal of dairy wastes: (1) pouring waste directly into streams; (2) use of a sump to catch suspended solids with uncontrolled release of liquids; (3) ponding; (4) sump and tanker spreaders; (5) manure spreader trailer; (6) pumping through an open-ended hose; and (7) spray irrigation.

E-063 Phillips, F.W. 1970. Effluent disposal. IV. Spray irrigation. N.Z. J. Agr., 120(3): 34-37. 1 tab. 10 fig.
Discussion of spray irrigation as a method for completely overcoming the problems of direct pollution from cowsheds. With a herd of 100 cows, about 280,000 gallons of waste water must be disposed of with a total fertilizer value of about 10 cwt superphosphate, 5 cwt muriate of potash and 16 cwt of ammonium sulfate. The value of this waste water if applied to grassland is estimated. Various systems for disposal of wastes by irrigation onto pasture are described. It is suggested that the key to a successful spray disposal system is keeping the grass short to reduce the chances of unpalatability of the grass.

E-064 Humm, N.R. 1970. Effluent disposal. V. Handling poultry wastes. N.Z. J. Agr., 120(4): 49-51. 3 fig.
General report on manure handling from poultry houses in New Zealand. Various poultry housing systems were discussed, with reference to the problems presented by each. Several waste handling systems were reviewed, and the alternatives for ultimate disposal were outlined.

E-065 Phillips, F.W. 1970. Effluent disposal. VI. Removal of pig wastes. N.Z. J. Agr., 120(4): 52-53, 55. 1 fig.
General discussion on swine waste disposal in New Zealand, with particular reference to liquid handling and disposal systems. Problems encountered with animal health as a result of effluent spraying onto grassland are discussed. The approximate fertilizer value of the annual waste output from 100 pigs was estimated.

E-066 Hunt, N.L. 1970. Effluent disposal. VII. Effective use of manure. N.Z. J. Agr., 120(4): 56-57. 2 tab. 3 fig.
Report on the waste utilization program adopted by a New Zealand dairy and pig farm. Installation costs and the manurial value of the effluent are given. The system used incorporates collection of slurry in a sump followed by irrigation onto grassland. It was suggested that the results obtained from land spreading of wastes are only as good as the equipment used and the common sense and discretion of the operator.

E-067 Van't Wout, P.J. and R. Kent. 1971. Cattle fattened on poultry litter. N.Z. J. Agr., 122(1): 33.
Report on one farmer's experiences with the feeding of poultry litter to steers. Litter is collected from the hen houses after the egg-laying season is over and is built into a heap and covered with a polythene cover. Steers are fed the litter in a ration of hay and barley meal. The profit realized

from feeding the litter has been estimated.

E-068 New Zealand J. Agriculture. 1971. Poultry manure diet for cattle. N.Z. J. Agr., 123(2): 117-118.
Discussion on the value of poultry litter in the ration of ruminants. Experience with Friesian steers has indicated that feed costs can be reduced by feeding poultry manure. However, litter should not be fed to young calves because of the risk of transferring salmonellae organisms. Care must be taken not to feed litter from poultry which have been fed arsenic drugs, high levels of copper or litter which has been sprayed with DDT.

E-069 Schwiesow, W.F., H.L. Brodie and H.J. Eby. 1970. Disposal of waste from swine feeding floors to minimize stream pollution. Report No. A-004-MD, Water Resources Research Center, University of Maryland, College Park, Maryland. 11 pp. 4 fig.
Report on research to investigate the feasibility of a septic disposal system with an underground distribution system as a means of eliminating runoff from swine feeding floors into surface waters. Manure was hydraulically cleaned from the feeding floors and washed into gutters leading into a septic tank. The septic tank was not adequate but performed primarily as a sedimentation tank, so that solids had to be mechanically removed. Based on field trials with 600 feet of perforated plastic drain tile, it was concluded that tile drainage fields will accept and distribute all effluent obtained from the waste handling system. Two potential problems now under investigation include clogging of the drains by accumulations of swine hairs, and possible pollution of the groundwater supply.

E-070 Alberta Department of Agriculture. 1963. Lagoons for livestock manure disposal. Bull. No. 164, Alberta Department of Agriculture, Extension Service, Edmonton. 7 pp. 4 fig.
Recommendations are given for the design and construction of lagoons to be used for swine waste disposal in Alberta. Diagrams illustrate particular aspects of the lagoon design.

E-071 Eby, H.J. 1963. Manure disposal lagoons. Agricultural Research Service Publ. No. ARS 42-75. U.S. Dept. of Agriculture. 12 pp. 34 ref. 1 tab. 1 fig.
Observations of manure disposal lagoons in Eastern and Midwestern United States and in Canada are reported. Discussion is included on types of lagoons, micro-biological decomposition processes within lagoons, construction of manure disposal lagoons, and lagoon management to avoid possible environmental contamination and to obtain the best results.

E-072 British Farming. 1970. Poultry manure into dry powder. British Farming, No. 1236/7.
Report on a batch drier designed in Britain to convert animal manures and slurry into a powder which can be used as a fertilizer or has a base for animal feedingstuffs.

E-073 British Farming. 1970. Farm waste disposal process. British Farming, No. 2734/7.
Report on a waste disposal process designed by a British firm which incorporates a large aeration basin, a settling tank and an irrigation system. Some of the

purified water is recycled for washing down the yards.

E-074 Schwiesow, W.F. 1971. State regulations pertaining to livestock feedlot design and management, December 1970. Agricultural Research Service Publ. No. ARS 42-189. U.S. Dept. of Agriculture. 8 pp. 1 tab. 1 fig.
Report on the status of 46 states in the U.S.A. regarding regulations governing feedlot construction and operation. Of the 46 states, 7 had specific regulations, 5 were currently developing regulations, 16 were regulated through existing water quality standards or public health requirements, and 18 had no specific regulations applicable to feedlots. An addendum to this report has since been published in which it is reported that the status of 11 states regarding feedlot regulations had changed by September 1971.

E-075 McAllister, J.S.V. and J.B. McQuitty. 1965. Release of gases from slurry. Rec. Agr. Res. Minist. Agr., N. Ire., 14, Part 2: 73-78. 8 ref. 131 tab.
"Heavy casualties among fattening pigs have occurred on a few farms in Northern Ireland while slurry tanks were being emptied. These deaths have been attributed to gas poisoning. The critical factors were evidently agitation of the contents of full or nearly full storage tanks under conditions where any gases released could escape directly back into the piggery. The effects of agitating stored slurry on the composition of the atmosphere in collection tanks and piggeries has been studied in a survey over 20 farms in Northern Ireland. The concentrations of carbon dioxide, methane and ammonia recorded during agitation, did not reach the levels normally considered toxic to man. The concentration of hydrogen sulphide, after a brief period of agitation, was often higher than the accepted toxic level."

E-076 Berglund, S., L. Djurberg and A. Hédren. 1964. Djurhållningen och vattenvården i jordbruket. (Water pollution control on livestock farms.) Meddelande nr. 306, Jordbrukstekniska Institutet, Uppsala. 143 pp. 31 tab. 37 fig.
Topics discussed in this bulletin included: (1) the polluting effects of urine and silage effluent; (2) the existing Swedish legislation and their application to agriculture; (3) the chemical properties and expected production of urine and silage effluent; (4) the collection of urine in special storage tanks; (5) design of practical liquid handling systems; (6) purification of liquid wastes by soil filtration; (7) the fertilizer value of liquid manure and silage effluent; (8) design criteria for drainage pipes for urine, silage effluent and liquid manure; (9) siting, choice of materials, calculation of capacity and design of storage tanks; (10) types of pumps and factors affecting their application; (11) land application of liquid wastes by irrigation equipment; (12) land spreading equipment; (13) special problems involving very large-scale animal production; and (14) the economics of waste disposal and evaluation of the alternatives. Several noteworthy conclusions were drawn.

E-077 Berglund, S., G. Aniansson and I. Ekesbo. 1965. Hantering av flytande gödsel. (Liquid manure handling.) Meddelande nr. 310, Jordbrukstekniska Institutet, Uppsala. 143 pp. 13 tab. 48 fig.
Report on studies of liquid manure handling systems in Sweden. The characteristics of liquid manure and the absorbancy of bedding materials were determined.

Special problems arising from the handling of manure in liquid form were discussed, including release of toxic gases. Four distinct systems for handling liquid manure were described and their applications to the housing of cattle, swine and poultry were discussed. Various types of handling equipment, including pumps and tanker spreaders, were described. An economic analysis indicated that the initial investment of liquid manure systems is greater, but the annual operating cost is lower, than that of mechanical cleaning of solid manure.

E-078 Skarp, S.U. 1971. Säkrare flytgödselhantering - Gödselanläggningens utformning och skötsel. (Safer handling of liquid manure - design and operation of installations for liquid manure.) Meddelande nr. 338, Jordbrukstekniska Institutet, Uppsala. 54 pp. 37 fig.
Report of investigations into the behavior of manure gases and the incidence of high gas concentrations in livestock buildings. Advice was given on how liquid manure installations should be designed and managed to prevent manure gas poisoning.

E-079 Swedish Institute Agricultural Engineering. 1968. Aktuellt från Jordbrukstekniska Institutet, Årsberättelse 1967/68. (Annual report of the Swedish Institute of Agricultural Engineering, 1967/68.) Meddelande nr. 327, Jordbrukstekniska Institutet, Uppsala. 47 pp.
Report on research conducted by the Swedish Institute of Agricultural Engineering, including a section on manure gases and ventilation. Investigations into the release of toxic manure gases into housing areas, identification of individual toxic and odorous compounds, and the effect of various ventilation systems on the gas concentrations in buildings were reported.

E-080 Swedish Institute Agricultural Engineering. 1969. Aktuellt från Jordbrukstekniska Institutet, Årsberättelse 1968/69. (Annual report of the Swedish Institute of Agricultural Engineering, 1968/69.) Meddelande nr. 332, Jordbrukstekniska Institutet, Uppsala. 50 pp.
Report on research conducted by the Swedish Institute of Agricultural Engineering, including a section on manure gases and ventilation, and on the handling of liquid manure. Investigations into the concentration and distribution of manure gases, and the effect of various ventilation systems on gas concentrations were reported. Some discussion was included on manure pits and aeration of liquid manure in such pits by compressed air.

E-081 Swedish Institute Agricultural Engineering. 1970. Aktuellt från Jordbrukstekniska Institutet, Årsberättelse 1969/70. (Annual report of the Swedish Institute of Agricultural Engineering, 1969/70.) Meddelande nr. 337, Jordbrukstekniska Institutet, Uppsala. 38 pp.
Report on research conducted by the Swedish Institute of Agricultural Engineering, including a section on manure gases and ventilation and the handling of liquid manure. Management systems to reduce odors and gases produced by liquid manure were discussed. Storage facilities were also described.

E-082 Swedish Institute Agricultural Engineering. 1971. Aktuellt från Jordbrukstekniska Institutet, Årsberättelse 1970/71. (Annual report of the Swedish Institute of Agricultural Engineering, 1970/71.) Meddelande nr. 342, Jordbrukstekniska Institutet, Uppsala. 40 pp.

Report on research conducted by the Swedish Institute of Agricultural Engineering, including a section on manure gases and ventilation and the handling of liquid manure. Particular references were made to studies on the effectiveness of various odor control measures including aeration, chemical or enzyme treatment, regular agitation of anaerobic storages and covering or burying immediately after field spreading. The special problems encountered with manure handling on farms with large numbers of animals were discussed.

E-083 Jones, D.D., D.L. Day and A.C. Dale. 1971. Aerobic treatment of livestock wastes. Bull. No. 737, Agricultural Experiment Station, Urbana, Illinois. 55 pp. 46 ref. 4 tab. 26 fig.
A complete review of the aerobic method of storage and treatment of livestock waste. An introduction to the theory of aerobic treatment is presented along with the results of several laboratory and field experiments with oxidation ditches and aerobic lagoons in North America and Europe. Recommendations for the design and operation of oxidation ditches and associated equipment are presented. Effective odor control is the major advantage of aerobic treatment of livestock wastes.

E-084 McQuitty, J.B., J.A. Robertson and E.M. Barber. 1971. Feedlot pollution - A literature review. Research Bulletin 71-2, Dept. Agr. Eng., Univ. Alberta, Edmonton, Alberta. 48 pp. 114 ref.
Review of recently published literature directly concerned with pollution aspects of feedlots. Feedlot runoff, groundwater contamination, pollution from airborne substances, pollution arising from feed storage and processing, health hazards and solid waste management were discussed. Future considerations, recommendations and research needs were presented in the concluding section.

E-085 Waldeigh, E.H. 1968. Wastes in relation to agriculture and forestry. Miscellaneous Publication No. 1064, U.S. Dept. of Agriculture. 112 pp. 139 ref.
Literature review giving consideration to radioactive substances, chemical air pollutants, airborne dusts, sediments, plant nutrients, inorganic salts and minerals, organic wastes, infectious agents and allergens, agricultural and industrial chemicals, and heat as pollutants, the importance of the problems posed by each, the extent to which agriculture and forestry are involved in the overall pollution problem, the contributions made to date to ameliorate the problems and areas requiring further research.

E-086 Robbins, J.W.D., D.H. Howells and G.J. Kriz. 1971. Role of animal wastes in agricultural land runoff. Water Pollut. Contr. Res. Ser. No. 13020 DGX 08/71, U.S. Environmental Protection Agency. 114 pp. 75 ref. 9 tab. 29 fig.
"Twelve typical agricultural areas representing three types of animal waste management techniques--lagooning, direct discharge into streams and land spreading including pasture and drylot units--were studied to determine the amounts of and factors governing stream pollution from swine, dairy, beef, and poultry production operations. More than 1500 stream and lagoon effluent samples were collected with an automatic sampler developed for the study. The samples were analyzed for bacteria, nutrients, and degradable organics. Hydrological and waste management data were also collected...."

E-087 Ngoddy, P.O., J.P. Harper, R.K. Collins, G.D. Wells and F.A. Heidar. 1971. Closed system waste management for livestock. Water Pollut. Contr. Res. Ser. No. 13040 DKP 06/71, U.S. Environmental Protection Agency. 111 pp. 19 ref. 20 tab. 28 fig.

"The vibrating screen separator is examined for liquid-solid separation of livestock wastewater. A general procedure for performance analysis and estimation of this type of dewatering apparatus is developed and verified using methods of dimensional analysis. Tests on swine and beef cattle wastewaters show that the resistant or slowly biodegradable solids are effectively removed on vibrating screens ranging in mesh size from #60 to #120. Although it is measurably less efficient than conventional dewatering devices such as centrifuges and vacuum filters, the gravity dewatering screen separator is better suited to the economic scale of the average livestock operation.... The salient aspects of this study are integrated into candidate confinement livestock waste management designs."

E-088 Miner, J.R. (ed.). 1971. Farm animal-waste management. (North Central Regional Research Publication 206), Special Rep. 67, Iowa Agricultural Experiment Station, Ames, Iowa. 44 pp.

"Current practices, technology, knowledge, and research results are summarized as related to the management and disposal or use of farm animal wastes in the 13 states of the North Central Region and other cooperating states. Among alternative systems of management and treatments described, attention is given to relative effectiveness in eliminating or minimizing detrimental environmental and ecological consequences. Detailed information is included on the biology and biochemistry of waste treatments; characteristics of animal wastes, including biological, physical, and chemical properties; aerobic, anaerobic, and combined treatments of animal wastes; composting, incineration, dehydration, and hydroponics; and actual and potential productive utilization of animal wastes. Needs for additional research are suggested."

E-089 Witzel, S.A., O.J. Attoe, E. McCoy, L.B. Polkowski and K. Crabtree. 1970. A study of farm waste - Farm animal waste: characterization, handling, utilization. Agr. Eng. Dept. Supplementary Report, Wisconsin University, Madison, Wisconsin. 141 pp. 6 ref.

"The farm animal waste problem in Wisconsin is multifaceted. Not only are there the usual aspects like kinds of animal manures, differences in farming practices (including size of herds, feeds and manner of feeding) but also there are problems because of the geographic location of the state. Its long cold winters enforce at least a consideration of 4 - 6 months of storage to avoid spreading of manure on frozen ground. Secondly, its glaciated soils present locally different bedrock and soil permeability. In the southern half of the state where both farming and population are concentrated, the waters are hard and fractured limestone formations underlie much of the area. Attention is now being called to the possible pollution of groundwater. And lastly, Wisconsin is a state of lakes and streams, many of which are undergoing critical eutrophication. Farm manure and fertilizer are being blamed at least in part, and thus surface water run-off, enriched by manure spread on hilly land, is a special problem."

E-090 Easton, P.H. and C.N. Harvey. 1965. Slatted floor systems for pigs - A review of research literature to 31st December 1964. Occasional Paper No. 2, Agr. Res. Council, Farm Bldgs. Unit, Silsoe, Bedford. 24 pp. 68 ref.

The system of slatted floors for pigs was described, including sections dealing specifically with manure storage and disposal.

E-091 Livingston, H.R. 1965. Slatted floors - An investigation into the use of slatted floors for dairy cows, heifers and fattening cattle. Exp. Farm Bldgs. Rep. No. 3, Agr. Res. Council, Farm Bldgs. Unit, Silsoe, Bedford. 16 pp. 6 ref.
The system of slatted floors for cattle, particularly dairy cattle, was investigated at 26 installations in 4 years of trials. Methods of manure disposal were reported, including the removal of semi-liquid (14% dry matter) manure with a 4-inch grain auger. The use of slatted floors for dairy cows was discontinued in eight out of eleven schemes tried.

E-092 Livingston, H.R. 1966. Slatted floors for beef breeding herds. Exp. Farm Bldgs. Rep. No. 7, Farm Bldgs. Dept., Nat. Inst. Agr. Eng., Silsoe, Bedford. 6 pp. 2 ref.
The system of slatted floors for beef breeding herds was investigated at 5 installations during 2½ years of trials. Manure storage, buildup and removal were studied and the results reported. Removal of manure took 20 - 45 man-min per month per cow-and-calf housed. The system of slatted floors appeared to be satisfactory from a labour and health point of view.

E-093 Livingston, H.R. and A.M. Robertson. 1967. Partially slatted floors and floor feeding in pig fattening houses. Exp. Farm Bldgs. Rep. No. 8, Farm Bldgs. Dept., Nat. Inst. Agr. Eng., Silsoe, Bedford. 11 pp. 11 ref.
The system of partially slatted floors in pig fattening houses and the incorporation of floor feeding in the management system were investigated at 10 installations over a 3-year period. Sections of the report dealt with manure storage and disposal and pen sanitation. Floor feeding, in conjunction with partially slatted floors, kept the pens clean and reduced the daily manure handling chore.

E-094 Forsyth, R.J. and J. Adams. 1966. Investigation into the flow of slurry in a slatted-floor drainage system at the Animal Husbandry Unit, The West of Scotland Agricultural College. Farm Bldg. Rep. No. 1, Scottish Farm Bldgs. Investigation Unit, Aberdeen. 14 pp.
The results of trials to measure the flow of slurry in three channels of different cross-sections are reported. All three channels had the same bottom slopes. Two of the channels had rectangular cross-sections and differed only in the depth of the channel. A third channel was V-shaped with a half-round glazed-tile bottom, this shape proving to be the most efficient from the aspect of self-cleaning. The rectangular channels were less costly per unit of storage capacity and were more easily fitted with sluice gates. All channel designs are illustrated including details of structural shape and materials.

E-095 Baxter, S.H., R.A. Pontin and J.S. Watson. 1966. Development of a prefabricated feeding piggery with waste treatment in Pasveer-type oxidation ditches. Farm Bldg. Rep. No. 2, Scottish Farm Bldgs. Investigation Unit, Aberdeen. 30 pp.
Interim results of trials with aerobic stabilization of piggery wastes from a prefabricated panel frame building. Attempts were made to measure noxious gases and dust in the building but equipment available was inadequate. A

primary oxidation ditch was installed beneath the slatted floor of the piggery, the effluent from this passing into a secondary ditch outside the piggery. Experience with rotors is reported, including reference to oxygenation capacity and the effects of intermittent operation. Operation features of both ditches are discussed, including foaming, odor, freezing problems and composition of the effluents. Suggestions for further research are given.

E-096 Baxter, S.H. 1967. A study of stall housing for dry and in-pig sows. Farm Bldg. Rep. No. 3, Scottish Farm Bldgs. Investigation Unit, Aberdeen. 51 pp. 27 ref.
A section of this report concerned itself with patterns of defecating and urinating of sows in stalls. Sows tended to defecate and urinate on average twice per day, just after feeding and just after periods of prolonged rest. On average, the quantity of urine and feces voided per day by a stall-housed sow were 1.0 - 1.5 gallons and 2.5 - 5.0 lb, respectively. Moisture content of the feces varied from 62% to 74% but was independent of water intake by the sow. Some limited data were given on manure disposal costs and labour requirements.

E-097 Baxter, S.H. 1969. The environmental complex in livestock housing - a review. Farm Bldg. Rep. No. 4, Scottish Farm Bldgs. Investigation Unit, Aberdeen. 62 pp. 169 ref.
Problems encountered in defining the environment in livestock production buildings are discussed, including a detailed review of the problems caused by the non-thermal environment. The effects of noxious gases, odors, dust and bacterial content on animals, humans and equipment are discussed. The author suggests a bio-climatic approach to the design of ventilation systems for livestock buildings.

E-098 Robertson, A.M. 1970. The treatment of animal wastes. Farm Building Progress, No. 21, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 15-20. 11 ref.
Some methods of animal waste disposal, both anaerobic and aerobic, are discussed, with special emphasis on possibilities for re-use. Research projects on animal waste management currently being undertaken by the Scottish Farm Buildings Investigation Unit are outlined in some detail.

E-099 Robertson, A.M. 1970. Pig housing - Future developments. Farm Building Progress, No. 22, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 21-31. 24 ref.
In a section on waste disposal, the author indicates that the choice of waste disposal system in the future will dictate the choice of housing system used for all classes of pigs. Constraints likely to be placed on pig producers include government legislation against pollution and noxious gases, and availability of labour. Labour requirements with different flooring systems are given. A major development in the future must be the design of systems to produce waste effluents to satisfy certain legal requirements.

E-100 Tannahill, J. 1971. Farm waste disposal - Legal requirements. Farm Building Progress, No. 25, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 19-23.
The Rivers Acts (Scotland) of 1951 and of 1965 are discussed in view of how

they pertain to farm wastes. Under the Acts, it is unlawful for farmers to deposit refuse on any land so that it falls or is carried into a stream. Farmers making discharges of farm effluent to a stream must apply to the river pollution authority for consent to do so. River Boards generally encourage confinement of farm wastes and their disposal on the land and insist that toxic or highly polluting discharges such as silage liquor and piggery wastes be excluded from farm effluent entering streams.

E-101 Wight, H.J. and A.M. Robertson. 1971. Manure storage tanks. Farm Building Progress, No. 25, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 31-36. 1 ref.

The design and construction costs of manure storage tanks are examined. An important first step in the choice of storage facilities is to relate the size of the storage tank to the daily output of the animals being housed and the proposed period of storage. Daily output of urine and feces from various classes and weights of livestock are tabulated.

E-102 Scottish Farm Buildings Investigation Unit. 1971. 370-cow dairy unit. Farm Building Progress, No. 27, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 11-15.

This report on a newly built unit contained reference to manure collection and storage. Manure is scraped twice daily from the passages between the cubicles into a central slatted passage. All slurry and wash water pass into the central slurry channel, which is divided into three parts by two sluice gates. This channel empties into a sump from which slurry is pumped into tanker spreaders or into one of the two above-ground tanks of glass-lined steel, each of which holds 680 m^3 or about 14 weeks' storage between the two of them.

E-103 Robertson, A.M. 1971. Effect of ventilation on the gas concentration in a part-slatted piggery. Farm Building Research & Development Studies, No. 1, Scottish Farm Bldgs. Investigation Unit, Aberdeen. pp. 17-28. 21 ref.

"Report on investigations into the effect of ventilation on H_2S, NH_3 and CO_2 present in the atmosphere of a growing/finishing piggery with slatted dung passage. Distribution of gases within the piggery depended on air movement, while gas concentrations depended on ventilation rate and increased with the volume of manure in the channel."

E-104 National Institute of Agricultural Engineering. 1966. N.I.A.E. tests of slurry handling equipment. Report No. 527, Nat. Inst. Agr. Eng., Silsoe, Bedford.

Explanatory report for purposes of introducing a series of tests on slurry handling equipment. Slurry characteristics were discussed as they relate to handling. Procedures used in the testing of various types of slurry handling equipment were reviewed. Results of tests on manure tankers, slurry pumps, augers, conveyors and ancillary equipment were published in later reports, including the following: Reports Nos. 535, 538, 547, 549, 550, 567, 568, and 571.

E-105 Bell, D.D., W.R. Bowen, A.S. Deal and E.C. Loomis. 1965. Diazinon dust for fly control in poultry manure. Calif. Agr., 19(2): 8-9. 3 fig.

"Tests conducted over a three-year period show that dust made from Diazinon

50% wettable powder and agricultural gypsum will successfully kill domestic flies on poultry ranches. Best results were obtained when the dust was applied at weekly intervals to droppings beneath the poultry cages of commercial layer houses. These treatments gave good control of the little house fly (Fannia canicularis) and the false stable fly (Muscina stabulans), but failed to control the house fly (Musca domestica)."

E-106 McKell, C.M., V.W. Brown, R.H. Adolph and R.L. Branson. 1965. Chicken manure as rangeland fertilizer. Calif. Agr., 19(6): 6-7. 3 fig. 2 tab.
"Preliminary studies indicate that utilization of chicken manure as a rangeland fertilizer is a possibility, especially in areas of nitrogen and phosphorus deficiency."

E-107 Legner, E.F., E.C. Bay, H.W. Brydon and C.W. McCoy. 1966. Research with parasites for biological control of houseflies in southern California. Calif. Agr., 20(5): 10-11. 4 fig.
Report on studies to determine the effectiveness of Muscidifurax raptor and Spalangia endius as parasites on house fly pupae in poultry manure, and to study the effects of mass releases of parasites introduced from the midwest and West Indies. The introduction of new exotic species of larval and pupal parasites and the artificial distribution of existing parasites appear to offer the most immediate means for a more successful biological control effort in Southern California, especially against Musca domestica. Existing species are not as effective against M. domestica as they are against Fannia and certain other species.

E-108 May, D.M. and W.E. Martin. 1966. Manures are good sources of phosphorus. Calif. Agr., 20(7): 11-12. 3 tab.
"Animal and poultry manures are often evaluated on the basis of their nitrogen content. Field experiments in the Antelope Valley on producing alfalfa fields have shown that poultry, steer, and dairy manure are also good sources of phosphorus. In this study, yield comparisons were made between treble superphosphate and manures when applied in amounts to provide the same rates of phosphorus as conventionally used on alfalfa."

E-109 Legner, E.F. and G.S. Olton. 1968. The biological method and integrated control of house and stable flies in California. Calif. Agr., 22(6): 2-4. 8 fig.
"Full utilization of the biological method in fly control requires the preservation of existing predatory and parasitic enemies in animal dung. The use of residual poisons to control adult flies did not interfere with natural enemy complexes in these tests. Alternating the removal of manure deposits, and abstaining from chemical treatment of manure were essential procedures in maintaining largest populations of predators and parasites."

E-110 Baker, N.F., J.B. Burgess and G.L. Crenshaw. 1968. Gastrointestinal parasitism of lambs. . . . A survey of Imperial Valley feeder lambs. Calif. Agr., 22(11): 9-10. 3 fig.
Forty individual fecal samples were collected at random from several flocks of sheep for quantitative determinations of the number of parasite eggs per gram of feces. The data collected indicate that under the management conditions of Imperial Valley, no significant exposure to and/or build-up of roundworm parasites in the gastrointestinal tract of lambs takes place.

When clinical parasitism occurs, it is usually the result of the purchase of parasitized animals.

E-111 Van Dam, J. and C.A. Perry. 1968. Manure management - costs and product forms. Calif. Agr., 22(12): 12-13. 2 tab. 2 fig.
Report on a study to determine the actual cost of removal and disposal of manure from a beef feedlot in Los Angeles County, California. Manure was prepared for market in three basic forms (unprocessed, processed bulk, and packaged processed) and sold under four pricing conditions. The processing plant used incorporated a vibrator screen separator and a pulverizer. The study confirmed that there is a market for various product forms and that a livestock operator can probably make a profit from the sale of manure.

E-112 Stephens, E.R. 1971. Identification of odors from cattle feed lots. Calif. Agr., 25(1): 10-11. 2 ref. 1 fig.
Report on laboratory trials to investigate sampling procedures for field analysis of odors, to devise analytical odor identification techniques that might be useful in the laboratory, and to evaluate the concentration of several compounds necessary to produce an odor response in human subjects. The most important odorous compounds in feedlot air were the low molecular weight amines. Several of the analytical methods studied showed considerable promise toward a practical means for field study of odors. Perhaps the best of these was paper chromatography.

E-113 Adriano, D.C., P.F. Pratt, S.E. Bishop, W. Brock, J. Oliver and W. Fairbank. 1971. Nitrogen load of soil and groundwater from land disposal of dairy manure. Calif. Agr., 25(12): 12-14. 5 fig.
Report on deep drilling of soil profiles in the Chino-Corona dairy area to determine the nitrate concentration in drainage water underneath pastures and cropland to which dairy manure had been applied. Values for nitrate concentrations which were estimated on the basis of excreted nitrogen and crop uptake of nitrogen, agreed well with measured values. Research needs were outlined. (Note: article contains errors as it appears in the original; corrected copy is available on request from publisher.)

E-114 Adriano, D.C., P.F. Pratt, F.H. Takatori, K.M. Holtzclaw and J.B. Johanson. 1972. Nitrate concentrations in the unsaturated zone beneath some selected row-crop fields. Calif. Agr., 26(2): 8-10. 1 tab. 1 fig.
In the spring of 1971, three holes at least 200 ft apart and to a depth of 50 ft (or water table) were drilled at nine sites in the Santa Ana Drainage Basin, and soil samples were analyzed for nitrate-nitrogen. Each of the sites had received varying amounts of commercial fertilizer and manure for a number of years. The average NO_3-N concentrations in the drainage water in the unsaturated zone were all above 10 ppm (range from 36 to 123 ppm). The amount of NO_3-N in drainage water was affected by N inputs, crop removal of N, drainage volume, and gains and losses of NO_3-N.

E-115 Meyer, J.L., E. Olson and D. Baier. 1972. Manure holding ponds found self-sealing Calif. Agr., 26(5): 14-15.
". . . This report outlines some preliminary findings in a study of operation of waste ponds, and delineates subsequent necessary research to evaluate their total impact on the environment. The most significant of these preliminary findings was that there was hardly any seepage of water from manure-

laden ponds in this study, and that artificial seals were not needed under these soil conditions."

E-116 Muehling, A.J. 1969. Swine housing and waste management - a research review. Publ. No. AEng-873, Dept. Agr. Eng., Univ. Illinois, Urbana-Champaign, Illinois. 91 pp. 232 ref.
Comprehensive summary of research findings in the area of swine housing and swine waste management. Topics covered in the section on waste management were: (1) daily waste production rates and physical, chemical and biological properties of swine wastes; (2) returning wastes to the land for their fertilizer value; (3) anaerobic and aerobic treatment of hog wastes; (4) other methods of disposal, including dehydration, incineration, composting and refeeding; (5) gases and odors from stored manure; (6) legal implications of waste handling; and (7) recommendations for future hog waste management research.

E-117 Ministry of Agriculture, N. Ireland. 1967. Annual Report. Ministry of Agriculture, N. Ireland.
Report on research activity of the Research Divisions, Agricultural Colleges and Experimental Centres of the Ministry of Agriculture for Northern Ireland, including: (1) the effect of additions of animal slurry to soil on the soil microflora; (2) the effectiveness of pig slurry as a complete fertilizer for the production of grass from permanent pasture; (3) the effect of time and rate of application of cow, pig and poultry slurry on the yield of barley; (4) the development of a rapid method for the determination of available nitrogen in animal slurries; and (5) evaluation of poultry manure as a nitrogen fertilizer.

E-118 McQuitty, J.B. 1964. A slatted-floored multi-purpose building. Agr. N. Ire., 38: 282-285. 2 fig.
Report on the construction and operation of a building designed to be used at different times of the year for ewes, calves and hay drying. The building was constructed with fully slatted floor, removable exterior walls and portable partitions. Manure was mechanically removed from the installation during the first period of use, but has since been hydraulically removed and distributed by an organic irrigation system. The experimental house has proved successful for housing of calves, indoor wintering of ewes and lambs, handling and clipping of sheep, barn hay drying, and in-sack drying of rye-grass seed and seed grain, thereby spreading the capital cost over more than one enterprise.

E-119 Hileman, L.H. 1967. The fertilizer value of broiler litter. Report Series 158, Agricultural Experiment Station, Fayetteville, Arkansas. 12 pp. 7 ref. 8 tab. 1 fig.
Report on a study to determine the chemical composition of broiler house litter and to investigate some of the factors influencing its quality when used as a fertilizer material. The value of broiler litter was estimated, based on its NPK content. Significant quantities of secondary and micro-nutrient elements are also contained in broiler manure. The fertilizing value of litter was not affected by litter source, depth of litter, or bird density. For pastures and meadows, an application rate of 2-3 tons/acre of broiler litter was recommended.

E-120 Rollo, C.A., J.R. Howes and W. Grub. 1969. Dust production of

poultry litter materials. Circular 169, Agricultural Experiment Station, Auburn, Alabama. 15 pp. 2 ref. 4 tab. 9 fig.
Report on studies to determine the origin of dust in poultry houses, its composition, and the quantity produced. Two types of dust particles were identified on the basis of shape. Dust production was found to be a function of the type, age and breed and strain of birds, the form in which feed is offered, the method of housing, density of floor-housed birds, type and age of litter material, illumination schedule and bird activity, atmospheric humidity and ambient temperature, and the ventilation and filter system used.

E-121 Ware, L.M. and W.A. Johnson. 1968. Poultry manure for vegetable crops - effects and value. Bulletin 386, Agricultural Experiment Station, Auburn, Alabama. 31 pp. 8 ref. 17 tab.
Report on studies conducted with poultry manure over a period of 5 years to determine initial and residual effects and comparative effects of poultry manure and commercial fertilizer. The effects of manure on the yields, grade, maturity and size of tomatoes were reported. In years of normal rainfall, manure gave higher yields than commercial fertilizers but in seasons of high rainfall, the reverse was found to occur. Commercial fertilizers increased soil acidity whereas manure did not. The fertilizer value of manure for tomatoes and turnips was estimated.

E-122 Hammond, D.M. and D.E. Worley. 1969. Regional research in nematode parasites of ruminants in the Western United States - a 10-year summary, 1958-1968. Bulletin 480, Utah Agricultural Experiment Station, Logan, Utah. 25 pp. 125 ref.
Review of findings and publications arising from a regional investigation of internal parasites of ruminants in the Western United States. Factors influencing the survival of nematode eggs and larvae in feces include temperature, humidity, forage species, season of deposition, snow cover, and species of nematode. The influence of management practices on nematode infestations, prophylactic and therapeutic measures, effects of parasitism, immunity and resistances, physiology of parasites, and biology, life history and host specificity of nematodes were also discussed.

E-123 Kesler, R.P. and R.A. Hinton. 1966. An economic evaluation of liquid manure disposal from confinement finishing hogs. Bulletin 722, Agricultural Experiment Station, Urbana, Illinois. 28 pp. 13 ref. 15 tab. 6 fig.
Report on a study to compare and evaluate total hauling and spreading (Method A), total lagooning (Method B), and partial hauling and spreading and lagonning (Method C) for handling swine manure. A survey of 13 farm liquid manure disposal systems was made to collect data on the quantity of liquid manure for handling, equipment and labor requirements, and investment and operating costs. Methods A, C, and B provided least cost disposal methods in that order. The effects of size of hog operation, wage rate, fertilizer prices and nutrient recovery rate on the selection of the optimal system were discussed.

E-124 Papanos, S. and B.A. Brown. 1950. Poultry manure: Its nature, care and use. Bulletin 272, Storrs Agricultural Experiment Station, Storrs, Connecticut. 51 pp. 33 ref. 25 tab. 2 fig.
Report on 3 years of investigations on the nature, care and use of poultry

manure. Losses occurring to poultrymen from improper use of manure include the opportunity cost of not using the manure as a fertilizer and the direct losses from increased disease caused by ammonia escaping from the manure. Laboratory experiments were conducted to determine the chemical composition of hen manure, and to investigate means for reducing the nitrogen losses from stored poultry manure. The results of 3 years of fertilizer trials with fifteen crops were reported, including recommended rates of application for the various crops.

E-125 Bailey, W.A., W.A. Junnila, W.A. Aho and W.C. Wheeler. 1957. A heated septic tank for disposal of dead poultry. Progress Report 21, Storrs Agricultural Experiment Station, Storrs, Connecticut. 7 pp. 6 fig.
Report on laboratory and field investigations of the heated septic tank for disposal of dead poultry. At 100°F, the breakdown period for dead chickens in a 55-gallon tank was about 20 days. Construction of a 950-gallon tank was described. The tank digested about 4,000 pounds of birds in its first year of operation at a cost comparable to other methods of disposal. The temperature dependence of this method of disposal was noted.

E-126 Frink, C.R. 1970. Plant nutrients and animal waste disposal. Circular No. 237, Connecticut Agricultural Experiment Station, New Haven, Conn. 10 pp. 13 ref. 1 tab. 1 fig.
Review of the problems posed by plant nutrients in wastes. A nutrient balance was given illustrating the relative amounts of plant nutrients from various sources in Connecticut. Animal wastes contain about as much nitrogen and half as much phosphorus as human wastes in the State. Since present treatment systems used for animal wastes do not adequately remove plant nutrients, application onto land will probably continue to be the most satisfactory method of disposal. Research priorities include research on assessment of the pollution implications of animal wastes, research on reduction of nitrogen losses from storage and handling of farm manure, and research to develop new agronomic practices and new animal and plant breeds for improved nitrogen utilization.

E-127 McKiel, C.G., W.K. Durfee and R.W. Gilbert. 1969. Storage of liquid manure under caged layers. Bulletin 398, Agricultural Experiment Station, Kingston, Rhode Island. 9 pp. 4 ref. 3 tab. 1 fig.
Report on studies to investigate the storage of poultry manure liquid in indoor lagoons. The influence of storage tank water depth on the rate of solids accumulation was discussed in relation to sizing of indoor lagoons. Limited heating of the tanks did not appreciably reduce the rate of solids accumulation. Odors from the experimental units were considered offensive and were not reduced by addition of moderate amounts of hydrated lime. Flies were generally not a problem in the building or in the manure pits; they did tend to congregate outside the building near the exhaust of the ventilation system, suggesting that they were attracted by the odor.

E-128 Soil Conservation Service. 1970. Disposal lagoon. Engineering Standard and Specifications, Soil Conservation Service (Arkansas), U.S. Dept. of Agriculture. 12 pp. 2 tab. 4 fig.
"This Standard establishes the minimum acceptable quality for design and construction of disposal lagoons located to serve predominantly rural or agricultural areas. Final plans for construction of a lagoon designed

according to this standard must be approved by an engineer."

E-129 Soil Conservation Service. 1970. Animal wastes pollution abatement system. Engineering Standard and Specifications, Soil Conservation Service (Arkansas), U.S. Dept. of Agriculture. 6 pp.
"This Standard includes, within practical limitations, any conservation practice presently covered by SCS standards and specifications which are needed to minimize erosion and control runoff either through, across, or from within confined feeding or holding areas. Such practices may include, but are not limited to terraces, diversions, waterways, closed conduit outlets, lined or unlined channels, debris basins, or settling tanks, pipelines, holding ponds, lagoons and dams for specific purposes."

E-130 Soil Conservation Service. 1970. Liquid manure tank. Engineering Standard and Specifications, Soil Conservation Service (Arkansas), U.S. Dept. of Agriculture. 3 pp.
"This Standard establishes the minimum acceptable quality for design and construction of a liquid manure tank to serve as an integral part of a liquid manure disposal system. The storage tank may be a separate container or it may be a part of the livestock facility such as a trench or pit under a slotted floor."

E-131 Soil Conservation Service. 1970. Disposal lagoon. Engineering Standard, Specifications and Notekeeping, Soil Conservation Service (Louisiana), U.S. Dept. of Agriculture. 16 pp. 1 tab. 5 fig.
"This standard establishes the minimum acceptable quality for design and construction of disposal lagoons located to serve predominantly rural or agricultural areas. A set of plans shall be prepared for each lagoon system."

E-132 Soil Conservation Service. 1971. Disposal lagoons for no-discharge anaerobic lagoons for livestock and poultry. Engineering Standard, Soil Conservation Service (South Carolina), U.S. Dept. of Agriculture. 19 pp. 3 tab. 7 fig.
A recommended code of practice concerned with the design, construction, operation, and maintenance of no-discharge anaerobic lagoons in South Carolina. A permit to operate a lagoon system is required by the South Carolina Pollution Control Authority. The construction of new installations is carefully controlled and inspected by the Soil Conservation Service and the Pollution Control Authority.

E-133 Appell, H.R., Y.C. Fu, S. Friedman, P.M. Yavorsky and I. Wender. 1971. Converting organic wastes to oil: a replenishable energy source. Bureau of Mines Report of Investigations 7560, U.S. Dept. of the Interior. 20 pp. 4 ref. 10 tab. 3 fig.
"The Bureau of Mines is experimentally converting cellulose, the chief constituent of organic solid waste, to a low-sulfur oil. All types of cellulosic wastes, including urban refuse, agricultural wastes, sewage sludge, wood, lignin, and bovine manure, have been converted to oil by reaction with carbon monoxide and water at temperatures of 350° to 400°C and pressures near 4,000 psig, and in the presence of various catalysts and solvents. Cellulose conversions of 90 percent and better (corresponding to oil yields of 40 to 50 percent) have been obtained."

E-134 Anon. 1971. Maine standards for manure and manure sludge disposal on land. University of Maine and Maine Soil and Water Conservation Commission. 21 pp. 1 tab.

This standard is concerned with conditions for: (1) total recycling of nutrients through planned crop production; (2) disposing of excess manure on the land by spreading, (3) piling on the land; (4) bulk burying in landfill; (5) composting; (6) lagoon treatment with sludge and liquid disposal; (7) disposal by irrigation; and (8) dehydrated manure disposal. Maximum rate for spreading manure on land and for other methods were developed from the physical and chemical characteristics of each individual soil, and from the available knowledge of the movement of manure liquids and residues on and through each soil type. The limiting factor in determining application rate is the pounds of nitrogen per acre to be applied. An extensive table is given summarizing the permissable disposal practices and maximum manure application rates for several Maine soils.

E-135 Lehman, O.R., B.A. Stewart and A.C. Mathers. 1970. Seepage of feedyard runoff water impounded in playas. Publ. No. MP-944, Texas Agricultural Experiment Station, College Station, Texas. 7 pp. 5 ref. 5 tab. 3 fig.

"Data from a playa that impounded feedyard runoff for 1 year indicate minimal seepage of contaminants into the playa bottom. Therefore, the major threat for pollution of ground water appears to be seepage of runoff and impounded water through the more permeable sloping soils immediately surrounding playa bottoms. This hazard will be greater for small, deep playas located in coarse-textured soil areas. Additional data are required to determine the long-range effects of feedyard runoff into playas."

E-136 Reddell, D.L. and R.E. Stewart. 1971. Land disposal of animal wastes in Texas. Agricultural Research and Pollution, Proc. Conference of Collaborators from Southern Agricultural Experiment Stations. Publ. No. ARS 72-94, Agricultural Research Service, U.S. Dept. of Agriculture. pp. 37-47. 8 ref. 6 tab. 4 fig.

Report on research to investigate the disposal of manure at high rates of application by deep plowing. Four different types and sizes of plows were compared with regard to the ability of each to completely bury the large amounts of solid manure. Rates of manure up to 900 tons/acre were plowed under with a 30-inch moldboard plow. Application rates considerably higher than 900 tons/acre could be handled by a trencher. No serious water quality problems were observed as a result of the manure disposal program.

E-137 Sweeten, J.M. 1971. State agencies regulating confined animal feeding operations. Open-File Report (TO 01.0.543/1), U.S. Environmental Protection Agency. 37 pp. 4 ref. 1 tab.

Results of a study to identify the State agencies in the U.S.A. that regulate livestock feeding operations and to delineate the type of regulatory control that each exerts. All States have adopted water quality standards, with the result that there is at least one agency in each State regulating the operation of feedlots. Ten States have passed specific feedlot statutes and/or regulations. Technical assistance on feedlot planning, design and operation is available in all States by the Soil Conservation Service, and in most States by the Cooperative Extension Service of the land grant university.

E-138 Anon. 1968. Liquid manure handling for dairy cattle in Wisconsin.

Guidelines and suggestions supplement to Dairy Cattle Housing Guidelines in Wisconsin. Agr. Eng. Dept., Univ. Wisconsin, Madison, Wisconsin. 15 pp.
Guidelines outlining the two basic requirements of liquid manure disposal systems: (1) legal requirements; and (2) economy and efficiency. Suggestions were presented to aid dairymen in the design and operation of each of the components of a liquid manure system, including storage tanks, agitation and water distribution facilities, pumps, spreaders, and scraping and cleaning equipment.

E-139 Pratt, G.L. 1968. A feasibility study of a livestock waste disposal system involving the reuse of water. Research Project Technical Completion Report to Office of Water Resources Research, Department of the Interior, Washington, D.C. 24 pp. 2 ref. 11 tab. 4 fig.
Report on trials conducted at the North Dakota Agricultural Experiment Station to evaluate settling tanks and sand filters for separating solid materials from liquid wastes, with the ultimate objective of providing high quality water for reuse as wash water. In one phase of the work involving beef wastes, a settling tank was found to remove the bulk of the solids. Aeration and alum treatment of the settling tank effluent did not upgrade the waste water sufficiently to render it suitable for recycling. In a second phase of the work, the slow sand filter was shown to do a satisfactory job of upgrading reclaimed water. The effects of temperature on the effectiveness of the sand filter were reported.

E-140 Alberta Institute of Agrologists. 1971. Agriculture and the environment - a handbook. Alberta Institute of Agrologists, Edmonton, Alberta. 92 pp.
An assessment of the effects of various agricultural practices on the quality of the environment in Alberta. A specific section was devoted to water pollution from animal wastes, while another section included reference to air pollution resulting from animal wastes.

E-141 Ogilvie, J.E. 1971. Feedlot finishing in cold climates: animal waste handling systems. Minutes of the Work Planning Meeting on Beef Cattle Production Systems - Cow-Calf Operation and Feedlot Finishing in Cold Climates, Winnipeg, Manitoba. Canada Dept. of Agriculture, Research Branch, Ottawa, Ontario. pp. 151-157. 6 ref. 1 tab. 3 fig.
Outline of the basic components of the animal production system with regard to waste handling. Influences can be exerted at each phase of the system to lessen the waste handling problems. Fifty-one questions were posed dealing with volume reduction, soil pollution, and collecting, holding, transporting and spreading of manure.

E-142 Reid, J.L. 1971. Feedlot finishing in cold climates: Animal waste handling systems - 1970 stream survey. Minutes of the Work Planning Meeting on Beef Cattle Production Systems - Cow-Calf Operation and Feedlot Finishing in Cold Climates, Winnipeg, Manitoba. Canada Dept. of Agriculture, Research Branch, Ottawa, Ontario. p. 159.
Results of a preliminary stream survey conducted in Alberta to investigate the incidence and magnitude of pollution resulting from cattle feeding operations. Further surveys are being conducted in the same watersheds.

E-143 Dale, A.C. 1967. Oxidation of swine wastes can control odors. Report, Agricultural Experiment Station, Lafayette, Indiana.
Discussion of the oxidation ditch system for aerobic storage and treatment of liquid swine manure. Properly designed and operated, the oxidation ditch treatment provides relatively odorless storage, causes some breakdown of organic matter and concentrates minerals in dissolved form. However, even properly designed oxidation ditches have the disadvantages of high cost, large water requirements, and the necessity of periodic maintenance. Furthermore, there are still some solid wastes which must be spread or otherwise disposed of. Other methods of aerating animal wastes were discussed briefly.

E-144 Jones, O.R. 1968. Movement of coliform bacteria and organic matter in the Ogallala aquifer at Bushland, Texas. Miscellaneous Publ. 873, Texas Agricultural Experiment Station, College Station, Texas. 8 pp. 9 ref. 2 tab. 8 fig.
Report on research to investigate the movement of coliform bacteria and oxidizable organic matter in a sandy Ogallala aquifer when artificially recharged with polluted playa water. Bacteria move only a few inches in surface soil during periodic flooding, but polluted water can move up to ½ mile with little purification in creviced rock formations. In the sandy Ogallala aquifer, coliforms are not likely to travel more than 100 feet in the fine sand formations, however, very little organic matter was filtered from recharged water by travel through 66 feet of the aquifer.

E-145 McClurg, C.A., E.L. Bergman and G.O. Bressler. 1971. The influence of ashed poultry manure on soil, snap beans, and tomatoes. Progress Report 312, Agricultural Experiment Station, University Park, Pennsylvania. 10 pp. 18 ref. 12 tab.
Report on four experiments conducted to determine the growth of snap beans and tomatoes in a Hagerstown clay loam soil containing various proportions of ground dried and/or ashed poultry manure. Addition of ash significantly increased soil pH, available P, and millequivalents and percent saturation of K, Mg, and Ca in the soil. Application of ash to field soils at 60 tons/acre resulted in a 45% mortality of tomato plants. The stand and yield of beans were not significantly affected by ash additions at the rate of 30 tons/acre, although pod maturity was delayed. It was concluded that ashed poultry manure should be used in crop production only in conjunction with a soil test to avoid excessive concentrations of soluble salts.

E-146 Sobel, A.T. 1971. Removal of water from animal manures. Part II: Effects of velocity on air drying. In A.T. Sobel (ed.). Animal waste management and odor control. Final report AWM 71-04, Agricultural Engineering Department, New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 8 pp. 4 ref. 2 tab. 7 fig.
"Investigations into drying characteristics of chicken manure were extended to include the effects of velocity. Standard samples of 1/8 and 1/4 inch thickness were subjected to velocities varying from static to 1600 fpm. Velocities greater than 800 fpm did not decrease the drying time appreciably. Drying times for velocities of 800 fpm or greater were approximately one-third that for 'static' conditions."

E-147 Day, D.L. 1971. Measurement of manure gases by gas chromatography. In A.T. Sobel (ed.). Animal waste management and odor control.

Final report AWM 71-04, Agricultural Engineering Department, New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 6 pp. 3 tab. 1 fig.
"Investigations were made into the measurement of ammonia utilizing gas chromatography equipment. Considerable difficulty was experienced. The threshold measureable concentration of ammonia with thermal conductivity and hydrogen flame detectors was about 1 percent."

E-148 Sobel, A.T. 1971. Olfactory measurement of animal manure odor. In A.T. Sobel (ed.). Animal waste management and odor control. Final report AWM 71-04, Agricultural Engineering Department, New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 21 pp. 11 ref. 7 tab. 12 fig.
"Utilizing the human nose, a rating method of odor evaluation was adapted to manure handling and treatment systems. Odors were rated as to offensiveness and presence on a 0-10 scale. Descriptive terms were applied to the manure being evaluated. Examples are described for (1) a laboratory study with various treatments and (2) a semi-field study with various handling systems."

E-149 Ludington, D.C., A.T. Sobel and B. Gormel. 1971. Control of odors through manure management. In A.T. Sobel (ed.). Animal waste management and odor control. Final report AWM 71-04, Agricultural Engineering Department, New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 17 pp. 2 ref. 8 tab. 13 fig.
"Experiments were conducted to check the influence of moisture removal and manure removal on the odor offensiveness of chicken manure. The tests showed that removing moisture reduced the odor level. Diluted manure produced the highest offensiveness. A manure management system which either removes the manure from the building at least daily or removes moisture from the manure will cause a minimum amount of air pollution by the release of odorous compounds."

E-150 Gormel, B., A.T. Sobel and D.C. Ludington. 1971. Under cage drying of poultry manure. In A.T. Sobel (ed.). Animal waste management and odor control. Final report AWM 71-04, Agricultural Engineering Department, New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 15 pp. 7 tab. 7 fig.
"Investigations were made into various devices to partially dry chicken manure droppings before they fell onto dropping boards. Devices such as screens, metal fins at various angles, and rotating pins were tried. Screens became clogged with feathers. Angles greater than 45° allowed manure to dry but did not hold enough manure. Fins at an angle of 45° and scraped daily and supplemented with fins at 40° allowed manure to dry to moisture contents near 50 percent."

E-151 Walsh, L.M. and R.F. Hensler. 1971. Manage manure for its value. Circular 550, Cooperative Extension Service, University of Wisconsin, Madison, Wisconsin.
Discussion of the fertilizer value of manure, the quantity and composition of manure produced by Wisconsin livestock, and some methods of conserving and handling manure. Specific odor control methods were described.

E-152 Taylor, R.B. 1971. Farm waste management - clean water. Publ.

71-54, Cooperative Extension Service, The University of Connecticut, Storrs, Connecticut.

There has been an ever-increasing number of justified complaints of significant water pollution associated with farming activities, including silage drainage, feedlot runoff, surface runoff from stockpiled and field-spread manure, and direct discharge of processing wastewaters. The Connecticut Clean Water Act contains provisions for control of agricultural pollution, some of which were discussed.

E-153 Savos, M.G. 1972. Fly control on poultry farms. Publ. 72-12, Cooperative Extension Service, University of Connecticut, Storrs, Connecticut.

Successful fly control programs involve sanitation and the use of insecticides. Manure management to minimize fly breeding was discussed briefly. A list of insecticides which can be applied to manure pits was given.

E-154 Junnila, W.A. 1968. Twelve year performance of a heated septic tank. Poultry Notes 68-5, Cooperative Extension Service, University of Connecticut, Storrs, Connecticut.

A heated septic tank has been used successfully under Connecticut conditions for the disposal of dead poultry. The tank was insulated and was heated by hot water from a hot water brooding system. No air, soil or water pollution was evidenced during twelve years of operation of the tank. The accumulation and composition of sludge and scum was reported, and methods used for cleaning the tank were discussed. Suggestions were made concerning the design, construction and operation of a heated septic tank for dead bird disposal.

E-155 Aho, W.A. 1972. A disposal pit for poultry. Extension Report No. 62, Cooperative Extension Service, University of Connecticut, Storrs, Connecticut.

An advisory paper dealing with the design, construction, and operation of disposal pits for dead poultry.

E-156 Smythe, P.E. 1969. Rural zoning. Circular 408, Cooperative Extension Service, Kansas State University, Manhattan, Kansas.

General discussion on zoning for land use. Ways in which zoning can protect the farmer were outlined; things which zoning cannot do were also outlined. The differences between zoning and subdivision regulations, building codes and deed restrictions were discussed. The major obstacles to effective land use are social in nature, not technical.

E-157 Kimball, N.D., L.V. Lenschow and R.E. Rieck. 1970. Economic evaluation of liquid manure disposal systems for dairy cattle. Bulletin 597, Research Division, College of Agricultural and Life Sciences, University of Wisconsin, Madison, Wisconsin.

Report on the various manure disposal systems used by dairy farmers, the investment and operating costs for alternative systems, and the value of manure as compared to handling costs for the various systems. For herds larger than 50, liquid systems had lower net costs than conventional systems. Annual disposal costs were inversely related to herd size. For a completely liquid system, doubling the storage period from 3 to 6 months increased costs per cow but the additional value of nutrient saved more than offset this increase. Farmers handling part of their manure conventionally and the remainder as a liquid incurred higher equipment costs but lower storage costs, resulting in higher total costs per cow for smaller herds but lower total costs for larger herds.

E-158 Barth, C. 1970. Dairy plant waste treatment. Resource Report No. 15, Cooperative Extension Service, University of Wisconsin, Madison, Wisconsin.
Review of some procedures which may be used, at reasonable cost, for treating wastes from rural dairy plants to minimize the possibility of pollution. Procedures considered were extended aeration, aerated lagoons, and irrigation. For economic treatment, dairy plant wastes should be segregated into cooling and rain water, human sanitary waste, and processing waste, with separate treatment of each waste.

E-159 Barth, C. 1970. Slaughterhouse waste treatment. Resource Report No. 14, Cooperative Extension Service, University of Wisconsin, Madison, Wisconsin.
Review of some procedures which may be used, at a reasonable cost, for treating wastes from rural slaughterhouses to minimize the possibility of pollution. The three waste treatment systems considered were irrigation, lagoon, and septic tank. Possibilities for waste-saving and segregation of wastes into various components for reuse were noted.

E-160 Turner, D.O. and D.E. Proctor. 1971. A farm scale dairy waste disposal system. Scientific Paper 3360, Washington Agricultural Experiment Station, Washington State University, Pullman, Washington. 9 pp. 6 ref. 4 tab. 1 fig.
Report on the development and operation of a practical farm waste disposal system which utilizes a covered confinement barn, lagoons for winter detention of manure, and a pump-pipe distribution system. Field applications of manure slurry have increased forage yields without developing excessive nitrate concentrations in the feed or the soil. Manure application to grass-legume forages should not exceed 1 acre-inch of 10% suspended solids and should be applied to stubble just after harvest. Up to 5 acre-inches of manure slurry can be applied to cropland prior to seeding.

E-161 Milligan, J.H. 1971. Livestock waste management guidelines. Extension Multilith 3479, Cooperative Extension Service, Washington State University, Pullman, Washington.
Guidelines for proper waste management. Animal waste management systems must control objectionable odors, dust, flies, rodents and other nuisances, prevent nitrogen contamination of groundwater, control waste movement so that wastes do not enter public water supplies, and should make the wastes easier and safer to handle. Site evaluation was considerated as the major factor in controlling water pollution from livestock operations. Land disposal is currently the only acceptable method for ultimate disposal of animal wastes.

E-162 Davis, E.H. and R.E. Roffler. 1969. Guidelines for handling animal wastes as related to water and air pollution control. Extension Multilith 3107, Cooperative Extension Service, Washington State University, Pullman, Washington.
Outline of some of the water and air pollution problems facing livestock operators, and a guide to some practices which might aid them in meeting

pollution regulations at minimum expense. Some suggested practices were sprinkler irrigation, maintenance of good public relations, keeping animals clear of water sources and completely controlling all wastes from entering surface or ground water.

E-163 Davis, E.H. 1969. Animal waste data and population equivalents. Extension Multilith 2592, Cooperative Extension Service, Washington State University, Pullman, Washington.
A guide to the average daily production of manure by farm animals, its NPK, and its dollar value as a fertilizer. Load factors for planning lagoons were also tabulated.

E-164 Myklebust, R.J. and E.H. Davis. 1965. Guidelines for sanitary handling of animal manure. Extension Multilith 2582, Cooperative Extension Service, Washington State University, Pullman, Washington.
Description of manure tanks and lagoons for sanitary handling of manure. Tanks can be covered or open, and should be large enough to hold manure for the period when the land is too wet to permit distribution by portable units. Aerobic lagoons have not worked satisfactorily in Western Washington because of a lack of sunshine for proper bacterial action. Any manure management system must be judged by how well it prevents contamination of water supplies, prohibits the breeding of flies and mosquitoes, and prevents sanitation problems.

E-165 Davis, E.H. 1964. Cattle manure handling and disposal. Extension Multilith 2416, Cooperative Extension Service, Washington State University, Pullman, Washington.
Review of manure handling alternatives. If manure is handled as a solid, it may be mechanically removed from the animal quarters; once removed, the manure may be stockpiled or immediately spread on cropland. Liquid manure may be removed from buildings and pens either hydraulically or mechanically, may be stored in pits or in lagoons, and may be field spread by irrigation equipment or by tanker trucks. Manure handling equipment was described.

E-166 Davis, E.H. and H.A. Bunten. 1971. The stockman's role in water pollution control. Extension Circular 361, Washington State University, Pullman, Washington.
Discussion on ways in which feedlots may pollute surface and groundwater. Animals should be fenced away from streams or waterways. Runoff from feedlot surfaces and feed storage areas should be kept out of streams by dikes, culverts or other such diversion facilities. If lagoons are to be used to impound animal wastes, they should be lined with an impervious material to prevent seepage of effluent and should be protected with dikes in the event of floods. Equipment for applying animal wastes to fields was described.

E-167 Dawson, J.S. Jr. and L. Bynum. 1966. Incinerator and disposal pit facilities recommended for farm animals. Circular 1027, Cooperative Extension Service, Virginia Polytechnic Institute, Blacksburg, Virginia.
Description of several methods for disposal of dead animals (incineration, disposal pits, freezing, heated septic tank and chemical degradation), with emphasis on incineration and disposal pits. Legal requirements (Virginia) and recommended management and security practices were outlined.

E-168 Newton, W.H. and B.C. Wormeli. 1970. Fly control in poultry houses. Fact Sheet L867, Agricultural Extension Service, Texas A & M University, College Station, Texas.
General review of fly control in poultry houses, with emphasis on good manure management. Housefly breeding can be stopped by quickly reducing the moisture content of manure to 30% or less, or by immediate liquifaction of fresh droppings in liquid manure pits. Dry and liquid manure management systems were considered with regard to the potential for fly breeding. The use of insecticides for fly control was also considered.

E-169 Jones, J. 1970. Water pollution and the causes. Miscellaneous Publ. 960, Agricultural Extension Service, Texas A & M University, College Station, Texas.
A review of the sources of water pollution, and the relative importance of each, with particular reference to Texas. The cattle feeder industry is a major source of agricultural pollution; however, runoff from feedlots can be controlled at a practical cost by lagooning.

E-170 Jones, J. 1971. Solid wastes. Miscellaneous Publ. 989, Agricultural Extension Service, Texas A & M University, College Station, Texas.
Solid waste generated by householders, agriculture and other industries is becoming a major problem. The sanitary landfill disposal method was discussed, and figures were given on the land areas required for solid waste disposal by this method. Solid waste management legislation and citizen action were outlined.

E-171 Beanblossom, F.Z., M.M. Miller and W.F. Bennett. 1962. Poultry manure: value - sales - application. Miscellaneous Publ. 516, Agricultural Extension Service, Texas A & M University, College Station, Texas.
Outline of the quantities of poultry manure produced, its NPK composition, and its dollar value based on supplying an equivalent amount of nutrients as commercial fertilizer. Poultry manure may be handled in an unprocessed form or it may be processed for easier handling by dehydration, grinding, pelleting, and bagging. Suggestions were given on the application of poultry manure to soil to achieve maximum benefit from it.

E-172 Durland, G.R. and L. Lubinus. 1968. Free stall housing and liquid manure handling systems for dairy cows. Extension Mimeographed Circular 553, Cooperative Extension Service, South Dakota State University, Brookings, South Dakota.
Description of free-stall housing for dairy cattle, complete with construction details and management suggestions. One section dealt specifically with waste disposal in dairy housing, including design data for storage structures and equipment specifications. Various waste handling alternatives were outlined. Precautions must be taken with liquid manure systems to avoid accumulations of toxic concentrations of manure gases.

E-173 Lubinus, L., F.F. Kerr and J.J. O'Connell. 1971. What livestock feeders and producers need to know about livestock pollution regulations. Cooperative Extension Service, South Dakota State University, Brookings, South Dakota.
Review and interpretation of existing and anticipated regulations pertaining to discharge of animal wastes into public waters in South Dakota, and an

assessment of what livestock enterprises most likely will be affected. Enforcement of regulations was discussed, including an explanation of the permit requirement, and a statement of how the South Dakota Department of Health expects to administer its task in regard to animal waste control.

E-174 Lucas, T.E. and J.H. Bailey. 1970. *E. coli* infections in poultry. Fact Sheet 510, Cooperative Extension Service, South Dakota State University, Brookings, South Dakota.
Outline of diseases of poultry caused by *E. coli*, transmission and control of *E. coli*, cleaning and disinfection, and diagnosis of *E. coli* infections. *E. coli* has been isolated from the large intestine of poultry and from litter, dust and water of poultry houses.

E-175 Allen, J.B. and J.C. McWhorter. 1971. A status report on waste treatment lagoons in Mississippi. Water Resources Research Institute, Mississippi State University, State College, Mississippi. 17 pp. 4 ref. 8 tab. 2 fig.
Results of a study to evaluate the current use of, and attitudes toward, lagoons as devices for waste treatment. It was reported that, at the time of a State survey, there were 216 municipal lagoon systems, covering 2,972.5 acres, and 241 animal waste treatment lagoons, of which 221 were used for swine, 16 for dairy, and 4 for poultry. The BOD of the municipal lagoon effluents varied from 18.0 to 79.5 mg/l compared to a range of BOD from 92 to 870 mg/l for agricultural waste treatment lagoons. Agricultural waste treatment lagoons have been readily accepted by farmers and the number of lagoons is expected to increase rapidly, partially because the federal government will cover 80% of the construction cost.

E-176 Brodie, H.L. 1972. Regulations on pollution abatement. Agricultural Engineering Release No. 53, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Outline of the requirements which must be met by all industrial wastes, including animal wastes, before discharge to natural waterways, as outlined in the Maryland Water Resources Law.

E-177 Brodie, H.L. 1972. Disposal of swine manure from oxidation ditches. Agricultural Engineering Release No. 52, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Practical description of the oxidation ditch as used for disposal of swine waste. Suggestions for the proper operation and management of oxidation ditches were presented.

E-178 Brodie, H.L. and J.T. Kennedy. 1972. Land disposal of livestock waste. Agricultural Engineering Release No. 54, Environmental Series No. 5, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Discussion of land disposal of manure with regard to possible environmental damage and methods for preventing such damage.

E-179 Bock, C.A. and A.J. Muehling. 1971. Illinois Environmental Protection Act. Farm Buildings No. 30, Agricultural Engineering Tips, Dept. Agricultural Engineering, University of Illinois, Urbana-Champaign, Illinois.
Report on the Illinois Environmental Protection Act, agencies involved in

enforcement of the provisions outlined in the Act, and the effect of the Act on livestock producers.

E-180 Sprague, D.C., A.T. Sobel, H.R. Davis and T.L. Todd. 1972. Performance observations of a high-rise system for collecting, conditioning, handling, and utilizing caged layer manure. AWM 72-06, Agricultural Engineering Dept., New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 14 pp. 7 tab. 8 fig.
Report on the operation of a high-rise system for handling poultry manure. Data are presented on ambient temperatures inside and outside the facility, moisture content and fertilizer value of accumulated droppings, and labor and machine time for manure removal and spreading. The high-rise system satisfied the requirements for the control of pollution and the conservation of nutrients.

E-181 Sobel, A.T. 1972. Undercage drying of laying hen manure. AWM 72-05, Agricultural Engineering Dept., New York State College of Agriculture & Life Sciences, Cornell University, Ithaca, New York. 17 pp. 4 ref. 2 tab. 12 fig.
Report on drying poultry manure with mechanical devices (fins and screens), forced air drying through slots along each side of sloped dropping boards, and forced air drying by circulating fans hung below caged birds (high-rise housing). All the systems reduced moisture contents of the droppings to below 60%, the slot-outlet system provided the highest rate of moisture removal; mechanical raking of the droppings further increased the effectiveness of this system.

E-182 Brodie, H.L. 1971. Measures for controlling surface water pollution from livestock confinement pastures. Agricultural Engineering Release No. 45, Cooperative Extension Service, University of Maryland, College Park, Maryland.
A discussion of seven runoff control measures, namely proper site selection, controlled surface water flow into and within the pasture, collection and transport of surface water flow from the pasture, maintenance of proper areas for runoff disposal, maintenance of sediment control measures along any streams, and maintenance of proper animal watering facilities.

E-183 Brodie, H.L. 1971. Dairy farm waste disposal and utilization. Agricultural Engineering Release No. 40, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Discussion of some practical waste handling systems. Manure disposal alternatives include stock piling, storage in underground tanks, incineration and lagoons. Manure utilization alternatives include organic irrigation, anaerobic methane digestion, dehydration and field application. Factors to be considered in the selection of a waste disposal or utilization system were outlined. Some management tips with regard to field spreading of manure were presented.

E-184 Brodie, H.L. 1970. Biological systems for livestock farm waste disposal. Agricultural Engineering Release No. 39, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Digest of information concerning the available biological methods of manure disposal, namely lagoons and oxidation ditches. The fundamental biological

processes involved in animal waste treatment systems were explained. The advantages of biological systems for manure handling were discussed, including odor control, storage of wastes prior to disposal and reduction in the total solids to be handled. The influence of management on the operation of biological waste treatment systems was emphasized.

E-185 Boyd, J.S. 1972. Alternatives for handling manure. Agricultural Engineering Information Series No. 257, Agricultural Engineering Dept., Michigan State University, East Lansing, Michigan.
Discussion on waste handling alternatives for open lot and cold or warm covered buildings. Manure must be collected, stored, processed in some way, and disposed of to keep the animals clean, prevent contamination of surface or underground water, and control air pollution from odors and flies. The manure from open lots is generally handled as a solid; runoff is collected in some form of detention pond prior to ultimate disposal on cropland such as by irrigation equipment. Manure from covered feedlots is usually stored as a slurry in underground tanks. Manure from bedded stalls may be stacked on a concrete slab. Where odor control is necessary, the oxidation ditch system is sometimes used. Farm milk plant wastes may be handled in septic tanks or lagoons. Some costs were presented for the various manure handling alternatives.

E-186 Willson, G.B. 1963. Sewage lagoons for dairy farms. Agricultural Engineering Fact Sheet No. 20, Agricultural Extension Service, University of Wyoming, Laramie, Wyoming.
General description of lagoons, the principle of their operation, and details of lagoon site selection and construction.

E-187 Martin, J.P. and S.A. Waksman. 1971. Synthetic manure. Circular 470, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey. 8 pp. 2 tab. 1 fig.
Discussion on the synthesis of "manure" from plant wastes. Manure so produced can have value as a soil additive and fertilizer which is as great or greater than animal manure. The author suggested that there is a shortage of animal manures, thereby necessitating the synthesis of manure from other organic waste products.

E-188 Barr, H.T., B.A. Tower, C.D. Steelman and L.J. Cabes, Jr. 1969. Farm lagoons in Louisiana. Bulletin No. 638, Louisiana Agricultural Experiment Station, Baton Rouge, Louisiana. 19 pp. 2 tab. 7 fig.
Report on experiences with manure lagoons in Louisiana. Some design data were presented for poultry and hog manure lagoons. Odors, organic matter reduction and mosquito control in lagoons were discussed. Several factors to consider in the design of lagoons were noted.

E-189 Gilbertson, C.B., T.M. McCalla, J.R. Ellis, O.E. Cross and W.R. Woods. 1970. The effect of animal density and surface slope on characteristics of runoff, solid wastes and nitrate movement on unpaved beef feedlots. Bulletin 508, Nebraska Agricultural Experiment Station, Lincoln, Nebraska 23 pp. 23 ref. 7 tab. 5 fig.
Report on research. The quality and quantity of rainfall runoff (summer runoff) were more dependent on rainfall than on feedlot slope or cattle density. An equation was developed showing the relationship between runoff

and total rainfall. Both the quantity and quality of winter runoff were higher for high density than for low density lots. Feedlot slope did not affect the quantity of winter runoff. Rainfall runoff had a very high salts content. The downward movement of pollutants was minimal directly beneath the feedlots, but was greater beneath the waterways immediately surrounding the lots.

E-190 Eno, C.F. 1962. Chicken manure: Its production, value, preservation and disposition. Circular S-140, Florida Agricultural Experiment Station, Gainesville, Florida. 18 pp. 8 ref. 5 tab.
A compilation of information and data on: (1) the composition and dollar value of chicken manure, the availability of nutrients in chicken manure, and a comparison of chicken manure to inorganic fertilizers; (2) losses of nutrients from manure during storage, and methods of preservation and disinfection; and (3) methods for disposal of chicken manure and suggestions for the use of chicken manure as a source of nutrients.

E-191 Lampman, C.E., J.E. Dixon, C.F. Petersen and R.E. Black. 1967. Environmental control for poultry housing. Bulletin 456, Idaho Agricultural Experiment Station, Moscow, Idaho. 27 pp. 15 ref. 14 tab. 21 fig.
This comprehensive guide to environmental control for poultry housing contained information on the rate of manure production by growing chicks, and on ammonia accumulations in poultry houses.

E-192 Zindel, H.C. and C.J. Flegal. 1970. Introduction - Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 4-7.
Discussion of water, air and soil pollution resulting from improper management of animal wastes, including contamination of lakes, fish kills, nitrate contamination of soil, off-flavors in food, annoying odors and dusts, dissemination of bacteria or viruses capable of infecting animals and man, depreciation of recreational values of rural land and streams, and reproduction of insect and rodent pests. Trends in animal production methods which have intensified the waste handling problem were noted. A program for controlling pollution from animal wastes must involve: (1) making use of existing technology, (2) developing new and improved animal waste management methods and facility design, new and improved waste treatment and disposal methods, and new and improved methods for converting wastes to useful products, and (3) establishing and enforcing standards, and providing criteria for land use planning.

E-193 Davidson, J.A. and C.J. Mackson. 1970. Poultry manure handling by indoor septic tanks. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 8-9.
Report on 5-years experience at Michigan State University with indoor lagoons for handling poultry manure. Indoor lagoons covering half the floor space can handle the droppings from 300 laying hens for at least 11 months, necessitating only one annual cleaning. The indoor lagoon system is especially adaptable to cage operations. Present emphasis in poultry manure handling is away from the indoor lagoons and toward drying of the product for recycling.

E-194 Robertson, L.S. and J. Wolford. 1970. The effect of application rate of chicken manure on the yield of corn. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 10-15. 4 tab.
Report on the rate of production of poultry manure, its chemical composition and value as a plant food, the effect of high rates of application of poultry manure to soil on soil properties, and the effect of chicken manure on corn yields. It was concluded that poultry operations should be located only in rural areas and should have access to sufficiently large acreages of cropland on which to spread manure. Poultry farms should be located on soils that are well drained but not near streams or lakes. Field applied manure should be plowed under as soon as practical after application to reduce the opportunities for environmental contamination.

E-195 Surbrook, T.C., J.S. Boyd and H.C. Zindel. 1970. Drying animal waste. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 16-20. 6 tab. 1 fig.
Report on the operation and performance of a commercial dryer for on-the-farm drying of manure. The dryer successfully processed dairy, beef, swine and poultry excreta. Odors in the vicinity of the machine were less intense and unlike that of fresh excreta. The moisture content of the dried product ranged from 5 to 15%, which is sufficiently low to ensure safe storage. The product was not odor-free, but was less offensive than fresh excreta. The average granule size, bulk density, NPK content, and protein content of the dried excreta were reported in tabular form.

E-196 Flegal, C.J. and H.C. Zindel. 1970. The utilization of poultry waste as a feedstuff for growing chicks. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 21-28. 21 ref. 5 tab.
Report on experiments to determine the nutritional value of dehydrated poultry waste (DPW) for growing chicks. The four-week mean body weight of Leghorn-type chicks was not adversely affected when up to 20% of the diet consisted of DPW. However, the four-week mean body weight of broiler-type chicks was reduced by levels of DPW greater than 5%. Feed efficiency was inversely related to the level of DPW in the diet. Inclusion of additional fat in the DPW rations improved the feed efficiency and weight gains of broiler chicks. The DPW used in these trials was considered a low energy product.

E-197 Flegal, C.J. and H.C. Zindel. 1970. The effect of feeding dehydrated poultry waste on production, feed efficiency, body weight, egg weight, shell thickness and Haugh score. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 31-33. 3 tab.
Results of trials conducted at Michigan State University. Hen-housed production and body weight were not significantly affected by 10% dried poultry waste (DPW) in the ration. Feed efficiency was inversely proportional to the amount of DPW in the ration; however, addition of animal fat to rations containing DPW increased the feed efficiency. Egg weight and shell thickness were not significantly affected by DPW in the ration, but Haugh scores were significantly increased by the experimental diets.

E-198 Flegal, C.J., H.C. Goan and H.C. Zindel. 1970. The effect of feeding dehydrated poultry waste to laying hens on the taste of the resulting eggs. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 34-38. 9 ref. 2 tab.
Report on trials. The dietary levels of dried poultry waste (DPW) had no significant ($P < 0.05$) effect on the taste of eggs. A Consumer Preference Panel was unable to detect any consistent taste difference between the DPW and control eggs.

E-199 York, L.R., C.J. Flegal, H.C. Zindel and T.H. Coleman. 1970. Effect of diets containing dehydrated poultry waste on quality changes in shell eggs during storage. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 39-41. 3 ref. 1 tab.
Report on trials. Inclusion of 10, 20 or 30% dehydrated poultry waste in the diet of hens had no significant deleterious effect on the quality of shell eggs as measured by Haugh units, storage weight loss, color, odor and/or microbial count.

E-200 Thomas, J.W. 1970. Acceptability and digestibility of poultry and dairy wastes by sheep. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 42-44. 2 tab.
Report on trials, indicating that dried poultry and dairy wastes as one third of the total ration were readily accepted by sheep. The digestibility of poultry feces was greater than that of dairy feces. Although protein of these wastes was less digestible than that of soybean meal, it had a biological value equal to that of soybean meal for growing sheep.

E-201 Zindel, H.C. 1970. Bacteriological procedures. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 45-46. 2 tab.
Description of the procedures employed in the bacteriological examination of both fresh and dried chicken feces. The types of bacteria recovered from dried and fresh fecal samples, and the relative incidence of each, were reported in tabular form. Care must be taken when placing wet feces into a dryer not to contaminate the dried product as it comes out of the machine.

E-202 Anon. 1970. Research on dried poultry waste in progress. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 47-48.
Outline of current research projects at Michigan State University, including investigations of: (1) drug residues in dried poultry wastes; (2) the effect of storage and drying temperature on the protein content of dried poultry waste; (3) drying chicken manure under laying cages on electrically heated panels; and (4) the replacement of standard protein sources in beef cattle rations with dried poultry waste.

E-203 Benne, E.J. 1970. A compilation of all samples of poultry waste analyzed by Dr. E.J. Benne, 1966-1970. Poultry pollution: problems and solutions. Research Report No. 117, Agricultural Experiment Station, East Lansing, Michigan. pp. 49-55. 1 tab.
A table providing data on the moisture, protein, nitrogen free extract,

non-protein nitrogen, potassium, calcium, phosphorus, ash, crude fibre and ether extract contents of 77 samples of fresh and dried poultry manure.

E-204 Zindel, H.C. 1971. Early experiments at Michigan State University involving the use of chicken manure. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 2-3.
Review of early experiments involving the use of poultry manure as a feed ingredient. Original research was concerned with the relationships between the response of poultry to antibiotics and the presence or absence of feces in the diet.

E-205 Zindel, H.C. and C.J. Flegal. 1971. Economics of dried poultry waste (DPW) as a feed ingredient or a fertilizer. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 4-7. 1 ref.
The cost of drying poultry manure varies with dehydration equipment, type and cost of heat used, labor cost, wetness of manure, output of machine and moisture content of the final product. The dried product can be used as a feedstuff for livestock and poultry, thereby effecting a direct saving in feed costs. Other indirect savings afforded by this method of disposal include easier handling, lowered pollution potential, odor and fly control and promotion of better public relations.

E-206 Thomas, J.W. and H.C. Zindel. 1971. Feeding dehydrated poultry waste to dairy cows. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 8-11. 4 ref. 2 tab.
Report on trials in which dehydrated poultry waste was successfully used as a source of dietary protein and energy in the diet of milking cows. Products similar to those used in these trials could replace 15-20% of the dietary protein of ruminants.

E-207 Sheppard, C.C., C.J. Flegal, D.A. Dorn and J.L. Dale. 1971. The relationship of drying temperature to total crude protein in dried poultry waste. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 12-16. 3 ref. 2 tab. 1 fig.
Results of trials indicating an inverse relationship between the drying temperature and the resulting total protein content of the dried waste. The correlation of drying temperature and the resulting total protein approached significance at the 5% probability level.

E-208 Esmay, M.L. and C.C. Sheppard. 1971. Drying of poultry manure in a cage-layer house. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 17-27. 3 tab. 2 fig.
Report on a project to evaluate the effectiveness of a heated floor panel drying system in removing moisture from the droppings, and to determine the optimum energy requirement for effective partial drying. Over 2000 B.t.u's of electrical energy were required to evaporate each additional pound of water from the wet fecal matter, representing an efficiency of electrical use of less than 50%, and a cost of 1 cent per pound of water evaporated. Removal of additional moisture from droppings by this method

was considered impractical under winter conditions, but may be necessary under hot weather conditions to control odors. Care must be taken to avoid heat stress in the poultry as a result of the large input of sensible heat to the poultry environment.

E-209 Bucholtz, H.F., H.E. Henderson, C.J. Flegal and H.C. Zindel. 1971. Dried poultry waste as a protein source for feedlot cattle. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 28-31. 2 tab.
Report on trials to determine the value of dehydrated poultry waste (DPW) as a source of protein for feedlot cattle. Average daily gain and feed efficiency were superior for the soybean supplemented ration as compared to the DPW supplemented rations. Feed costs per pound of gain were increased when all the supplemental protein in the ration was supplied as DPW. Steers refused to consume the DPW portion of the ration, this explaining the poor feed efficiency and performance of the steers when fed DPW. Carcass quality was not adversely affected by DPW in the ration of steers.

E-210 Polin, D., S. Varghese, M. Neff, M. Gomez, C.J. Flegal and H.C. Zindel. 1971. The metabolizeable energy value of dried poultry waste. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 32-44. 15 ref. 5 tab. 1 fig.
Report on studies to assign metabolizeable energy values to dehydrated poultry waste (DPW) on the basis of feeding trials with poultry. Metabolizeable energy values of 0.35 and 1.35 Kcal/g of material were found for cellulose and a DPW sample, respectively. Protein, calcium and phosphorus utilization were depressed by cellulose but not by DPW. Fat utilization was unaffected by adding either cellulose or DPW to the test diets.

E-211 Flegal, C.J. and D.A. Dorn. 1971. The effects of continually recycling dehydrated poultry wastes (DPW) on the performance of SCWL laying hens - a preliminary report. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 45-48. 2 ref. 3 tab.
Report on an experiment to test the concept of recycling feces within a closed system of egg production for an extended period. Feces from pullets were dehydrated and fed to the same birds; this was repeated in a closed system concept. At the completion of 14 cycles, there was a trend toward a slight accumulation of P and Ca in the feces. Egg production was not adversely affected; however, feed consumption was higher for birds fed a diet containing 25% dehydrated poultry waste as compared to birds fed a control diet.

E-212 Benne, E.J. 1971. A compilation of some samples of dried poultry waste analyzed by Dr. E.J. Benne, 1970-1971. Poultry pollution: research results. Research Report No. 152, Agricultural Experiment Station, East Lansing, Michigan. pp. 49-63.
A table providing data on the moisture, protein, calcium, phosphorus, crude fiber, ether extract, and non-protein nitrogen content of 190 samples of fresh and dried poultry waste.

E-213 Brodie, H.L. and J.T. Kennedy. 1972. Regulating livestock waste. Agricultural Engineering Release No. 54, Environmental Series, No. 1,

Cooperative Extension Service, University of Maryland, College Park, Maryland.
Discussion of public and private nuisance laws which directly affect livestock producers, and of steps which can be taken by livestock operators and public planners to avoid urban-rural conflicts.

E-214 Brodie, H.L. and J.T. Kennedy. 1972. Designing and managing systems of our environment. Agricultural Engineering Release No. 54, Environmental Series No. 2, Cooperative Extension Service, University of Maryland, College Park, Maryland.
Industrial, agricultural, social and political processes need to be redesigned as an industrialized ecosystem to operate in harmony with the natural environment in a closed life-support system. Because the assimilation capacity of the natural environment is limited, many biodegradable materials, such as animal wastes, must be recycled through human methods.

E-215 Brodie, H.L. and J.T. Kennedy. 1972. Agricultural practices influence surface water quality. Agricultural Engineering Release No. 54, Environmental Series No. 3, Cooperative Extension Service, University of Maryland, College Park, Maryland.
The nature and extent of surface water pollution arising from fertilizers, animal wastes, and pesticides are discussed. Judicious use of soil conservation practices and proper incorporation of manure into the soil will minimize the pollution potential of animal wastes.

E-216 Anon. 1962. Disposal of dead birds. Poultry leaflet No. 4, Cooperative Extension Service, Clemson University, Clemson, South Carolina.
Description and discussion of incineration and the use of disposal pits for dead bird disposal.

E-217 Hamm, D. 1967. Effective poultry house sanitation. Circular No. 507, Cooperative Extension Service, Clemson University, Clemson, South Carolina.
Discussion on various aspects of poultry house sanitation, including references to the proper management of manure for improved sanitation. Data are given on the presistency of disease organisms in poultry litter.

E-218 Hinish, W.W. 1959. 40 questions and answers on manure. Leaflet No. 213, College of Agriculture Extension Service, Pennsylvania State University, University Park, Pennsylvania.
Questions and answers dealt with the composition and fertilizer value of cattle and poultry manure, changes in manure composition during storage, and conservation of the fertilizer value of manure by adding superphosphate and by proper management during collection, storage, and field spreading.

E-219 Wooding, N.H. 1972. Disposal of liquid wastes from parlors and milkhouses. Special Circular 154, College of Agriculture Extension Service, Pennsylvania State University, University Park, Pennsylvania.
Dairy liquid wastes may be disposed of separately in stabilization lagoons, by sprinkler irrigation and by septic tank systems, or they may be disposed of by the same system as used for liquid manure. Regulations pertaining to waste disposal are briefly reveiwed.

E-220 Tucker, B.B., C.H. Burton and J.M. Baker. 1972. The use and value of

animal waste as fertilizer for crop production. Circular E-815, Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma.
Report on research to compare poultry, swine, dairy cattle and feedlot cattle wastes on the basis of their nutrient composition. Some figures are given for the dollar value of the various manures.

E-221 Black, D.O. 1965. Disposal pits and incinerators for poultry. OSU Extension Facts, Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma.
Advisory report on disposal pits and incinerators for disposal of dead poultry. Drawings of homemade disposal units were included.

E-222 Witz, R.L., S.L. Vogel and G.L. Pratt. 1970. Sewage disposal systems for your farm home. Extension Bulletin No. 8, Cooperative Extension Service, North Dakota State University of Agriculture and Applied Science, Fargo, North Dakota.
Advisory report on rural sewage systems in which a septic tank is installed as the main component. Various aspects of design and maintenance of septic tanks are discussed. A brief review of North Dakota State Health Department regulations governing sewage disposal systems is appended.

E-223 Skinner, J.L. and H.L. Wiegers. 1962. Disposal of dead birds. Extension Circular 62-1405, Cooperative Extension Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
Good disposal units should be easy to use, safe, sanitary, economical, adequately sized, durable and dependable, and properly located. Pits or subsurface digestion chambers, and incineration are discussed and some commercial and home made units are illustrated.

E-224 DeShazer, J.A. and E.A. Olson. 1970. Gas removal from swine housing. Extension Circular 70-224, Cooperative Extension Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
Review of the most important gases generated from stored swine manure during anaerobic decomposition, and report on model research studies concerning the control of odors and noxious gases by the use of a ventilation system which draws air from the pit area. The oxidation ditch system was considered impractical for existing swine facilities.

E-225 Olson, E.A. ____. Farm sewage disposal. Extension Circular 703, Cooperative Extension Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
The design, construction and maintenance of septic tank disposal systems are considered in detail. Detailed drawings are included in the report.

E-226 Cross, O.E. and E.A. Olson, 1968. Livestock liquid manure disposal systems. Extension Circular 68-776, Cooperative Extension Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
Advisory report on the design, sizing and operation of liquid manure handling systems. The advantages and disadvantages of lagoons, detention ponds, and oxidation ditches as components of liquid manure systems are outlined.

E-227 Olson, E.A. 1971. Guidance for livestock producers on waste management systems. Extension Circular 71-794, Cooperative Extension

Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
Review of the requirements and restrictions imposed on livestock operators by recent state legislation in Nebraska. A copy of the data sheet for livestock waste control facilities used by the Nebraska Water Pollution Control Council is appended.

E-228 Olson, E.A. 1971. Waste management for feedlots. Extension Circular 71-795, Cooperative Extension Service, University of Nebraska College of Agriculture, Lincoln, Nebraska.
Advisory circular dealing with selection of a new site for livestock production facilities and with methods for controlling and managing waste runoff from new and existing lots. The techniques described are based on the results of recent research on waste management by the USDA and the University of Nebraska, and include diversion facilities, debris basins, holding ponds and irrigation systems.

E-229 Bandel, V.A., C.S. Shaffner and C.A. McClurg. 1972. Poultry manure - a valuable fertilizer. Fact Sheet 39, Cooperative Extension Service, University of Maryland, College Park, Maryland.
The value of poultry manure as a fertilizer is reviewed. Manure should be stored in an area protected from rain and snow to protect it from leaching. Nitrogen losses in stored poultry manure can be reduced with superphosphate added at a rate of 200 pounds per ton. Suggestions and guidelines are offered on the use of poultry manure as a fertilizer for field crops, vegetables and fruit trees.

E-230 Holyoke, V. 1971. Recycling animal wastes through crops. Fact Sheet UME-3, Cooperative Extension Service, University of Maine, Orono, Maine.
Discussion on the disposal of animal wastes by spreading them on cropland. The major problems in utilizing manure are the variable nutrient content and the difficulty in spreading it evenly, especially at low application rates. It was suggested that forests may prove to be an effective crop for recycling poultry manure.

E-231 Hutchinson, F. 1971. Phosphorus in the environment. Fact Sheet UME-4, Cooperative Extension Service, University of Maine, Orono, Maine.
General discussion on the role of phosphorus as a pollutant and the fate of phosphorus applied to soils in the form of organic materials such as manure.

E-232 Hutchinson, F. 1971. Decomposition of animal wastes in soils. Fact Sheet UME-5, Cooperative Extension Service, University of Maine, Orono, Maine.
When animal wastes are applied to the soil they are immediately subjected to decomposition by soil microorganisms. Aeration, acidity, moisture level and temperature are discussed in relation to the effect they exert on the growth and activity of manure-decomposing bacteria in the soil.

E-233 Rourke, R. 1971. Soil features that influence animal waste disposal. Fact Sheet UMS-6, Cooperative Extension Service, University of Maine, Orono, Maine.
Soil characteristics that regulate water movement and storage and thereby strongly influence the effectiveness of a soil used for waste removal are

discussed. These soil characteristics are slope, internal drainage, texture, depth, organic matter content, structure and the presence of impermeable soil layers.

E-234 Hutchinson, F. 1971. Nitrogen in the environment. Fact Sheet UMS-8, Cooperative Extension Service, University of Maine, Orono, Maine.
General discussion on forms of nitrogen and the role of nitrogen as a pollutant. Overloading the nitrogen cycle of the soil with manure results in the accumulation of excessive amounts of nitrate nitrogen.

E-235 Hanway, J.J., J.B. Herrick, T.L. Willrich, P.C. Bennett and J.J. McCall. 1963. The nitrate problem. Special Report No. 34, Cooperative Extension Service, Iowa State University, Ames, Iowa. 20 pp. 114 ref. 1 tab. 2 fig.
Literature review on the hazards of nitrates in feeds and water, sources of nitrates (including animal manures), diagnosis of nitrate toxicity, and control of nitrates in the environment. The application of manure to soil usually results in increased nitrate levels.

E-236 Melvin, S.W. 1971. How to comply with Iowa's feedlot runoff control regulations. Agricultural Extension Pamphlet Pm-511, Cooperative Extension Service, Iowa State University, Ames, Iowa.
Interpretation of Iowa's feedlot runoff control regulations and evaluation of how these regulations affect existing and proposed livestock production facilities. Registration is now required of most livestock operations in the State. Costs incurred and benefits accrued from runoff control facilities are reviewed.

E-237 Dale, A.C. 1968. A deep aerated lagoon combined with an irrigation system for animal waste disposal. Prairie Farmer Article, Cooperative Extension Service, Purdue University, Lafayette, Indiana.
A combination of an aerated lagoon with an irrigation system for disposal of the effluent was described and evaluated on the basis of field trials with such an installation at a Purdue dairy farm. An aerated lagoon with a detention time of about 2 years may be expected to operate for 10 to 15 years without objectionable odors, and will reduce total solids by 70%.

E-238 Dale, A.C. and J.E. Mentzer. 1969. Swine waste management and disposal. Publ. AE-76, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 15 pp. 12 ref. 8 fig.
Some of the general aspects of swine waste management are discussed, including the production, composition and value of swine manure, methods of handling and disposing of swine manure - land disposal, biological treatment, dehydration, incineration, composting - and pollution problems arising from mismanagement of manure. A well managed land disposal system appears to be the most feasible from the standpoint of economics and reliability.

E-239 Koenig, H.W., B.W. Mitchell, J.E. Mentzer and N.J. Moeller. 1966. Liquid manure handling for dairy cattle. Publ. DH-114, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 10 pp. 3 tab. 4 fig.
Report on the various elements of a liquid manure system for dairy cattle, including collection, storage, agitation and disposal facilities. Public Health requirements and safety regulations are discussed with respect to

odors, toxic gases, flies, contamination of water supplies, and general sanitation.

E-240 Connor, L.J., R.L. Maddex and L.L. Leighty. 1971. Environmental quality legal considerations for Michigan livestock producers. Extension Bull. E-732, Cooperative Extension Service, Michigan State University, East Lansing, Michigan. 8 pp.
Review of Federal, State and private regulation of pollution caused by livestock operations. Implications for livestock farmers of these regulations are discussed, including site selection, zoning, prior operation, licensing and registration, and compliance with regulations. Cases involving litigation of livestock producers are cited.

E-241 Maddex, R.L. 1971. Whose responsibility? Livestock and poultry waste. Extension Bull. E-720, Cooperative Extension Service, Michigan State University, East Lansing, Michigan.
In this bulletin, 27 questions regarding pollution and pollution control for livestock and poultry wastes are answered. The questions and answers deal with the general aspects of pollution, ways in which animal wastes cause pollution, pollution legislation and standards, the availability of technical assistance for the design of pollution control facilities, presently acceptable methods for disposal of animal wastes, and the role of each livestock producer in preventing pollution.

E-242 Ryan, D.M. 1971. Cold hog finishing houses with either slats or bedding. Publ. M-146, Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota. 11 pp. 14 fig.
Fully illustrated description and evaluation of cold hog finishing houses with either slatted or solid bedded floors. Animal parameters, costs, labor requirements, and construction details are reported. The effects of each type of housing on odors, sanitation and other aesthetic values are discussed, and the manure handling facilities described.

E-243 Ryan, D.M. 1971. Warm hog finishing houses with slatted floors. Publ. M-145, Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota. 12 pp. 15 fig.
Fully illustrated description of slatted-floor hog finishing barns, with emphasis on construction and design details. The advantages of slatted floor housing systems for hogs include decreased space requirements, elimination of bedding, and simplified manure handling.

E-244 Bates, D.W. 1970. Free-stall housing for dairy cattle. Publ. M-138, Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota. 19 pp. 43 fig.
Fully illustrated description of free-stall housing for dairy cattle, with emphasis on manure handling methods and facilities. Manure handling equipment is described and required storage capacities are outlined.

E-245 Bates, D.W., J.A. Moore, G.D. Marx and M.C. Jacobson. 1971. Manure grate design for dairy barns. Publ. M-155, Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota. 4 pp.
Manure grates are installed over the gutters in dairy barns to keep the cows' tails clean. Several grate designs were described and evaluated on the basis of manure hangup, cow safety, acceptance and cleanliness, ease of

cleaning, general management, and keeping the cows' tails out of the gutter.

E-246 Warden, W.K. 1963. Handling and disposing poultry manure. Extension Folder F-323, Cooperative Extension Service, Michigan State University, East Lansing, Michigan.
Discussion on the handling and disposal of poultry manure. The manure is generally accumulated in dropping pits and then field spread. Because of problems with flies, odor, rodents and disease bacteria, other methods are being considered, including inside and outside lagooning, incineration and drying by heat, bacterial action and electrical charges.

E-247 Dale, A.C. 1971. Farm waste disposal systems. Publ. AE-80, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 11 pp. 34 ref.
Review of the present available alternatives for farm animal waste disposal, including land disposal, anaerobic lagoons, aerobic lagoons or oxidation ponds, oxidation ditches, aerated lagoons, drying and refeeding, and deep pit composting. Criteria for selection of one of these systems are presented.

E-248 Purdue University Animal Waste Committee. 1972. Waste handling and disposal guidelines for Indiana dairymen. Publ. ID-81, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 12 pp. 3 tab. 3 fig.
Advisory report intended to acquaint the Indiana dairy farmer with present pollution laws and regulations that most directly affect him, and the present waste handling and disposal guidelines that will help the dairyman determine how nearly he complies with these laws and regulations or how he might develop a system that will comply.

E-249 Purdue University Animal Waste Committee. 1972. Waste handling and disposal guidelines for Indiana poultrymen. Publ. ID-82, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 13 pp. 3 tab. 2 fig.
Advisory report intended to explain the pollution laws and regulations that directly affect Indiana poultry producers, and to provide waste handling and disposal guidelines that will prevent pollution problems.

E-250 Purdue University Animal Waste Committee. 1972. Waste handling and disposal guidelines for Indiana swine producers. Publ. ID-83, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 12 pp. 4 tab. 3 fig.
Advisory report intended to acquaint the Indiana swine producer with present pollution laws and regulations that most directly affect him, and to present waste handling and disposal guidelines that will help the producer determine how nearly he complies with these laws and regulations or how he might develop a system that will comply.

E-251 Purdue University Animal Waste Committee. 1972. Waste handling and disposal guidelines for Indiana beef producers. Publ. ID-84, Cooperative Extension Service, Purdue University, Lafayette, Indiana. 13 pp. 4 tab. 3 fig.
Advisory report intended to acquaint the Indiana beef producer with present pollution laws and regulations which most affect him, and to present waste handling and disposal guidelines that will help the beef man determine how

nearly he complies with these laws and regulations or how he might develop a system that will comply.

E-252 Peterson, C.L. 1966. Planning a liquid manure handling system. Bull. 478, Idaho Agricultural Extension Service, University of Idaho, Moscow, Idaho.
A liquid manure system is made up of four essential elements - storage pit or tank, agitation of material within the tank, a method for emptying the tank, and field distribution. All four elements are discussed and illustrated in this bulletin.

E-253 Kurker, C. 1971. Farm waste management - public health code regulations and statutes. Cooperative Extension Service, University of Connecticut, Storrs, Connecticut.
Sections of the Public Health Code of the State of Connecticut which refer either directly or indirectly to the management of farm animal wastes are listed and interpreted.

E-254 Whitham, G.E. and M.N. Frazier. 1971. Farm waste management. Cooperative Extension Service, University of Connecticut, Storrs, Connecticut.
General discussion on the role of agriculture in maintaining a clean environment, with a brief discussion on manure management. Land disposal is considered to be the ideal method of manure disposal.

E-255 Hansen, R.W. 1971. Livestock waste disposal and water pollution control. Bull. 480a, Cooperative Extension Service, Colorado State University, Fort Collins, Colorado. 26 pp. 6 ref. 2 tab. 4 fig.
This bulletin provides general information on types of systems that may be used to prevent pollution from feedlot runoff, including collection and retention ponds, settling basins and channels, and lagoons. Factors affecting the quantity and composition of runoff are discussed. Management and design factors which are important in odor reduction are noted. A description of legal regulations and standards which apply to the control of water pollution from livestock confinement facilities is appended.

E-256 Hansen, R.W. 1970. Septic tank sewage disposal systems. Bull. 390-A, Cooperative Extension Service, Colorado State University, Fort Collins, Colorado. 22 pp. 5 ref. 4 tab. 11 fig.
Comprehensive report on the septic tank system of sewage disposal. Aspects considered include site selection, legal requirements, design of the disposal field, variations of the system for use in waterlogged or impermeable soils, and construction and maintenance of the tank.

E-257 Vogt, J.E. and J.S. Boyd. 1970. Questions and answers about home sewage disposal. Extension Bull. 577, Cooperative Extension Service, Michigan State University, East Lansing, Michigan.
Advisory report on septic tanks for use in rural sewage disposal systems. Aspects considered include site selection, standards, design and construction of a tile drainage field, sludge and scum accumulation, and the limitations of the septic tank disposal system.

E-258 Parsons, R.A., F.C. Price and W.C. Fairbank. 1970. Poultry manure lagoons. Bull. 750c, Agricultural Extension Service, University of

California, Davis, California.
Report on the sizing, construction, and operation of lagoons for poultry manure storage and/or treatment. Malfunctions of lagoons are described, and data are given on operating and construction costs.

E-259 Anderson, J.R., W.R. Bowen, A.S. Deal, G.P. Georghiou, E.F. Legner, E.C. Loomis and M.H. Swanson. 1972. Fly control on poultry ranches. Publ. AXT-72, Agricultural Extension Service, University of California, Berkeley, California. 18 pp. 6 ref.
A comprehensive report on flies associated with poultry farms, chemical control of flies and the associated hazards of insecticide use, and the control of flies through proper manure management and general farm sanitation.

E-260 Fairbank, W.C. and E.L. Bramhall. 1971. Dead bird disposal supplement. Publ. AXT-n171, Agricultural Sanitation and Waste Management Series, Agricultural Extension Service, University of California, Berkeley, California.
Report on two methods for dead bird disposal which do not create environmental or social hazards, and at the same time reduce dead poultry to saleable by-products: (1) rendering plant disposal in which the by-products are sold as animal feeds or used by feed, soap, and chemical industries; and (2) hydrolysis in which the protein of dead poultry is converted into a high protein feed additive. The principles involved in each recycling process are described and the limitations of each are outlined. Some costing figures are also reported.

E-261 Curley, R.G. and W.C. Fairbank. 1964. Poultry manure management. Publ. AXT-95, Agricultural Sanitation Series, Agricultural Extension Service, University of California, Berkeley, California.
Report on the rates of production of poultry manure, the composition and fertilizer value of poultry manure, fly and odor control, and various utilization/disposal alternatives. The effect of climate on the choice of a manure handling system is discussed. Factors affecting the costs of or returns from manure management systems are outlined.

E-262 Fairbank, W.C. and E.L. Bramhall. 1968. Dairy manure liquid-solids separation. Publ. AXT-271, Agricultural Sanitation Series, Agricultural Extension Service, University of California, Berkeley, California.
Description and illustration of a solids-liquid separation system for use by dairies. The system incorporates a rotary or vibro-energy 20-mesh screen. Data are given on the operation of such a system.

E-263 Petersen, R.T., R.S. Baskett, T.S. Torngren and B.A. Krantz. 1969. Poultry manure for fertilizing winter cereals on phosphorus deficient upland soils. Publ. AXT-306. Agricultural Extension Service, University of California, Berkeley, California.
Results of trials are reported which have shown that, when properly applied, poultry manure gives results equal to, or better than, commercial fertilizers. Poultry manure supplies micronutrients and organic matter in addition to nitrogen, phosphorus and potassium. Nitrogen losses from poultry manure during storage can be substantial, but phosphorus is not lost from the manure by leaching or fermentation. Problems encountered with land disposal of manure include odor, flies, weed growth and salts accumulations.

E-264 Chapman, S.L., W.N. Miley, L. Lankford, L. Barton and L. Hileman. 1972. Fertilizing with poultry litter. Soils and Fertilizers Information Article 1-72, Cooperative Extension Service, University of Arkansas, Fayetteville, Arkansas. 6 pp. 10 ref. 2 fig.
Information is given on the composition and fertilizer value of hen and broiler manure and on average quantities of manure produced by poultry. The use of poultry manure as a fertilizer is reviewed with regard to efficiency of utilization by plants, optimum application rates, and the effect of time of application.

E-265 Adams, D. and R.H. Johnson. 1961. Poultry litter is valuable fertilizer. Agricultural Extension Service, University of Arkansas, Fayetteville, Arkansas.
Advisory report on the composition and rate of production of poultry manure, storage of manure to minimize nutrient losses, and optimal use of poultry litter as a cropland fertilizer or soil conditioner.

E-266 Watson, H. and R.E. Hermanson. 1968. Liquid manure handling systems. Circular R-4, Cooperative Extension Service, Auburn University, Auburn, Alabama. 15 pp. 10 ref. 7 tab. 3 fig.
Advisory report on liquid manure systems, their advantages and disadvantages, design considerations, economics, and operating techniques. The physical properties of liquid manure are reviewed with respect to pumpability. Discussion is included on associated equipment, including agitators, pumps, tanker spreaders, scrapers, storage tanks and sprinklers. Recommendations are given on land areas required for disposal of liquid manure.

E-267 Hermanson, R.E. and H. Watson. 1968. Manure disposal lagoons. Circular R-6, Cooperative Extension Service, Auburn University, Auburn, Alabama.
Advisory report on lagoons, the advantages and disadvantages of the lagoon system for manure treatment, the lagoon process, and site selection, sizing, construction and management of anaerobic lagoons.

E-268 Roney, J.N. 1970. Controlling flies around dairies and corrals. Folder 162, Cooperative Extension Service, University of Arizona, Tucson, Arizona.
Advice is given on the selection and use of insecticides for fly control around dairies and corrals. The importance of good manure management and sanitation was noted.

E-269 Berge, O.I., E.G. Bruns, T.J. Brevik and L.A. Brooks. 1971. Considerations in selecting dairy manure disposal systems. Cooperative Extension Service, University of Wisconsin, Madison, Wisconsin.
The disadvantages and advantages of daily hauling, stacking and liquid manure systems are discussed. Data are presented on the costs of the three types of manure handling systems or variations thereof. Information is also given on the fertilizer value of dairy cattle manure and on the importance of conserving urine. Field applied manure should be worked in soon after spreading, since up to 60% of the nitrogen in fresh manure is lost within four days of excretion.

E-270 Hall, H.J. 1963. Size and maintenance of septic tanks for homes. Science and Technology Guide No. G-1714, Extension Division, University

of Missouri, Columbia, Missouri.
General discussion on the design and maintenance of septic tank systems for rural sewage.

E-271 Russell, W. 1966. Incinerators for use on poultry farms. Science and Technology Guide No. G-8458, Extension Division, University of Missouri, Columbia, Missouri.
Discussion of the advantages and disadvantages of incineration for dead poultry disposal. Features to consider when buying a commercial incinerator or in designing a homemade one are outlined, and include such points as site selection, capacity, cost, sturdiness and automation.

E-272 Russell, W. and G. Geiger. 1968. How to build a poultry disposal unit. Science and Technology Guide No. G-8459, Extension Division, University of Missouri, Columbia, Missouri.
Report on various aspects of dead poultry disposal in disposal pits, including site selection, construction, sizing and operation.

E-273 Russell, W. and J. Falloon. 1971. Poultry manure - a valuable fertilizer. Science and Technology Guide No. G-9331, Extension Division, University of Missouri, Columbia, Missouri.
Information is given on the average chemical composition and fertilizer values of broiler litter, hen manure, and turkey manure, and on the average amount of manure produced by poultry. Advice is offered on the proper storage of manure to conserve its fertilizer value, on the calculation of the proper amount of manure to apply to various crops, and on possible harmful effects from improper use of manure as a fertilizer.

E-274 Moseley, B., S. Nelson, W. McCulloch, S. McKibben, C.G. McNabb, W. Russell, G. Garner, A.J. Dyer, M. Bradley, G. Stiles, R. Frederickson and J. Meyer. 1971. Disposing of dead animals in Missouri. Science and Technology Guide No. G-2900, Extension Division, University of Missouri, Columbia, Missouri.
Discussion of approved methods for the disposal of dead animals, namely disposal at rendering plants, incineration, disposal by burial or in a disposal pit, chemical degradation, and disposing in sanitary landfills. Health aspects of dead animal disposal were briefly discussed, and the legal requirements with respect to transporting dead animals were outlined.

E-275 U.S. Dept. of the Interior. 1970. The economics of clean water. Volume II. Animal wastes profile. U.S. Federal Water Pollution Control Administration, U.S. Dept. Interior, Washington, D.C. 85 pp.
This section of the annual report on the economics of clean water examines the pollution potential of livestock operations in the United States. An estimate of the total pollution potential of livestock and poultry based on the total numbers of livestock being fed is misleading, since not all animal wastes need to be considered as sources of pollution. In order to more accurately estimate the extent of the problem, feedlot cattle, dairy cattle, poultry, swine and sheep are considered individually with regard to geographical distribution and current pollution control measures practiced. The greatest source of pollution is considered to be the fattening of beef cattle.

E-276 Alberta Dept. of Agriculture. 1971. A guide to animal manure disposal

in Alberta. Alberta Dept. of Agriculture, Edmonton, Alberta.
This publication was prepared jointly by the Alberta Department of Agriculture and the Alberta Department of the Environment. It is intended primarily as a guide for farmers and extension personnel to facilitate the efficient and effective disposal of animal manures from confined animal enterprises without creating environmental problems. Prevention of pollution from the farmyard, methods of manure disposal on land, and the use of animal manures as fertilizers and soil amendments were considered. Suggested maximum field application rates were formulated on the basis of the nitrogen content of manure and the utilization of nitrogen by crops.

E-277 Pearce, P.R. 1965. Manure disposal the lagoon way - a factual report. Farm Bldg. Assoc. J., No. 9. pp. 64-65.
Report on trials with a lagoon installation in an area of high rainfall and low sunshine in south-west England. Design criteria, construction details and operational data are reported. After one years' operation, the lagoon was judged to be working satisfactorily. Some problems with flies had been experienced, but odor was not a problem.

E-278 McQuitty, J.B. and J.S.V. McAllister. 1965. Toxic gases from pig slurry. Farm Bldg. Assoc. J., No. 9. pp. 98-99.
Report on the toxic gas hazard resulting from the agitation of liquid swine manure. The results of a survey are reported, confirming that ammonia, methane, hydrogen sulfide and carbon dioxide are produced during the decomposition of pig slurry and that these gases may be released in toxic concentrations by agitation of slurry in storage tanks. Some safety recommendations are outlined.

E-279 Todd, J.R. and G.H.K. Lawson. 1965. Chocolate pigs - a toxicity problem. Farm Bldg. Assoc. J., No. 9. p. 100.
Report on the deaths of several pigs, believed to have been caused by high levels of nitrite in condensate from ventilation shafts and exterior walls of pig barns.

E-280 Anon. 1972. Maine guidelines for manure and manure sludge disposal on land. Miscellaneous Report 142, The Life Sciences and Agriculture Experiment Station, University of Maine, Orono, Maine. 21 pp.
The guidelines presented cover total recycling of nutrients through planned crop production, disposing of excess manure on the land by spreading, piling on the land, bulk burying in landfill, composting, lagoon treatment with sludge and liquid disposal, disposal by irrigation, and dehydrated manure disposal. Maximum rates for manure spreading and for other disposal methods were developed from the physical and chemical characteristics of each individual soil found in Maine and from accumulated research and technical knowledge of the movement of manure liquids and residues on and through each soil type. The guidelines are all presented in tabular form.

E-281 Light, R.G. 1968. Liquid manure handling from milk production systems. Unpublished Paper, Agr. Eng. Dept., University of Massachusetts, Amherst, Massachusetts. 14 pp. 18 ref. 2 tab.
Discussion on the engineering, management, economic, legal and research aspects of liquid manure handling systems for dairy operations. The conventional liquid manure handling system includes equipment for collection and transport of manure, watertight storage or tanks, means to add dilution water to the

storage tank, means for agitation of the resulting slurry prior to removal, provision to empty the storage tank, and provision to haul and spread the manure on the fields. Such a system cannot usually be justified from an economic standpoint; however, the system may be used for convenience, utility or to satisfy pollution regulations. Odor control during pump out and spreading is still one of the major problems.

E-282 Light, R.G. 1971. Handling liquid wastes from milking centers. Cooperative Extension Service, University of Massachusetts, Amherst, Massachusetts. 28 pp. 16 ref. 4 tab.
Review of the characteristics of wastewaters from dairy production operations and of alternatives presently available for disposal of these wastewaters. Handling and treatment systems discussed include settling and holding tanks, subsurface drainage fields, liquid manure systems, oxidation ponds, grass filtration beds, lagoons, and irrigation. Special problems encountered with each system and the advantages and disadvantages of each are outlined. Various types of wastewater pumps and other equipment are described.

E-283 Light, R.G. ____. Materials handling to expedite disposal of agricultural wastes. Cooperative Extension Service, University of Massachusetts, Amherst, Massachusetts. 9 pp.
This paper provides, in outline form, a list of methods which can be used to handle wastes from milk production systems and the problems related to various handling methods.

E-284 George, R.M., M.R. Peterson, C.G. McNabb, J.W.D. Robbins and G.B. Garner. 1971. The Missouri approach to animal waste management. Miscellaneous Publ. MP232, Extension Division, University of Missouri, Columbia, Missouri. 65 pp.
These guidelines for planning, design, construction, and management of alternative systems of livestock waste management were developed by the Missouri Water Pollution Board in cooperation with the Extension Division and Department of Agricultural Engineering, University of Missouri-Columbia. Information is given on water pollution legislation in Missouri, developing waste management systems and obtaining approval of the same, components of waste management systems, soil plant filters, liquid and solids handling systems, and irrigation waste disposal systems. Work sheets are provided throughout the publication to illustrate the concepts described. Tables with design data are appended.

E-285 Allott, D. and D. Willows. 1970. Planned waste management. Leaflet No. 16309, Royal Agricultural Society of England, National Agricultural Centre, Kenilworth, Warwicks.
This leaflet, prepared specifically for the 1970 Royal Show of the Royal Agricultural Society of England, expounds upon the benefits accrued from, and the problems associated with, the use of a planned, systematic approach to waste management at the farm level. The suggested approach involves (1) calculating quantities of waste to be handled and the fertilizer value of the manure; (2) selecting possible storage and handling systems; (3) evaluting all possible systems for suitability and cost; and (4) relating the problem to other wastes and finalizing the selected plan. Information is also included on health aspects of waste management. A short enclosure circulated with the main leaflet expresses some thoughts on the sociological and political aspects of waste management, reviews current research effort in

Britain, and gives some illustrations and specifications for manure handling equipment.

E-286 Dale, A.C. 1967. Tentative criteria for design, construction and operation of the batch type Pasveer oxidation ditch system for the treatment of animal wastes. Unpublished Paper, Dept. Agr. Eng., Purdue University, Lafayette, Indiana. 16 pp. 20 ref. 2 tab. 15 fig.
Review of available information on the principles involved in waste treatment by the Pasveer oxidation ditch, the design of oxidation ditches and associated equipment and installations for treatment of farm animal manures, and factors and problems involved in the operation of batch-type and continuous systems. The oxidation ditch system provides odor free treatment of wastes, reduces the dry matter content of manure by 40-50%, concentrates minerals and salts and oxidizes nitrogen to nitrates. Some cost estimates are given.

E-287 N. Scotland College Agr. 1971. Treatment and disposal of piggery wastes. Final Report to the Meat and Livestock Commission. Mimeo. 23 pp.
Studies of aerobic methods for the treatment and disposal of piggery wastes have been undertaken by the North of Scotland College of Agriculture. This report gives an account of work carried out during 1970-71, briefly reviews previous years work, and draws some general conclusions as to the feasibility of aerobic treatment of piggery wastes and possible systems of treatment. Parameters and factors examined include: (1) the effect of physical factors such as aeration rate, temperature and agitation on oxygen transfer; (2) the aeration efficiency of cage and disc rotors; (3) the microflora associated with aerobic treatment and microbial response to environmental changes; (4) solids and soluble nitrogen degradation and the inhibitory effect of copper; and (5) the biodegradability of separated solid and liquid fractions. Systems considered include a surface aerator system, lagoons and an oxidation ditch. Sand filtration, settling beds, flocculants and flotation have not proved to be consistently satisfactory for clarification of the final effluent from the three major types of installations under trial.

E-288 Morris, W.H.M. 1967. The treatment of manure in oxidation ditches. Mimeo., Dept. Agr. Economics, Purdue University, Lafayette, Indiana. 34 pp. 49 ref. 6 tab. 12 fig.
The oxidation ditch system for wastewater treatment has been used with some success for the treatment of farm animal manure. Some commercial and experimental installations in Europe and America are described. Various aspects of the design, construction and operation of oxidation ditches and associated equipment are discussed. Data are presented on some operational parameters, including sludge accumulation, bacteriology, BOD reduction, oxygen requirements, nitrogen transformations, and costs.

E-289 Atkinson, H.J. and A.J. MacLean. 1962. Manures and compost. Publ. 868, Canada Dept. of Agriculture, Ottawa, Ontario.
Advisory information on the use of manures and manure-composts as soil conditioners and fertilizers. The quantity and composition of animal manure, factors influencing composition, and methods of application are discussed.

E-290 Commonwealth Bureau of Soils. 1963. Manure gas. Publ. No. 874, Commonwealth Bureau of Soils, Harpenden, England. 40 ref.

Research reports published from 1941-1963 are cited in this annotated bibliography on manure gases.

E-291 Commonwealth Bureau of Soils. 1970. The chemical composition of farmyard manures. Publ. No. 1363, Commonwealth Bureau of Soils, Harpenden, England. 71 ref.
Research reports published from 1956-1969 are cited in this annotated bibliography on the chemical composition of farmyard manures.

E-292 Commonwealth Bureau of Soils. 1970. Effects of fertilizers and manures on soil fauna. Publ. No. 1417, Commonwealth Bureau of Soils, Harpenden, England. 61 ref.
Research reports published from 1957-1970 on the effects of fertilizers and manure on soil fauna are cited in this annotated bibliography.

E-293 Commonwealth Bureau of Soils. 1971. Some references to human and livestock non-parasitic diseases in relation to soils. Publ. No. 1437, Commonwealth Bureau of Soils, Harpenden, England. 144 ref.
A few references in this annotated bibliography are concerned with nitrate poisoning, toxic gas poisoning, and water and pasture contamination resulting from the storage and/or disposal of animal manures.

E-294 Commonwealth Bureau of Soils. 1971. Physical properties of soils in temperate areas as affected by organic manuring. Publ. No. 1465, Commonwealth Bureau of Soils, Harpenden, England. 65 ref.
Research reports published from 1965-1970 on the effects of organic manuring (including farmyard manure) on the physical properties of soils in temperate areas are cited in this annotated bibliography.

E-295 Commonwealth Bureau of Soils. 1971. Chemical properties of soils in temperate areas as affected by organic manuring. Publ. No. 1466, Commonwealth Bureau of Soils, Harpenden, England. 82 ref.
Research reports published from 1965-1971 on the effects of organic manuring (including farmyard manure) on the chemical properties of soils in temperate areas are cited in this annotated bibliography.

E-296 Commonwealth Bureau of Soils. 1971. Biological properties of soils in temperate areas as affected by organic manuring. Publ. No. 1467, Commonwealth Bureau of Soils, Harpenden, England. 66 ref.
Research reports published from 1965-1970 on the effects of organic manuring (including farmyard manure) on the biological properties of soils in temperate areas are cited in this annotated bibliography.

E-297 Commonwealth Bureau of Soils. 1971. Physical, chemical and biological properties of soils in tropical and subtropical areas as affected by organic manuring. Publ. No. 1472, Commonwealth Bureau of Soils, Harpenden, England. 60 ref.
Research reports published from 1964-1970 on the effects of organic manuring (including farmyard manure) on the physical, chemical and biological properties of soils in tropical and subtropical areas are cited in this annotated bibliography.

E-298 Canada Dept. Agr. 1971. Pollution on the farm. Publ. 1433, Canada Dept. of Agriculture, Ottawa, Ontario.

This report discusses all forms of pollution on the farm, including that pollution which is caused by farming and livestock operations. Land disposal was considered to be the best method for the controlled disposal of animal manures.

E-299 Ontario Dept. of the Environment. 1972. A suggested code of practice for the establishment of new livestock buildings, renovation or expansion of existing buildings, and disposal of animal wastes. Ontario Dept. of the Environment, Ottawa, Ontario.
This publication, prepared jointly by the Ministry of the Environment and the Ministry of Agriculture and Food, is a revision of an earlier code of the same title. Guidelines presented suggest a co-operative approach to waste management rather than a purely regulatory approach. The code suggests reasonable distance and acreage requirements for stockpiling, treatment and disposal of manure. A "Certificate of Compliance" may be obtained by farmers to give them some protection against future pollution disputes.

E-300 Baars, J.K. and J. Muskat. ____. Oxygenation of water by bladed rotors. Report No. 28, Research Institute for Public Health Engineering T.N.O., The Hague, Netherlands. 71 pp.
Results of large-scale testing of aeration rotors to determine the effect of rotor type and design on oxygenation capacity and economics. Variations of brush rotors, angle steel rotors, plate steel rotors and cage rotors were tested. It is reported that angle steel rotors, with practically the same economy, introduce almost twice as much oxygen as brush rotors of the same length. The effects of rotor diameter, immersion depth and speed of revolution are also reported.

E-301 Hazen, T.E. and J.R. Miner. 1971. Manure management system at swine finishing unit, Iowa State Unitersity. Unpublished Report, Agr. Eng. Dept., Iowa State University, Ames, Iowa. 12 pp. 6 fig.
Description of the Iowa State University swine finishing facility waste management system, and of past experiences and research with it. The system involves an insulated house with good control over ventilation, flushing gutters, an anaerobic lagoon, facilities for recycling of lagoon supernatant for use in the flushing system, and irrigation of surplus water. Design data and drawings of some of the system components are given.

E-302 McCalla, T.M. and F.G. Viets, Jr.. 1969. Chemical and microbial studies of wastes from beef cattle feedlots. Northern Plains Branch, Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Dept. of Agriculture, Washington, D.C. 24 pp. 77 ref. 14 tab.
Discussion of some of the chemical and microbial characteristics of beef cattle wastes and some of the possible microbial and chemical transformations that reduce the disposal problem. Some of the problems that need investigation from a microbial and chemical viewpoint are noted.

E-303 Humenik, F.J., R.W. Skaggs, C.R. Willey and D. Huisingh. 1972. Evaluation of swine waste treatment alternatives. Unpublished Paper, Biological and Agricultural Engineering Dept., North Carolina State University, Raleigh, North Carolina. 19 pp. 6 ref. 11 tab. 1 fig.
Report on the treatment of swine waste by a single unaerated lagoon, unaerated series lagoon system and preliminary data for land disposal of

effluent from a single unaerated lagoon. Major constraints on the lagoon system are the disposal of excess liquid and the potential of odor and excessive leakage. On the basis of preliminary data, an allowable nitrogen loading for sandy loam appears to be 10 - 15 lb/acre/week. Results have indicated that heavy metal feed additives, such as copper, can pose an environmental and health threat; however, lagoons act as a copper trap when used prior to land disposal.

E-304 Humenik, F.J. and G.J. Kriz. 1972. Comparison of carbon versus oxygen-based parameters for agricultural water quality management. Unpublished Paper, Dept. of Biological and Agricultural Engineering, North Carolina State University, Raleigh, North Carolina. 14 pp. 7 ref. 4 tab. 1 fig.
Report on research in animal waste treatment which has pointed out that analyses routinely employed for the characterization of sewage or municipal wastewater cannot be indiscriminately used for the characterization of agricultural wastes. It is suggested that the conjunctive use of an instrumental oxygen-based (COD) and carbon-based (TOC) analyses provides a rapid, simple and reliable method of determining the pollutional potential and oxidation state of wastewater. Research with lagoons suggests that the COD/TOC ratio is a better indicator of treatment progress than BOD or TS.

E-305 Kriz, G.J. 1972. Effects of agricultural practices on aquifers. Unpublished Paper, Dept. of Biological and Agricultural Engineering, North Carolina State University, Raleigh, North Carolina. 18 pp. 88 ref.
Review of the literature published since 1969 on the effects of agricultural practices on aquifers. One section is devoted specifically to animal wastes. On the basis of published research, it is reported that nitrate levels beneath feedlots usually decline markedly with depth, probably as a result of denitrification and the effect on infiltration of a manure packed cover. Some type of pollution is probably occurring beneath feedlots but how fast the pollutants are moving to the water table and how far they move in aquifers is not generally known.

E-306 North Carolina Board of Water and Air Resources. 1972. Tentative design criteria for the design, installation and operation of animal waste treatment lagoons in North Carolina. North Carolina Board of Water and Air Resources, North Carolina Department of Natural and Economic Resources, Raleigh, North Carolina. 5 pp.
This document establishes the minimum acceptable criteria for design and construction of disposal lagoons located to serve predominantly rural or agricultural areas of North Carolina.

E-307 Pratt, G.L. and R.L. Witz. 1970. Confinement housing of beef in North Dakota. Progress Report, Annual Agricultural Engineering Field Day, North Dakota State University, Fargo, North Dakota. 8 pp. 2 ref. 2 tab. 4 fig.
Preliminary results of beef cattle confinement housing research in North Dakota. Early work was conducted with a small pilot-scale system in which wastes were collected beneath slats, the liquids being continuously drained away to an evaporation pond, and the solids being removed with a scraper on a daily basis. A larger research facility now in operation compares the system described above to a slurry handling system in which slurry is stored

in a manure cellar below a slatted floor. Studies are being conducted to evaluate methods of handling and utilization of manure solids.

E-308 Reed, C.H. 1972. Recycling and utilization of biodegradable wastes by incorporation in the soil by plow-furrow-cover and sub-sod injection. Unpublished Paper, Dept. of Biological and Agricultural Engineering, Rutgers University, New Brunswick, New Jersey. 9 pp. 4 fig.
Description of recently developed equipment designed to incorporate slurried and semi-solid wastes into the soil by plow-furrow-cover and sub-sod-injection techniques. Seven prototypes have been designed, assembled and field tested since initiation of the Rutgers program to develop rapid cover land disposal systems.

E-309 Dale, A.C., J.L. Halderson, J.R. Ogilvie, M.P. Douglas, A.C. Chang and J.A. Lindley. 1971. Management of dairy cattle wastes by the deep aerated lagoon and irrigation onto soils and plants. Progress Report, Dept. Agr. Eng., Purdue University, Lafayette, Indiana. 10 pp. 5 ref.
After preliminary field testing indicated the feasibility of an aerated lagoon and sprinkler irrigation system for management of dairy cattle manure, a full scale system has been installed at the Purdue Dairy Farm. Design criteria and operational characteristics are reported. The system is convenient and relatively odor free, does not involve a large amount of labor, is economically feasible, provides a place for storage during the winter months, conserves nutrients in the wastes, and minimizes pollution of surface and subsurface waters.

E-310 Ministry of Agriculture, N. Ireland. 1968. Annual Report on Research and Technical Work. Ministry of Agriculture, N. Ireland.
Report on research activity of the Research Division, Greenmount Agricultural and Horticultural College, including: (1) the use of pig slurry as a grassland fertilizer; (2) oxidation ditches for aerobic treatment of poultry droppings; and (3) the removal of cattle slurry from underneath slatted floors by the continuous flow method.

E-311 Ministry of Agriculture, N. Ireland. 1969. Annual Report on Research and Technical Work. Ministry of Agriculture, N. Ireland.
Report on research activity of the Research Division, Greenmount Agricultural and Horticultural College, including: (1) the effect of continuous applications of pig slurry on grassland; and the production of beef from permanent pasture using pig slurry as the only source of fertilizer; (2) the production of barley when manured with pig slurry and the effect of method of application; (3) use of an oxidation ditch for aerobic treatment of poultry droppings; (4) the effect of varying rates of pig slurry applied to grassland, on the herbage, soil and chemical composition of the drainage water; and (5) the removal of cattle slurry from underneath slatted floors by the continuous flow method.

E-312 Ministry of Agriculture, N. Ireland. 1970. Annual Report on Research and Technical Work. Ministry of Agriculture, N. Ireland.
Report on research activity of the Research Division, Greenmount Agricultural and Horticultural College, including: (1) long term effects of applying high rates of pig slurry to grassland the effect of copper returned in the slurry on the health of sheep grazing the grass; (2) the effect of pig slurry

and method of application of the slurry on the production of barley; (3) oxidation ditches for treatment of poultry manure; and (4) the aerobic treatment of cattle manure.

E-313 Stewart, T.A. 1968. The effect of age, dilution, and rate of application of cow and pig slurry on grass production. Rec. Agr. Res., Minist. Agr., N. Ireland, 17(1): 67-90. 55 ref. 24 tab. 8 fig.
Report on a number of one-year experiments carried out to assess the importance of age, dilution and rate of application on the response from cow and pig slurry when used as a grassland manure. Production was similar for cow and pig slurry. Grass yields were increased when cow slurry was stored for a period before use, whereas the reverse was true of pig slurry. The length of storage period, up to three months, had no effect on the fertilizer value of either type of slurry. The rate of application did not change the effects produced by the other parameters under study. Split applications were generally much more efficient than large one-time applications. Dilution had a favorable effect on the response of grass to slurry, but the optimum dilution was dependent upon the type of slurry (cow or pig) and on the stage at which the grass was cut. The fertilizer value of slurry was assessed relative to commercial fertilizers.

E-314 Stewart, T.A. 1968. A rapid method for estimating the soluble nitrogen content of animal slurries. Rec. Agr. Res., Minist. Agr., N. Ireland, 17(1): 91-96. 8 ref. 7 tab.
"The development and operation of a rapid method for estimating the soluble-N content of animal slurries is described. After brief digestion of the slurry in dilute acid at room temperature, filtration, and dilution of the filtrate, ammonium-N is read off directly on a B.D.H. Lovibond Nessleriser. The method can be carried out independently of laboratory facilities by unskilled personnel and determinations can be completed in less than 20 minutes. The soluble-N contents of a range of pig slurries, determined by the Rapid method, were compared with those obtained by the method used by Hoyle and Mattingly to estimate the soluble-N content of composts. A highly significant correlation was obtained between the two methods and a regression equation for use with pig slurries is given. A practical use of the rapid method to maintain a constant rate of nitrogen application when manuring grassland with slurry, is discussed."

E-315 Stewart, T.A. 1968. The collection of slurry samples on a field scale and the subsequent storage for chemical analysis. Rec. Agr. Res., Minist. Agr., N. Ireland, 17(1): 97-100. 1 ref. 6 tab.
"A simple and effective method of collecting slurry samples on a field scale where application is made by vacuum tanker, is described. This involves the attachment of buckets to the tanker in the vicinity of the spreading mechanism. Two buckets placed on either side of the tanker outlet were found to reduce sample variation compared with a single bucket suspended directly under the tanker outlet. Total-N, soluble-N, P_2O_5 and K_2O contents of fresh slurry samples collected by the two bucket method were similar to those obtained from samples collected in shallow trays placed at random around the field. The percentage dry matter and pH were significantly lower when collected in buckets attached to the tanker compared with field trays. The effects of a brief storage period on the chemical composition of slurry samples was examined in a single laboratory study. Storage at room temperature, in one-

litre polythene bottles with tightly fitting screw-on lids, had the least effect on chemical composition when compared with storage of samples at room temperature after acidification and at temperatures below zero Centigrade. This was also the most convenient of the storage methods considered. Total and soluble nitrogen contents were unaffected after one week, and phosphate and potash contents after eight weeks storage at room temperature in this type of bottle.

E-316 Stewart, T.A. 1970. Studies on the use of animal slurries to manure barley. 1. The effect of age and dilution of cow and pig slurry when applied at various rates, both before and after sowing. Rec. Agr. Res., Minist. Agr., N. Ireland, 18(2): 125-136. 31 ref. 13 tab. 3 fig.
"Experiments in 1965 and 1966 assessed the effects of storage period, dilution rate and time of application of cow and pig slurry on barley, grown as a 6th and 7th year cereal crop. Pig slurry gave slightly more grain than did cow slurry. Slurry applied immediately after sowing, gave two cwt per acre more grain than when it was applied to the ploughed surface before cultivations. Storage of slurry for up to three months before application did not affect yield. The response of seedbed applications of slurry was increased by dilution. The optimum dilution is probably not greater than 1 part slurry: 2 parts water for either type of slurry. Yields were not increased when diluted slurry was applied to the ploughed surface, and indeed were considerably reduced when slurry was applied at a dilution rate of 1:5. The experiments suggest that slurry nitrogen is almost as effective on barley as is inorganic fertiliser nitrogen."

E-317 Stewart, T.A. 1970. Studies on the use of animal slurries to manure barley. 2. The effect of autumn, winter and spring applications of cow, pig and poultry slurry. Rec. Agr. Res., Minist. Agr., N. Ireland, 18(2): 137-142. 6 ref. 12 tab.
"Experiments in 1966 and 1967 examined the effects of cow, pig and poultry slurry applied in the autumn, winter and spring to barley grown as a 7th or 8th year cereal crop. The slurry was applied to stubble ground and to the ploughed surface at rates supplying 50, 100 and 150 lb total N per acre. Winter and spring applications of slurry gave similar yields which were significantly higher than those from autumn applications. Pig and poultry slurry behaved similarly, outyielding cow slurry, particularly when applied in the winter and spring at the higher rates. Differences between slurry types and rates of application were small at the autumn application, presumably because of nutrient losses through leaching. Yields were not improved by ploughing-in slurry immediately after application when compared with applications made to the ploughed surface. Results from one experiment suggest that supplementation of slurry with inorganic phosphate may be necessary under conditions of low available soil phosphate."

E-318 Stewart, T.A., D. Magill, D. Morris and J. Gordon. 1972. Slurry storing and handling. Booklet prepared for Slurry Handling Demonstration, Loughry Agricultural College, Cookstown, Co. Tyrone. 19 pp.
This booklet contains the details of a demonstration presented at Loughry College and four advisory articles entitled: (1) Using Slurry on the Farm; (2) Collection and Storage of Slurry; (3) Slurry Spreading Machinery; and (4) Handling Slurry Safely.

SECTION F

Articles on farm animal wastes appear in many semi-technical publications such as farming papers and magazines and occasionally receive attention in the popular press. This material may include such useful items as indications of farming and public opinion concerning animal wastes, information on individual operator's attempts to solve immediate problems, and matters of political and regulatory significance. This sixth section contains some more recent material from such sources.

F-001 Mitchell, W.H. 1961. Pelleting poultry manure. Crops Soils, 13(4): 16.
Report on research at the University of Delaware on poultry manure pelleting. Poultry wastes to be pelleted were removed from the broiler house, passed through a hammer mill, supplemented with 100 pounds superphosphate per ton of manure (to reduce ammonia losses and raise the phosphorus content of the finished product) and pelleted. The pellets were sold at $80.00 per ton as an organic soil conditioner. A big problem with the system was wear on the pelleting equipment, resulting from sand and other abrasive materials in the manure.

F-002 Hinish, W.W. 1961. Manure - Handle with care. Crops Soils, 14(2): 7-9.
Emphasis in this general paper on animal waste handling was on preserving the nutrient value of the manure. A ton of average livestock manure was rated equal in nutrient value to a 100-lb. bag of 10-5-10 fertilizer, the nutrient content of poultry manure (20-16-8) and sheep manure (20-6-20) being somewhat higher. The forms in which each nutrient appears in manure were discussed. Recommended management practices included keeping liquid losses to a minimum, avoiding large excesses of bedding, using watertight floors, using superphosphate to reduce ammonia losses and increase phosphorus value of the manure and storing manure to avoid spreading on snow or frozen ground.

F-003 Hanson, L.D. and W.E. Fenster. 1969. What's killing our lakes? Crops Soils, 22(1): 13-15.
Various sources of nutrients and organic loadings on lakes and streams were considered, including fertilizers, manures and plant residues. Sediments were not considered to be a significant source of phosphorus to the lake ecosystem. Water from snowmelt carries much higher amounts of phosphorus than runoff water during other times of the year, this phosphorus coming from plant residues that have been frozen over the winter, allowing phosphorus compounds to be washed out. Recommended practices to reduce nutrient runoff from animal operations included not spreading manure on frozen land or slopes, diverting feedlot and grain storage runoff away from streams and lakes, and storing manure in 'safe' places.

F-004 Crops and Soils. 1970. Manure, not flooding, reduces rootworm hatching rates. Crops Soils, 22(4): 14.
Applying manure to corn fields before planting can reduce rootworm populations by as much as 60%. Predatory mites in the manure reduce corn rootworm populations by feeding on the larvae and eggs of the rootworm. Three times as many beneficial mites were found in plots which received manure as in plots that did not receive manure.

F-005 Turner, D.O. 1971. Disposing of animal wastes. Crops Soils, 23(5): 10-11.
Report on attempts to solve the manure handling problems from dairy farms in Washington. To overcome the problem of heavy winter rainfall, covered housing units were constructed. Wastes from the buildings were pumped to the fields or to winter storage lagoons, thereby eliminating the need for ground transport in wet fields. Further studies are underway to determine the effects of continued high nitrogen loadings on the manured fields. Current recommendations call for 1 acre of disposal land for every two cows.

F-006 Long, D. (ed.) 1963/67. Farmbuildings. Farm Journals Ltd., London, England.
In addition to many research reports on animal waste management (which are indexed individually in this bibliography), several short articles on various related aspects of waste management also have appeared from time to time. These include (with their respective issue number and page): concrete sectional effluent tanks (1: 69); plastic manure tanks (2: 77); wooden effluent tanks (4: 77); Archimedes screw-type sludge auger and effluent tank spreader (5: 65); Pasveer oxidation ditch (6: 15); prefabricated sewage disposal plant (6: 53); chemical deodorants (7: 67); butyl synthetic rubber sheeting for effluent ponds (8: 63); paint for preventing corrosion of effluent tanks (8: 65); carbon dioxide poisoning (10: 11); overground slurry storage (11: 10); and organic irrigation manure disposal (12: 11). Several structure study sheets have also appeared in each issue, in which references were made to the application of manure handling systems to various production enterprises.

F-007 Roberts, L., E. Uldall-Ekman, S. Berglund and P. Broad. 1964. Easy manure handling. Farmbuildings (London), No. 2. pp. 23-27. 12 fig.
The disposal of the waste products from livestock enterprises is primarily a husbandry rather than a farm buildings matter but there are many ways in which the design of buildings and associated works can ease the herdsman's job. This article reviews these points and discusses those aspects of the problem which most interest those seeking solutions in Holland, Sweden, Denmark and North America.

F-008 Trask, A.B. 1964. Report on manure lagoons. Farmbuildings (London), No. 3. pp. 28-29. 2 fig.
General review of lagoon practice in North America with discussion on the biological processes involved, lagoon design and construction, and feasible loading rates. Some of the problems and merits of the lagoon system are assessed on the basis of practical experience with large lagoon installations in the United States.

F-009 Dawson, R.E. 1964. Manure tank construction. Farmbuildings (London), No. 3. pp. 61, 64. 2 fig.
"With the new regulations covering the discharge of effluents into rivers and sewers more farmers need to build tanks to hold dung and urine before it is spread on the land. In many cases these tanks will have to be of considerable size. This article describes a relatively simple and yet structurally sound method whereby a farmer can construct his own tank without help from builders where necessary providing he or his staff are sufficiently experienced."

F-010 Harvey, N. 1964. Slatted floors for fattening pigs. Farmbuildings (London), No. 3. pp. 73-75. 2 tab.
Summary of the main conclusions of 33 published reports on investigations into slatted floor systems for fattening pigs. Research leading to those reports was conducted over four years at 9 European and 8 American research stations. Specific references are made to manure storage and handling, the prevention of gas poisoning, the control of odor, and the labor requirements of the system.

F-011 Baxter, S.H. and D.S. Soutar. 1964. Slatted floors for intensive beef.

Farmbuildings (London), No. 4. pp. 16-21. 9 fig. 1 tab.
Review of experience with slatted floor systems for beef housing, including specific references to waste management and environmental control.

F-012 Harvey, N. 1964. Slatted floors for beef in Ireland. Farmbuildings (London), No. 5. pp. 63-64.
Report on four years of experimentation at research stations in Ireland comparing slatted floor systems and conventional strawyard systems for fattening cattle. Manure handling systems were described and assessed.

F-013 Rijkenbarg, G.J.H. 1965. Cowshed manure handling. Farmbuildings (London), No. 6. pp. 43, 45. 4 tab. 5 fig.
Interim report on work conducted by the Netherlands Institute for Farm Buildings to develop systems and fittings for the mechanization of mucking out cowhouses. The five systems compared were shovel and wheelbarrow, mechanical dung scraper, continuous or reciprocating dung scraper, sludge collection beneath slatted dunging channels with 1 month storage, and sludge collection in a pit with 3 months' storage. A table is presented giving the total annual costs of each system for different sized operations.

F-014 Farmbuildings. 1965. Slurry painting. Farmbuildings (London), No. 8. p. 14.
The Planning Department of Somerset County Council has recommended that new buildings with white asbestos cladding should be painted with cow dung, applied as a slurry on the outside surfaces. The treatment is supposed to encourage the growth of lichen on the white asbestos, have a discoloring effect, and generally make the buildings less conspicuous, thereby preserving the natural beauty of the surrounding countryside.

F-015 Tilley, M.F. 1965. Handling manure from cubicles. Farmbuildings (London), No. 8. pp. 27-29. 1 ref. 3 tab. 4 fig.
Report on a study of three alternative methods of storing and disposing of the slurry from cow cubicles: (1) all slurry kept above ground level and scraped to a dungstead, the liquid to be drained away into drains; (2) slats above watertight slurry pits in the access areas only; and (3) suspended floor over the entire area of the building so that both the slatted floor access area and the cow cubicles bridge over the slurry pit, increasing the storage capacity. Data were presented on labour requirements, time required to clean buildings, and costs. Each system had its own advantages and disadvantages, so that the choice of a particular system will depend on the individual circumstances of the farm under consideration.

F-016 Goodman, D.A.S. 1965. Corrosion of metals. Farmbuildings (London), No. 8. pp. 44, 47, 49.
Discussion of the causes and prevention of corrosion of metal farm buildings. References were made to the corrosive effects of manure and the need to prevent the direct contact of manure and metal by concrete to prevent corrosion.

F-017 Druce, R.G., P. Franghaide, G.E. Jones and H.J.M. Messer. 1965. Manure lagoons for poultry. Farmbuildings (London), No. 9. pp. 65-66. 2 tab.
Report on an investigation by the Agricultural Research Council Farm Buildings

Unit at Silsoe, Bedford, on the use of indoor poultry manure lagoons. Two houses were investigated, one in a warm climate and the other in a cooler climate. Data were presented on the pH, dry matter content and temperature of sludge, sludge accumulation, house temperature and humidity, stocking rates and costs, and bird performance. It was concluded that, since the decomposition of manure was not great enough to enable the lagoons to be used for a second year, and as the weight of the contents of the lagoon were greater than when the droppings are kept dry, the indoor lagoon system does not have any advantages except when there is already a liquid manure disposal system on the farm. Research needs were outlined.

F-018 McAllister, J.S.V. 1966. Gases from dung under slats. Farmbuildings (London), No. 11. pp. 23-24. 20 ref.
Review of what is presently (1966) known about manure gases and their effect on animal and human health. The characteristics of, and reaction of humans to, methane, carbon dioxide, ammonia and hydrogen sulfide were discussed. Research reports pertaining to the effect of these various gases on poultry, pigs and cattle were reviewed. Recommendations on means to avoid casualties due to toxic manure gases were outlined.

F-019 Long, D. 1966. Do manure lagoons work? Farmbuildings (London), No. 11. pp. 34-36. 2 ref. 7 fig.
Report on the design and operation of 7 lagoons in Britain. All the lagoons appeared to be working well, although none had been in operation long enough to make an assessment of the long-term performance of the lagoon system. Most of the lagoons showed an appreciable reduction in the BOD of the neat wastes. Since rainfall exceeds evaporation in most of Britain, provisions must be made to handle the liquid effluent. In some cases, seepage will take care of the excess liquid but, in other cases, the effluent must be drained off into other ponds or ditches.

F-020 Sanderson, P. 1966. Choosing a fattening piggery. Farmbuildings (London), No. S1. 20 pp. 10 fig.
An authoritative and up-to-date (1966) handbook on pig housing with many references to aspects of waste management. The type of waste handling system selected depends on many factors, including feeding system, availability of labor, type and numbers of pigs housed, and eventual disposal system.

F-021 Haartsen, P.I. 1967. Cows poisoned by dung gases. Farmbuildings (London), No. 15. p. 21.
Report from the Netherlands of an investigation into an obvious case of asphyxiation of cows, caused by the release of manure gases during agitation of dung in an adjoining manure tank. Gas concentrations were measured at the same locality some days after the casualty under practically the same conditions. Concentrations of the various gases were low before agitation, but by strong agitation, concentrations of ammonia, hydrogen sulfide and carbon dioxide were increased. Concentrations of ammonia and hydrogen sulfide of 0.07% and 0.06%, respectively, were measured near the heads of cows in the building. Bad ventilation probably played a role in the buildup of high gas concentrations within the cowshed.

F-022 Poelma, H.R. 1967. Oxidation ditch for pig manure. Farmbuildings (London), No. 16. pp. 11-12.

Recognizing the inadequacy of drying, the Bihu process (methane digestion), and lagooning for treatment of piggery wastes, research was conducted in Holland with the oxidation ditch system. Data were given on the design and operation of the first Pasveer oxidation ditch to be used under farm conditions. The BOD of diluted hog wastes was reduced from 7,500 mg/l to 30 mg/l. Problems included scum formation and sludge accumulation.

F-023 Linn, A. 1966. Whipping the manure problem. Farm Quart., 21(6): 56-59, 115-116.
Review of the oxidation ditch principle and description of some of the early oxidation ditch installations in the U.S.A. The major advantages of the oxidation ditch are labor saving, convenience of handling manure, odor free operation, concentration of the fertilizer value of manure, and reduction in equipment investments. The design and management of oxidation ditches were described in some detail, based on research with oxidation ditches at Purdue University. The costs of operating an oxidation ditch were estimated.

F-024 Straub, C. 1967. Feedlot under roof. Farm Quart., 22(2): 74-75, 100, 102.
Report on total confinement systems for beef production, with a description of two working installations. Manure handling and ventilation systems were described and evaluated.

F-025 Young, P. 1968. Pollution: The costly nuisance. Farm Quart., 23(1): 82-83, 133-134.
Many feedlot operators are being taken to court and tried under the law of nuisance. Application of this law is troublesome for those associated with agriculture for three reasons: (1) The principle that "a landowner should be able to do anything he wants on his own land" must be modified to include the phrase "so long as this does not cause grief to his neighbors or violate a statute"; (2) The law of nuisance does not respect the order in which the "nuisance" and the "neighbor" arrived at a particular location; and (3) The law of nuisance is not influenced by whether or not an offender is making an effort to avoid pollution. It was suggested that good public relations can solve urban-rural conflicts which the law can not.

F-026 Anderson, E.D. 1970. Turning wastes into profits. Farm Quart., 25(6): 48-49, 85.
General discussion on drying poultry wastes with emphasis on investment and operating costs, and marketing. Several experiences by U.S. poultry producers are described.

F-027 Anderson, E.D. 1971. Helping feedlots restrict pollution. Farm Quart., 26(2): 96-98.
Review of the feedlot situation in Kansas. Recently enacted legislation is discussed and methods being employed by feedlot operators to comply with the new legislation are described.

F-028 Anderson, E.D. 1971. How to decode the pollution law maze. Farm Quart., 26(3): 67-69.
Review of water and air pollution legislation in the U.S.A. as it affects agriculture and, in particular, livestock operations. A list of state water quality agencies is given.

F-029 Fichte, B.E. 1971. A feedlot dies. Farm Quart., 26(6): 35, 38-40. 3 fig.
The recent case of Sun City, Arizona (a large residential development) versus Spur Industry (a large cattle feedlot) is reported from the viewpoint of the feedlot and of agriculture in general. Even though Spur was operating a licensed and inspected legal agricultural operation, and had been doing so all the time that Sun City was developing, they have been ordered by the Arizona Supreme Court to cease operation of the 33,000 head feedlot as a result of complaints by Sun City residents of odor and flies from the feedlot.

F-030 Harley, R. 1971. The people who complained. Farm Quart., 26(6): 36-40. 3 fig.
The recent case of Sun City, Arizona (a large residential development) versus Spur Industry (a large cattle feedlot) is reported from the viewpoint of the residents of Sun City. The odor and flies from the feedlot, before it ceased operation, had caused considerable nuisance to Sun City homeowners who had been told nothing of the proximity of the feedlot to Sun City when they purchased their new homes. Several unsuccessful attempts had been made to get Spur to install odor control devices before Sun City residents decided to sue the feedlot operator. Another farmer in the area has been forced to replace a gasoline pump engine with an electric motor, as a result of complaints by Sun City residents of excessive noise.

F-031 Anderson, E.D. 1972. Managing animal waste disposal systems. Farm Quart., 27(2): 56-58.
One man's experiences with lagoons are described. Six lagoons are used to receive wastes from hog farrowing, nursing and fattening barns and are reported to be performing satisfactorily. In the spring of 1970, one lagoon failed to activate due to a build-up of toxic elements from the arsenic and copper feed additives used in the ration of fattening pigs. Seepage from some of the lagoons was noticed. Recommendations are given on the design and operation of lagoons.

F-032 Feedlot. 1968. Here's a manure disposal system that makes money. Feedlot, 10(12): 30-32.
Report on a unique manure disposal system which serves a 9,600-head, close-confinement steer finishing unit. The steers are fed on concrete slatted floors through which all the excrement falls to pits below. Once through the slats, the manure is scraped every 20 minutes to a deeper pit at the centre of the long pens by a pair of metal drags. Material in the pit, which is about 85% water, is pumped through underground pipes to a large holding tank where it is agitated and subsequently pumped to a dehydrator. The large dehydrator, heated to about 200°F, dries the manure to about 10% moisture. Most of the dehydrated manure is sold as a fertilizer to the Far East, but the operators are now looking at the possibility of using it as a high nutrient supplement.

F-033 Feedlot. 1969. Feedlot pollution. Feedlot, 11(1): 24-26, 28-29.
Discussion of antipollution regulations in the U.S.A. which directly or indirectly apply to feedlots, and evaluation of several alternatives to comply with the regulations. It was stressed that people who are proposing new feedlots or expanding existing operations should plan ahead and should consider manure handling as an intricate part of the entire feedlot system.

F-034 Feedlot. 1969. Waste management - a review of the problem and some solutions. Feedlot, 11(5): 14-15, 18, 33-34.
A general review of the problems posed by large accumulations of manure in small areas where farm animals are confined. Feedlots can contribute nutrients to groundwater through seepage and to surface water by runoff, seepage and ammonia volatilization. Some solutions to the problem of waste handling at feedlots were discussed, but it was recognized that an ideal solution has not yet been discovered.

F-035 Feedlot. 1969. Reader survey report. Feedlot, 11(5): 20.
Of 298 respondents to Feedlot's reader survey, 282 said they put manure back onto the land. This was their means of disposal, but they also valued it at $4.46/ton. Twenty-three of those responding said they had liquid manure systems; the average size of feedlot in this category was only 464 head. Some reports were given of marketing the manure, either as is or after some sort of stabilization.

F-036 Montgomery, G.A. 1969. Runoff control Kansas style. Feedlot, 11(5): 24-26.
The author reports on the development of more stringent controls on stream pollution from feedlots in Kansas. Several new feedlots and the systems used by them to control runoff are described. A description is also given of the experimental setup used by ARS scientists at the University of Nebraska to provide information on feedlot waste management.

F-037 Feedlot. 1969. Waste - a nutritious livestock feed. Feedlot, 11(5): 28, 32.
Report on research at Auburn University to evaluate feedlot wastes as a feed for beef cattle. The effect of such a program of recycling feed was evaluated from the standpoint of feedlot economy, waste management and public acceptance.

F-038 Feedlot. 1969. Researcher produces commercial fertilizer from livestock wastes. Feedlot, 11(5): 57.
Report on a manure handling system developed in Indiana. Poultry droppings are collected in a weak phosphoric acid solution which immediately denatures and stabilizes the droppings. Liquids are recirculated through the system and solids are drawn off for chemical supplementation to reduce acidity and bring about the desired fertilizer analysis. It was estimated that a 20% profit, or about $15.00/ton, might be realized from the product prepared by the system described.

F-039 Blair, J.F. 1969. Run-off control system aids waste management. Feedlot, 11(5): 58-60.
Description of the runoff control facilities at a new 30,000-head feedlot in Texas. Water not falling directly on the lot is diverted and collected in a settling basin. Runoff from the lot is collected in a lagoon. Effluent from the settling basin and lagoon can be used for irrigation.

F-040 Montgomery, G.A. 1969. Outdoors with slatted floors. Feedlot Management, 11(10): 14-17.
The author reports on two operational feedlots in the lower Mississippi Valley which have incorporated the idea of slatted floors over manure

holding tanks into the design of their outdoor feeding areas. Periods of frost in the area do not last longer than a few days and the slatted floors have worked well. The solid feeding floors are sloped 1:6 to provide for manure movement back onto the slatted floor area.

F-041 Miner, J.R. 1970. Environmental challenge: acceptance as a neighbor or rejection as a nuisance. Feedlot Management, 12(5): 14-15, 34.
Site selection is of greatest importance in determining the acceptability of a feedlot operation, including distances to residences, wind direction and topography, adequacy of land area for waste disposal and for an odor buffering zone, and soil type and structure. The principle water pollutants from animal manures are organic matter, plant nutrients and infectious agents. Steps to be taken to avoid water and air pollution are outlined. Other nuisances arising from feedlots are discussed and include noise, unsightliness, flies and other pests.

F-042 Feedlot Management. 1970. Reader survey report. Feedlot Management, 12(5): 18, 42.
The results of a reader survey indicate that feedlot operators are willing and ready to accept the advent of feedlot regulations by the State. They realized that antipollution regulations will become a vital part of feedlot management and will mean an additional cost that must be borne if natural waters are to be preserved. Feedlot operators are depending on research for guidance. They also indicated that they do not know what regulations exist in their own state. Specific comments by feedlot operators are quoted and include ideas such as: (1) Governments should share the cost of pollution control devices; (2) Before laws are made, there should be a waste management system that is proven to work; (3) It must be established in what way and to what extent feedlots are guilty before plunging into regulations; (4) The farmer feeder is polluting no more now than ever before; and (5) Feedlots smaller than 500 head/year pose no pollution problem.

F-043 Feedlot Management. 1970. Two systems provide comparison. Feedlot Management, 12(5): 19.
Report on a 1,000-head/year feedlot where half the animals are fed in a $35,000 enclosed barn with liquid manure storage and half in an outside lot with conventional manure removal. The two systems provide a good comparison of different ways of handling manure. The owner of the feedlot says that he realizes his feedlot is polluting to some extent, but he does not want to do anything until he knows that what he does will conform to regulations.

F-044 Castner, S.L. 1970. Pollution and politics. Feedlot Management, 12(5): 24, 48.
The controversy surrounding the plans for a proposed 10,000-head beef cattle feedlot in Indiana is discussed. The plan submitted for approval called for the construction of a 16-acre lagoon in the centre of an oval of cattle pens. However, the lagoon would be only 80 ft. from a stream supplying water to a recreational and drinking water supply. The proposed feedlot was eventually rejected by the Indiana Stream Pollution Control Board which must approve all new feedlots.

F-045 Montgomery, G.A. 1970. Feeding barn returns investment in three years. Feedlot Management, 12(5): 26-28.

This article reports on the use of a covered, pole structure which is open to the front and completely floored with hardwood slats over liquid manure holding tanks. The feeding barn holds up to 1,200 steers at one time and cost $42,000 to build. The operator reports a feed saving of $6.00/head over the conventional uncovered lot and thus returns the original investment every 3 years. The liquid manure has been distributed onto 600 acres at the rate of manure from 4 steers/acre for the first two years of operation.

F-046 Feedlot Management. 1970. Highlights of speech presented by W. Krejci at a feedlot waste control symposium, University of Nebraska. Feedlot Management, 12(5): 44.
"Rather than one steer producing as much waste as 16 persons, the actual fact is that one human contributes a pollution potential equal to 22 steers. In one day, a human sends down the sewer 75 gal. of water containing kitchen wastes, toilet wastes, shower and washbasin wastes and laundry wastes. Waste runoff for feedlots will average only 3.41 gal. per animal per day in an area which has 30 in. annual precipitation. Also, most animal waste stays in the feedlot until hauled away and most liquid wastes evaporate, but all human waste is flushed down the drain. 'A thousand-pound steer does not flush anything unless we have at least a 1 in. rain...and he certainly does not take a bath, wash his clothes or wash his dishes.'"

F-047 Manthey, E.W. 1970. Odor control on trial in feedlots. Feedlot Management, 12(5): 50, 52, 54.
An experimental program is being carried out at two feedlots and a stockyard in Arizona to test the effectiveness of a commercial odor control product. The treatment consists of spraying the cattle yards with a culture to hasten bacterial breakdown of the manure. An estimated improvement in air quality of 20% or more has been claimed as a result of the odor control program. A short note on other odor control products is included.

F-048 Feedlot Management. 1970. If waste is no longer waste, flies are for more than swatting. Feedlot Management, 12(5): 64.
George Rauenhorst, a cattle feeder at Olivia, Minn., and a regent at the University of Minnesota, proposes a scheme to use manure sludge to grow flies and then use the flies as a protein supplement in animal rations. Sludge would be seeded with fly maggots which, in their development to flies, would feed on the organic materials in the waste, converting the sludge to an easily handled granular material, about 80% reduced in organic matter content, 60% reduced in moisture content and with 50% of the dry matter destroyed. At the pupae stage, the flies stop feeding and become dormant at which time they would be separated from the granular mass, killed and used for their protein value in feed supplements.

F-049 Feedlot Management. 1970. Large-scale environmental control. Feedlot Management, 12(6): 58, 63.
Description of a new 20,000-head covered feedlot. In all, about 25 acres are under cover. Before construction of the pens, the ground was compacted, thereby creating an impenetrable surface which prevents groundwater pollution. Since snow and rain cannot fall on the manure, runoff is minimized. It was also noted that the only two gases produced are ammonia and carbon dioxide, thereby eliminating the malodorous air pollutants, hydrogen sulfide and methane. Manure from the buildings is transferred to a large digestor where

it is sterilized in a six-day process and ultimately sold as a weed-free organic fertilizer.

F-050 Matthew, F.L. 1970. Four steps for developing a pollution regulation. Feedlot Management, 12(7): 51, 54.
This article presents a recommended plan of action for the development of a model feedlot regulation that could serve as a guide for state water pollution control agencies. These four steps were envisaged as necessary before embarking on a feedlot control program: (1) Establish the need for regulation; (2) Define the objectives; (3) Consider the necessary limitations; and (4) Establish evaluation criteria. Feedlot regulations should be developed co-operatively with feeder organizations rather than by government alone.

F-051 Feedlot Management. 1970. Chemical 'screen' neutralizes feedlot odor. Feedlot Management, 12(12): 14-16, 71.
A conflict involving an Arizona feedlot and Sun City residents is reported. The owners of the 35,000-head one-time capacity feedlot are being sued for damages because of odor and fly nuisances to residents in the nearby residential area. The feedlot was established long before the residential area was conceived and is built on land that was traditionally designated agricultural land. A large odor control program involving the use of a chemical masking agent has been installed in an attempt to avoid court judgment demanding a move out of the area. This case has been going on since 1967 and may be setting a precedent for further cases of a similar nature.

F-052 Feedlot Management. 1971. More housed confinement seen in future for Midwest. Feedlot Management, 13(2): 32, 34, 36.
Results of a reader survey on the potential for total confinement feeding of beef cattle. Some readers felt that manure handling and pollution control would be easier with housed confinement operations. There are still some problems connected with manure handling to be solved, especially in areas of cold winters where storage is a necessity.

F-053 Feedlot Management. 1971. Innovative operation 'processes' wastes. Feedlot Management, 13(3): 22-23. 6 fig.
Description of a large oxidation ditch which is being used in a cold confinement cattle feeding barn in Iowa. Investment costs are reported.

F-054 Feedlot Management. 1971. 'Warm' barns share popularity among confinement feeders. Feedlot Management, 13(4): 38.
Results of a Feedlot reader survey on total confinement feeding of beef cattle. Questions and answers in this report dealt with floor type, costs, feed efficiency, animal performance, insect control, freezing of manure, removal of manure, fertilizer value of manure, odor, storage capacity, and runoff.

F-055 Feedlot Management. 1971. Solution to a runoff problem. Feedlot Management, 13(5): 12-15. 5 fig.
Description of the runoff control facilities and managerial practices at a 12,000-head feedlot in Kansas. All runoff is collected in a series of small lagoons. Water from the small lagoons is pumped to a central station for distribution to a centre-pivot sprinkler irrigator. The total cost of the

runoff control facilities was estimated at $20,000. Manure from the lot is spread by two independent manure companies. It was noted that the current trend is for feedlots to move to the feed supply rather than to the cattle supply; an 8:1 conversion ratio of feed to beef means that it takes eight times as many trucks to haul feed as it takes to haul beef.

F-056 Feedlot Management. 1971. Spreading systems bury odor of liquid manure. Feedlot Management, 13(5): 20. 2 fig.
Report on a rapid-cover manure disposal system being developed at the Canada Department of Agriculture Experimental Farm in Ontario. Manure is either injected directly into the ground or is covered within minutes of being spread by a plow. The system has reduced odor from field spreading of liquid manure, preserves the fertilizer value of manure and allows higher application rates. However, the system is not without problems, including a large capital investment, high storage costs and poor labor distribution.

F-057 Feedlot Management. 1971. Steel-floored feedlot. Feedlot Management, 13(5): 22-23, 52.
Description of a prototype outdoor feedlot in operation in South Dakota. Basically the system involves a perforated steel mat over two feet of sand filter. Perforated plastic pipes run through the sand at varying depths and carry percolating water to a lagoon. Both the lagoon and the soil surface under the sand layer are lined with an asphalt seal. Material from the lagoon is field spread. The relatively solid material retained on the steel mat is easily handled. The system has functioned very well and has experienced very few problems.

F-058 Feedlot Management. 1971. Liquid seeps from one basin to another. Feedlot Management, 13(6): 56-57.
Report on an experimental manure handling system installed at a 1,000-head feedlot in Nebraska. Manure solids and liquids go into a "debris basin" where the solids are settled out. The liquid fraction then passes through a rock-filled retaining wall and seeps through the porous soil median strip to a second lagoon. From this lagoon, water is pumped onto a terraced hill side which is seeded to grass. From the terraced area, the water is channeled through furrow-flood irrigation outlets to cropland, where it seeps into the ground releasing its plant nutrients and eventually entering the Missouri River through an underground aquifer.

F-059 Manthey, E.W. 1971. Move to new location solves many problems for custom feeder. Feedlot Management, 13(8): 34-35, 38-39, 41, 43-44.
Report on a new feedlot established in an area of Arizona which is zoned for cattle. Incorporated in the design of the lot is an antipollution pond for bacterial and anaerobic breakdown of animal wastes and for retention of the effluent on the land. Fly control is achieved by releasing gnats into the lot. These gnats, which are raised in Phoenix, lay eggs in the fly pupae and attack the flies themselves. The gnats do not bother humans or animals.

F-060 Kiesner, J. 1971. More technology than money available for waste control. Feedlot Management, 13(12): 34, 36, 38.
Report on a three-day National Symposium on Animal Waste Management held at Warrenton, Vermont. Nineteen recommendations arising from the conference were presented. These recommendations made reference to cost-sharing in

pollution control, copraphagy, aesthetics, standards, human health, odor, research, noise, field application, and zoning. It was noted that, of the 1,335,000 dollars in financing recently required to build a Texas feedlot, 323,255 dollars were used for drainage and pollution control measures.

F-061 Zurowski, T. 1971. 10 feedlot pollution observations. Feedlot Management, 13(12): 42-43, 46-47.
The U.S. President's Water Pollution Control Advisory Board has issued 10 observations dealing with pollution by cattle feeding operations. These observations, which have been sent to the Environmental Protection Agency for review, are based on a tour of mid-America feedlots. The observations were concerned with regulations, intensification of livestock operations, relative severity of cattle, sheep, swine, and poultry waste management problems, surface water pollution potential, implications of feedlot pollution, runoff control facilities and recycling of manure.

F-062 McCalla, T.M. 1972. Think of manure as a resource, not a waste. Feedlot Management, 14(5): 10-11, 68. 3 tab. 1 fig.
General discussion on some possible uses for animal wastes, including: (1) processing into petroleum; (2) refeeding; (3) conversion into yeast; (4) building materials, e.g. "ecolite"; and (5) recovery of numerous organic compounds. Pollution problems associated with feedlots were discussed. Some design and management aspects of cattle feedlots were discussed with particular reference to groundwater and surface water contamination and odor control.

F-063 Fetterolf, J. 1972. Total waste management systems. Feedlot Management, 14(5): 16-18. 3 fig.
Description of solid waste and runoff handling at three beef cattle feedlots in Kansas. Solid wastes are removed from all three lots by a commercial contractor. Manure can be stockpiled in the lots. When the lots are cleaned, about one inch of hardpack manure is left on the lot surface to reduce infiltration. The runoff systems involve collection and dispersion of liquids and have been designed to handle a one-time rainfall of over 6 inches.

F-064 Feedlot Management. 1972. That inescapable byproduct. Feedlot Management, 14(5): 20.
Description of the runoff control facilities and solid manure handling practices at a 6,000-head feedlot in Colorado. All solid wastes are applied to 600 acres of cropland. Runoff is collected in a retention pond.

F-065 Feedlot Management. 1972. Composting: one solution to feedlot waste disposal. Feedlot Management, 14(5): 32-33, 36, 43.
Discussion of a waste treatment process known as the continuous aerobic-thermophilic composting process. The process yields a product, in which the organic matter is reduced to a stable, pelleted material, rich in humus and in plant nutrients, which can be used as a feed supplement, soil conditioner or as a basis for fertilizer. The only products of the process are carbon dioxide, water vapor and the odor-free, pathogen-free humus. Costs of the treatment are estimated at from $4.00 to $12.00 per ton. By the addition of a proper catalyst, the nitrogen content of the final product may be increased by capturing nitrogen from the air. Equipment used is described and a step-by-step account of the process is outlined.

F-066 Blair, J.F. 1972. Cleanest feedlot in Kansas. Feedlot Management, 14(5): 52, 54, 66-67.
Description of manure handling and sanitation methods at a 14,000-head feedlot in Kansas. Manure is scraped from the lots twice each year and spread on cropland or mounded and sold to farmers. All the pens were carefully graded during construction so that all runoff flows to the back of the pens and is carried to a lagoon. Fly control is accomplished by chemical sprays at a cost of about $20.00/day for the chemical. The feedlot has not received any complaints from neighbors.

F-067 Feedlot Management. 1972. The door's still open to refeeding cattle waste. Feedlot Management, 14(5): 60.
The present stand of the U.S. Food & Drug Administration on the refeeding of animal wastes is discussed. Currently, this method of waste utilization is not approved because the waste may be adulterated with drugs and antibiotics or their metabolites and disease organisms may be transmitted to humans or other animals. Research objectives are outlined.

F-068 Feedlot Management. 1972. This plant will convert waste into protein. Feedlot Management, 14(5): 70-71. 2 fig.
Description of a new system for conversion of animal wastes into a high-protein supplement. Shredded manure is mixed with water to produce a slurry. Fibrous material is separated from the slurry and flows through a series of fermentation tanks in which thermophilic bacteria convert the cellulose, hemicellulose and lignin to usable protein. The soluble portion of the slurry is fermented for less time. All digested material is passed through a vacuum filter where water is removed and reused. The protein is further dried and is used as a feed supplement.

F-069 Feedlot Management. 1972. Sagebush for odor control: In the feed or the manure? Feedlot Management, 14(5): 74.
Report on trials conducted at Colorado State University which have shown that sagebush, as a feed additive, helps curb feedlot odor, probably because of the action of its volatile oils in the manure. Further research is needed to establish the effectiveness of feeding the sagebush as compared to scattering the volatile oils from the sagebush onto the manure.

F-070 Feedlot Management. 1972. Many uses for composted manure. Feedlot Management, 14(5): 74a.
Composting as a pre-treatment to land utilization of manure, reduces the volume, decreases toxicity from biocides, kills weed seeds and pathogens, eliminates odor and makes the waste easier to handle, transport, spread, and use. A mechanical composter is described which is basically a large four-wheel drive tractor with a series of paddles for lifting manure and casting it into a windrow.

F-071 Hoard's Dairyman. 1969. This Canadian built his own liquid manure system. Hoard's Dairyman, 114: 138-139. 6 fig.
In this on-the-farm interview, a Quebec dairy farmer describes his liquid manure system. The equipment is mostly all homemade, including a concrete storage tank ($900 for 25,000 gal capacity), a tanker spreader and spreader device (total cost of $60 for 1,200 gal capacity) and a p.t.o. chopper pump ($29). The system has been judged successful by the owner.

F-072 Longo, L.P. 1969. The problems of manure and manure handling. Hoard's Dairyman, 114: 234-235.
General discussion of the problems of manure handling being faced by the dairy farmer and of present-day techniques to solve those problems. Investment and operating costs were given prime consideration in the report, as well as the maintenance of good public relations.

F-073 Casler, G.L. 1969. Liquid manure - boon or bane? Hoard's Dairyman, 114: 994, 1022-1023. 3 tab. 1 fig.
Reasons given by farmers for installing liquid manure systems include: (1) saves time; (2) eliminates disagreeable daily job; (3) results in better labor distribution; (4) elimination of need for parlor waste disposal system; (5) increases value of manure; (6) less runoff and stream pollution; and (7) cheaper. The validity of each of these reasons was analyzed on the basis of practical experience and research results. Costs of liquid manure systems and data on the fertilizer value of manure were given. Problems with some facilities now in operation were described.

F-074 Bishop, S.E. 1969. Aids to cow comfort and waste disposal for cows on concrete. Hoard's Dairyman, 114: 1052-1053. 4 fig.
A section of this article was devoted to a discussion of manure handling from free-stall installations, including a description of solid-liquid separation techniques. When solids and liquids are separated, both of the separated fractions are fly-free and relatively odor-free and are easier to handle than the combined waste.

F-075 Benne, E.J. 1969. What is the fertilizer value of liquid manure? Hoard's Dairyman, 114: 1063. 1 tab.
Liquid manure collected from several Michigan dairy farms was analyzed for water, mineral matter, organic matter, nitrogen, phosphorus and potassium. Moisture content averaged 91.6% (88.8 - 93.9) as compared to 80% for fresh dairy cattle manure. Mineral matter varied from 1.1 to 2.6% and organic matter from 5 to 10%. The fertilizer value of the manure, calculated on the basis of what the N, P, and K content would cost on the retail market in the form of commercial fertilizers, varied from $0.96/ton to $1.90/ton. Reasons were suggested for the large variations in all the parameters measured.

F-076 Keeney, D.R. and L.M. Walsh. 1970. The pollution problem: Nitrates in groundwater. Hoard's Dairyman, 115: 820. 2 tab. 2 fig.
Sources and control of nitrogen from agricultural practices were discussed. The nitrogen content of manure, legumes, and soil organic matter should be assessed when developing a fertilizer program. Data were presented to show that manure storage and silo drainage areas are potential sources of large accumulations of nitrogen.

F-077 Keeney, D.R. and L.M. Walsh. 1970. The pollution problem: Phosphorus in surface waters. Hoard's Dairyman, 115: 870. 4 tab. 1 fig.
Data were presented to demonstrate the amounts of phosphorus contributed to surface waters by runoff from frozen ground spread with manure, feedlots, soil erosion sediment, runoff and sediment from cultivated land receiving phosphorus fertilizer and municipal, industrial and private sewage systems. In Wisconsin, less than 30% of the total phosphorus in surface waters originates from agricultural sources.

F-078 Hoard's Dairyman. 1970. Manure stacking...a new look at an old idea. Hoard's Dairyman, 115: 1028, 1067. 3 fig.
Description of manure stacking and of equipment used to build stacks. Experience with manure stacking by Wisconsin dairy farmers was reported. Water pollution by runoff and seepage from the stacks, and the potential odor and fly problems were discussed.

F-079 Longo, L.P. 1970. Manage manure carefully...or risk being forced out of business. Hoard's Dairyman, 115: 1160-1161.
Causes for complaints against livestock producers include: (1) odor from field spreading operations; (2) overloaded manure spreaders spilling on public roads; (3) manure spread on frozen ground; (4) improperly planned piles; (5) excessively high rates of application to cropland. The author emphasized the importance of proper manure management for good public relations.

F-080 Long, M. 1971. Which manure spreader for you? Hoard's Dairyman, 116: 126, 166-167. 6 fig.
Various types of manure spreaders were discussed with reference to differences in size, drive method, distributor, construction, and attachments. The spreader best suited for a particular situation depends upon many factors, including the type and frequency of manure hauling.

F-081 Bates, D.W. 1971. Handling methods for liquid manure are tested. Hoard's Dairyman, 116: 273. 3 fig.
Report on a research project conducted in Minnesota to investigate the behavior of manure stored in an external tank over an extended period of time. The tank used received waste from a 60-cow tie-stall dairy barn. It was left uncovered in summer and was covered with woven wire, polyethylene and straw bales during the winter. It was found that (1) manure deposited in one end of the 90' long tank would distribute itself sufficiently under its own weight so that a conveyor was not necessary; (2) waste heat from the barn ventilation system was a valuable resource in preventing freezing of manure in the exposed storage tank; and (3) manure stored in a large tank can be agitated and removed with little difficulty under proper management.

F-082 Berge, O.I. 1971. Waste handling: What are the choices? Hoard's Dairyman, 116: 353, 383.
Review of the advantages and disadvantages of daily hauling, stacking and liquid manure systems.

F-083 Berge, O.I. 1971. Waste management: What does it cost? Hoard's Dairyman, 116: 420. 8 tab.
The investment and annual costs of seven manure handling systems (based on a 50-cow dairy herd) are presented. The systems considered were: (1, 2, 3) daily hauling, stacking, and liquid manure in stanchion barns; (4, 5, 6) daily hauling, stacking, and liquid manure in free-stall barns; and (7) liquid manure with a slotted floor over a storage tank in a free-stall barn. Daily hauling required the least investment and liquid manure systems the most. Both stacking and daily hauling were less costly than liquid manure systems.

F-084 Wright, E.O. 1971. Dairymen take the lead in pollution control. Hoard's Dairyman, 116: 429-430.

The dairy industry is one of the few where adequate disposal systems are required before it is allowed to market its product. It was recognized, however, that improvement is needed in the area of manure handling after the manure has been removed from the dairy installation.

F-085 Gojmerac, W.L. 1971. Do manure stacks add to fly control problems? Hoard's Dairyman, 116: 556.
A survey of 70 farms in northeastern Wisconsin has indicated that flies were not more numerous on farms which stored manure over summer than on farms which hauled manure regularly. Gutters, mangers and calf pens were primary sources of fly breeding on the farms visited.

F-086 Bork, D.C. 1971. They invented their manure system. Hoard's Dairyman, 116: 1063, 1091. 3 fig.
Report on the manure handling system designed for use in a cold climate. Manure is pumped via a homemade piston pump through an 8" pipe to the bottom of the middle of a large storage pit which was designed for 180-day storage.

F-087 Elam, L. 1971. Cows rest on manure mattress. Hoard's Dairyman, 116: 1239. 4 fig.
The manure handling system used by one Washington dairyman involves separation of the solids from liquids using a vibratory separator. The solids are then partially dried and used as a material for bedding free stalls, or are dried and sterilized by forced heat and sold as a garden soil conditioner. The liquids are spread onto grassland by irrigation equipment.

F-088 Loehr, R.C. 1970. Treatment and disposal of animal wastes. Industrial Water Eng., 7(11): 14-18.
General review of the subject. Nine alternate methods of treatment and disposal of animal wastes were discussed.

F-089 Pembrey, M. 1967. Sudden death in the hog barn. Family Herald, No. 12. p. 12.
Report on the death of several pigs, supposedly caused by manure gases released from the liquid manure tanks below the partially slatted floor of the pighouse. Several safety precautions were given to farmers who have liquid manure systems. Structural failure of underground slurry storage tanks was also considered.

F-090 Wright, G. 1971. Clampdown coming on plant-food use. Chem. Eng. (New York), 78(17): 70.
Review of proposed regulations by the Illinois Pollution Control Board to control the application of chemical fertilizers and animal manures to cropland. The proposals would limit the total amount of nitrogen that could be applied, would forbid spreading of manure and fertilizer on frozen fields having more than a 5% slope and the spreading of manure by mechanical means to fields within 40 rods of a stream or lake, and would exclude domestic livestock from streams or lakes, except for limited access for watering or crossing. Opposition to the proposals was discussed.

F-091 Chemical and Engineering News. 1971. Process converts animal wastes to oil. Chem. Eng. News, 49(33): 43. 1 fig.
Report on initial research at the U.S. Bureau of Mines' Pittsburgh Energy

Research Center in attempts to convert animal wastes to oil. Manure is placed in a reaction vessel with carbon monoxide at an initial pressure of 1,200 psi and heated at 380°C for 20 minutes. Based on dry manure, the yield is 3 barrels per ton. Whereas the energy content of manure ranges from 5,000 to 7,000 B.t.u. per pound, the oil has an energy content of 14,000 to 16,000 B.t.u. per pound (compared to normal oil at 20,000 B.t.u./lb and coal at 7,000 to 12,000 B.t.u./lb). The oil is low in aromatics, has a nitrogen content of 2%, an oxygen content of about 9%, and a sulfur content of less than 0:35%.

F-092 Bragg, D.D. 1968. Ammonia in poultry houses. United Co-operative Farmers, Inc., Fitchburg, Massachussets, Market Bull. No. 604. (cited in Feedstuffs, 40(8): 62.)
Reference was made to studies at Deleware University showing that eye inflammation of chickens developed above 50 ppm of ammonia. Levels of 15 ppm were detectable by smell, while concentrations of 25-35 ppm caused the eyes of workers to "burn". Concentrations of 75 ppm did not retard growth of broilers. Ventilation at a rate of 1 cfm per bird usually kept ammonia at safe levels for birds. It was suggested that ammonia is not a problem for the chicken until it is a problem for the attendant.

F-093 Lancaster, J.L. Jr., J.S. Simco and R. Everett. 1968. Control of housefly breeding under caged layers reviewed. Feedstuffs, 40(28): 18. 1 tab.
Results of tests on the use of three different formulations of Cygon and three experimental insecticides to control the development of housefly larvae in poultry manure.

F-094 Hamm, D. 1968. Fly control and in-house manure management. Feedstuffs, 40(28): 44, 48.
"In summary, flies can be controlled without much consideration for proper manure management, but it's difficult and usually costly. To economically control flies you must have a positive manure management program. Wet manure is conducive to fly breeding and bacterial breakdown of manure constituents so that nitrogen is lost as ammonia. Dry manure does not provide flies a breeding site nor do bacteria cause ammonia loss. Water management is one very important phase of manure management."

F-095 Stephenson, E.L. 1968. Problems associated with litter management and disposal. Paper presented at Auburn University Poultry Litter Seminar, Auburn, Alabama. (cited in Feedstuffs, 40(28): 60.)
Poultry litter should be easy to obtain, inexpensive, resistant to caking, relatively absorbent, free from dust, easy to handle, not readily consumed by birds, and buoyant. Litter should be cleaned out of houses after each group of brids is marketed and can be used as a fertilizer. To avoid nitrate contamination of water supplies, poultry litter should not be added to crop land at a rate of more than 1 ton/acre in any given year.

F-096 Rollo, C.A., J.R. Howes and W. Grub. 1968. Poultry litter materials and dust production. Paper presented at Auburn University Poultry Litter Seminar, Auburn, Alabama. (cited in Feedstuffs, 40(28): 60.)
Report on a series of studies to investigate the origin of dust in poultry houses, its composition, the quantity produced, and methods to control it.

Twelve factors which greatly influence dust production include type of birds, age of birds, breed and strain of birds, form in which feed is offered, method of housing, density of birds, type of litter material, age of litter, illumination schedule and bird activity, atmospheric humidity, environmental temperature, and ventilation and filter system.

F-097 Claybaugh, J.W. 1968. Day to day litter management. Paper presented at Auburn University Poultry Litter Seminar, Auburn, Alabama. (cited in Feedstuffs, 40(28): 60-61.)
Litter management to reduce odors and dust and to promote healthy birds was discussed. The recommended optimum moisture content for litter was 20-25%. The importance of proper ventilation was noted.

F-098 Harms, R.H. and C.B. Ammerman. 1968. Feeding value of poultry litter containing citrus pulp for ruminants. Feedstuffs, 40(36): 21-22. 12 ref. 5 tab.
Experiments conducted with broiler chicks and lambs indicated that citrus pulp was a satisfactory source of litter for broiler houses and the resulting material can be a useful feedstuff for ruminants. Possible toxic effects of citrus by-products were noted.

F-099 Howes, J.R. 1968. Management and utilization of poultry wastes. Feedstuffs, 40(50): 22-23. 7 tab. 4 fig.
Discussion on the disposal and reuse of poultry litter and cage manure. Flow charts were provided to indicate the alternative waste management systems available to today's poultry producers. Data were given on the composition of poultry litter subjected to various treatments. Recent successes with drying, composting and other techniques are showing that waste disposal can be turned into waste utilization with proper management.

F-100 Quisenberry, J.H. and J.W. Bradley. 1969. Nutrient recycling by laying hens. Feedstuffs, 41(5): 19-20. 1 ref. 7 tab.
Report on experiments to test the feasibility of recycling three types of poultry wastes through laying hens: (1) wastes from pullets grown on pine litter; (2) wastes from broilers grown on litter; and (3) droppings from beneath screened roosts in a hen house. Bird performance and mortality were not adversely affected by inclusion of 10 or 20% of any of the wastes in the diet of laying hens. Feed costs were significantly reduced, as compared to a control diet of corn, sorghum and soybean meal. It was concluded that the returns from recycling of poultry manure are large enough to justify artificial drying where necessary.

F-101 Kiser, J.S., G. Kemp and H. Jarolmen. 1970. Medicated feeds and transferable antibiotic resistance. Feedstuffs, 42(13): 28-29. 2 tab. 1 fig.
Report on experiments with poultry and swine to investigate the transfer of resistance to certain antibiotics from enterobactericeae to other organisms. Feeding of chlorotetracycline to chickens resulted in large numbers of Gram-negative bacteria in the gut with transferable resistance to chlorotetracycline and streptomycin. Trials with pigs indicated that the normal fecal flora of these animals harboured E. coli, the majority of which possessed transferable R factors. Data obtained from the swine trials led to the conclusion, however, that acquisition of R factors by disease-causing salmonella resulted in a substantial loss of disease-causing ability. It was

suggested that there is little danger to public health from the feeding of antibiotics to animals.

F-102 Claybaugh, J.W. 1971. The fallacy of deep pits for poultry house. Feedstuffs, 43(6): 36. 4 fig.
General discussion of the deep pit system for poultry housing. Deep pits have the advantage of eliminating the daily chore of manure removal. However, the additional cost in construction of deep pit systems, and the potential for anaerobic conditions (with the inevitable production of odors and reduction in fertilizer value of the manure) and rodent infestations, tend to limit the application of deep pits. The ventilation of deep pit cage layer houses was discussed in some detail.

F-103 Dendy, M.Y. 1971. Changes in pH of broiler house litter, and the incidence of leukosis after various litter treatments, management. Feedstuffs, 43(21): 32-33. 3 ref. 6 tab.
Report on trials to test the effects of pH of broiler litter on bird performance. Favourable effects of acidified litter on broiler performance were noted.

F-104 Wilkinson, B.M. 1971. Monfort's newest feedlot designed with pollution control in mind. Feedstuffs, 43(30): 29-30. 3 fig.
Report on the pollution control facilities at a 100,000 head beef cattle feedlot in Colorado. The drainage system directs runoff to a 90-acre holding pond which was designed to handle any runoff from the lot caused by heavy rains up to 3 inches at a time. Several fire plugs have been installed in the lot for dust control. An odor control system was installed along the property lines. A 30 feet green belt of pine trees and grass around the perimeter of the feedlot was planned for aesthetic reasons.

F-105 Feedstuffs. 1971. Recycling wastes: The potential and the problems. Feedstuffs, 43(32): 1,55. 1 fig.
General discussion on recycling of animal manures by field application, incorporation into building materials, use as a litter or bedding, and refeeding to livestock. Regulatory and aesthetic aspects were considered.

F-106 Couch, J.R. 1972. Feeding poultry manure to animals. Feedstuffs, 44(31): 24-25, 27.
Review of research on feeding poultry manure to animals. The best possible utilization of poultry is in rations for ruminants.

F-107 Bridson, R. 1972. Iowa beef processors researching confinement feeding, recycling waste. Feedstuffs, 44(33): 35-36. 7 fig.
Report on research into the confinement feeding of beef cattle and the associated manure handling systems. In the experimental facility described, wastes are treated in an oxidation ditch and the effluent is pumped to primary and secondary lagoons for further purification. The material from the bottom third of the ditch is collected and fed to fattening steers. Results have been promising.

F-108 Free Press Weekly. 1972. High protein supplement from feedlot waste. Report on Farming, Free Press Weekly, 92(16).
Report on a proposed scheme to convert feedlot wastes into a high-protein

supplement. Thermophilic bacteria feed on the cellulose and lignin in the waste, and are harvested for their protein value. The entire process can happen in a few days under controlled conditions.

F-109 Mander, C.E. 1972. Waste systems on beef cubicle units. Farm Buildings Digest, 7(1): 5-10. 3 ref. 17 fig.
Discussion of various systems of waste management and an assessment of the systems based on personal observations. Lagoons are probably the only effective answer for very large units.

F-110 McQuitty, J.B. 1970. The farm animal waste problem. New Trail, University of Alberta, 27(1): 10.
General discussion on the problems created by concentrated livestock operations and their associated waste production. It was noted that research into farm animal waste problems has been slow to develop in Canada. Current research programs related to animal wastes at the University of Alberta are briefly described.

SECTION G

This last section is devoted to papers presented at various technical meetings in recent years. They represent a valuable source of data and informed opinion on many facets of farm animal wastes. Original abstracts or summaries have been used in most cases where available.

A number of these papers have been published in journals or technical reports subsequent to their presentation. Such papers may appear, therefore, in both this and some other section of the bibliography. However, while several have been published in their original form, there is more usually some change either in content or emphasis. Though recognizing that any duplication of references is undesirable, the actual number of cases involved compared to the total in the bibliography is small and is considered preferable to possible omission of useful material.

G-001 Wolf, D.C. 1963. What's going on in hog manure disposal? Paper No. 63-917, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 7 pp.
Status report on two phases of liquid manure handling: (1) cleaning pens; and (2) getting manure from the building site to the field or other disposal point. The first phase, that of getting manure out of hog pens, has been reasonably well solved through adaptions of flushing gutters or slatted floors, and by good management. The second phase is not so easily solved. Some on-paper figures for investment and operating costs of several representative manure disposal systems were given.

G-002 Jeffrey, E.A., W.C. Blackman, Jr. and R. Ricketts. 1963. What it takes to make a lagoon work. Paper No. 63-919, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 28 pp. 16 ref. 9 tab. 8 fig.
"A study has been made of the aerobic and anaerobic digestion characteristics of livestock wastes. The results obtained in the hog waste digestion studies are compared to design criteria for domestic sludge digestion units. Design loading conditions and water requirements are calculated for using an anaerobic lagoon for treating hog wastes. Design requirements for an aerobic lagoon are also indicated. It is concluded that disposal of hog wastes by use of aerobic lagoons is prohibitive because of the large requirements of both water and land area. The use of anaerobic lagoons is feasible, but it is accompanied by the problem of eventually having to dispose of the accumulated digested sludge. Future studies should be made on the operation of series lagoons. By using the first lagoon for settling and as an anaerobic lagoon, the area requirement of the second to serve as an aerobic lagoon would be greatly reduced, perhaps to the point of practicality."

G-003 Dobie, J.B. 1964. Airborne dust in agricultural environments. Paper No. 64-914, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"This report covers samples taken during three summer periods in cage and litter poultry houses, and beef, dairy, sheep, and hog environments. Three dust samplers were used and amounts of airborne dust are compared for representative locations and weather conditions."

G-004 Reed, M.J. and H.D. White. 1964. Water-spray filtering in ventilation and air-conditioning systems. Paper No. 64-915, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"An air washer was used in lieu of a dry-type filter to protect the cooling coil in an experimental broiler house. Preliminary information on dust-removal efficiency, water usage, humidification, ammonia control, and dust build-up on cooling coil is presented."

G-005 Labeda, D.L., D.L. Day and I. Hayakawa. 1964. Air pollutants in swine buildings with fluid waste handling. Paper No. 64-940, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 17 pp. 15 ref. 5 tab. 14 fig.
Report on studies to determine the concentrations of ammonia, hydrogen sulfide, carbon dioxide, sulfur dioxide and air-borne bacteria within a swine confinement building with a fluid waste-handling system. Attempts were made to relate the concentration of gases to management, ventilation, and building parameters. None of the gas concentrations were above the suggested threshold levels for humans. Decreasing ventilation resulted in increased gas concentrations.

G-006 Crane, D.E. 1965. Nitrates in rural water supplies--corrective equipment and procedures. Paper No. 65-222, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Paper discusses removal of nitrates from farm water supplies by the ion exchange process, the technical problems involved, types of equipment required, maintenance of nitrate removal equipment, and economics of nitrate removal."

G-007 Maddex, R.L. 1965. Free stall: the most significant new development in dairying. Paper No. 65-914, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The free stall makes possible tremendous improvements in the efficiency of dairy facilities. It will encourage mechanization of feed and waste handling and standardization of new layouts. It is adaptable to existing, as well as new, facilities in either cold or warm housing. And the free stall improves sanitation."

G-008 Witzel, S.A., N.A. Jorgensen, R.F. Johannes, N.J. Larsen and C.O. Cramer. 1965. Cold deep-bedded pack vs. cold free-stalls for loose cow housing. Paper No. 65-944, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Simultaneous evaluation, in a two-year study, of dairy cattle management under two systems of housing was conducted. A discussion of animal performance, animal health, animal cleanliness, bedding requirements (3 types), labor requirements, and outdoor-indoor-bedded pack temperature relationships are described and results presented."

G-009 Jones, E.E. and W.N. Long. 1966. Sanitary hazards for farmstead and rural water system and plumbing connections. Paper No. 66-222, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Health hazards from plumbing on the farmstead may seem remote. Usually it is thought this is confined to a public water supply distribution system. Such is not the case. The hazards involved, and what the farm occupant can do to correct them are described."

G-010 Green, R.L. 1966. Processing waste disposal. Paper No. 66-346. Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Waste effluent from agricultural-product processing plants carries organic materials in solution or suspension in excess of permissible limits for discharge into streams. A satisfactory method of waste disposal has been attained by distribution through sprinkler irrigation systems."

G-011 Dobie, J.B. 1966. Effect of air ions on swine and poultry. Paper No. 66-354, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Environments with excess of positive or negative ions with normal ion concentrations, using both swine and Japanese quail as test animals, are compared. Results based on weight gain and feed efficiency for swine; weight gain, mortality, and maturity for quail."

G-012 Brooks, L.A., M.F. Finner and O.I. Berge. 1966. Large electric motors for farmstead applications. Paper No. 66-357, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Electric motors with phase converters in sizes up to 60 hp are performing satisfactorily on a variety of applications on single-phase farm lines. Data has been obtained from installations on crop blowers, grain driers, irrigation pumps, liquid manure pumps and conveyors."

G-013 Myers, E.A. 1966. Waste-water conservation and renovation research. Paper No. 66-713, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Waste water can be renovated and recharged into the groundwater reservoir. Specifics relative to amounts applied, degree of renovation, amounts recharged, and to possible uses are considered."

G-014 Wilson, L.G. and G.S. Lehman. 1966. Grass filtration of sewage effluent for quality improvement prior to artificial recharge. Paper No. 66-716, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Experiments are being conducted near Tucson, Arizona, to evaluate the effectiveness of grass filtration for quality improvement of sewage effluent prior to artificial recharge. Quality changes of oxidation pond effluent are being determined during passage through three 1000 x 25 ft. Bermudagrass strips, using standard water quality analyses."

G-015 Haen, E. 1966. Dairy-housing systems. Paper No. 66-922, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Advantages and disadvantages of the different types of dairy housing, namely loose housing, free-stall housing and stanchion barns. Feeding, manure handling and milking methods will be compared in each case for labor efficiency."

G-016 Dale, A.C. and D.L. Day. 1966. Some aerobic decomposition properties of dairy cattle manure. Paper No. 66-925, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 9 pp. 6 tab. 13 fig.
Experiments were conducted to determine some decomposition properties of dairy cattle manure which might be helpful in designing oxidation ditches. It was shown that volatile solids reductions of 50% could be attained in a retention time of 18-½ weeks at a loading rate of ½% of the volume. Increasing the loading rate decreased the decomposition of volatile solids. BOD_5 reductions of 90% were attained. Salts were concentrated to some extent but did not retard bacterial action for the concentrations obtained in this experiment.

G-017 Polkowski, L.B., L.C. Gramms and S.A. Witzel. 1966. Lagooning of liquid manure (bovine)--material balance and design aspects. Paper No. 66-926A, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"An experimental lagoon received weekly additions of liquid manure throughout an annual period. The results obtained from solids and chemical analyses of both the manure charge and lagoon contents, respective of depth, are used to evaluate lagoon performance and develop design guidelines."

G-018 McCoy, E. 1966. Lagooning of liquid manure (bovine)--bacteriological aspects. Paper No. 66-926B, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Bovine feces contain rumen and intestinal bacteria, including coliforms and enterococci. In manure lagoons fermenters are displaced by proteoytics and a well-balanced population as in soil. Organic decomposition can proceed actively if overload is avoided and growth conditions permit."

G-019 Converse, J.C., G.L. Pratt and R.L. Witz. 1966. The effect of low-volume and high-volume aeration on a hog lagoon. Paper No. 66-927, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 12 pp. 5 ref. 5 tab. 8 fig.
Report on an experiment to determine the effect of low-volume and high-volume subsurface aeration on a hog lagoon. Low-volume aeration had no significant effects on the lagoon as compared to no aeration. High-volume aeration, which maintained dissolved oxygen concentrations of 2.28 mg/l in the lagoon contents, had a significant effect on nitrate and nitrite levels, BOD and COD reductions, ORP values, volatile acids, alkalinity, pH and odor.

G-020 Hammond, W.C., D.L. Day and E.L. Hansen. 1966. Treatment of liquid hog manure to suppress odors. Paper No. 66-928, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 14 pp. 3 ref. 5 tab. 12 fig.
Laboratory and field trials were conducted to investigate the effect of lime and chlorine, in conjuction with sand bed filtering, on gas and odor production from anaerobically stored liquid manure. Chlorination virtually stopped the production of ammonia, hydrogen sulfide, and methane, and reduced carbon dioxide production. Lime did not affect ammonia production but reduced hydrogen sulfide and carbon dioxide production and increased methane production. The estimated costs of the two treatments were given on a per hog basis. Both chlorine and lime were also effective in controlling maggots and rodents in the building. Passage of liquid hog manure through a sand filter resulted in about 50% reduction in BOD, COD and total solids.

G-021 Taiganides, E.P. 1966. Farm-waste management in Europe and India. Paper No. 66-930, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Animal-waste management practices on farms in Holland, Germany, and India are reviewed with the purpose of comparing them with animal-waste management practices on American farms."

G-022 Wolfe, R.R., D.P. Anderson, F.L. Cherms, Jr. and W.E. Roper. 1967. Effect of dust and ammonia air contamination on turkey response. Paper No. 67-424, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 10 ref. 3 tab. 17 fig.
Turkeys were subjected to two levels of atmospheric dust and ammonia in a 2 x 2 factorial experiment. Three trials, each of 12 weeks duration, were conducted. The incidence of airsacculitis at slaughter was significantly increased by increasing dust contamination, but was unaffected by ammonia. No significant dust-ammonia interactions were detected. Mortality rates and feed conversion were not affected by the treatments. Birds exposed to high dust and ammonia concentrations showed losses of cilia from the epithelial lining of the trachea, and an increase in mucus secreting goblet cells. Dust contamination also caused areas of consolidation to appear in the lungs.

G-023 Smith, R.J. and T.E. Hazen. 1967. The amelioration of odor and social behaviour in, together with the pollution reduction from, a hog house with recycled wastes. Paper No. 67-434, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 7 ref. 4 tab. 6 fig.
Report on an automatic experimental swine manure handling system in which running water transports manure to an anaerobic lagoon. The ensuing supernatant from the lagoon is pumped into an oxidation ditch. Settled effluent is returned to the house and discharged into the dunging gutter to flush manure into the lagoon. Intermittent flushing reduced the total volume of

flushing water required, and had a beneficial effect on social behaviour of the pigs. The combined anaerobic-aerobic treatment provided an effluent of suitable quality to be used as a manure transport vehicle. Odor levels and ventilation requirements were reduced by rapid removal of manure from the house.

G-024 Taiganides, E.P. 1967. The battle at the forgotten end. Paper No. 67-925, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 8 pp. 3 fig.
"It has become possible to automatically feed, ventilate, light, and generally control the environment of animal production units to induce the well-being of the front end of the animals. The battle is now being waged at the other end which was either completely forgotten or not fully considered in the design of these production centers. The recent gains of the battle are traced and a strategy to attack our animal waste management problems is proposed."

G-025 Gribble, D.J. 1967. Manure slurry storage, processing and pumping. Paper No. 67-926, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 4 pp.
"The problems of storing, agitating, and transporting liquid manure slurry and the solutions of a few of the problems are covered. A system for the collection, storage and high pressure pumping of manure slurry is described."

G-026 Blough, R.S. 1967. Aerobic waste treatment ditches in action. Paper No. 67-927, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Aerobic waste treatment ditches under slotted floors for controlling odor and decomposing organic wastes are discussed."

G-027 Dale, A.C. 1967. Discussion of Paper No. 67-927. Paper No. 67-927A, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 9 pp. 14 ref. 5 fig.
"Aerobic treatment, Pasveer oxidation ditches for animal wastes and problems encountered in the operation of oxidation ditches such as foaming, excessive settling, sludge removal and equipment are discussed. Included are experiences with floating aerators to convert normally facultative or anaerobic animal waste lagoons (ditches) to aerobic lagoons."

G-028 Miner, J.R. 1967. Discussion of Paper No. 67-927. Paper No. 67-927B, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"An oxidation ditch is being used at Iowa State University to further treat effluent from an anaerobic lagoon. The lagoon receives liquid manure from a confinement swine unit. Under these conditions, the oxidation ditch produces an effluent suitable for discharge or reuse under suitable circumstances."

G-029 Davis, E.H. 1967. Law suit against a dairy operation by urban neighbors. Paper No. 67-928, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Early birds don't always get worm--sometimes they get the axe. Why must a dairyman who was established first, concede to neighbors' objections to odor particularly when papermill stench also contributes. The Law of Nuisance in this court case is most specific."

G-030 Hermanson, R.E., T.E. Hazen and H.P. Johnson. 1967. A laboratory investigation of the activated-sludge stabilization of swine waste. Paper No. 67-929, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"A mathematical model was hypothesized for the biochemical oxygen demand

reduction efficiency of an extended-aeration, activated-sludge waste treatment plant. The hypothesis was verified by data obtained from treating the effluent of an anaerobic swine lagoon in a laboratory-scale plant."

G-031 Mills, K.C. and B.F. Parker. 1967. Some effects of composition of feed on the biochemical oxygen demand of the excreta produced from this feed. Paper No. 67-930, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 6 tab.

Report on research to study the effect of various rations (all grain, grain plus silage, all grass) on the rate of aerobic decomposition of steer manure. It was concluded that the composition of feed for steers does significantly affect the rate of oxidation of organic matter in the excreta, and therefore is a variable in the BOD determination by the standard five-day test.

G-032 Jones, D.D., D.L. Day and B.A. Jones, Jr. 1967. Aerobic digestion of dairy cattle waste. Paper No. 67-931, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 4 ref. 19 fig. 2 tab.

"Undiluted dairy-cattle waste was aerated in the laboratory to determine its decomposition properties. A similar study was conducted using beef-cattle waste. A computer program was developed which, using laboratory data, generated comparison curves of organic decomposition for different loading rates."

G-033 Ludington, D.C., D.E. Bloodgood and A.C. Dale. 1967. Storage of poultry manure with minimum odor. Paper No. 67-932, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 3 ref. 5 tab. 8 fig.

Report on research to study means by which the odors produced by stored poultry manure could be reduced or eliminated. Production of hydrogen sulfide was the parameter used to evaluate the success of a system to control odors. The results indicated that significant quantities of hydrogen sulfide were produced when chicken manure was stored without aeration, but that insignificant quantities were produced when the manure was stored with aeration. Maintenance of an ORP of -400mv. resulted in no hydrogen sulfide production, but increasing the ORP to 0 resulted in a higher reduction of volatile solids.

G-034 Hart, S.A. 1967. Agricultural wastes management in the future. Paper No. 67-933, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Management of livestock manures, crop residues, and other wastes of intensive agriculture will become even more critical in future years. Research effort is necessary today, and it must be a team effort by crop and animal scientists, and engineers."

G-035 Black, R.J. 1967. Review of the national solid wastes program. Paper No. 67-934, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Record of action compiled since the passage of the Solid Waste Disposal Act of 1965 is discussed. Agricultural engineers and scientists are using imagination and innovation to help solve the problem. The Research and Demonstration Grant mechanisms are pointed out as useful tools for this purpose."

G-036 van Rest, D.J. 1968. Bioengineering aspects of livestock environment contamination. Paper No. 68-418, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Livestock environments generally contain important numbers of microorganisms. An engineering approach to their control is outlined and the engineering data available are reviewed."

G-037 Hazen, T.E. 1968. The wiles of wet waste. Paper No. 68-556, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp. 14 ref.
"The impact of liquid - or semiliquid - livestock wastes on the design of essential physical, climatic, social and economic controls for confinement-livestock production is discussed. Some current waste-management systems are evaluated and findings are reported of recent research directed to better and safer handling, treatment and disposal."

G-038 Robbins, J.W.D. and G.J. Kriz. 1968. Role of agriculture in ground-water pollution. Paper No. 68-723, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Orientation to groundwater-pollution problems caused by agricultural practices is reviewed under three general areas: (a) groundwater as a receiving medium for agricultural wastes; (b) sources of agricultural groundwater pollutants; and (c) types of solutions needed for agricultural groundwater quality problems."

G-039 Bressler, G.O. 1968. Drying manure electrically-inside poultry houses. Paper No. 68-821, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 7 pp.
"Drying manure electrically inside the poultry house can be accomplished at electrical costs ranging from 0.2 cent to about 1.0 cent per dozen eggs. Stirring droppings daily, blowing high velocity air across the droppings, and use of supplemental heat, provided by heat cables installed in a narrow area underneath the water troughs, have proven successful. To achieve a moisture level of 15 - 20 per cent in the manure requires the application of all three methods. If only a 30 per cent level is to be attained, stirring and high velocity air have been adequate for most seasons of the year."

G-040 Thompson, J.E. 1968. Air-pollution problems in agriculture and forestry. Paper No. 68-906, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Air-pollution problems related to forestry and agriculture are discussed in terms of the effects of air pollutants on crops, forests, and livestock and in terms of agriculture and forestry as producers of air pollution, with special emphasis on the role of agricultural engineers in solving air-pollution problems."

G-041 Burnett, W.E. and N.C. Dondero. 1968. The control of air pollution (odors) from animal wastes - Evaluation of commerical odor control products by an organoleptic test. Paper No. 68-909, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 13 ref. 5 tab. 3 fig.
"An organoleptic test was developed to evaluate the ability of more than 40 commercial odor control products to eliminate or mask the malodor from liquid poultry waste. The method enables one to find the most effective chemicals in a rapid, systematic manner and provides information on the lowest concentration of chemical needed to obtain a desired effect. Masking agents and counteractants were found to be the most effective, deodorants moderately effective and digestive deodorants least effective in controlling odors. The results of a preliminary field trial of the most effective masking agents indicated that the cost of treatment would be 63 cents per 450 gallons of

liquid manure when used prior to field spreading."

G-042 Miner, J.R. and T.E. Hazen. 1968. Ammonia and amines: components of the swine building odor. Paper No. 68-910, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 6 ref. 7 tab. 5 fig.
"Ammonia and amines have previously been identified as components of the swine building environment. Further work is reported on the identification and measurement of these compounds. Also included is a discussion of the importance of these compounds in the characteristic swine building odor."

G-043 Light, R.G. 1968. Environmental design parameters for veal calf production. Paper No. 68-921, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The interaction between management and environment is discussed. Consideration is given to animal feeding and management, housing system design, housing densities, manure and odor management, ventilation rates and systems, and possible utilization of air filters and germicidal lamps."

G-044 Grub, W., R.C. Albin, D.M. Wells and R.Z. Wheaton. 1968. Engineering analyses of cattle feedlots to reduce water pollution. Paper No. 68-929, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 12 pp. 2 tab. 5 fig.
Report on studies of selected cattle feedlots in the Southern High Plains to determine engineering and management practices for minimizing the pollution potential of confined livestock operations. Data and/or pertinent facts are presented on: (1) the effect of ration composition on the composition and quantity of wastes produced; (2) changes in the composition of accumulated wastes; (3) the composition and quantity of runoff as affected by precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout and ration composition; and (4) various treatment and disposal systems, including anaerobic and aerobic lagoons, evaporation ponds, irrigation, and land disposal.

G-045 Pratt, G.L., R.E. Harkness, R.G. Butler, J.L. Parsons and M.L. Buchanan. 1968. Treatment of beef cattle waste water for possible reuse. Paper No. 68-930, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 9 pp. 3 tab. 1 fig.
Report on trials using a recycled waste water for flushing wastes from an experimental cattle barn. Wastes were flushed from the barn and subjected to one or more of the following treatments after primary settlement: (1) secondary settlement; (2) aeration; (3) chemical coagulation. Whereas aeration and alum treatment reduced dissolved and suspended solids, further treatment was considered necessary to remove odor before the water could be reused as wash water.

G-046 Shaw, R.H. and J.S. Boyd. 1968. Agitation in liquid-manure tanks as affected by physical properties of manure and shape of tank. Paper No. 68-931, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 16 ref. 3 tab. 8 fig.
"The study of physical properties of liquid manure showed that it behaves as a pseudoplastic liquid with the viscosity being primarily dependent on the moisture content. The density was similar to that of water. Of the two different shapes of model liquid manure holding tanks studied, square and rectangular, the square tank lent itself to the most efficient agitation."

G-047 Nelson, G.L., J.J. Kolega, Jr., U. Agena, Q. Graves and G. Hoffman. 1968. Basic performance parameters for oxygenation and liquid circulation in rotor aerated liquid waste systems. Paper No. 68-932, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 41 pp. 17 ref. 8 tab. 15 fig.
"Dimensionless parameters were identified and experimental correlations developed for predicting oxygen transfer effectiveness and liquid circulation velocity in rotor-aerated tank or ditch systems for livestock waste treatment. The prediction equations were validated by data from prototype installations."

G-048 Witz, R.L., G.L. Pratt and J.L. Sell. 1968. Reuse of wash water for cleaning caged layer houses. Paper No. 68-933, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 6 pp. 10 fig.
Report on experiences with a liquid manure handling system in an experimental cage-type poultry house in North Dakota. Droppings from the birds are collected in concrete gutters. A wooden scraper and flushing water are used to remove the wastes from the gutters to an outside, 4-compartment storage pit. Water from the fourth tank is recycled for use as wash water. Attempts have been made to reduce odor in the recycled water by additions of alum and by aerating the contents of the fourth chamber prior to recycling.

G-049 Cairns, J.G. 1968. Housing requirements for gestating sows. Paper No. 68-943, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Various types of housing including tethering, total confinement, and other, with emphasis on management problems related to engineering, are discussed. Waste handling, feeding, and ventilation are among the major considerations."

G-050 Bloodgood, D.E. 1969. Water quality parameters of interest to agricultural engineers. Paper No. 69-223, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 7 pp.
Brief report on standard tests used in water and wastewater analysis. Some of the standard tests discussed included dissolved oxygen, temperature, coliforms, pH, and solids determinations.

G-051 Schleusener, P.E. 1969. Water quality - a concern of agricultural engineers. Paper No. 69-232, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 26 pp. 18 ref. 1 tab.
"The broad sweep of water quality problems are briefly described with occasional specific examples for emphasis. Consideration is given to physical, chemical, biological, esthetic, economic, and social aspects. This broad sweep of problems is directed toward the abilities and concerns of agricultural engineers."

G-052 Law, J.P., Jr. and H. Bernard. 1969. The impact of agricultural pollutants - on subsequent users. Paper No. 69-235, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 24 ref. 3 tab.
"Pollutants arising from agricultural activities can have adverse and detrimental effects on the water quality requirements of subsequent users. The major sources and types of pollutants involved are discussed. Their effect and impact on subsequent users are considered. The need for improved management and/or treatment concepts to minimize the effects of the pollutants discharged to receiving waters is discussed. Suggestions are offered regarding agriculture's responsibility in water pollution control activities."

G-053 White, R.K. and E.P. Taiganides. 1969. A procedure to identify malodors from animal wastes. Paper No. 69-425, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 19 ref. 6 fig.
"An equilibration collecting and concentration procedure of sampling odors for gas chromatographic analysis is presented and compared with other methods. This procedure can be used for an objective measurement of environmental odors by giving data on kinds, concentration, and intensity of odorous compounds. A typical chromatogram of odors from the head space gases over dairy cattle wastes is presented."

G-054 Ludington, D.C., A.T. Sobel and A.G. Hashimoto. 1969. Odors and gases liberated from diluted and undiluted chicken manure. Paper No. 69-426, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 8 ref. 1 tab. 12 fig.
"Chicken manure stored in a diluted state produces considerably more H_2S than when stored in an undiluted state but release of the H_2S is only about twice as fast. Diluted manure also produces more NH_3 but the undiluted manure releases significantly more NH_3. The relationship between the production and release of these gases is due to their solubility in water and pH. During quiescent storage, the strength of the odors released is comparable for both systems but vastly different in quality. Odor strength of animal manures can be measured by liquid dilution and the strength of the released odors can be measured by vapor dilution methods."

G-055 Witzel, S.A., N.E. Minshall, E. McCoy, R.J. Olsen and K.T. Crabtree. 1969. The effect of farm wastes on the pollution of natural waters. Paper No. 69-428, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 24 pp. 14 ref. 4 tab. 2 fig.
Preliminary report on a study to determine the sources and amounts of plant nutrient losses from agricultural operations and to locate any health hazards that may result from the disposal of farm animal wastes. The analysis of over 2500 samples of water and several hundred samples of soil, waste and plant tissue showed that: (1) nutrient losses in the base flow of Wisconsin streams during a period of high winter runoff totaled about 25% as much N and K and 10% as much P as in surface runoff; (2) heavy manure applications in barnyards and heavy fertilizer applications to cropland can result in groundwater contamination; (3) application of nitrogen which allows more than 13.5 lb/acre of N to pass beyond the root zone can result in groundwater contamination; and (4) measurement of the cummulative effects of pollutants may, in time, permit effective corrective measures to be taken.

G-056 McCoy, E. 1969. Removal of pollution bacteria from animal waste by soil percolation. Paper No. 69-430, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Fresh bovine manure contains Escherichia coli and enterococci in numbers ranging 10^5 per gr. and 10^6 to 10^7 per gr., respectively. With manure applications of 5 to 80 tons per acre both types of pollution bacteria are removed within the top 14 in. of silt loam soil."

G-057 Nordstedt, R.A., H.J. Barre and E.P. Taiganides. 1969. Analysis of animal-waste storage and land-disposal systems. Paper No. 69-431, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Animal-waste storage and land-disposal systems are analyzed with respect to meteorological conditions, emanation and tolerance of odors, and land avail-

ability. The systems are modeled as multistage decision processes and dynamic programming techniques are used to determine schedules for land-disposal operations."

G-058 Vanderholm, D.H. and C.E. Beer. 1969. Use of the soil to treat anaerobic lagoon effluent - design and operation of a field disposal system. Paper No. 69-459, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"A field experiment was installed to study the design of a sprinker irrigation system for safe and economical disposal of livestock lagoon effluent. Primary design variables were application amount and frequency. Results indicate excellent renovation characteristics with no apparent nuisance problems."

G-059 Koelliker, J.K. and J.R. Miner. 1969. Use of the soil to treat anaerobic lagoon effluent - renovation as a function of depth and application rate. Paper No. 69-460, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The characteristics of a natural soil profile indicate promise as a treatment media for anaerobic livestock lagoon effluent. Sprinkler irrigation spreading and resulting percolation of effluent through 4 ft. of soil not only removed the organic load but also much of the associated phosphorus and nitrogen."

G-060 Gramms, L.C., L.B. Polkowski and S.A. Witzel. 1969. Anaerobic digestion of farm animal wastes (dairy bull, swine and poultry). Paper No. 69-462, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 29 pp. 6 ref. 7 tab. 10 fig.
"Farm animal wastes were digested anaerobically in intermittently mixed units at two detention times, 10 and 15 days, and at two levels of organic loading 0.12 and 0.24 pounds of volatile solids per cubic foot per day at 90°F. The treatment response was measured in terms of volatile solids and COD reduction and gas production. Other parameters were measured such as total organic acids, gas composition, alkalinity, organic nitrogen and NH_3-N. Various methods of sludge handling were evaluated for the digested sludge such as drainability, filterability and the thickening properties."

G-061 Hensler, R.F., R.J. Olsen, S.A. Witzel, O.J. Attoe, W.H. Paulson and R.F. Johannes. 1969. Effect of method of manure handling on crop yields, nutrient recovery and runoff losses. Paper No. 69-468, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 26 ref. 10 tab.
Report on greenhouse and field trials to study the effect of type of manure, method of handling, amount of bedding, drying treatment, and rate of application on the fertilizer value of cattle manure for corn and hay and on runoff losses. Application of manure in the greenhouse and in the field gave increased corn yields. The most pronounced effect of liquid manure on alfalfa-grass meadows was an increase in grass and weed species over legumes. Fresh, fermented and anaerobic liquid manure gave better yield increases than aerobic liquid manure in the greenhouse but not in the field trials. Recovery of N, P and K were reduced by allowing manure to dry for one week before incorporation into the soil. High levels of bedding decreased the fertilizer value of the manure, but there were no significant differences between the type of bedding used. Winter applied manure resulted in higher losses of N, P, and K than spring applied manure. Soil analysis indicated that exchangeable K, available P and organic matter were increased by manure treatments.

G-062 Robbins, J.W.D., G.J. Kriz and D.H. Howells. 1969. Quality of effluent from swine production areas. Paper No. 69-706, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 40 pp. 14 ref. 20 fig.
"Effluents from swine growing operations using waste management practices of land spreading, dry lot pasturing, lagooning, and direct discharge into streams were analyzed for bacterial densities, nutrients, and degradable organics in order to identify the amounts of and factors governing swine wastes entering streams."

G-063 Miner, J.R. 1969. Livestock production in the urban fringe. Paper No. 69-720, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Conflicts along the agriculture-urban interface involve water quality, odor control, noise, dust, and insect control. Landscaping, water resource development and better management offer possible improvements."

G-064 Harl, N. 1969. Social and political considerations at the urban-agricultural interface--government. Paper No. 69-721C, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Rising land values lead to property tax concerns prior to conversion to urban uses, increased population densities create pressures in supplying public services, and burgeoning water use and waste disposal strain institutional frameworks provoking water allocation and quality control guidelines."

G-065 Williford, J., J.A. McKeag and W.R. Johnston. 1969. Field techniques for removing nitrates from drainage water. Paper No. 69-733, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Two techniques were used to investigate the removal of nitrates from a continuous flow of agricultural drainage water. Both were designed to promote anaerobic bacterial denitrification through the use of agricultural products. One method utilized barley straw placed in a 10-ft deep trench and the other the growth of water grass in a shallow pond."

G-066 Day, D.L., D.D. Jones, J.C. Converse and A.H. Jensen. 1969. Oxidation ditch treatment of swine waste--summary report. Paper No. 69-924, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Aerobic treatment research since the initial laboratory experiment in 1964 is summarized. Upon finding that swine manure could be aerobically treated, a modification of the oxidation ditch seemed feasible for odorless treatment beneath slotted floors. This method presents an odorless solution to the management of liquid manure."

G-067 Jones, D.D., D.L. Day and U.S. Garrigus. 1969. An oxidation ditch in a confinement beef building. Paper No. 69-925, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"A totally slotted floor confinement beef barn was converted to accommodate an aeration rotor. The mixed liquor overflows into a lagoon. A cow-calf program was first investigated and now the unit is housing feeder beef. The unit has been operating since February 1969."

G-068 Nye, J.C., A.C. Dale and D.E. Bloodgood. 1969. Effect of temperature on the aerobic decomposition of dairy cattle waste. Paper No. 69-926, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The effect of temperatures (35F to 45F) on the aerobic decomposition of dairy cattle manure was studied. Data on the reduction of volatile solids

and COD, and on the settling characteristics and composition of the sludge after 74 days of aeration are presented."

G-069 Smith, R.E. and J.D. Jenkins. 1969. Salt concentrations in a recycling aerobic waste disposal system. Paper No. 69-927, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 14 ref. 3 tab. 3 fig.
"The spectrum of the inorganic products of biological degradation of poultry waste was synthesized to varying concentrations for use in laboratory digestors to determine the influence of salt concentrations on biological activity. Only the highest concentration inhibited activity."

G-070 Robbins, J.W.D., G.J. Kriz and D.H. Howells. 1969. Total organic carbon determinations on swine waste effluents. Paper No. 69-928, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 26 pp. 19 ref. 7 fig.
"Total organic carbon measurements (using a Beckman 915 TOC analyzer) were made on swine waste effluents to establish a rapid and accurate auxiliary method to substitute for and/or complement the BOD test for determining degradable organic contents and/or oxygen demand loadings."

G-071 Frus, J.D., T.E. Hazen and J.R. Miner. 1969. Chemical oxygen demand as a numerical measure of odor level. Paper No. 69-929, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 17 pp. 8 ref. 6 tab. 5 fig.
"A classification of odor level in a confinement swine building atmosphere by use of the conventional method of chemical oxygen demand (COD) has been investigated. The technique was found to be responsive to noticeable differences in odor level, pH of manure in the pit, and the rate of dilution by the ventilation air."

G-072 Jedele, D.G. 1969. Swine waste management. Paper No. 69-934, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 4 pp.
"Pork producers are looking to researchers for economical, successful swine-waste treatment. But while there has been much research there is still a great need to combine the results into practical systems. This is a report of the urgent need for publication of specifications that farmers can use now."

G-073 Moore, J.A. and D.W. Bates. 1969. Handling, storage and treatment of dairy and beef cattle waste in confined systems. Paper No. 69-935, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Partial and complete slat floors or grated gutters, with manure storage beneath, eliminate daily manure handling in confined housing. Natural and mechanical distribution systems, removal equipment, and waste treatment are discussed."

G-074 Newtson, K. and J. Stevenson. 1969. Use of the oxidation ditch in practice. Paper No. 69-937, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 6 ref. 5 fig.
"Experiences resulting from use of in-the-building oxidation ditch waste treatment systems for swine are discussed. Both design and management factors are covered. Experimental projects involving similar systems for beef, dairy and poultry wastes are reviewed."

G-075 Koelliker, J.K. and J.R. Miner. 1970. Pasture application of aerobic lagoon water: a practical experience. Paper No. 70-406, Amer. Soc.

Agr. Eng., St. Joseph, Michigan. 7 pp. 2 tab. 2 fig.
"A non-overflowing anaerobic-aerobic lagoon receiving poultry and various livestock wastes was lowered by sprinkler irrigation of water from the aerobic cell onto adjacent sheep pasture. The pasture received about 12 inches of water over a 5-week period. No nuisance problems were noted. Also, this paper includes a sludge survey of two lagoons receiving animal wastes. Neither lagoon was in eminent danger of filling with sludge."

G-076 Williams, R.B. 1970. Litterless broiler production - a progress report. Paper No. 70-414, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Several self-cleaning flooring systems, adaptable to container growing and handling of broilers, were investigated. Initial results with these floors indicate carcass quality can equal that of litter grown birds. Bird cleanliness, apparent comfort, and cage waste removal are discussed."

G-077 Barth, C.L. 1970. Why does it smell so bad? Paper No. 70-416, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 22 pp. 65 ref. 1 tab. 5 fig.
"Researchers must learn more about manure odor production and control. Many unanswered problems face the farmer now. A review of pertinent literature clarifies the present status of the knowledge of odor perception, and creates an awareness of the pitfalls to be avoided in planning, conducting and analyzing odor related research."

G-078 Sobel, A.T. 1970. Olfactory measurement of animal manure odor. Paper No. 70-417, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 10 ref. 6 tab. 10 fig.
"Utilizing the human nose, a rating method of odor evaluation was adapted to manure handling and treatment systems. Odors were rated as to offensiveness and presence on a 0-10 scale. Descriptive terms were applied to the manure being evaluated. Examples are described for (1) a laboratory study with various treatments and (2) a semi-field study with various handling systems."

G-079 Moore, J.A., R.E. Larson, R.O. Hegg and E.R. Allred. 1970. Beef confinement systems - Oxidation ditch. Paper No. 70-418, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 17 pp. 5 ref. 3 tab. 7 fig.
"The oxidation ditch has been used in Minnesota for two years for treatment of beef cattle wastes. It has been operated as a batch system with various loading rates and environmental conditions. Results are evaluated on the basis of BOD, COD, TS, TVS, pH, nitrogen, temperature of the waste, and odor and foam control."

G-080 Bell, R.G. and J. Pos. 1970. The design and operation of a pilot plant for composting poultry manure. Paper No. 70-419, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 20 pp. 6 ref. 6 fig.
"A composter was constructed to treat poultry manure in association with litter materials. Successful operation under both winter and summer conditions suggests that engineered composting could be a practical solution to the poultry manure problem."

G-081 Gilbertson, C.B., T.M. McCalla, J.R. Ellis and W.R. Wood. 1970. Methods for removing settleable solids in runoff from outdoor beef feedlots. Paper No. 70-420, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 37 pp. 11 ref. 2 tab. 19 fig.

Report on experiments with two feedlot runoff control systems incorporating the hydrologic principle of reducing velocity of flow to allow settling out of heavier particles. One method, termed the "batch system", consisted of a primary settling basin and a secondary basin into which the supernate from the primary basin was pumped. The second system, termed "continuous flow", consisted of a settling channel of three porous dams and a detention pond. Both systems efficiently removed settleable solids but the "batch system" had considerable maintenance disadvantages. It was concluded that the "continuous flow" concept might be adapted to many existing feedlots experiencing runoff pollution problems.

G-082 Meiering, A.G., W. Clifford and F.W. Bakker-Arkema. 1970. Drying of a bed of composted waste. Paper No. 70-421, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 14 ref. 15 fig.
"Composted waste consisting of a mixture of municipal refuse materials and sewage was experimentally dried and the process simulated on computers. The simulation model is based on the laws of simultaneous heat and mass transfer. Experimental and calculated drying rates agreed well."

G-083 American Iron and Steel Institute. 1970. Corrosion of steels in the environment of enclosed swine production buildings. Paper No. 70-424, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 23 pp. 10 tab. 7 fig.
Report on research to investigate the corrosive resistance of a number of steel products in the environment of an enclosed swine production building. Three test areas of different corrosiveness were considered: (1) wall panels - least corrosive; (2) pen partition panels - moderately corrosive; and (3) floor slats - most corrosive because of heavy manure accumulations, contact with moisture, and abrasiveness of animal hooves. It was concluded that a suitable steel product is available for any application in a hog confinement environment. Porcelain on steel, and modified stainless steel gave excellent corrosive resistance to areas judged highly corrosive.

G-084 Bellcour, Z.P. 1970. Mobile housing for swine. Paper No. 70-425, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"More profit through labor-saving, larger and healthier swine litters for the tenant, landowner, or landlord hog farmer by using an environment-controlled, self-contained liquid manure holding pit, Mobile Farrowing Unit that is adequately insulated, heated, ventilated, and easily financed."

G-085 Swanson, N.P., L.N. Mielke and J.C. Lorimor. 1970. Sediments of feedlot origin. Paper No. 70-705, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The sediment loads carried by runoff from rainfall and snowmelt on a sloping feedlot, and from simulated rainfall on another feedlot were studied and physically characterized. A comparison is made with sediments produced on cultivated land with similar precipitation."

G-086 Braids, O.C. and L.F. Welch. 1970. Nitrate in drainage water from soils receiving sludge and fertilizer. Paper No. 70-751, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp. 1 tab. 7 fig.
"If drainage water is to be kept at currently acceptable nitrate levels, nitrogen content of sludge will be the first limiting factor to application rate. Flow rate and nitrate concentration in tile drains are apparently independent of each other."

G-087 Johnson, D.W. 1970. Survey of feeding beef cattle inside sheds. Paper No. 70-905, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Some 15 North Dakota operations were observed that fed cattle inside sheds. Operations were mostly 'semiconfinement' type where cattle had free access to outdoor lots. Feeding was done inside an uninsulated building using auger bunk feeder or unloading wagon equipment. Observations were made in regard to manure handling, ventilation, space requirements, and management."

G-088 Meenaghan, G.F., D.M. Wells, R.C. Albin and W. Grub. 1970. Gas production from cattle wastes. Paper No. 70-907, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"A two-stage completely mixed isothermal digestion system, having a capacity of 30 gal/stage, was fed wastes from a beef cattle controlled environment chamber. Gas production was monitored and analyzed by a wet test meter and a gas chromatograph, respectively. Physical, chemical, and biochemical tests were also performed."

G-089 Gilbertson, C.B. 1970. Beef cattle feedlots - production alternatives. Paper No. 70-908, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Labor shortages, coupled with regulations for pollution control, are forcing operators to study various management alternatives for beef production. The type of operation selected will depend upon factors of waste management and facility design."

G-090 Grub, W., J.D. Martin and L.L. Keeton. 1970. Aerobic stabilization of beef feedlot waste. Paper No. 70-909, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Solid waste that had accumulated on Southwestern beef cattle feedlots was aerobically stabilized under controlled conditions in enclosed digesters and in open air piles. Conditions for stabilization were determined and changes of physical, chemical and biological characteristics were established."

G-091 Keeton, L.L., W. Grub, D.M. Wells, G.F. Meenaghan and R.C. Albin. 1970. Effects of manure depth on runoff from southwestern cattle feedlots. Paper No. 70-910, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 7 pp. 1 ref. 2 tab.
The effects of manure accumulations on the quantity and quality of runoff from concrete and dirt-surfaced lots for various precipitation rates were determined. The quality of feedlot runoff was primarily a function of the moisture content of the manure, rainfall intensity and feedlot slope. Erosion and channeling of the manure pack occurred only when the pack was dry. The quantity of runoff from a dry manure pack was dependent on manure depth, feedlot slope and rainfall intensity, whereas the quantity of runoff from a wet pack was independent of manure depth. Moisture content of the pack can be maintained at a high level by increasing the cattle population density in the feedlot.

G-092 Kumar, M., H.D. Bartlett and N.N. Mosenin. 1970. Flow properties of animal waste slurries. Paper No. 70-911, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The flow properties of animal waste slurries were studied with the use of a coaxial cylinder type viscometer to determine shear diagrams, flow behavior indices, viscosity indices and apparent viscosities in relation to dilution, temperature and sawdust bedding content of the slurries."

G-093 Drury, L.N. 1970. Filtered-air positive-pressure ventilation systems for poultry houses. Paper No. 70-914, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Systems for ventilating poultry houses with filtered air under positive pressure to prevent airborne diseases are described and their performance is disucssed."

G-094 Kittridge, C.W. 1970. The Maine deep pit cage laying house. Paper No. 70-915, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 8 pp. 3 fig.
"The Maine deep pit cage laying house provides an effective means of housing layers in cages. The deep pit principle provides storage for manure below the cages and offers flexibility and ease of handling manure. Proper construction and management of the deep pit cage layer house are essential."

G-095 Madden, J.M. and J.N. Dornbush. 1971. Pollution potential of runoff from livestock feeding operations. Paper No. 71-212, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 15 pp. 3 ref. 5 tab.
"The quantity and quality of runoff from production feedlots in eastern South Dakota has been studied for a two-year period. A statistical analysis is used in evaluating the relationship between the volume of runoff, precipitation amounts, and animal concentration and the pollutional constituents associated with the runoff."

G-096 Allen, J.B. and J.C. McWhorter. 1971. Field crop irrigation with oxidation pond effluent. Paper No. 71-246, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Results from an 18-month study of irrigation of sudax, wheat, soybean, corn, sweet clover, and alfalfa with oxidation pond effluent are presented. No unusual difficulties were encountered in the use of effluent for irrigation."

G-097 Kolega, J.J., B.J. Cosenza, A.W. Dewey and R.L. Leonard. 1971. Septage: wastes pumped from septic tanks. Paper No. 71-411, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 5 ref. 4 tab. 4 fig.
"The presentation of data for use in the design of treatment processes and systems for the handling of septic tank pumpings (septage); microorganisms found in septage; volume estimate methodology; cost considerations; and governmental aspects of regional collection and treatment systems."

G-098 Hendricks. G.F. 1971. Pressure sewage system and treatment, Grandview Lake, Indiana. Paper No. 71-412, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp. 1 tab. 4 fig.
"The need for an unconventional approach to sewage collection and treatment at Grandview Lake, Indiana, resulted in a Demonstration Project supported by the U.S. Department of Interior, the Department of Agriculture, the users and the consultant. Reviews are made of the home unit grinding and pumping units, systems design and treatment facilities."

G-099 Rose, C.W. 1971. New concepts for collection and disposal of rural domestic wastes. Paper No. 71-414, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 7 pp.
Discussion of past, present, and anticipated systems for the disposal of rural domestic wastes. Engineering and social concepts were considered.

G-100 Soderquist, M.R. and D.W. Taylor. 1971. A mobile laboratory for food

processing wastewater analyses. Paper No. 71-418, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The design, construction and analytical capabilities of the Oregon State University mobile food processing wastewater laboratory are discussed. Based on the first year's operational experiences the major advantages and shortcomings of the design and proposals for improvements are presented."

G-101 Larson, E.W. and J.V. Jemski. 1971. Fundamentals of quantitative aerobiology as related to infectious diseases of animals. Paper No. 71-425, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 14 pp. 17 ref. 7 fig.
"Environmentally controlled cloud chambers and the technology for safely studying small particle, infectious microbial aerosols within them are described. The fundamental parameters describing the airborne survival characteristics of microorganisms and respiratory disease transmission are discussed. The practical aspects of aerobiological research as related to disease control are considered."

G-102 Prince, R.P., T.N. Fredrickson and J.H. Carrozza. 1971. Aerobiologic transmission of Marek's disease. Paper No. 71-426, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 15 ref. 3 tab. 2 fig.
"Physical and biological systems involved in the transmission of Marek's disease among chickens are described. Methods for removing the agent from dust, infectivity of dust collected from different houses, effect of thermal and physical treatment of dust infectivity, methods of inoculation and isolation are presented."

G-103 Jemski, J.V. and E.W. Larson. 1971. Selected aspects of respiratory dose host response characteristics. Paper No. 71-427, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 23 ref. 5 tab. 7 fig.
"Respiratory dose host response relationships in animals challenged with biological aerosols are discussed. Experimentally controlled environmental conditions (humidity, temperature, pollutants), animal exposure methodology and subsequent husbanding of the animals contributing to the quantitation of the host-pathogen interaction in air-borne infections are described."

G-104 Junnila, W.A., K.A. Jordon and M.C. Kumar. 1971. Salmonella and other microorganisms pose a new parameter to designers of poultry houses. Paper No. 71-429, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 9 pp. 5 ref.
The incidence of Salmonellae in poultry houses was reviewed, and present-day building methods were discussed as they relate to the potential for dust and microorganism accumulations. Experimental facilities designed for the study of microorganisms in poultry environments were described, as well as some of the results of initial experiments.

G-105 Swanson, N.P. and C.B. Gilbertson. 1971. Feedlot waste management: some solutions to the problem. Paper No. 71-522, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 6 pp. 9 ref.
Report on the problems encountered and solutions employed in qualitatively and quantitatively measuring runoff and accumulated wastes from Nebraska feedlots. Sampling techniques and equipment used were described.

G-106 Barth, C.L. and L.B. Polkowski. 1971. Identifying odorous components of stored dairy manure. Paper No. 71-568, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 27 pp. 27 ref. 2 tab. 7 fig.
"Volatile and liquid odorous components produced in stored liquid dairy manure were identified. Selective absorption, steam distillation and paper chromotography were the procedures used to identify four organic acids, ammonia, four amines and the sulfur containing odorants - hydrogen sulfide, disulfides and mercaptans."

G-107 Hamilton, H.E., I.J. Ross and S.W. Jackson. 1971. Techniques for the enumeration of anaerobic microbes in waste fermentation systems. Paper No. 71-570, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 4 ref. 10 fig.
"Equipment for the preparation and handling of large quantities of anaerobic culture media has been developed and used on microbial studies, with poultry waste. Techniques and equipment to aid in rapid plating and counting have been developed."

G-108 Goodrich, P.R. and L.F. Huggins. 1971. A digital integrated circuit counter-timer for radioactive counting. Paper No. 71-571, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The dynamic tracing of a radioisotope tagged pollutant within a soil column was accomplished using five internal solid scintillators and automatic data collection instrumentation. For the data acquisition instrumentation a precise counter-timer was designed and constructed, using digital integrated circuits on printed circuit boards."

G-109 Swanson, N.P. 1971. A programed sampler for runoff and bedloads. Paper No. 71-572, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"A programed, automatic sampler collects individual 3-liter samples of runoff over 5-min intervals. Twelve samples can be programed over 1 to 24 hr of runoff. The runoff need not be continuous. Flow stoppage is virtually eliminated since no pumps or solenoid valves are used."

G-110 Swanson, N.P., L.F. Elliott, T.M. McCalla and F.G. Viets, Jr. 1971. Use of caissons in measuring chemical and biological conditions beneath a beef feedlot. Paper No. 71-593, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Metal caissons were installed in a feedlot so that soil gas and soil solution samples could be obtained 'in situ'. Values indicate the system permits the measurement of the effect of feedlot management on the downward movement of pollutants."

G-111 Jones, E.E., Jr. 1971. Well construction and water quality. Paper No. 71-703, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Wells lacking adequate sanitary protection serve as unauthorized uncontrolled ground-water recharge points. Common easily detected sanitary defects are described. A detailed investigation of a contaminated well, apparently having adequate sanitary protection, was made. Recommendations for improved design and construction are made."

G-112 Lyle, W.M. and E.A. Hiler. 1971. Electrophoretic and electrochemical water purification systems. Paper No. 71-704, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Laboratory models utilizing electrophoretic and electrochemical means to clarify water were both found to be operationally successful. Models incorporating electrochemical flocculation along with electrochemical disinfection were found superior to other models both economically and operationally. Complete automation appears to be possible."

G-113 Culberson, G.B. 1971. Field observations on water quality effects on livestock. Paper No. 71-705, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Bacteriological contamination by the livestock themselves, biological growth and chemical changes in the waterer plus similar factors in the source water are enumerated. Their apparent (and often dramatic) effect on the health and productivity of animal and bird is described."

G-114 Holt, R.F. 1971. Surface water quality is influenced by agricultural practices. Paper No. 71-740, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 34 ref. 3 tab.
"Fertilizers, animal wastes, pesticides and crop residues affect the composition of the surface water discharged from an agricultural watershed. The nature of the additions to the water varies from exotic organic compounds to single inorganic ions and from mineral sediment to infectious organisms. Proper incorporation of soil amendments into the soil and judicious use of soil conservation practices will minimize the extent to which they modify the water leaving agricultural fields."

G-115 Armstrong, D.E. and W.C. Weimer. 1971. Storage and cycling of pollutants in water bodies. Paper No. 71-748, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 23 ref.
"Pollutant storage and cycling in lakes are controlled by interrelated physical, chemical, and biological processes. These processes are reviewed through a sequence of simple models or schemes considering the residence time of water, lake circulation and mixing, and major chemical and biological processes. The relationships of these processes to the distribution of phosphorus, organochlorine pesticides, and heavy metals in lakes are discussed."

G-116 Kriz, G.J. 1971. Effects of agricultural practices on aquifers. Paper No. 71-760, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 88 ref.
"Recent literature (primarily 1968 to 1971) on the effects of animal wastes, fertilizers, pesticides, bacteria and viruses and saline waste water on aquifers is reviewed and discussed with respect to type of waste, climatic conditions, soil-water movement and geologic conditions."

G-117 Lorimor, J.C., L.N. Mielke, L.F. Elliott and J.R. Ellis. 1971. Nitrate concentrations in ground-water beneath a beef cattle feedlot. Paper No. 71-761, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 14 pp. 6 ref. 3 tab. 4 fig.
"An intensive 3-day pumping study was conducted at a feedlot near central Nebraska at the start of the 1970 irrigation system. Little nitrate contamination was found in the ground-water coming from beneath the feedlot. Pumping caused a slight increase in nitrate concentrations over the average concentration for the previous 2 years."

G-118 Mulkey, L.A. and R.E. Smith. 1971. Inclined-plane liquid contact time measured with radiotracer. Paper No. 71-807, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 11 pp. 6 ref. 1 tab. 3 fig.
"A short-lived gamma-ray tracer was used to measure the contact time for the liquid of a falling film on an inclined plane. Values of mean residence time were determined from count rate-time plots. An isotope generator described is well suited to this and similar applications."

G-119 Cross, O.E., A.P. Mazurak, L. Chesnin and G. Vollmar. 1971. Animal waste utilization for pollution abatement. Paper No. 71-906, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Manure was applied to cultivated and irrigated soils. Techniques involved four manure application rates, three depths of plowing, and three plant populations. Results consisted of pollutional probabilities of surface run-off water and underground water, crop response, and physical and chemical changes in the soil."

G-120 Gilbertson, C.B., T.M. McCalla, J.R. Ellis and W.R. Woods. 1971. Control of beef cattle feedlot runoff. Paper No. 71-907, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Beef feedlot runoff transports considerable quantities of solids. The settleable solids must be separated from the liquids prior to storage in a holding pond. Design and management consideration of the 'continuous flow' system concept of removing settleable solids is discussed."

G-121 Ogilvie, J.R. and S. Thauvette. 1971. Manure slurry spreading by irrigation, broadcast, injection and plowdown. Paper No. 71-908, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Data collected from four methods of spreading dairy and hog manure are presented. Time and motion studies and economic evaluations compare and contrast the use of each method."

G-122 Chuang, F.S. and J.T. Clayton. 1971. Animal sewage effluent percolation through sandy loam of a subsurface disposal system. Paper No. 71-909, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"The disposal of effluent from dairy manure biological treatment systems in subsurface fields has been studied. The effects of effluent on the physical properties of constructed soil profiles, and the degree of tertiary treatment of the effluents that takes place in the soil were of particular interest."

G-123 Cramer, C.O., J.C. Converse, G.H. Tenpas and D.A. Schlough. 1971. The design of solid manure storages for dairy herds. Paper No. 71-910, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 23 pp. 10 ref. 15 tab. 5 fig.
"Design data and operating experiences for solid manure storage facilities for dairy cattle housing are presented. The liquid portion was separated from the solids with the liquids stored in a detention pond and the solids stored in an above-ground bunker type storage structure."

G-124 Fletcher, W.J. 1971. Safety hazards associated with livestock waste. Paper No. 71-911, Amer. Soc. Agr. Eng., St. Joseph, Michigan.
"Changes in livestock waste handling methods have added new risks for workers.

Educational needs and basic design changes to prevent accidents are presented. Analysis of accidents has led to recommended countermeasures.

G-125 Howell, E.S. and R.H. Brown. 1971. A new concept of litter management for broiler production. Paper No. 71-915, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 6 ref. 4 tab. 4 fig.
Report on a research project conducted in Georgia aimed toward total mechanization of broiler production, including handling of waste, clean-up, and sanitation. Experiments were conducted to determine the amount of litter required for broilers grown in a house with an electrically heated concrete floor and to evaluate handling characteristics of the waste at the end of the growing cycle. Results indicated that waste production under the zero-litter system average 2.0 lb/bird per 8-week cycle, and that the wastes had highly desirable physical characteristics for handling and utilization. Bird performance was not adversely affected by the absence of litter.

G-126 Esmay, M.L. and C.C. Sheppard. 1971. In-house drying of poultry droppings. Paper No. 71-917, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 19 pp. 7 tab. 2 fig.
"The removal of a portion of the fecal matter moisture immediately after deposit could be critical in controlling odors particularly in hot weather. Electrically energized panels below the dropping pits provide a means for some additional in-house drying of poultry droppings."

G-127 Levi, D.R. 1971. Philosophy on livestock waste regulations. Paper No. 71-918, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp.
"Private and public regulation of livestock-related air, water and solid waste pollution are outlined and general legal philosophies advanced. Practical considerations in avoiding injunctions and damages for pollution discussed include effectiveness of zoning, site location and feedlot licensing laws."

G-128 Schwiesow, W.F. 1971. State regulations pertaining to livestock feedlots. Paper No. 71-919, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 1 tab.
"Emphasis on water pollution control has resulted in laws governing installation and operations of livestock feedlots in several states. Need for uniformity in these regulations is recognized. Awareness of these regulations will assist other states in developing regulations similar to those already in force. A listing of state offices that may be contacted for additional information is included."

G-129 Hore, F.R. 1971. Pollution legislation in Canada affecting the livestock industry. Paper No. 71-920, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 4 ref.
Review of the extent of existing legislation pertinent to livestock production and manure management in Canada. The Federal Fisheries Act has implications in all parts of Canada since this Act covers the control of pollution in water frequented by fish, and fish frequent most lakes and rivers in Canada. All provinces have legislation to control pollution from any source where public health is endangered. The provinces differ in the legislation each has developed (or has not developed) to specifically control pollution from animal wastes.

G-130 Johnston, P. 1971. The effect of regulations on the livestock industry. Paper No. 71-921, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 8 pp.

Report on the effect that legal regulations are having on the feedlot industry. Seven case histories of problems in feedlot waste control were reported, including cases where feedlot operators have been forced to move their operations or comply with strict new regulations. Emphasis was given to the feedlot pollution situation in Nebraska, and to agencies working on the problem in that state. The author concluded that water pollution problems relating to feedlots can be solved, whereas solutions to air pollution problems will not come so easily.

G-131 Watson, H. 1971. Swine housing systems for the Southeast. Paper No. 71-928, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Housing systems for farrow-to-finish, feeder pig and finishing operations are discussed. Environmental control, house types, manure disposal are major topics covered. Trends for future construction of swine housing systems to fit southern climatical conditions and production practices are also predicted."

G-132 Schacht, C.J. and L.D. van Fossen. 1971. Engineering swine housing for management. Paper No. 71-931, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"A controlled environment swine facility is presented along with a suggested schedule of operation. Emphasis is placed on factors influencing management ability to predict performance and profitability of the operation. Facilities include boar, gestation, farrowing, nursery, finishing, feed processing and manure handling."

G-133 Dale, A.C., W.H. Friday, V.B. Mayrose and K.B. Meyer. 1971. Waste management and swine housing. Paper No. 71-932, Amer. Soc. Agr. Eng., St. Joseph, Michigan.

"Effects of the waste handling system on swine housing and building elements are discussed along with effects of manure gases on herdsmen and swine. Methods of controlling gaseous odors by changes in the ventilation system are enumerated."

G-134 Sewell, J.I., J.R. Owen and J.W. High, Jr. 1972. Liquid manure system operations at two dairies. Paper presented at Amer. Soc. Agr. Eng. Southeast Region Meeting, Richmond, Virginia. 5 pp. 3 tab.

"Two liquid manure systems were put into operation at dairies in 1967. Construction costs, management data, operational costs and system performance have been evaluated. Suggestions for system planning and operation are offered."

G-135 Sewell, J.I. and J.M. Alphin. 1972. Effects of agricultural land use on the quality of surface runoff. Paper presented at Amer. Soc. Agr. Eng. Southeast Region Meeting, Richmond, Virginia. 8 pp. 7 ref. 3 tab.

"Surface-water samples from twenty-four sites at four locations were analysed to determine the effects of agricultural land use on the quality of surface runoff. Concentrations of livestock increased the biochemical oxidation demand, orthophosphate levels, and especially the bacterial counts of surface runoff samples from the areas affected."

G-136 Reddell, D.L. 1971. Land disposal of manure by deep plowing. Paper No. SWR 71-402 presented at Amer. Soc. Agr. Eng. Southwest Region Meeting, Sequoyah State Park, Oklahoma. 20 pp. 8 ref. 6 tab. 4 fig.
"Manure from large commercial beef feedlots was applied on land at El Paso and Pecos, Texas, at the rates of 0, 300, 600 and 900 tons per acre. A 30-inch moldboard, an 18-inch moldboard, a 50-inch disc plow and a 27-inch trenching machine were used to plow the manure under in a modified land fill operation. Preliminary results of surface water and groundwater pollution are reported."

G-137 Butchbaker, A.F., J.E. Garton, G.W.A. Mahoney, M.D. Paine and A. Wetmore. 1971. Alternatives for waste management for open beef feedlots. Paper No. SWR 71-403 presented at Amer. Soc. Agr. Eng. Southwest Region Meeting, Sequoyah State Park, Oklahoma. 20 pp. 16 ref. 1 tab. 3 fig.
"This paper discussed alternative waste handling systems for open feedlots and the cost of various mechanical methods of removing solid wastes and runoff control systems for retention of runoff transported wastes."

G-138 Reed, C.H. 1970. Recycling and utilization of biodegradable wastes by plow-furrow-cover and sub-sod injection. Paper No. NA 70-206 presented at Amer. Soc. Agr. Eng. North Atlantic Region Meeting, Newark, Delaware. 11 pp. 4 fig.
"Equipment has been developed to incorporate biodegradable wastes in slurry form into the aerobic portion of the top soil. With a selection from seven interchangeable components, slurries with solid contents ranging up to 30% (wet basis) may be disposed of by plow-furrow-cover and sub-sod injection. There are no odors and no opportunities for flies to breed or feed. Surface runoff and soil erosion is negligible."

G-139 Koon, J.L., R.E. Hermanson, T.A. McCaskey and A.E. Hiltbold. 1969. Experiences with anaerobic swine lagoons. Paper presented at Amer. Soc. Agr. Eng. Southeast Region Meeting, Memphis, Tennessee. 13 pp. 5 ref. 3 tab.
Report on the biological processes involved in anaerobic lagoons, and a review of experiences with anaerobic lagoons receiving swine wastes in Alabama. General recommendations on lagoon design and management were given. It was emphasised that the role of anaerobic lagoons is the destruction and stabilization of organic matter, and not water purification.

G-140 Hudek, E.P. 1963. Hog lagoons in Manitoba. Unnumbered paper, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 5 pp.
Report on the operation of two hog lagoons in Manitoba. Odor problems were noted in both cases. It was suggested that lagoons for hog wastes have two cells, providing primary anaerobic treatment followed by aerobic stabilization. Some consideration should be given to the sealing of lagoons in sandy areas.

G-141 Turnbull, J.E. 1966. European experience with removal of cattle manure from slotted-floor barns. Paper No. 66-005, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 15 pp. 2 ref. 6 fig.
Discussion of several successful European manure removal systems which could be adapted to the Canadian cattle industry. The physical characteristics of

cattle manure and factors influencing them were reviewed. Four liquid manure systems were compared from a management point-of-view: (1) pumping directly from comparted storage; (2) continuous-flow gravity system; (3) sluice-gate gravity system; and (4) sluice-gate plus recirculation system.

G-142 Dougherty, R.S. and R.S. Broughton. 1969. Pipeline transport of manure. Unnumbered paper, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 12 pp. 3 ref. 7 tab.
Report on a pipeline waste disposal system and a tank spreader system in operation at Macdonald College Farm, Quebec. Data are presented on operating times and power requirements of the two systems, and various management problems are reported. A comparison of the handling capacities and costs of the two systems revealed that, for a 30,000 gallon hog manure unit, the pipeline and tanker spreader systems were equally expensive; for larger hog operations and for 100-cow dairy herds, the pipeline system was shown to have a significant economic advantage. Research is required to overcome agitation and pumping problems with the pipeline system, and to determine the minimum dilution possible for successful transport of manure slurries.

G-143 Brannigan, P.G. and J.B. McQuitty. 1970. The influence of ventilation on distribution and dispersal of atmospheric gaseous contaminants. Paper No. 70-204, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 18 pp. 20 ref. 17 tab. 5 fig.
Report on laboratory bench-scale experiments to investigate the effects of ventilation on the concentrations and dispersal of atmospheric gaseous contaminants in pig houses. Under the conditions of the experiments, the density of the gases studied had no practical effect on their horizontal or vertical distributions. Comparison of isothermal and non-isothermal conditions indicated the importance of the sensible heat production of livestock as a major factor in the diffusion of gases in the atmosphere.

G-144 Nodwell, J.H. and C. MacFarlane. 1970. Suggested code of practice for air pollution control in agriculture. Paper No. 70-206, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 8 pp. 3 ref.
Report on Ontario's Suggested Code of Practice regarding livestock production systems. Conditions on which the Code was formulated are discussed, and some of the major features of the Code are described. While the Code does not carry any legislative authority, it has been well accepted by most farmers.

G-145 Black, S.A. 1970. Agriculture and water pollution in Ontario. Paper No. 70-207, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 20 pp. 3 tab.
Discussion of water pollution contributed by agricultural operations in Ontario, including pollution caused by (1) farm animal wastes; (2) wastes from industrial processing of raw agricultural products; (3) sediment; (4) commercial fertilizer; (5) pesticides; and (6) miscellaneous minor sources such as crop residues, infectious agents, toxins and allergens. It was concluded that the total agricultural contribution to pollution is a significant one. With regard to animal wastes, it was suggested that proper waste management can greatly reduce the pollution contributed from this source. Some discussion was included on water quality standards and on social and economic aspects of water resources management.

G-146 Feldman, M. and F.R. Hore. 1970. A plow-down method for rapid cover of liquid manure. Paper No. 70-208, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 16 pp. 2 ref. 2 tab. 7 fig.
Report on the development of a rapid-cover system, and the associated equipment, for field application of liquid manure. A modified tanker applies the manure in a 50 - 60 inch swath, and is immediately followed by a 4-bottom plow which completely buries the manure. Odors from the field spreading operation are controlled by this system. Three or four tankers can be used with one plow resulting in a high capacity system. Reasonable application rates may be obtained by adjusting the tractor p.t.o. and ground speeds. Further research is required to adapt the principles to a farm where less equipment and labor are available, to develop a sub-sod injection system for different field conditions, and to determine the effects of various application rates on crops and the environment.

G-147 Ogilvie, J.R. and P. Phillips. 1971. Process variations in an oxidation ditch. Paper No. 71-201, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 14 ref. 7 fig.
Report on three models proposed for future design of, and experimentation with, oxidation ditches to treat animal wastes. The models are based on variations in hydraulic flow patterns and microbial growth; they do not account for variations in detention time or temperature. Steady state versus non-steady state conditions in oxidation ditches were discussed with reference to microbial health and process stability.

G-148 Aasen, A.K., J.B. McQuitty and P.H. Bouthillier. 1971. Storage of beef cattle wastes under aerobic and anaerobic conditions. Paper No. 71-202, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 21 ref. 5 tab. 4 fig.
Results of a field study conducted at the University of Alberta comparing anaerobic decomposition and two levels of aerated storage. A regression equation was formulated for the estimation of BOD_5 of wastewater in terms of two easily measured parameters, the oxygen demand index (ODI) and total solids content. The quantities of plant nutrients in a liquid manure pit were estimated on the basis of cumulative inputs of nutrients in the feed and the quantity of dry matter in the manure. When compared on a dry matter basis, significant differences in BOD_5, total nitrogen, ammonia-nitrogen and phosphorus content were observed between the anaerobic and aerobic treatments; no significant differences existed between the two levels of aeration for any of the parameters tested.

G-149 Pos, J. and J.B. Robinson. 1971. Winter operation of liquid aerated animal waste storage systems. Paper No. 71-203, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 9 ref. 2 tab. 12 fig.
Report on tests conducted at the University of Guelph on aeration of poultry manure using mechanical and pneumatic aerators. Under freezing conditions, pneumatic aerators appeared more favourable than mechanical aerators. When relatively high temperatures could be maintained, aeration reduced nitrogen content of the manure by more than 50%. The need for further research to establish design parameters for field application was indicated.

G-150 Bell, R.G. and J. Pos. 1971. Winter high rate composting of broiler manure. Paper No. 71-205, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 5 ref. 2 tab. 10 fig.

Report on the design and operation of an aerated horizontal silo-type high rate composting unit at Guelph, Ontario, which accepted wastes from a commercial broiler operation. Large accumulations of snow and very low ambient temperatures hampered the operation of the unit; however, despite the adverse conditions throughout the winter, a compost of reasonably consistent analysis was produced without the use of supplemental heating equipment. It was suggested that composting of animal manures could benefit from the addition of extra carbon.

G-151 Milne, C.M. and J.T. Redmon. 1971. Outdoor slatted floors for beef cattle under several climatic conditions. Paper No. 71-207, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 3 ref. 5 fig.

Report on studies conducted at Montana State University to determine the feasibility of outdoor slatted floors and liquid manure systems for beef cattle. The results indicated that such a system will work satisfactorily under proper management. The effects of the system on feed conversion, rate of gain, bedding requirements, time and cost of waste handling and on space requirements were reported. Other aspects included in the report included an evaluation of the economic feasibility of the system, climatic effects, effects of electric heating of concrete slats, methods of fluid manure handling, and mechanical considerations.

G-152 Witz, R.L. and G.L. Pratt. 1971. Beef confinement housing and equipment. Paper No. 71-208, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 3 ref. 4 tab. 9 fig.

Report on a research facility built at North Dakota State University and some of the initial results of tests performed therein. It was concluded that confinement housing of beef cattle can prevent environmental contamination and maintain an optimum environment for animal production. The facility was designed so that a comparison could be drawn between handling of manure as a liquid-solid mixture and handling of liquids and solids separately. Ventilation systems of various types can be compared. A rock heat sink is being used for recovery of part of the heat from the exhaust air.

G-153 Gunn, J.D. and G.E. Bishop. 1972. Application of hog lagoon liquid to forest land. Paper No. 72-206, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 6 pp. 3 tab. 1 fig.

Preliminary report on a project in Nova Scotia involving application of hog lagoon effluent to forest land. Modified irrigation equipment is utilized for spreading. Odors have been minimal. The effect of the manure application on forest growth and the environment is now being studied.

G-154 Bell, R.G. and J. Pos. 1972. High rate composting of municipal refuse and poultry manure. Paper No. 72-210, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 24 pp. 6 ref. 6 tab. 7 fig.

"Municipal refuse was hand sorted to remove metal, glass, plastic and rags, and then passed through a hammer mill. The shredded refuse was then moistened and blended with broiler manure in the ratio of 5:4. This mixture was treated in a high rate composting unit for 8 days and then discharged to a stockpile and allowed to mature. The mature compost direct from the stockpile is being evaluated as an aid to the restoration of vegetative cover on a former gravel pit site, while reground compost is being tested by the horticultural industry. An economic analysis of the plant operation suggests that presorting of refuse by the householder may be a prerequisite for the successful operation of a commercial unit."

G-155 West, B.S. 1972. Drying and marketing poultry manure. Paper No. 72-211, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 14 pp. 2 ref. 2 tab. 6 fig.
Progress report on the use of poultry manure dryers in Alberta. Experiences of two Alberta farmers indicate that reliable, functional and efficient manure dehydrators are available on the market. In-the-house drying significantly reduces dehydration costs. Marketing of the dried product will require additional investigation.

G-156 Talbot, D.N. 1972. Low-cost effluent treatment plant for chicken processing. Paper No. 72-212, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 20 pp. 4 tab. 5 fig.
A full report on the design and operation of the new treatment facilities at a 17,500-bird/day poultry processing plant. The waste treatment plant provides for suspended solids removal, grease separation, BOD reduction by mechanical aeration, clarification of mixed liquid from the aeration tanks, further clarification in a facultative lagoon, lime treatment, alum treatment, coagulant addition, chemical clarification, filtration, and chlorination prior to discharge of the effluent to a nearby surface water supply. Investment and operating costs are reported. Final effluent from the plant has a BOD of 5 mg/l, suspended solids of 5 mg/l, and a phosphate content of 1 mg/l.

G-157 Milne, C.M. 1972. Ion-selective electrodes in agricultural waste management research. Paper No. 72-213, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 27 pp. 7 ref. 6 tab. 11 fig.
Report on the use of ion-selective electrodes in a research project concerned with the pollutional effects of livestock wintering operations in Montana. General and theoretical aspects of specific-ion electrode operation, the use of electrodes in the project referred to, and recommendations concerning the application and use of such instruments in water quality determinations are considered in the report.

G-158 Staley, L.M., M.A. Tung and G.F. Kennedy. 1972. Flow properties of dairy waste slurries. Paper No. 72-214, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 16 pp. 8 ref. 1 tab. 8 fig.
"Dairy manure slurries of varying solids content were tested in a Haake rheometer over a wide range of shear rates. The resulting data accurately fitted a power-law model for which flow parameters were determined. These parameters were used to calculate a generalized Reynold's number and Fanning friction factor. Darcy's equation then gave pressure drops for selected pipe sizes and flow rates. Field experiments were conducted by pumping dairy manure through 3 and 4 inch diameter irrigation pipe. Flow rates, solids content and pressure drops were measured. After applying corrections for the effect of pipe couplers, measured and calculated pressure drops were compared and found to be in good agreement. The method of applying viscometric data to predict pipeline flow appears to have good potential in the design of distribution systems for dairy waste slurries."

G-159 Hore, F.R. 1972. Manure management practices in Canada to-day.

Paper No. 72-215, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 5 pp.
Review of manure management practices in Canada. Variable climatic conditions, different animal species and regional management differences eliminate the possibility of a singular manure management system for all of Canada. Several generally accepted manure management principles were discussed (adequate separation from neighbors, frequent removal of manure from barns, adequate storage, access to sufficient crop land, and rapid soil cover of field applied manure) and examples were given of some new practical developments based on meeting those principles.

G-160 Robinson, J.B. 1972. Manure-handling capacity of soils from a microbiological point of view. Paper No. 72-217, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 18 pp. 18 ref. 4 fig.
Discussion of soil microbial processes as related to the fate of manure components (carbon, nitrogen, phosphorus, and pathogenic organisms) in the soil. Nitrogen losses to the groundwater are the first indication that the manure handling capacity of the soil microflora has been exceeded. The possibility of leakage of pathogenic organisms from the system appears to exist at all levels of manure application. The question of setting maximum manure application rates was discussed.

G-161 Elrick, D.E., J.W. Ketcheson, R.W. Sheard and J.A. Smith. 1972. Crop utilization of manure. Paper No. 72-218, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 11 pp. 5 ref. 8 tab. 3 fig.
Discussion on (1) the plant nutrient content of manures, (2) the availability of nutrients in organic manures as compared to commercial inorganic fertilizers, (3) harmful effects on crops from applying manure, and (4) nutrient cycling in soil to which manure has been added.

G-162 Roberts, J.A. 1972. Manure management related to soil, water & air - the challenge to agricultural scientists. Paper No. 72-220, Can. Soc. Agr. Eng., Suite 907, 151 Slater St., Ottawa, Ontario. 6 pp.
General discussion of the farm animal waste problem. The author presented, and elaborated on, three major challenges facing agricultural scientists: (1) to become involved in land use, economic, and systems planning; (2) to solve the problems of recycling livestock wastes; and (3) to make livestock production systems compatible with high density human populations.

G-163 Fisher, L.J. 1972. Factors which influence the utilization of animal excreta either directly by animals or indirectly through plants. Unnumbered paper, Can. Soc. Anim. Sci., Suite 907, 151 Slater St., Ottawa, Ontario. 15 pp. 21 ref. 4 tab.
Review of the literature on three methods for recycling animal manures: (1) recycling into the crop production system by field application of manure; (2) recycling of manure by hydroponic growth of algae, bacteria, yeast, cereals, and/or grasses; and (3) recycling by direct refeeding of manure to animals. The author concluded that hydroponics and integrated cropping systems are efficient methods for utilization of manure. Direct recycling of poultry manure through ruminants may have potential worth developing.

G-164 Barker, J.C. and J.I. Sewell. 1972. Effects of spreading manure on groundwater and surface runoff. Paper No. 72-203, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp. 8 ref. 4 tab.
"An experimental manure slurry irrigation system was established and the effects of the surface spreading of dairy manure slurry on surface runoff and groundwater quality were studied. Except for isolated cases, the bacterial and chemical concentrations of water samples from an area saturated with manure slurry were within the permissible criteria for raw water for public supplies."

G-165 Cross, O.E. and P.E. Fischbach. 1972. Water intake rates on a silt-loam soil with various manure applications. Paper No. 72-218, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 4 ref. 9 fig.
"The application of manure to cultivated and irrigated soils changes the intake rate of irrigation water when compared to the intake rate of non-manured soils. This paper presents the findings of two years of irrigation study on manured soils. The intake rates are a necessary guide-line to the irrigator."

G-166 Davis, S., W. Fairbank and H. Weisheit. 1972. Dairy waste ponds effectively self-sealing. Paper No. 72-222, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 10 pp. 10 ref. 2 tab. 1 fig.
"Infiltration rates of a dairy waste pond were measured with irrigation water before manure water was applied. Infiltration rates decreased from 48 inches per day with clean water to 0.2 inch per day with manure water after 4 months."

G-167 Houkom, R.L., A.F. Butchbaker and G.H. Brusewitz. 1972. Thermal properties of beef manure. Paper No. 72-316, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 34 pp. 14 ref. 4 tab. 11 fig.
"Thermal conductivities, specific heat, and bulk densities were determined at 25%, 45%, 65% and 85% wet basis moisture levels. The thermal conductivities were determined by a heated probe inserted into the slurry. The specific heat was determined by the mixing calorimetric method. Both thermal conductivity and specific heat were dependent upon moisture content."

G-168 Butchbaker, A.F., G.W.A. Mahoney and J.E. Garton. 1972. Climate and the selection of a beef waste management system. Paper No. 72-410, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 35 pp. 28 ref. 1 tab. 10 fig.
"Two climatological models for beef housing and waste management systems were developed. One model used average January and July temperature lines and moisture deficit lines. The second model used only mean annual temperature and moisture deficit. Both models can be used to identify regions that require different beef housing and waste management practices."

G-169 Bates, D.W. 1972. Observations of dairy manure handling systems. Paper No. 72-413, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 3 pp.
"Systems may range from a gutter cleaner and daily hauling with a manure spreader to extended storage in concrete tanks beneath or adjacent to the housing facility. Available capital, labor, land for manure disposal, climate, sanitary regulations, and personal preferences are factors in choosing a system."

G-170 Butchbaker, A.F., J.E. Garton, G.W.A. Mahoney and M. Paine. 1972. Effect of feedlot laws and climate on open feedlot waste management. Paper No. 72-438, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 38 pp. 16 ref. 6 tab. 12 fig.
"The effect of annual precipitation, storm design rainfall, annual evaporation, and local feedlot laws on runoff control design were determined. Costs of facilities, solid waste handling systems and runoff control were also determined."

G-171 Person, H.L., J.R. Miner, T.E. Hazen and A.R. Mann. 1972. A comparison of three systems for transport and treatment of swine manure. Paper No. 72-439, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 31 pp. 6 ref. 2 tab. 8 fig.
"Three full scale systems for hydraulic transport treatment and disposal of swine manure have been constructed. An evaluation of these systems has been made. All three systems have operated successfully."

G-172 Gilbertson, C.B. and J.A. Nienaber. 1972. Prototype runoff control system design and installation. Paper No. 72-440, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 20 pp. 19 ref. 4 tab. 4 fig.
"Criteria for design and installation of a runoff control facility for a 1000 head capacity feedlot are discussed. Design components of the facility include solids removal area, a liquid holding pond, and a disposal area for the runoff."

G-173 Barth, C.L. 1972. Using odor intensity limits in air quality standards. Paper No. 72-441, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 16 pp. 19 ref. 3 tab.
"It is imperative that a continuing effort be made to understand the production and control of agricultural odors, to develop the technology and procedures for objective determinations of odor characteristics and to implement regulations which recognize the limitations of the best practical environmental protection technology available."

G-174 Hsu, T.S., C.O. Cramer and J.C. Converse. 1972. Seepage losses and fertilizer preservation in manure stacking practice. Paper No. 72-442, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 23 pp. 15 ref. 8 tab. 11 fig.
"A model study of manure stacking using a 3 x 3 factorial design with two replicates was conducted to determine the effect of type and amount of bedding on seepage losses, manure degradation and volumes."

G-175 Sewell, J.I. 1972. Manure slurry irrigation system receiving lot runoff. Paper No. 72-443, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 13 pp. 5 ref. 7 fig.
"A manure slurry irrigation system consisting of a storage tank, chopper-agitator-pump unit, flush pits, irrigation pipe and a large sprinkler was installed at the University of Tennessee Knoxville Cherokee Dairy. The runoff from the concrete lots and the manure scraped into the pits is delivered into the tank from which it is irrigated onto land."

G-176 Butchbaker, A.F., G.W.A. Mahoney, M.D. Paine and J.E. Garton. 1972. Effect of climate on the selection of a beef housing system. Paper No. 72-444, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 37 pp.

20 ref. 3 tab. 12 fig.
"Beef housing and waste management zones were based upon temperature and moisture deficit. Open feedlot and confinement building systems were compared as affected by climate. An optimum climatic area for feeding beef in outdoor open feedlots was the Southern Great Plains and Southwest; most other areas of the U.S. required modification of climatic variables."

G-177 Hellickson, M.A., H.G. Young and W.B. Witmer. 1972. Ventilation characteristics of a beef confinement building. Paper No. 72-446, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 14 pp. 14 ref. 7 fig.
"Observations of summer ventilation characteristics in a closed confinement beef building revealed undesirable air distribution. A system employing a center ceiling inlet for summer and winter ventilation was designed and tested. Results revealed improved summer ventilation air distribution without excessive solar tempering."

G-178 Jedele, D.G. and F.W. Andrew. 1972. Slotted-floor cold-confinement beef-cattle housing. Paper No. 72-448, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 1 tab. 22 fig.
"Slotted-floor cold-confinement beef cattle housing is at the innovative stage of adoption, but enough is known so that success of a building design can be assured. This paper cites nine advantages. Each beef cattle feeder will have to decide if enough of those advantages apply to this situation to make this system of beef production the correct choice."

G-179 Payne, F.A., I.J. Ross, H.E. Hamilton and J.D. Fox. 1972. High-temperature, high-pressure extrusion of chicken excreta. Paper No. 72-450, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 22 pp. 17 ref. 1 tab. 6 fig.
"Chicken excreta and a chicken excreta-feed mixture were extruded to determine the sterilization parameters. The sterilization potential of an extruder was theoretically analyzed. The extrudate was tested for some chemical and physical changes."

G-180 Midden, T.M., I.J. Ross and H.E. Hamilton. 1972. Drying parameters of formed poultry excreta. Paper No. 72-451, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 21 pp. 5 ref. 2 tab. 9 fig.
"Fresh poultry manure has been formed into long cylinders and air dried at temperatures in the range of 100 to 950F. The thin layer drying characteristics have been determined in the temperature range 100 to 220F and the crusting characteristics determined at the higher temperatures."

G-181 Stevenson, J.S. and L.J. Roth. 1972. Experiences with oxidation ditches in a pullet growing house. Paper No. 72-452, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 8 pp. 1 ref.
"Oxidation ditches have performed satisfactorily for eighteen months in a 32,000 bird pullet growing house. Some start-up problems were encountered and are discussed. Also mentioned are drying of effluent, addition of dilution water and estimated operating costs."

G-182 Morgan, N.O. and H.J. Eby. 1972. Animal wastes aeration improves bioreduction by fly larvae. Paper No. 72-453, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 9 pp. 1 ref.
Report on bioreduction of manure by housefly larvae under controlled temp-

erature and humidity conditions. Each 100 pounds of manure is degraded in 4-5 days to 2.5-3.0 pounds of good protein supplement and 50-60 pounds of semi-dry, practically odorless soil conditioner. The exhaust gas can be filtered and the gases recovered as salts or slurries.

G-183 Hamilton, H.E., I.J. Ross, J.D. Fox and J.J. Begin. 1972. Nutrient changes in poultry excreta fermented with rumen bacteria. Paper No. 72-454, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 18 pp. 13 ref. 1 tab. 8 fig.
"Proximate components and uric acid were measured in poultry excreta during anaerobic fermentation with rumen fluid as an inoculum. Nitrogen, ether extract, and ash were affected by pH and solids levels. Uric acid was completely decomposed or converted to another compound."

G-184 Zindel, H.C., T.S. Chang and G.R. Carter. 1972. Bacteriological procedures for analyzing wet and dried poultry feces. Paper No. 72-455, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 4 pp. 2 ref.
Bacteriological procedures used for analyzing poultry feces in drying experiments at Michigan State University were outlined. The results of analysis of many samples of dried feces have shown that drying does not sterilize the manure. The importance of sanitary procedures for loading and unloading drying units was noted.

G-185 Hummel, J.W., W.F. Schwiesow and G.B. Willson. 1972. A mechanized compost channel for animal wastes. Paper No. 72-456, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 15 pp. 6 ref. 6 tab. 6 fig.
"An experimental mechanized composting channel was designed and tested using an artificial test material and dairy manure. Functional ability and power requirements were evaluated. The mechanized channel is a promising system for composting agricultural wastes."

G-186 Högsved, O. and P. Holtenius. 1968. Liquid manure gas poisoning. Paper presented at World Veterinary Conference, Opatija, Yugoslavia. 7 pp. 28 ref.
Review of: (1) the history of liquid manure handling in Europe; (2) the composition of air in barns with liquid manure facilities; and (3) reported cases of acute and chronic poisoning of livestock by manure gases. Hydrogen sulfide was implicated as the manure gas which most often creates health problems.

G-187 Kolega, J.J., A.W. Dewey, R.L. Leonard and B.J. Cosenza. 1972. Land disposal of septage. Paper presented at the Society of Engineering Science First International Meeting on Pollution: Engineering and Scientific Solutions, Tel Aviv, Israel. 11 pp. 7 ref. 1 tab.
Report on the development and field testing of a subsurface disposal system for septic tank pumpings (septage). Equipment and facilities involved in receiving, storing, and applying septage to the land are described. Three basic methods of septage application were employed: (1) Terreator; (2) plow-furrow-cover; and (3) sub-sod-injection. Up to two gallons of septage could be applied per linear foot of travel. There has been little evidence of soil and water pollution beneath the disposal fields. Research needs are outlined.

G-188 Muehling, A.J. 1972. Housing requirements for swine. Paper presented

at Illinois Swine Seminars. Dept. Agr. Eng., University of Illinois, Urbana-Champaign, Illinois. 17 pp. 8 fig. 2 tab.
General discussion on the planning, design, construction and management of swine housing facilities, with specific references to waste handling. It was suggested that slotted floors or some other method of mechanized waste handling must be used to minimize labor.

G-189 Muehling, A.J. 1971. Handling swine manure to avoid pollution. Paper presented at Illinois Swine Seminars. Dept. Agr. Eng., University of Illinois, Urbana-Champaign, Illinois. 6 pp.
General discussion on handling manure from swine operations. Five systems were discussed, namely: (1) solid floors with bedding--store and haul; (2) slotted floors--store and haul; (3) slotted floors--combination of lagoon and hauling; (4) slotted floors--oxidation ditch with lagoon; and (5) flushing gutter--lagoon and irrigation. The effects of recent anti-pollution legislation on swine waste management requirements are discussed.

G-190 Johnston, P. 1970. Nebraska's feeding industry. Paper presented at Conference on Engineering Design for Livestock Waste Management, Nebraska Center for Continuing Education, Lincoln, Nebraska. 8 pp.
Statistics are presented to illustrate the scope of the feedlot waste management problem in Nebraska. The author suggests that there is a large need for the technical know-how of the professional engineer to help solve this problem.

G-191 Ross, I.J., H.E. Hamilton and B.J. Barfield. 1970. Agricultural waste management. Paper presented at Annual Meeting Kentucky-Tennessee Section, American Water Works Association - Water Pollution Control Federation. 22 pp. 28 ref. 4 fig.
Review of the trends in the livestock industry which have created the present problems of waste management. The basic concepts of, and results of experience with, several waste management systems are described, namely land disposal, lagoons, oxidation ditches, activated sludge, trickling filters, extended aeration, composting, dehydration, landfill, growth and harvesting of algae, fish and flies, and refeeding.

G-192 Pratt, G.L. 1971. System components to separate solids and liquids. Paper presented at Animal Waste Management Conference, Iowa State University, Ames, Iowa. 7 pp. 3 fig.
Discussion on two general methods used to separate the solid and liquid fractions of manure: (1) mechanical separation; and (2) settling. Design and operational data are given for settling tanks and channels, filters, centrifuges, and gravity-mediated separation.

G-193 Reddell, D.L. 1972. Utilizing manure on farm land. 1972 Cattle Feeders Annual, Texas Cattle Feeders Association. pp. 45-50. 2 tab. 3 fig.
Report on research conducted in Texas to investigate the disposal of large amounts of manure by deep plowing. Up to 900 tons/acre were successfully plowed under using a 30-inch moldboard plow. The effects of such high levels of manure application on the chemical and physical properties of the soil and groundwater, and on the quality of crops grown on land receiving the manure, were reported. Where sufficient land is available, application rates should be limited to 10-20 tons/acre.

G-194 Baldwin, L.B. 1971. Regulations governing animal waste disposal systems in Florida. Paper presented at Extension Section, Society of Animal Science Southern Agricultural Workers Meeting, Jacksonville, Florida. 10 pp. 4 ref. 4 fig.
Discussion on present and proposed regulations set forth by the Florida Department of Pollution Control to control pollution from all industries. Laws are presently being formulated which will require that all livestock operators be licensed. A New Engineering Standard for Animal Waste Treatment Lagoons in Florida was described and an example given of an engineering data sheet for examination of animal waste handling systems.

G-195 Frecks, G.A. and C.B. Gilbertson. 1972. Instrumentation for monitoring small weight changes. Paper No. 72-519, Amer. Soc. Agr. Eng., St. Joseph, Michigan. 14 pp. 18 ref. 1 tab. 5 fig.
"A continuously recording weighing device was designed and constructed to develop drying curves for beef cattle feces. Instrumentation consisted of strain gages mounted on a cantilever beam. All output values at predetermined weighing intervals were recorded by a digital voltmeter."

G-196 Hawkins, D.E. 1971. Summary of design concepts for animal waste disposal systems. Paper presented at the State Meeting, National Society of Professional Engineers, Little Rock, Arkansas. 5 pp. 3 ref. 3 tab.
Report on waste disposal systems recommended by the U.S. Soil Conservation Service. These systems involve either a disposal lagoon, liquid manure systems or a feedlot runoff control system. Data are presented on the quantities and composition of various animal excrements, and these are discussed with respect to their influence on the design of a disposal system.

SUBJECT - AUTHOR INDEX

This subject-author index was prepared by means of a modified KWIC* Quick Index Program**. Each entry contained in the bibliography was assigned a "record" of up to 240 characters in length consisting of authors' surnames and initials, several descriptive keywords and modifiers, and its appropriate accession number.

The program selects all surnames and keywords and arranges them in alphabetical order. Each significant word is located in a column, termed the "gutter", in a more or less central position in the computer printout or page. The remainder of each record is printed, exactly as it appears on the program input record, on either side of the guttered word. In the event that all of a record can not be printed in the available space on the specified side of the gutter, the balance (or fraction thereof) is printed at the end of the record on the opposite side of the gutter. Some words are modifiers only and should not be considered as keywords. Such words are not placed in the gutter. Words of less than three characters, such as authors' initials, also are not placed in the gutter. In all cases, the accession number appearing in the record is printed unchanged in the last five columns of the printed index.

Procedure for Reference Location

1. Scan the guttered words for the subject (or author) of interest.
2. Search the words on either side of the gutter for more specific information or for modification of the guttered word.
3. Using the accession number as a key, locate the abstract of the pertinent reference in the appropriate section of the bibliography.
4. Read the abstract for a description of the material in the reference sought.
5. Use the reference citation presented to locate the original article or paper.

* Keyword in context.

**Heaps, H.W. 1972. Program, CS-KWIC. Department of Computing Science, University of Alberta, Edmonton.

Notes on Keywords and Modifiers

When a keyword is sufficient to describe material in a particular reference without use of a modifier, that keyword appears as such in the guttered record and is separated from other words by commas. Certain keywords also are used as modifiers to other keywords while some words are modifiers only and never appear as keywords. Authors' names are separated from descriptive words in each record by means of the sign "/". The same sign is used where a ratio is involved in the descriptive wording.

While one word might be adequate as a modifier to a keyword in a given situation, frequently more than one modifier is necessary to better describe the material covered by the keyword. This may be illustrated by the following groups of words used with respect to specific information contained in a particular reference.

Example 1.	aerobic lagoon, aerated lagoon, anaerobic lagoon,
Example 2.	soil structure, soil cation exchange capacity, soil carbon/nitrogen ratio,
Example 3.	nitrogen availability, nitrogen uptake, nitrogen accumulation, phosphorus availability, phosphorus uptake, phosphorus accumulation,

Words in each of these examples are combined to save space in the index and to decrease the time spent by the user in locating pertinent information. The groups of words thus would appear in the index as follows:

Example 1.	, aerobic aerated anaerobic lagoons,
Example 2.	, soil structure cation-exchange-capacity carbon/nitrogen-ratio,
Example 3.	, nitrogen phosphorus availability uptake accumulation,

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