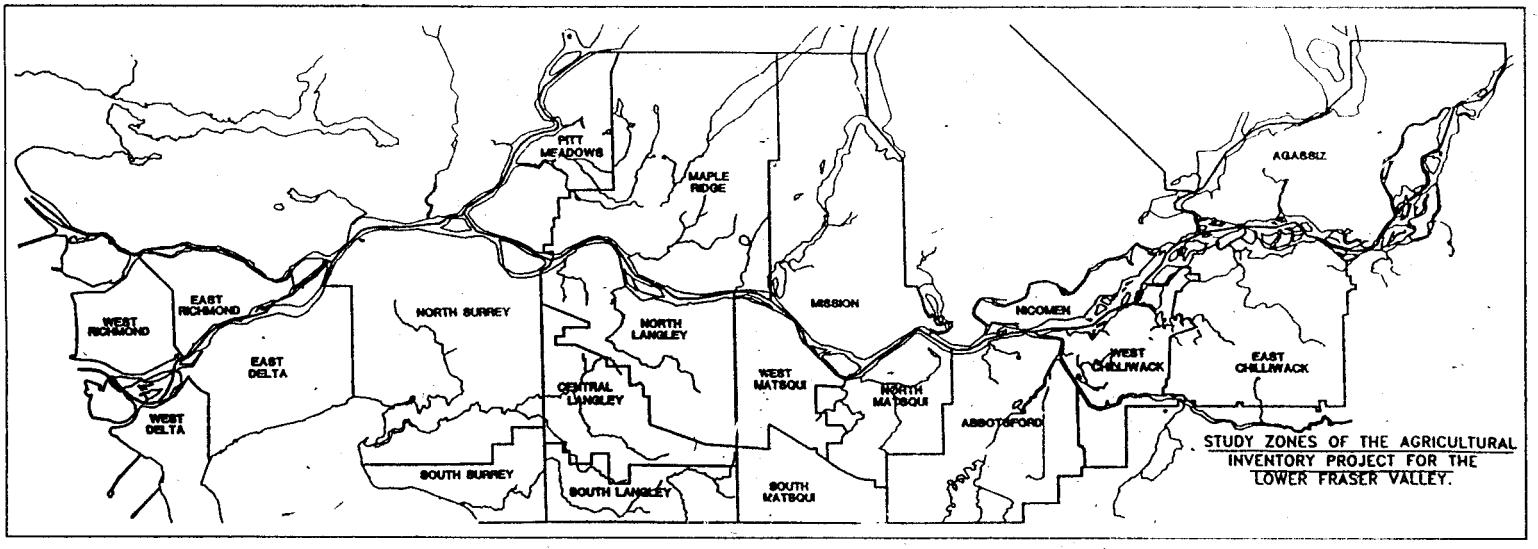
LIVESTOCK WASTE MANAGEMENT PRACTICES AND LEGISLATION OUTSIDE BRITISH COLUMBIA JULY 1995



Component Project
of
Management of Livestock and Poultry Manures in the Lower Fraser Valley

REPORT 5

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Environment Canada
FRASER RIVER ACTION PLAN

Environnement Canada
PLAN D'ACTION DU FRASER

Fisheries and Oceans
FRASER RIVER ACTION PLAN

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Ministry of Environment, Lands and Parks

Ministry of Agriculture, Fisheries and Food

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JULY 1995

Prepared for

BC Ministry of
Environment, Lands and Parks

Environment Canada
Fraser River Action Plan

BC Ministry of
Agriculture, Fisheries and Food

Fisheries and Oceans
Fraser River Action Plan

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1. EXECUTIVE SUMMARY

This report one of a series of projects to assess management of agricultural wastes in the Lower Fraser Valley. The objective of this specific project is to identify livestock waste management practices and legislation outside of British Columbia.

The broad objectives of the overall initiative, of which this project is a component, are to evaluate the production, management and use of agricultural wastes, and then to utilize this information in developing strategies for improving nutrient (manure and inorganic fertilizer) management.

The key problems identified from experience elsewhere include:

. the underlying public concern with manure management and its pollution and potential pollution risks associated with air, water, habitat and soil resources;

. large quantities of manure have been applied to a limited land area often without considering the potential hazards; and

. most emphasis appears to be on potential water pollution and a focus of concern on the decreasing quality of drinking water.

Problems directly associated with manure management are similar in many locations, what differs is the practices to deal with the problems.

The review of legislation, regulation and policy elsewhere should be considered a "snapshot in time' as the various governmental approaches to livestock waste management are extremely dynamic at this time in Europe and the USA.

While we cannot expect to extrapolate from the experience of another jurisdiction directly and apply it to the Fraser Valley, the combination of experiences elsewhere are helpful in that they provide various policy approaches - some successful, others not.

Lessons learned include:

- In areas of intensive livestock production in Europe, U.S.A. and Canada waste management and associated environmental considerations are becoming increasingly key public policy issues.

- Approaches to livestock waste management practices, legislation, regulation and policy are extremely dynamic at the present time. Changes result from new research findings, applied experience, industry economics and integration with other environmental and land use planning policy.

- B.C. is not alone in searching for innovative ways to address the problems associated with livestock waste management and receiving environments.

- There is no one model elsewhere that can be considered as a prototype for addressing livestock waste management issues in the Lower Fraser Valley. However, experience elsewhere should help with developing a "made in" the Lower Fraser Valley livestock waste management planning policy.

- Governments, agencies and farmers are struggling with intensive livestock waste management issues, but with so many areas of concern and such a diverse and complicated system, the best solutions to its problems remain to be found.

- Actions taken elsewhere, to date haven't necessarily remedied the problems, but rather attempted to abate the problems while searching for other answers.

- Any consideration of off-farm central processing of livestock waste must be exposed to rigorous economic and technical analysis as a result of unfavourable experiences elsewhere.

- A priority must be given to educate the producer, government resource manager and the public.

2. INTRODUCTION TO LIVESTOCK WASTE MANAGEMENT PROBLEMS AND PRACTICES IN OTHER JURISDICTIONS

The BC Ministry of Environment, Lands and Parks (BCMELP), Environment Canada, Fisheries and Oceans and BC Ministry of Agriculture, Fisheries and Food have jointly undertaken an initiative to assess Agricultural Waste Management in the Lower Fraser valley. The broad objectives of this initiative are to evaluate the production, management and use of agricultural wastes, and then to utilize this information in developing strategies for improving nutrient (manure and inorganic fertilizer) management.

These objectives are consistent with the needs of Environment Canada's Fraser River Action Plan whose broad goals include reducing the loading of agriculturally related chemicals and wastes to the environment.

This report is one in a series of projects in the Fraser Valley Agricultural Waste Management program. The objective of this project is to identify livestock waste management practices and legislation outside of British Columbia.

No matter what part of Europe, Canada or the United States one might choose to examine, the underlying public concern associated with manure and manure management is pollution and potential pollution.

Recent patterns of concentrated intensive livestock operations, profitability of large scale livestock production and agricultural policies have all contributed to the increased production of manures. As a result, large quantities of manure have been applied to a limited land area often without considering the potential hazards. The threat of pollution in all its forms, affects and potential affects is prevalent where these large quantities of livestock waste are produced.

Concerns with potential pollution of air, water, habitat and soil resources resulting from livestock manure management is a key public policy concern in many countries. Most emphasis appears to be on water pollution and a focus of concern is on the decreasing quality of drinking water. However, European countries seem most willing to acknowledge the range of complex issues associated and attempt to address the problems in a constructive fashion.

2.1 POLLUTION

2.1.1 NUTRIENT LOSS

Nutrient loss is a basic focal point being given consideration in all jurisdictions. That is, nitrate (NO_3) and phosphorus (P) leaching along with surface runoff are seen to be the primary factor in potential water and soil pollution. Timing of application of manure is an important issue in preventing leaching and surface runoff. Ideally, applications should be made when crop uptake is at its maximum and weather conditions are optimal. When livestock manures are applied to correspond with the needs of the crop, the potential of damage to the environment is lowered. But if manure is applied in excess of crop needs or when the crop is not growing then there is a potential of polluting soil, water, habitat and air.

If careful practice is not followed and the soil and crop no longer need the nutrients being added through the manure, nutrients begin to leach out of the soil and through surface runoff enter waterways.

The Chesapeake Bay Agreement between Maryland, Pennyslvania, Delaware and Virginia is a multi-state cleanup pact developed to control farm runoff and introduce nutrient management strategies in order to reduce nonpoint source nutrient loading by 40% by the year 2000.

In response, Maryland has developed the Nutrient Management Program which is set up as a network of nutrient management consultants (certified) who help individual farmers create nutrient management plans.

Pennyslvania responded to the problem by enacting the Nutrient Management Act (1994) to establish criteria, planning requirements and implementation schedules for nutrient management control as well as provide educational programs on nutrient management and give technical and financial assistance for nutrient management. Nutrient Management Plans are required for concentrated animal operations. A similar Nutrient Management Certification Program to Maryland's is also available.

2.1.2 WATER POLLUTION

Disposal of excess manure from intensive livestock production is seen to be one of the sources of pollution to groundwater and in some cases drinking water supplies. Water pollution, whether it is surface or groundwater, is the most obvious concern related to livestock waste management and the initial reason many governments have been forced to deal with livestock waste policy development. Over the last decade, levels of groundwater contamination by nitrogen have become apparent. When people perceive that their drinking water may be polluted with livestock wastes, they become intensely concerned. Almost every country has some type of water protection legislation which is often the basis for starting to deal with manure management as a problem.

In several countries, Public Health or other like bodies have certain powers where safety or public health is at risk (France, Canada). United Kingdom policy includes the Code of Good Agricultural Practice for the Protection of Water (1991) which are guidelines based on a medical perspective. Some countries including Germany, the Netherlands and the United Kingdom have designated Water Protection Zones with restrictions on farming practices to reduce leaching of nitrogen.

2.1.3 AIR POLLUTION

Livestock wastes produce ammonia, methane, fine particulate and volatile organic compounds. Air pollution begins from the time manure leaves the livestock. The smell of manure gases gets the publics attention. The complaints regarding smell against operations are an added pressure on farmers in dealing with manure management. Minimizing ammonia losses to the atmosphere has become a major policy target. Several countries have general air quality legislation such as the US Federal Clean Air Act. The United Kingdom's Environmental Protection Act (1990) covers nuisance from odours. However, countries such as the Netherlands and Sweden have the Nuisance Act and the Law of Management respectively which directly contain measures to reduce ammonia losses from livestock wastes. For example, Swedens target is to reduce ammonia losses 25% by 1995 and 50% by 2000 (the Netherlands has similar goals).

Air pollution is also controlled through manure storage and application policies. For example, in the Netherlands all storage structures must have covers and manure must be incorporated into the soil within 24 hours after spreading. Sweden manure must be incorporated within 4 - 12 hours after spreading depending on location.

2.1.4 SOIL POLLUTION

Very few countries appear to have legislation that specifically relates to soil contamination. The Netherlands have a Soil Protection Act (1987) which covers a number of the problems related to pollution from manure by indirectly enforcing N, P, and NH_3 standards as well as reducing the acidifying effects of ammonia on the soil. The Law of Soil Protection in the Netherlands restricts application of manure, regulates spreading of manure and suggests working the manure into the soil.

2.1.5 HABITAT

Water pollution is not just limited to the human use issues, but plays a major role as it impacts on habitat for fish and wildlife. Aquatic habitat contamination and oxygen depletion is a major consideration as well as toxicity of ammonia and nitrite from manure sources. In Canada, the Federal Fisheries Act pertains to the unauthorized discharge of any substance harmful to fish. The European Communities 1991 Directive Concerning the Protection of Waters Against Pollution Caused by Nitrate from Agricultural Sources states, that members must designate areas where the total nitrogen concentration in water exceeds 50mg/Lor where eutrophication occurs. Denmark has also developed an ActionPlan forthe Aquatic Environment to control pollution of aquatic habitats.

In France, the Civil Code may require ecological damage to be 'made good', that is, restoration to its original condition.

A unique program in the U.S.A. resulted from a conglomerate of several states (Maryland, Pennsylvania, Delaware & Virginia) developing the Chesapeake Bay Agreement to improve water quality and habitat by reducing nutrients entering the Bay.

2.2 MANAGEMENT AND PRACTICE PROBLEMS

Pollution caused or perceived to be caused by spreading manure in excess has given rise to specific problems related to manure management. Individual countries, states, provinces, counties and so on are being forced to deal with what appears to be inadequate manure storage, inappropriate manure application, increased livestock densities and a lack of efficient manure disposal methods. Each jurisdiction handles these direct and often diverse manure management problems in a variety of ways.

2.2.1 STORAGE

Concentration and intensification in livestock production has resulted in a need for storage of solid manure and slurry. Because the application of manure in many countries has been limited to certain times of the year related to crop and soil condition, storage during low demand periods is necessary (i.e., fall/winter). Manure storage capacities are often based on livestock units. Adequate storage capacity is related to the size of facility, livestock units, length of storage and consideration of high rainfall and flood conditions. Many jurisdictions require storage capacity for a certain length of time (ie. 5 months) and enough to withstand a 24 hour 10 to 25 year rainfall. Permanent manure storage permits are required in the Netherlands. Specific design details such as cover and ventilation are a large part of current manure storage requirements set out within government regulations.

Besides the design of storage facilities, location and type (earthen, concrete) of facility poses yet another dilemma. Distance from waterways, wells, farmhouses are all considerations when determining where to locate manure storage structures.

Designing, constructing and maintaining manure storage facilities is a large expense to the farmer. Many jurisdictions offer funding and cost-share programs to help off-set the farmer's monetary output.

2.2.2 APPLICATION

The details of the application requirements for manure appear in many of the regulations and policies. In several countries, manure application has strict technical limits imposed with respect to timing, soil nutrient requirement, rate of application and water protection. Timing is dependent on season, soil condition (frozen, unfrozen), soil moisture, cover crop and so on. Placing restrictions on when manure can be applied helps to prevent excessive runoff. The method and equipment used to apply manure is sometimes restricted as well. Many countries require manure to be injected directly into the soil or spread and integrated within a short period of time (ie. 6 -24 hours). In Denmark specific timing and application regulations exist under the Environmental Protection Act. Quantity and rate of manure application is often limited to the type of crop being grown and its nutrient requirements. Several European countries totally restrict any manure application in designated areas called water protection zones. Along similar lines, manure application is usually only permitted within a certain distance of a stream, open ditch or other water body.

2.2.3 DENSITY

Livestock density is yet another issue related to quantity of manure and pollution extent and risk. Restricting livestock numbers based on calculations of area of land associated with a farm unit has been used in some instances and is being considered in others. This poses an economic problem for the farmer who, with improved technology, has intensified activities on a relatively small area to remain a viable business. Existing operations must either maintain/reduce their livestock numbers or find more land to spread manure. New livestock operations may only be permitted to start with a certain number of animals, which cannot be expanded upon.

For example, in Sweden, animal density requirements apply to the whole country. These regulations apply to all farms with at least 10 animal units. A balance must exist between the number of animals on the farm and the amount of land available for spreading livestock waste. Under the Law of Management the maximum number of animals has been accurately calculated with consideration given to the amount of phosphorus in manure and a crop's normal requirements of phosphorus. Dairy cows cannot be more than 1.6 animals per

hectare, fattening pigs 10.5 animals per hectare, laying hens 100 birds per hectare.

2.2.4 DISPOSAL

Disposal of manure remains the number one dilemma for both the individual farmer and the industry as a whole. In many cases, using manures has become less related to fertilizing and more accurately labelled waste disposal. As we move from farm-scale to industrial-scale production, disposing of manure in a safe, economical, efficient and non-polluting manner has been a leading research agenda item in many countries. Some countries have evolved strict and specific policy and practices while others approach the issue through education and voluntary actions.

To quote from an article in the North Carolina Journal of International Law and Commercial Regulation which is indicative of how severe the problem of manure surpluses can become, "For the time being, the Dutch may have won their constant battle against water, now they are in imminent danger of drowning in manure." (Brussard & Rosso Grossman, page 88, 1990).

Excess manure production is prevalent in countries that have increased intensive livestock production as population and thus demand have increased. Disposal of manure involves many factors including availability of land associated with the farm unit, manure contracts with other land owners, and maximum quantities of manure allowed for a farm unit per hectare.

The Netherlands has specific legislation related to disposal known as the Fertilizer Act (1984) which regulates trade in fertilizing products, removal of surplus manure and its financing as well as the production of animal manure. The Act restricts the transfer of manure production to another business or to another location and establishes regulations regarding surplus manure. The Manure Law of 1987 took over many of the Fertilizer Act regulations and created the Manure Bank which is unique to the Netherlands and was formed to aid in efficient transfer of excess manure. Membership is not mandatory and it is run as a non-profit operation. Some of the banks funding relies upon a levy paid on manure surpluses and is used to create facilities for efficient transport, supervision and processing of surpluses.

Contractual agreements for surplus manure to be applied elsewhere also exist in Switzerland. These supply contracts for surplus manure must be entered into by owners with a inadequate land base.

Adopted as general requirements by many jurisdictions are Nutrient Management Plans, Best Management Practices and Codes of Practice. In some cases they are part of detailed legislation and regulation, in others they are strictly voluntary. These plans cover a variety of purposes including reducing pollution, guidelines for use and management of manure, storage, application, water protection and standards for new livestock facilities. Financial assistance is often offered to encourage adoption of these plans and practices.

2.3 PROBLEM SUMMARY

Problems directly associated with manure management are similar in many locations, what differs is the practices adopted to deal with these problems, Unwin and Nash (undated) suggest that " The manure problem is widely regarded as one created by technology which technology now must solve" (pages not numbered - under "Future Changes"). Unfortunately, technologyandlarge scale research into management of excess manures andaffects of associated types of pollution is only as recent as the problemsthemselves

Governments, agencies and farmers are struggling with manure management issues, but with so many areas of concern and such a complicated system, absolute solutions remain to be found. Actions taken to date haven't necessarily remedied the problems, but have rather attempted to abate the problems while searching for solutions. In 1991, Denmark's Minister of Agriculture stated, "It isn't the farmer's fault that the goals for agriculture have not been achieved, but the fault of the politicians. Farming has done what was asked of it and invested millions of Danish Kroner. The instruments of the action plan are not

abletoattain the desired halving of nitrogen losses." (Farmer's Weekly. October, 1991).

3. LEGISLATION, REGULATION AND POLICY

This section is summarized in Table 1. The following should be considered a "snapshot in time" as the legislative, regulatory and policy frameworks with respect to livestock waste management are extremely dynamic at this time in Europe and in the U.S.A. While we cannot expect to extrapolate from any one other jurisdictions experience directly and apply it to the Fraser Valley, the combination of experiences elsewhere are helpful in that they provide various policy approaches - some successful, others not.

3.1 LEGISLATION

3.1.1 FEDERAL

Federal legislation, in other jurisdictions generally, incorporates livestock waste within wide scope environmental protection statutes and often hands off specifics to the provincial/state or local governments for implementation, eg.: European Community's Drinking Water Directive or the Netherlands Soil Protection Act.

European Community

The European Community legislation is based on the 1980 Drinking Water Directive which requires all members to observe standards established within a five year period. The nitrate standard established was a maximum of 50mg NO_3 per litre of drinking water with a recommendation for 25mg/L.

Implementation of the legislated directives has been very sensitive politically for member countries. For example, the experience in the Flanders region of Belguim wherein proposed new slurry application nitrate limits intended to move toward meeting the European Community directive of 170 kg. of N/ha. in sensitive zones recently resulted in the collapse of the coalition government.

This resulted from the fact that one political party close to the Flanders intensive livestock industry refused to endorse the limits on slurry application. Notwithstanding, Flanders has highly intensive livestock production with a shrinking cultivated area that has created a very significant manure problem that is seriously polluting surface and ground water, air and soil.

Denmark

Denmark's 1987 Environmental Protection Act sets a strictly regulated national framework for manure storage, application, designation of environmentally sensitive areas, and livestock density control through a production unit geographic location and size regulation.

France

France's legislation (The Water Act, 1964), in principle, does not apply to agricultural waste as such, but affects the ways in which any form of pollution resulting from intensive livestock production is to be dealt with. Legislation in 1976 focussed on a facilities classification for environmental protection purposes which includes intensive livestock.

Germany

Germany's legislation is focussed on the Water Management Law which provides for the regulation of agricultural activities insofar as they constitute a threat to water resources. The Waste Disposal Act provides authority to protect water quality if the "customary level" of agricultural fertilizing and manure application is exceeded.

The Netherlands

Netherlands' legislation includes the 1987 Soil Protection Act and Manure Law which provide national standards for manure application, timing, storage, local enforcement, animal density, levies on manure surpluses and creation of a national manure bank. The Nuisance Act provides opportunity for the development of ammonia emissions standards related to manure storage. The 1984 Fertilizer Act regulates removal of surplus manure from farm unit to farm unit and region to region as well as production of livestock manure by farm unit and region.

Sweden

Sweden's 1988 Law of Management and Environmental Protection Law provide for regulations regarding animal density requirements, manure application, storage, cover cropping and mechanisms to avoid ammonia loss.

Switzerland

Switzerland's Federal Water Protection Law provides national standards for the use of manure, air emissions, and a contractual framework for disposal of surplus manure.

United Kingdom

The United Kingdom's 1974 Control of Pollution Act, 1989 Water Act and 1990 Environmental Protection Act provide the national standards and framework for codes of agricultural practice (manure storage, application, slurry separation, and water resources protection).

United States of America

The United States federal legislation that has implications for livestock waste management include the Clean Water Act, Safe Drinking Water Act, Food Security Act, Environmental Protection Act, Water Quality Act, and perhaps the 1995 Farm Bill. (The latter is under debate in the US Congress over the next four months and may contain some new environmental provisions which could affect federal legislation on livestock waste management in the near future.)

All of this legislation, particularly the Environmental Protection Act, sets the legislative base for regulations that set effluent limitations and performance standards for concentrated livestock operations.

Canada

In Canada, with most of the waste management jurisdiction falling to the provinces the only federal legislation of significance that directly relates is the general provision of the Fisheries Act which provides the legislative base to take actions on the deposit of any substance harmful to fish.

3.1.2. PROVINCIAL/STATE LEGISLATION

Implementation actions tend to be based on combinations of federal, provincial/state and local/regional legislation, regulation and policy.

European Community

Directives with respect to livestock waste management as agreed to by European Community members apply at all levels of government including regional or state governments.

Denmark, the Netherlands, Sweden and the United Kingdom do not appear to have livestock waste management legislation at the provincial/state level.

France (Brittany) and Germany, (North Rhine - Westphalia and Lower Saxony)

In the cases of France (Brittany) and Germany (North Rhine - Westphalia and Lower Saxony), within a federal legislation framework, more specific legislation/ordinances associated with livestock waste management activities are regulated and include liquid manure directives, animal density, timing of manure application, length of storage and relationship with urban and rural land use planning and public health.

Germany

In Germany specifically, the 1982 Waste Disposal Act transferred power to pass ordinances and directives regulating the management of manure to the state government.

Switzerland

Implementation of Swiss Federal Agricultural Waste Management Law is under the jurisdiction of Cantonal authorities.

United States of America

In the USA many states have legislation which must conform with the federal legislative initiatives, but which provide for specific state regulation. In addition, many states have put legislation in place that requires that by 1995, all commercial operations have nutrient management plans that follow best management plans. There is significant state responsibility under federal regulations (eg. it is state responsibility under federal regulations to require a waste permit program for dairies with over seven hundred head of livestock). The Water Quality Act 1987 requires each state to develop programs to control nonpoint sources of pollution of both surface and groundwaters. Example state legislative initiatives are as follows:

Colorado

The Confined Animal Feeding Operations Control Law is designed to protect waters of the state from potential impact due to confined animal feeding operations; and includes provisions for conditions of manure storage, application rates, floodplain locations, discharge permit system and submission of manure and process wastewater management plans to the State Department of Health.

Delaware

Delaware has a range of mostly water oriented environmental protection legislation which provide options for regulation of animal waste disposal, development of manure management plans and a permitting process.

Illinois

The Illinois Livestock Waste Law provides a basis for regulations/guidelines for livestock waste quantity application criteria with focus on water and odour pollution concerns.

Indiana

The Indiana Confined Feeding Control Law provides the state authority to require operations of certain sizes and known polluters to obtain approval for their manure management systems, including storage, equipment and land for manure disposal.

Maryland

The multi-state clean up pact and the Chesapeake Bay Commission was established through the Clean Water Act with the objective of improving water quality and habitat by reducing nutrient loading in the Bay. Voluntary best management practices focus.

Missouri

The Clean Water Law provides for a discharge permit process to deal with intensive livestock.

Pennyslvania

The Nutrient Management Act (1993) establishes criteria, planning requirements and implementation scheduling for nutrient management control. The Clean Streams Law compliments this legislation.

Viriginia

Under the Clean Water Act a Virginia Pollution Abatement Permit requires a nutrient management plan for farms with 1,000 animals that have liquid or semi-solid manures. Also associated is the Chesapeake Bay Preservation Act.

Washington

Under the Water Pollution Control Act the State Department of Ecology has proposed for a permitting process which seeks to insure that manure or contaminated wastewater does not reach streams or groundwater.

Canada

In Canada, the provinces have the primary jurisdictional responsibility and authority for the regulation of livestock waste management under legislation with special exceptions. Province specific legislation includes:

Alberta

The Environmental Protection and Enhancement Act, Public Health Act, Planning Act, and Agricultural Operations Practices Act combine to provide municipalities with the authority to set bylaws; for example control intensive livestock operation location and waste management.

Manitoba

The Environmental and Public Health Acts provide authority for the provincial Livestock Production Operation Regulation.

New Brunswick, Newfoundland, Nova Scotia and Prince Edward Island

Water and environmental protection legislation (Clean Water Act, Water Protection Act, Act Respecting Water and Water Courses) are key to Maritimes livestock waste management approaches.

Ontario

The Environmental Protection Act, Health Promotion and Protection Act, Planning Act, Water Resources Act and Farm Practices Protection Act provide the framework legislation for regulations and policy.

Quebec

With the most stringent regulations in Canada, the Environmental Quality Act integrates efforts to manage livestock waste including potential water and air pollution.

Saskatchewan

The Pollution (by Livestock) Control Act provides the provincial livestock waste management regulatory authority.

3.1.3 LOCAL GOVERNMENT

Local governments are not commonly in the position whereby they develop their own legal authority for livestock waste management, but are more commonly associated with implementing legislation initiated by federal and provincial/state governments.

Local government bylaws or ordinances and administrative regulations tend to be for very specific purposes in Europe, U.S.A. or Canada:

France

Livestock waste management is integrated with the legal framework for land use planning by local governments.

The local Health Board and through administration of the national Rural Code enforcement of livestock waste regulations take place.

Germany

Legal enforcement rests with the waste disposal authorities at the local district level.

Sweden

At the county level the County Administration Board supervises the livestock waste management provisions of the Law of Management and the Municipal Bureau of Environment and Health Protection supervises the Environmental Protection Law.

U.S.A. Soil Conservation Districts

Federal or state authorities enforce and recommend farm specific best management plans and provide advise on nutrient management plans.

Alberta

Municipalities under provincial guidelines have the authority for intensive livestock development under a detailed permit process.

3.2 REGULATION AND ENFORCEMENT

Livestock waste management regulation and enforcement for the jurisdictions reviewed are a complex mixture of activity at various levels of government. In some instances a specific level of government is responsible, but more often a shared responsibility of two or three levels of government is utilized for integrated approaches to livestock waste management.

The direct involvement of livestock producers or their organizations in regulation and enforcement appears to be becoming more common.

European Community

In 1991 a directive concerning the protection of waters against pollution caused by nitrate from agricultural sources meant that members were required to designate land areas where the NO_3 concentration in water exceeded 50mg/L as vulnerable zones.

In addition, and specifically with reference to solid manure and associated slurry application since 1995, applications are limited to 210 kg. N/ha with reductions over the next 4 years to 170kg. N/ha.

Denmark

Key regulations which are described as being strictly enforced include:

. all farmers must develop and submit annual manure application plans

. properties with greater than 31 livestock units must have not less than 9 months manure storage capacity

. manure application rates are determined, for example, by the quantity of manure from cow rearing which must not exceed 2.3 livestock units/hectare/year

. manure must be incorporated into bare soil less than 12 hours after application

. location of livestock production facilities and manure storage facilities is regulated

. establishment of manure storage capacities based on livestock units is required

. environmentally sensitive areas are designated (4% of arable land)

Enforcement involves a peer group review by local livestock producer co-ops and in cases of non-compliance, legal action is taken through the Ministry of Environment. Penalties include fines for infringement and detention or imprisonment up to 1 year for acts of gross negligence.

France

Key regulations associated with livestock waste management include:

. discharge regulations to receiving waters are detailed and strictly enforced.

. storage capacity must be equivalent to 45 days

. under the Civil Code governments may require ecological damage to be restored to original conditions.

Enforcement is based on Local Health Board rules and the nationally

established Rural Code legal framework. Penalties include fines and imprisonment.

Germany

The first mandatory regulations were put in place for West German States in 1983/84 for slurry application. All regulations associated with manure and fertilizer applications focus on exceeding "customary levels" of application.

Key regulations include:

. livestock number control

. timing of manure application

. length of storage prior to spreading

. in some states a liquid manure directive restricts manure application quantities and time periods.

Enforcement is by waste disposal authorities at the district level.

The Netherlands

The Netherlands' livestock waste management regulations are the most detailed and perhaps the most dynamic. Phosphorus is largely the basis on which the use of livestock manure is regulated. The basis for using phosphorus rather than nitrogen as the indicator is associated with experience in the Netherlands which suggests that once the immobilization capacity of a soil profile is saturated, the leaching of phosphorus through the profile can be most significant. Where nutrient loading is the water quality concern, phosphorus may be the limiting nutrient. For this reason, it is suggested that surface water may be 10 to 15 times as sensitive to phosphorus loading as it would be to an equivalent nitrogen loading. Key regulations include:

. national standards for quantity of manure, timing and method of application

. detailed commodity specific manure storage regulations

. manure storage permits required

. restrictions on emissions of ammonia

. efficient transport and transfer of surplus manure

. indirectly enforce N, P, and NH_3 standards (reviewed every 2 - 5 years)

. slurry application by land injection methods

. restrict farm practices in designated water protection zones

. prohibition of expansion and starting new livestock enterprises

. detailed winter spreading, snow and frozen soils specifications

. manure must be incorporated within 24 hours

. limitations of chemical fertilizer use

. obligated to keep farm records of slurry and manure production

Enforcement of regulations is by the Department of Environment and Ministry of Agriculture. Violation of a maximum manure production limit is a criminal offence.

Sweden

Key regulations include:

. animal density specifications

. manure spreading limited from March to November only

. manure incorporation within 4 hours in South Sweden and 12 hours in North Sweden

. storage capacity must be sufficient to accommodate spreading time restrictions.

. separate requirements apply for application and storage in sensitive regions and coastal areas.

. green cover required during fall and winter

Enforcement is by the County Administration Board and the Municipal Bureau of Environmental Health Protection.

Switzerland

Key regulations include:

. provisions for ordinances which place limits on the application of manure and emissions to air

. manure application with strict technical limits imposed with respect to timing, soil nutrients and water protection

. surplus manure applied elsewhere under contractual agreements

Enforcement is by Cantonal authorities.

United Kingdom

Key regulations include:

. new enterprises must seek approval from planning authorities

. manure storage must have approval (slurry storage adequate to prevent pollution)

. controls on slurry and manure spreading to be developed for each Nitrogen Sensitive Area by end of 1995

. establish nitrate sensitive areas

. establishes framework for Code of Good Agriculture Practice

. United Kingdom Ministry of Agriculture, Fish and Foodprovides recommendations on N&P limits but no legal limits actually exist.

Enforcement responsibility falls to a number of agencies, National Rivers Authority and Local Environmental Health Department. Legal enforcement options are associated with interrelationships of the Control ofPollution Act and Code of Good Agriculture Practice Offenders list publishedannually. Penalties set by court decisions.

United States of America

Key regulations include:

. federally the Environment Protection Agency regulations set effluent limitations and performance standards for livestock operations

. federal regulations require a state permit program for dairies with over seven hundred head of livestock

. state regulations commonly provide guidelines for the field application of livestock waste and best management plans sometimes include nutrient management plans.

. Colorado's discharge permit system regulates manure storage requirements and land application rates and discharges to state waters

. Pennsylvania and Virginia's established regulations for nutrient management plans provides a constructive benchmark and appears to be firmer than the normal U.S. guidelines approach

. Washington's discharge permit process includes manure application, storage, monitoring and reporting requirements and discharge to waters. Single generic permit for all dairy operations rather than each individual obtaining a permit

The U.S.A. (federal or state) regulations are legally based, providing more than guidelines, and are enforced by a variety of agencies with penalties including fines and ordered compliance.

Canada

Regulations and enforcement, where they exist, are focussed on the provinces and include:

. provisions for codes of practice for livestock waste management (eg. Alberta, Manitoba, Ontario)

. standards for storage and handling of manure (eg. Ontario)

. discharge of pollutants into water courses (all provinces)

. air emissions directives (eg. Quebec)

3.3 POLICY

Policy is generally linked and integrated with the legislation, regulations and enforcement provisions described in 3.1 and 3.2.

European Community

All member countries must impose general pollution and nuisance control with limits to nitrate as per the Drinking Water Directive.

Denmark

All farmers must develop annual manure application plans. An action plan is being implemented to control pollution of the aquatic environment with N and P.

France

Civil and rural codes apply which may require rehabilitation and restoration of ecological damage to original conditions.

All livestock waste management initiatives are integrated directly with urban and rural land use planning by local governments.

Germany

Water protection zones may be designated with restrictions on farming practices to reduce the leaching of nitrates. Farmers are compensated by annual payments per hectare affected.

The policy strategy underlying the environmental strategies associated with liquid manure management has three focus areas: advisory services, subsidies and issuance of a directive. Liquid manure ordinances and directives stress agricultural responsibility to protect the quality of groundwater.

The Netherlands

Policy restricts certain farm practices in designated water protection zones and farmers are compensated on the basis of number of hectares affected. Standardization of the use and the production of animal manure is based on the

quantity of phosphate found in the manure. It is government policy to reduce ammonia emissions by 30% by the end of 1994 and 50% by 2000. A fertilizer levy is applied based on excess phosphorus production.

Sweden

County Administrative Boards are to provide special resources to produce free of charge manure and fertilizer plans that conform to regulations for farms with more than 25 animal units. It is government policy to move towards increasing the amount of autumn and winter covered land from 40% to 60%. Reductions in ammonia losses are targeted as 25% for 1995 and 50% by 2000.

Switzerland

Supply contracts approved by Cantonal water protection authorities for surplus manure must be entered into by owners with a limited land base. Strict technical limits are applied for manure application including timing, soil nutrient and water protection considerations.

United Kingdom

New enterprises must seek approval from land use planning authorities. A nitrate reduction scheme establishes nitrate sensitive areas with compensation for extra costs incurred in restricting agricultural practices. Codes of Good Agriculture Practice are the focus of livestock waste management policy. Policy emphasis is on education, awareness and financial incentive, rather than legislation and regulation.

United States of America

Most federal and state policies are based on extension education, guidelines, best management and nutrient management plans associated with financial incentives for livestock waste management.

Many states are requiring that by the end of 1995, all individuals have nutrient management plans that follow prescribed best management plans.

Canada

Policy emphasis on codes of practice for livestock waste management with some specific regulatory activity and financial incentives.

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
European Community	. Drinking Water Directive (1980) - all member states required to observe standards established within a 5 year period - standard is maximum of 50 mg NO_3/l of drinking water and recommends 25 mg NO_3/l	. Environmental Assessments (ED Directive 85/377) - EC considering a proposal to extend environment assessment scope in agriculture . Directive Concerning the Protection of Waters Against Pollution Caused by Nitrate from Agricultural Sources 1991 - members must designate areas where NO_3 concentration in water exceeds 50mg/litre or where eutrophication occurs (vulnerable zones) . New sites need building permits	. All countries impose general pollution and nuisance control . Limits to N . Financial assistance available for storage improvements . Set aside program; financial incentive		. From 1995 manure and slurry application limited to 210 kg N/ha with reductions over next 4 years to 170 kg N/ha
* REFERENCES: BCMELP (CH2M Hill); Farmers Weekly, 1991; Agriculture Canada, 1994.					
Denmark	. Environmental Protection Act 1987 - strictly regulated - properties with >31 livestock units must not have less than 9 months storage - manure contracts with other land owners must be + 5 years - quantity of manure from cow rearing shall not exceed 2.0 livestock units per hectare per annum, - manure incorporated into bare soil <24 hrs - location of animal houses - farm animal housing - manure storage facilities (liquid & solid) - manure application - large scale operations require environmental approval	. Slurry can't be spread in Fall with exceptions (review in 1997) . Slurry must be injected or spread on growing crops . solid waste ploughed in . Designated environmentally sensitive areas (4% of arable land) . Establishment of manure storage capacities based on livestock units is required . Restrictions on amount of nitrogen in animal manure applied per hectare	. All farms >10 ha. must develop manure application plans at the start of the year; voluntary compliance . Action Plan for the Aquatic Environment to control pollution of water with NO_3 & P . Reduce nitrate by 50% and P by 80% . 30% subsidy to expand storage facilities	. Through Ministry Of Environment and individual citizen case (affected party) to civil court . Fines for infringement and detention or imprisonment to 1 year for acts of gross negligence. . Manure application plans, reviewed by local co-op and enforcement action taken if not in compliance with plan	. Denmark considered but rejected a manure tax similar to the Netherlands and implemented land use regulations instead.
* REFERENCES: Bertrand, 1988; Farmers Weekly, Oct., 1991; BCMELP (CH2M Hill); Rolfe, 1993; Agriculture Canada, 1994.					

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
France	. The Water Act (1964) - basis for regulations applying to certain types of discharge; farmers charged a tax to cover pollution control . The Act? (July 1976) on installations classified for environmental protection purposes including livestock husbandry installations . "Barnier Law" - part of main focus is waste management and pollution prevention	. storage capacity requirement of 45 days . discharge subject to quite strict regulations . government has certain powers where safety or public health is at risk . environmental impact studies required before large operations are authorized	. Civil Code - may require ecological damage to be made 'good', that is restoration to original condition . related directly to urban and rural land use planning by local governments	. Penalties of fines and imprisonment according to local Health Board rules and the Rural Code	. In principle, the legislation concerned does not apply to agriculture as such, but affects the ways in which any form of pollution or disamenity associated with intensive livestock rearing has to be dealt with . Taxes on pollution have not been introduced in the Loire - Bretagne basin because it's not possible to determine the contributions to pollution of each of the farms and thus to apportion the tax
* REFERENCES: Young, 1991, pg. 115; Terrascope pg. 2, 1995; Agriculture Canada, 1994.					
Germany, N. Rhine - Westphalia, Lower Saxony	. Water Management Law - in principle allows the regulation of agricultural activities insofar as these may constitute a threat to water resources . Waste Disposal Act (WDA) to protect water quality if the customary level of agricultural fertilizing and manure application is exceeded - states to issue ordinances or directives regulating the applications of manure only if usual quantities of fertilizers have been exceeded . WDA (1982) transferred power to pass ordinances and directives regulating the use of manure to state government . Liquid Manure Ordinance (N. Rhine Whesphalia) and Liquid Manure Directive (Lower Saxony) - restrict manure application quantities and time periods	. State regulations: - animal numbers - timing of manure application - length of storage prior to spreading . First mandatory regulations in West German states in 1983/84 - slurry application . All regulations associated with manure and fertilizer applications focus on exceeding "customary level" of agricultural fertilizing (only that quantity considered to be waste) . Technical instructions for Air Quality Control specifies measures for manure storage - 6 month storage capacity - 9 month standard under study	. Water Protection Zones designated with restrictions on farming practices to reduce leaching of N (farmers compensated by annual payments per hectare affected) . The strategy underlying the environmental strategies on liquid manure rests on three pillars: advisory services, subsidies, and issuance of a directive	. Responsibility for enforcement rests with the waste disposal authorities at district level . In Saxony the liquid manure directive is only legally binding on individuals who have been served with a decree	. Considering subsidies to encourage storage and inter farm exchange of manure . Liquid Manure Ordinance and Directive Legislation both stress agricultural responsibility to protect the quality of groundwater
* REFERENCES: Rolfe, 1993; Conrad and Tehefani - Kronner, 1989; Agriculture Canada, 1994..					

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
Netherlands	. No minimum storage requirements set out in Dutch legislation . Soil Protection Act (1987) - provides, possibility of a special protection level eg. groundwater protection areas where manure application standards are considerably stricter than national ones - indirectly enforces N, P + NH3 standards (reviewed every 2-5 yrs) - National standards for quantity of manure timing & method of application - P is parameter on the basis of which the use of animal manure is regulated - Reduce additions by restricting animal numbers, manure application rates and time and method of application, covered storage reduce manure in pig operations and manure drying in laying houses . The Nuisance Act - nuisance to the surroundings caused by manure storage; permanent manure storage permits required - tool to restrict emissions of ammonia . Fertilizer Act (1984) - regulates trade in fertilizing products, removal of surplus manure and its financing as well as the production of animal manure . Fertilizer Act - restricts the transfer of manure production to another business or to another location - establishes regulations in the interest of efficient transport and transfer of surplus manure . Manure Law (1987) - prohibition of expansion and starting new farms	. Barns and storage ventilated air scrubbed to remove ammonia . Slurry application by land injection . Solid waste traditional method . Restrict certain farm practices in designated water protection zones and farmers compensated on number of hectares affected - longer closed periods for manure application - stringent manure limits (70kg/ha P_2O_5 . Expansion of farm operations and manure substitution banned . Winter spreading, snow and frozen soil regulations . Manure must be incorporated within 24 hours . fertilizer levy based on excess P production . limitations of chemical fertilizer use . National Manure Board - manure use, transport to shortage areas and processing . Must keep records of slurry production, sale, taxes on slurry - standards for the maximum quantities of manure that may be applied on agriculture land per hectare per year - provisions for manure spreading periods (based on time of year and crop) . Pig and poultry farmers, by 1995, must cut the amount of manure produced by their animals 30% against 1986 levels. . reduce nitrate levels in groundwater to 50 mg-L . reduce ammonia emmissions by 70% by 2000	. Levy paid for manure surplus - levy is in proportion to the amount of surplus animal manure, expressed in kg. of Phosphate, exptected to be produced each year - levy money used to create facilities for efficient transport, processing of surpluses & finance the manure bank . Manure Bank - aid for efficient transfer storage, treatment and processing of excess manure - accepts surplus manure, mediating trade in excess - supervise manure bookkeeping provisions - regulatory function - proofs of delivery - membership in manure bank not mandatory - non-profit . Manure Campaign Program - review of measures taken - monitoring - review legislation . Grants provided for more efficient manure storage	. Department Of Environment and Ministry Of Agriculture . Obligated to keep manure records on manure production and surplus . Violation of maximum manure production is a criminal offence	. Future legislation may outlaw reusing poultry manure as feed stock for dairy/beef . Promest - processing plant for pig manure slurry to pellets headed for closure . Government grants for manure storage improvements . Standardization of the use and the production of animal manure is based on the quantity of phosphate found in the manure . Reduction in ammonia emission by 30% by 1994 and 50% by 2000 . Integrated effectiveness is use of all pieces of legislation

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
Netherlands (cont'd)	- restrictions on the relocation of manure - levy on manure surpluses - balance sheet on manure - creation of national manure bank . Law on Soil Protection - restrictions on application of manure - regulations on the spreading of manure on fields - obligation to work the manure into the ground	. Farms with manure production greater than 125kg P_2O_5 cannot increase numbers of livestock			
* REFERENCES: Unwin & Nash; Rolfe, 1993; Canada - BC: Soil Conservation Program Training Report; Bertrand, 1988; BCMELP (CH2M Hill); Young, 1991, pg. 147; Farming and the Countryside, pg. 125; Brussard & Grossman, 1990, Canada Netherlands Chamber of Commerce; Agriculture Canada, 1994.					
Sweden	. 1988 Swedish Parliament Action Program - to reduce plant nutrient losses in agriculture . Law of Management (1988) - animal density requirements - application - storage - amount of fall and winter green cover - measures to reduce ammonia losses . Environmental Protection Law - requirements concerning application and storage of livestock waste	. Animal Density regulations in effect 1995 - apply to all farms with at least 10 animal units . Manure spreading only prior to fall planting and incorporation within 4 hours South Sweden and 12 hours North Sweden . Storage capacity - must be sufficient to fulfill spreading restrictions . Reduction in use of Fertilizers - environmental taxes for fertilizer use . Agricultural holdings with more than 100 animal units are required to apply for a permit at the County Administration Board under the Environmental Protection Law (since 1969) . Separate requirements for application and storage in sensitive regions and coastal areas . Green cover required during fall and winter; some areas 50 to 60% coverage on open fields; accepted crops . Capacity to store manure 8 to 10 months	. Increase amount of Autumn and Winter covered land (40% to 60% inc.) . Reduce Ammonia losses - 25% by 1995 and 50% by 2000 . County Administration Board provides special resources to produce free of charge manure and fertilizer plans that conform to regulations for farms with more than 25 animal units . 1988 - 1991 grants paid for enlargement of manure storage . Swedish EPA publishes "General Advise for Animal Production" - adequate storage for 6 to 10 months and good margins - application only in spring and fall - financial incentives to discontinue dairying	. County Administration Board (supervises Law of Management) . Municipal Bureau of Environment and Health Protection (supervises Environmental Protection Law) . Environment Protection Staff	
* REFERENCES: Canada - BC: Soil Conservation Program Training Report; Swedish Board of Agriculture, 1994; Western Producer, Mar. 1994; Agriculture Canada, 1994.					

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
Switzerland	. Water Protection Law - no use of commercial fertilizer and liquid manure unless soil covered with crop or immediately planted - cannot use chemical fertilizer unless manure unavailable or doesn't provide nutrient requirements for crop - surplus manure applied elsewhere under a contractual agreement	. Under the Agriculture Chapter of the Water Protection Law, ordinances place limits on the application of manures and emissions to air . manure application has strict technical limits imposed with respect to timing, soil nutrients, and water protection	. Supply contracts for surplus manure must be entered into by owners with a inadequate land base; Cantonal water protection authorities must approve these agreements	. The implementation of regulations is in jurisdiction of Cantonal authorities who must enforce the federal laws	
* REFERENCES: Bertrand, 1988.					
United Kingdom	. Water Act 1989 established National Rivers Authority (NRA) . Environmental Protection Act 1990 - nuisance from odors - new local authority air pollution control regime . Control of Pollution Act 1974 - water pollution - Legal options associated with interrelationship of Control of Pollution Act and Code of Good Agriculture Practice	. Control of Pollution Regulation 1991 - ensure slurry storage adequate to prevent pollution; minimum 4 months storage . Manure Storage must be approved . New enterprises must seek approval from planning authorities	. Nitrate Scheme - establishes nitrate sensitive areas with compensation for extra costs incurred in restricting agricultural practices . Restrictions for NSA's include: - limit 174 kg/ha/yr for amount of N - ban on fertilizer applications between July and Nov. - controls on ploughing - limit commercial N fertilizer . UKMAFF - advisory codes of good practice - grants for compliance . UKMAFF Code of Good Agriculture Practice - manure application - storage - slurry separation - low level slurry irrigation - solids composted on site - water protection - where to spread	. National Rivers Authority (NRA) - enforcement for pollution . Local Environmental Health Department . Water Authorities bring pollution cases into the courts under the Control of Pollution Act . Offenders list published annually . Penalties for offenses set in court decisions	

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
United Kingdom (cont'd)			. Emphasis on education, awareness and financial incentive rather than legislation . UKMAFF give recommendations on N & P limits but no legal limits actually exist . Code of Good Agriculture Practice for the Protection of Water (1991) - guidelines from a medical perspective . Action program includes controls on slurry and manure spreading to be developed for for each Nitrate Sensitive Area (NSA) by 1995 . Grants for pollution avoidance equipment		
* REFERENCES: Smith & Chambers, 1993; Canada - BC Soil Conservation Program Training Report; Bertrand, 1988; BCMELP (CH2M Hill); Agriculture Canada, 1994.					
USA - General Federal State Local	. Clean Water Act - address nonpoint source pollution . Safe Drinking Water Act - address agricultural nonpoint source . Food Security Act - conservation provision that can produce indirect agricultural water pollution control benefits . Environmental Protection Act (EPA) - point source pollution . Federal Water Pollution Control Act - nonpoint source pollution - section 208 planning and state water quality planning - section 208 requires state to develop and implement state and area wide waste treatment management plans designed to meet site water quality	. National Pollutant Discharge Elimination System - permit program based on effluent limitations for pollutants and performance standards for new sources of pollution, authorized by law . EPA - regulations set effluent limitations and performance standards for concentrated animal operations - Proposal 40 CFR 51.2961 (h) addresses volatile organic compounds from livestock waste generations . State regulations often govern, or at least provide quidelines for field application of livestock waste - management measures or "g" measures defined in CZARA (application of best available technology, siting criteria,	. Water Quality Incentive Program (WQIP) - financial assistance for voluntary adoption of water quality enhancing BMP's . Environmental Easement Program (EEP) - USDA can acquire easements for water quality protection . Region 5 of EPA encourages use of CZARA statewide not just coastal zones . Cost-Share Programs - required to have NMP to receive funding . Agricultural Stabilization and Conservation Program - provides cost-share assistance for waste storage		. Many of these programs emphasize erosion control . Best Utilization of Business and Biological Assets (BUBBA) - put on only what is needed, when it is needed and in a form and by a method that ensures the nutrients will be fully utilized . EPA and National Oceanic & Atmospheric Administration (NOAA) recently released "Program Development and Approval Guidance" describes what needs to be contained in each state . Environmental Protection Act - has used primarily a command and control approach based on regulations and enforcement

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA - General Federal State Local (cont'd)	. Federal Clean Air Act - objective measurement of pollutants hasn't been effective in controlling odors . Coastal Zone Act Reauthorization Amendments (CZARA) - develop and implement a Coastal Nonpoint Source Program - specific management measures for individual sources . Water Quality Act 1987 - requires each state to develop programs to control nonpoint sources of pollution of both surface and groundwaters . 1995 Farm Bill?	operating methods, or other alternatives) . Federal regulations require a permit program (state responsibility) to dairies over seven hundred head . Non-point-source pollution is largely within state jurisdiction, and states delegate authority to local governments	facilities and handling . State Revolving Fund		- state activities have mirrored federal policy and is administered on a pollutant-by-pollutant basis . Many states are requiring that by 1995, all individuals have NMP's that follow the prescribed BMP's. . At present, vertical integrators give many different requirements for contract growers to raise poultry but they seldom contain conditions for manure management
* REFERENCES: JSWC Vol. 45, No. 2, 1990 JSWC Vol. 47, No. 1, 1992; JSWC Vol. 49, No. 2, pg. 72, 1994; Brussard & Grossman, 1990; State of Washington; JSWC Vol. 50, No. 3, pg. 321, 1995; Kerns; Agriculture Canada, 1994.					
USA, California			. South Coast Air Quality Management District - adopted as part of their Air Quality Management Plan a commitment to adopt a measure to reduce emissions from livestock wastes - will address volatile organic compounds particulate matter and ammonia emissions		
USA, Colorado		. Confined Animal Feeding Operations Control Regulations (CAFR) - to protect waters of the state from potential impact due to confined animal feeding operations (average working capacity of more than 1,000 animal units fed for 45 days per year) - storage requirements detailed - retention facilities shall be		. Department of Health	

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA, Colorado (cont'd)		plain unless proper flood proofing measures provided - land application rate established by CAFR . Discharge Permit System - allows treated manure and process wastewater to be discharged to state waters according to provisions outlined in the permit or applied to agricultural land . All new, reactivated, expanded, or existing facilities out of compliance shall submit a Manure and Process Wastewater Management Plan to Colorado Department of Health - information demonstrates the facilities ability to comply with CAFR . Colorado Water Quality Commission - revised CAFR			
* REFERENCES: Walker.					
USA, Delaware	. Delaware Environmental Protection Act . Delaware Water Quality Standards for Streams . Delaware Regulations Governing Solid Waste . Delaware Regulations Governing the Control of Water Pollution . Delaware Guidance and Regulations Governing the Land Application of Wastes . 1971 Delaware Soil Conditioner and Fertilizer Act	. Delaware Department of Natural Resources and Environmental Control (DNREC) - manure management plans encouraged and developed with the assistance of the SCS - develop environmental guidelines and procedures - all activities that contribute to the discharge of a pollutant into any surface or groundwater are subject to the permitting process - farmers who adhere to a waste management plan that has been developed in accordance with the SCS and DNREC guidelines is not required to obtain a permit	. Nonpoint Source Pollution Management Program - goals are: reduce nutrient loading, establish standards for new facilities, implement demonstration projects, establish an effective educational and technical assistance delivery system		. No specific regulations have been adopted to address the general management of livestock wastes
* REFERENCES: Delaware Guidelines; Narrod et al, 1993.					

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA, Illinois		. Illinois Livestock Waste Regulations - regulatory premise guidelines based on "the quantity of livestock waste applied on soils shall not exceed a practical limit as determined by soil type, esp. its permeability, the condition of the soil (frozen or unfrozen), the percent slope of the land, cover mulch, proximity to surface waters and likelihood of reaching groundwater and other relevant consideration" - guidelines also focus on water and odor pollution - holding tank and runoff regulations - livestock waste shouldn't exceed the annual N application rate needed for a reasonable crop yield			
* REFERENCES: Brussard & Grossman, 1990.					
USA, Indiana	. Indiana Confined Feeding Control Law (1971) - operations of certain sizes and known polluters required to obtain approval for their manure management systems - must have adequate storage capacity, adequate equipment and land for manure disposal			. By Indiana Department of Environmental Management	
* REFERENCES: Sutton, 1990.					
USA, Maryland	. Clean Water Act	. Chesapeake Bay Commission - improve water quality and habitat by reducing nutrients in the Bay	. Nutrient Management Program - Voluntary - Develop nutrient management plan . Best Management Practices - Maryland Agricultural Cost Share Program (MACS) - Funding		. Looking at developing incentive policy that encourages farmers to implement BMP's

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA, Maryland (cont'd)			. Chesapeake Bay Agreement - multistate cleanup pact - controlling excessive farm runoff - nutrient management strategies utilizing winter cover crops . Innovation program includes a Nutrient Management Consultant Certification program		
* REFERENCES: JSWC Vol.49, No. 2, pg. 88, 1994; Maryland Nutrient Management Program Brochure; Bertrand, 1992; Narrod et al, 1993.					
USA, Missouri	. Clean Water Law "it is a violation to allow the discharge of a pollutant or contaminant to waters of the State" without a discharge permit	. No waste allowed to move off the owner's property or move directly or indirectly, into surface or subsurface waters of the State . Compliance required regardless of size of operation . State permit requirement dependent on size of operation . Based on number of animals on site at any one time rather than annual production . Two types of permit - construction approval - operating approval . Operating Approval letter issued when "as built" waste management system meets specifications . Smaller producers may obtain a letter of approval on a voluntary basis for protection from future environmental complaints . Federal permit - National Pollutant Discharge Elimination System Permit - the state issues a joint permit which fulfills both state and federal requirements		. Department of Natural Resources issue permits, do on site evaluations . letter of approval may be withdrawn due to violations and permit may be made mandatory	. Manures are considered a water pollutant under the Clean Water Law . Pasture livestock not included, only concentrated animal feeding

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA, Missouri (cont'd) * REFERENCES: Fulhage.		. Waste application must be in concert with the fertilizer requirements of the crop being grown			—
USA, Pennsylvania * REFERENCES: JSWC Vol.49, No. 2, pg. 85, 1994; Agronomy Facts 40.	. Nutrient Management Act (1993) - establish criteria, planning requirements and implementation schedule for nutrient management control - provide for development of educational program on nutrient management - require Department of Environmental Resources to assess the extent of other nonpoint sources of pollution . Clean Streams Law	. NMP's required for "concentrated animal operations" - plans will have to be certified by a specialist - farmers below animal unit limit encouraged to have voluntary NMP . State Conservation Commission - Administer Nutrient Management Act - develop regulations - evaluate emerging technologies for BMP's - review criteria for "concentrated animal operations" - educational program on nutrient management - funding for NMP's . Chesapeake Bay Agreement	. Nutrient Management Advisory Board - mixed representatives to review and comment on all regulations, criteria and policies of Conservation Commission (CC) . Nutrient Management Certification Program developed . Standard on-farm worksheets developed to follow in developing a farm nutrient plan	. By an authorized agent of the CC or conservation district - civil penalties - fines - warnings - farmer with approved NMP exempt from penalty	
USA, Virginia * REFERENCES: JSWC Vol.49, No. 2, pg. 88, 1994; Narrod et al, 1993.	. Clean Water Act . Virginia Pollution Abatement Permit - State Water Control Board requires a NMP for farms with 1,000 animal units that have liquid or semi-solid manures . The Chesapeake Bay Preservation Act	. Several counties have poultry ordinances which require NMP's	. Nutrient Management Program (1989) . Nutrient Management Plans . State tax credits & cost share assistance based on development of NMP by farmer . Best Management Practice Cost-Share Program - voluntary . Agricultural water quality cost-share program - established to help fund BMP's - 10 years minimum for plan		

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
USA, Washington Whatcom County	. Water Pollution Control Act	. Department of Ecology proposed dairy discharge permit - permit seeks to insure that manure or contaminated wastewater does not meet streams or groundwater - adequate storage - timely application - monitoring and reporting requirements - exemption from permit fees on farms where manure and wastewater well managed - each dairy registered and ranked by potential to pollute . Single permit for all dairy operations rather than each individual operation obtaining a permit . Dairy Farm National Pollutant Discharge Elimination System and State Waste Discharge General Permit (effect Sept. 1994 to Sept. 1999) - permittee authorized to discharge to State waters in accordance with special and general conditions - Department of Ecology may issue a compliance schedule for other permit conditions - all dairies covered by this permit must have a current animal waste management plan (including a NMP)	. Conservation District and SCS will recommend farm specific BMP's . ACSC funding available for installation of some BMP's . Emphasis on education and voluntary compliance	. Washington State Department of Ecology . Proposed permit system - immediate fines and ordered compliance	
* REFERENCES: State of Washington.					
Canada, Federal	. Fisheries Act - prohibit unauthorized discharge of any substance harmful to fish - wide scope of general provision			. Monetary penalty or incarceration up to 3 years	
* REFERENCES: Patni, 1994.					

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
Canada, Alberta	. Environmental Protection & Enhancement Act . Public Health Act . Planning Act . Agricultural Operations Practices Act	- Each municipality has it's own set of bylaws and permits to built intensive livestock barns - provincial guidelines for building hog barns	. Confined livestock facilities waste management code of practice	. Municipalities	
* REFERENCES:	Patni, 1994; Western Producer, April, 20 1995 & April 27,1995.				
Canada, Manitoba	. Environment Act . Public Health Act	. Livestock Production Operation Regulation . minimum standards for storage and handling of manure	. Code of Practice for Livestock Waste Management . Guidelines for hog barns		
* REFERENCES:	Patni, 1994; Western Producer, January 1994.				
Canada, New Brunswick	. Clean Environment Act . Clean Water Act	. Water Quality Regulations			
* REFERENCES:	Patni, 1994.				
Canada, Newfoundland	. Department of Environment and Land Act . Water Protection Act . Waste Materials Disposal Act . Department of Health Act	. Air Pollution Control Regulations			
* REFERENCES:	Patni, 1994.				
Canada, Nova Scotia	. Environmental Protection Act . Act Respecting Water and Water Courses . Agricultural Operations Protection Act				
* REFERENCES:	Patni, 1994.				

LIVESTOCK WASTE MANAGEMENT: LEGISLATION, REGULATION & POLICY BY JURISDICTION

JURISDICTION	LEGISLATION	REGULATION	POLICY & PROGRAMS	ENFORCEMENT	REMARKS
Canada, Ontario	. Environmental Protection Act - prohibits discharge of contaminants . Health Promotion and Protection Act . Planning Act . Farm Practices Protection Act . Ontario Water Resources Act - prohibits discharge of contaminants	. Guide to Agricultural Land Use (Agricultural Code of Practice) - assist farmers in reducing pollution - provide guidelines for rational use and acceptable management of manure - voluntary compliance - guidelines for buildings	. Certificate of Compliance - farmers can request certificate which can be issued to show compliance in terms of siting and manure management		
* REFERENCES: Patni, 1994.					
Canada, Prince Edward Island	. Environmental Protection Act				
* REFERENCES: Patni, 1994.					
Canada, Quebec	. Environment Quality Act	. Water pollution prevention . Directives for Protection Against Air Pollution From Livestock Operations	. Where expansion or construction of new facilities is permitted, an approval Certificate of process is required for issuing a Authorization which meets Regulations		. the most stringent regulations in Canada
* REFERENCES: Patni, 1994.					
Canada, Saskatchewan	. Pollution (by Livestock) Control Act				
* REFERENCES: Patni, 1994.					

4. AGRICULTURAL AND ENVIRONMENTAL PROGRAMS ASSOCIATED WITH LIVESTOCK WASTE MANAGEMENT

Programs are difficult to separate from, and are closely associated with the legislation, regulations, enforcement and policy discussed in Section 3.

The following outlines key programs in place which may be of interest in developing livestock waste management policy for the Lower Fraser Valley.

Germany

. Farmers are compensated through annual payments per hectare affected in designated water protection zones where restrictions are placed on farming practices to reduce leaching of nitrates. Compensation payments reflect the extent of restrictions and their impact on farm income. We were not able to obtain specifics on the amount of annual compensation payments or specific criteria used to designate a water protection zone.

. Considering subsidies to encourage storage and interfarm exchange of manure.

The Netherlands

. Levy paid for surplus manure production used to create facilities for efficient transport, processing of surpluses and financing the manure bank.

. The non-profit Manure Bank provides aid for efficient transfer of excess manure and supervises manure bookkeeping provisions. (Current financial problems with central processing).

. The Manure Campaign Program sets a framework for government and producers to review measures taken, monitoring and legislation/regulation review.

. Government grants are provided for manure storage improvements.

Sweden

. Provide resources for manure management plans that conform to regulations for farms with more than 25 animal units.

. Grants for manure storage improvements.

. Special financial consideration for separate requirements associated with environmentally sensitive and coastal areas.

United Kingdom

. Nitrate reduction program establishes nitrate sensitive areas with producer compensation for extra costs incurred in restricting agriculture practices.

. Financial incentives for complying with Code of Good Agriculture Practice.

United States of America

In general, program emphasis is on education,voluntary compliance andfinancial incentives.

. Federal cost-share agriculture programs can require nutrient management plans to receive funding.
. Federal Agricultural Stabilization and Conservation Program provides cost-share assistance for waste storage facilities and handling. In some states a revolving loan fund also exists for the same purposes.
. Some states have implemented nonpoint source pollution management programs which include demonstration projects, educational and technical assistance delivery systems.
. Some state governments have Nutrient Management Programs which are voluntary, but have access to implementation funding.
. Maryland has an innovative program which includes a nutrient management consultant certification program.
. Pennsylvania has established a Nutrient Management Advisory Board to review and comment on all regulations, criteria and policies.
. Virginia provides state tax credits and cost share assistance for producer developed nutrient management plans and best management plans.

5. APPLIED LIVESTOCK WASTE MANAGEMENT PRACTICES

5.1 LIVESTOCK FACILITIES

European Community

All European Community countries require building permits for new sites.

Denmark

The general trend in livestock facilities appears to be as follows:

Beef housing:

. seasonal pasture availability
. barns and slats

Dairy housing:

. mainly pasture during spring/summer/fall and barn during winter months

Swine housing:

. slatted floors
. mainly confined pen units
. mainly farrow to finish

Poultry housing:

. battery-eggs
. dry barn-broiler/turkeys

The Netherlands

The general trend in livestock facilities appears to be as follows:

Beef cattle housing:

. year round housing
. very limited pasture
. mainly slat floors
. ventilation required for scrubbing of ammonia emissions from barns

Diary housing:

. year round confinement in places
. ventilation required for scrubbing of ammonia emissions from barns

Swine housing:

. mainly confined to pen units
. slatted floors

. mainly farrow to finish
. ventilation for ammonia scrubbing

Poultry housing:
. battery-eggs
. dry barn-broiler/turkeys
. ventilation for ammonia scrubbing

United Kingdom

The general trend in livestock facilities appears to be as follows:

Beef housing:
. seasonal pasture available
. barns and slats

Dairy housing:
. mainly pasture during spring/summer/fall and barn during winter months

Swine housing:
. slatted floors
. some resurgence in field units

Poultry housing:
. battery-eggs
. dry barn-broiler/turkeys

United States of America

Delaware's effective waste management plan has three key components: livestock facility site selection, waste storage and land application. Facility site selection emphasizes natural land characteristics (slopes, surficial geology, soils, vegetation and surface drainage), and includes visual impact, microclimate, health and safety considerations.

The Michigan Agriculture Commission's "Generally Accepted Agricultural and Management Practices for Manure Management and Utilization" provides livestock facility runoff control, wastewater management and odour management (reduction of frequency, intensity, duration and offensiveness of odor) specifications.

Canada

Current research ongoing (Agriculture Canada and Ontario Poultry Producers) to measure NH_3 output from poultry building ventilation systems.

In Quebec and Ontario, calculations for siting and management of livestock operations are based on the concept of animal units where one dairy cow equals one animal unit. Regulation requirements are detailed for different management systems based on manure type, animal type etc. The Ontario Agricultural Code of Practice uses animal units and provides guidelines on design, location and management of new livestock buildings as well as renovation/expansion of existing facilities (this Code is currently under review now). The definition of animal unit differs by jurisdiction.

The Pollution (by Livestock) Control Act in Saskatchewan requires intensive livestock operations to acquire a permit before constructing or altering any facility. The permit is only issued if it can be determined that the operation will not cause pollution.

In Quebec, rapid expansion of swine operations without appropriate land base caused several serious pollution incidents. As a result, some municipalities have prohibited expansion of existing facilities and new swine operations. Where expansion is allowed and construction of new facilities is permitted, a process for issuing a Certificate of Authorization that meets Regulations concerning siting of facilities and separation distances for manure storage and land application.

General trends in livestock facilities in Southern Ontario appear as follows:

Beef housing:
. mostly open dryland feedlots or paved or concrete lots
. a few systems confined on slatted floors

Dairy housing:
. moving towards year round confinement in tie stall barns
. spring, summer and fall pasturing is still common
. some larger feedlots using free stall barns

Swine housing:
. all housing year round total confinement
. partially or fully slatted floors

Poultry housing:
. cage systems - eggs
. total confinement on bedded floors - broilers and turkeys

5.2 ON FARM-STORAGE FACILITIES

The need for storage facilities to match application rates and timing to crop demand is almost universally recognized and most have developed relevant regulations and financial incentives.

Financial assistance and government grants are offered in several countries to help farmers meet newly created storage requirements.

European - General

For beef operations, storage of manure is needed for a minimum of 4-6 months. Slurry is held in concrete lined lagoons while solid waste is confined to concrete slabs. Storage facilities are required to be covered in the Netherlands.

Dairy slurry is washed from parlor into concrete lined lagoons for 5-6 months storage. Silage runoff flows to the slurry lagoon.

Swine operations use concrete walled tanks, steel tanks and plastic lined lagoons (covered in the Netherlands).

Poultry solid waste is directly removed from benches and heavy slurry from deep pits.

Denmark

Denmark, unlike other countries and states, requires that properties with 31 livestock or more have the capacity to store not less than 9 months of manure production (versus 4-6 months in other countries). Denmark has established manure storage capacities based on livestock units.

France

In France (Brittany), specific rules with regard to installations include siting at least 100 m. from third-party dwellings, camping and sports facilities and premises of professional use, 35 m. away from watercourses, 200 m. away from bathing resorts and beaches and 500 m. from fish farms. Poultry slurry must be stored 500 m. from any dwelling.

The Netherlands

In the Netherlands, reception pits from swine manure must be covered due to odour and NH_3. Deep pits are decreasing in the Netherlands due to ammonia emissions.

United Kingdom

In the UNITED KINGDOM, where manure storage must be approved, guidelines for the quantities of excreta produced by livestock are contained in the Code of Good Agricultural Practice for the Protection of Water and can be used to plan storage requirements.

United States of America

The U.S. Agricultural Stabilization and Conservation Service provides cost-share funds for manure storage sheds (buildings designed to keep manure dry and in a stable condition until it can be applied to the land) as well as, dead bird composter facilities.

Delaware's manure storage guidelines suggest the following essential features for on-farm storage facilities:

. sufficient capacity to store manure until proper disposal application on cropland,

. proper location to avoid runoff to surface water or percolation to groundwater,

. measures that ensure effective odor and fly control.

Specific on-farm storage facility design and treatment recommendations are described.

Canada

Separation distances for storage facilities from other uses are variable depending on situations. In Quebec, manure storage tanks are suggested to be at a minimum of 75 m. from dwellings, less if covered.

The Prairie Agricultural Machinery Institute is researching effective covers for

manure lagoons to reduce odour impact. Barley straw has proven to be the most effective.

5.3 LAND APPLICATION OF WASTE

European Community

European Community manure and slurry application is limited to 210 kg N/ha with reductions by the year 2000 to 170 kg N/ha.

Denmark

Danish farmers are required to develop application plans at the beginning of each year for their manure disposal. These plans are reviewed and enforced by the local co-op. Punishment for not managing manure disposal effectively could be a reduction in stocking level. Applying slurry during the growing season makes it necessary for special machinery to be used in order to directly incorporate manure in the soil between the row crops or dribble it through flexible pipes at the foot of broadly sown plants in close rows. In Denmark it has been stated by farmers that new methods and machinery for more accurate application of livestock manures are expensive and demand high investment.

France

French farmers in Brittany are restricted by rules for slurry spreading. For pig slurry a distance of 200 m. is required from dwellings and business premises unless slurry has been deodorized (50 m.).

Sweden

Swedish regulations for manure spreading prohibit any application from December 1 to the end of February. And in some areas of southern Sweden and the coastal zones, spreading is only allowed from August to end of November.

Animal density for all of Sweden is regulated so that the supply of phosphorus by manure corresponds to the needs of the crop (approx. 20 kg/ha/yr). Farms wishing to expand or change their animal units, must show that they have enough associated land for spreading.

United States of America

Delaware's land application guidelines describe the appropriate equipment for solid, semisolid and liquid waste, application timing and integration of off-farm environmental impact considerations.

Michigan's accepted industry framework for land applications of manure is:

. Manures should be uniformly applied to soils. The amount of manure applied per acre (gallon/acre or tons/acre) should be known, so manure nutrients can be effectively managed.

. Manures should not be applied to soils within 150 feet of surface waters or to areas subject to flooding unless:

  - manures are injected or surface-applied with immediate incorporation (ie. within 48 hours after application) and/or

  - conservation practices are used to protect against runoff and erosion losses to surface waters.

. Liquid manures should be applied in a manner that will not result in ponding or runoff to adjacent property, drainage ditches, or surface water.

. As land slopes increase from zero percent, the risk of runoff and erosion also increases, particularly for liquid manure. Adequate soil and water conservation practices should be used which will control runoff and erosion for a particular site, taking into consideration such factors as type of manure, surface residue or vegetative conditions, soil type, slope, etc.

Wisconsin manure application method and rate-related quidelines set a useful framework:

. Whenever possible, manure should be injected or surface-spread and incorporated within 72 hours of application.

. Don't apply more than 25 tons per acre (63,000 kg./ha.) of solid dairy manure (or its equivalent on a P-content basis) annually unless it is incorporated.

- Where incorporation is not possible, limit applications to 25 tons per acre (63,000 kg./ha.) of solid dairy manure (or its equivalent on P-content basis) over a five-year period.

- Manure may be applied up to the rate that will provide the N needs of the crops to be grown. This will often result in over-application of P and/or K.

- When soil-test P levels reach 150 pounds per acre (168 kg./ha.), plant P-demanding crops such as alfalfa. Reduce manure application rates.

- If soil test P levels reach 300 pounds per acre (336 kg./ha.), discontinue manure application until soil P levels drop.

- Do not apply manure to frozen soils within 200 feet (61 m) of lakes and streams. Never apply it in grassed waterways, terrace channels, open surface drains or other areas where water flow may concentrate.

- Do not apply manure within the 10 year floodplain or within 200 feet (61 m) of lakes and streams unless it is incorporated within 72 hours.

- You can safely apply manure to frozen soils on slopes of 6 percent or less. Protect these areas from upslope runoff.

- If you apply manure to frozen soils on slopes between 6 and 12 percent, contour strips, terraces or other conservation measures must be in place.

- Do not apply manure to frozen soils on slopes greater than 12 percent.

- Do not apply manure where there is less than 10 inches (25 cm) of soil over bedrock.

- Where the soil cover is 10 inches to 20 inches thick, incorporate manure within 72 hours. Do not apply manure to these soils when they are frozen.

- On coarse-textured soils, such as sands or loamy sands, limit fall manure applications to areas where crops are growing, or delay applications until soil temperatures are less than 50 degrees F (10 decrees C).

5.4 OFF FARM COLLECTION AND TRANSPORTATION

Germany

Germany is considering subsidies to encourage storage and inter-farm exchange of manure. The subsidies (either direct payment or tax on fertilizers) are hoped to help improve use of manure.

The Netherlands

The Manure Bank in the Netherlands charges a levy for off farm transport of manure. Higher quality manures can be transported a greater distance at a lower net cost than low grade diluted slurry. Costs of transport for the farmer are often offset by subsidies from the manure bank funded by manure levies on excess phosphorus production. The bank subsidy increases as the dry matter content of the manure goes up therefore there is a strong incentive for minimizing dilution. The Dutch Fertilizer Act establishes regulations in the interest of efficient transport and transfer of surplus manure.

United States of America

Some in the U.S. argue that for transportation, a pelletized, composted product has several advantages:

. Stimulates microbiological propagation, reduces potential of ammonia burn and concentrates plant nutrients.

. Results in 12% reduction by weight and a reduced volume which makes the product easier to transport.

. Due to uniform size it can be used with conventional fertilizer spreaders and planting equipment.

. It is stable and free flowing and therefore can be handled with convenient bulk handling equipment, stored in bulk silos and transported in the same manner as any other commercial fertilizer.

In Rockingham County, Virginia an ordinance is in place that requires all poultry farmers to have a manure disposal plan (on and off-farm as necessary). Export of poultry manure from surplus to deficit areas for use as fertilizers was found to

be economically viable and environmentally attractive. Promoting such transfer is seen as a necessary public policy action step and transfer financial incentives are proposed.

U.S. experience reported in June 1995 suggests transport of solid poultry manure to deficit areas by spreader or large-bodied trucks is restricted to between 10 and 20 kms. Liquid poultry agitated slurries are either pumped from storage reservoirs into tank-bearing vehicles for transport off farm or pumped directly from storage reservoirs into pipeline systems for delivery to irrigation equipment at the site of application.

On the Delmarva Peninsula, a voluntary clearing house has been established to coordinate distribution of manure from surplus to deficit farms. This clearing house is a computer listing developed to assist poultry producers and crop farmers to contact each other and to promote a more efficient distribution of poultry manure. Some businesses have combined cleanout of poultry houses with transportation of manure to assist with overall economics of transport to deficit locations.

5.5 WASTE TREATMENT PROCESSES

5.5.1 ON FARM

The Netherlands

Solid waste and slurry flow under gravity to storage facilities in some operations, others must scrape the solid waste from facility floors or slab. Swine slurry flows in under slat channels where sluice gates control out flow to reception pits. For poultry, effluent drops to benches below cages where it is dried with ventilation of recirculating fans up to 90% dry matter. Benches are then moved out and scraped and the manure is trucked away.

Netherlands appear to be the only country to attempt to separate rainwater runoff from effluent.

New technologies are being tested including anaerobic digestion, composting and drying, however, many of these are limited due to high capital and low return on investments.

United States of America

Michigan's Agriculture Commission provides specific recommendations and references to design for on-farm livestock waste treatment including treatment lagoons and ponds, composting and methane digesters.

Methane production through anaerobic digestion is seen by some as a potential on-farm use of manure. Equipment used for producing methane is not simple and is fairly expensive.

On-farm poultry waste management systems have been developed using three main concepts:

. The systems handling liquid waste have been used and many producers find them very easy to manage; however, the problem of odour control has caused many producers to seek other methods.

. Dry manure systems seem to solve the odour problem of the liquid system partially, if not completely, but they usually require more labour and in some cases more equipment than the liquid systems.

. The third system is a dry manure system with some method of processing the manure for product recovery.

5.5.2 CENTRAL PROCESSING FACILITIES

The Netherlands

When manure processing can not occur on site, central processing units may be considered. They may be designed specifically to deodorize the product by adding enzymes, blocking fermentation or adding other products. Methanisation is another option which would provide bio-gas for energy purposes. However, feasibility studies have shown that swine wastes were so diluted that most of the gas was consumed in the process.

Another option for dealing with excess manure is the Manure Bank system developed in the Netherlands. The bank accepts manure surpluses from farms upon request with the cost of disposal and/or processing being charged to the supplier. The Manure Bank maps the flow of manures based on records they

are in charge of keeping. The bank promotes the use of manures in arable areas and mediates in the marketing, processing and disposal of manure surpluses.

A pilot project for slurry processing operated by Promest collects high dry matter pig slurry from farms within 25 km. radius. Anaerobic digestion followed by centrifuge separation allows the liquid portion to pass on to an aerobic treatment tank for concentration. The separated solids and nitrogen concentrate are mixed and dried into a powder form which may be turned into pellets or granulated fertilizer. Promest has stated that they believe that large-scale processing cannot solve the manure problem alone but that reductions in minerals in cattle feed and improved feed conversion are also important. Recent information indicates that this company is in financial trouble and the processing plant may be closed.

Proposals to process and export the huge surplus of manure to third world countries have not proven successful to date from what we could determine.

United States of America

Delmarva Peninsula analysis of the potential for central processing facility suggested the following questions must be asked:

. Will there be a timely delivery of feedstock to the facility at either a cheap price or free?

. Can the owners of the facility cover the cost of setting it up?

Although several studies have been carried out, it is our understanding that for one reason or another, no central facility has resulted, although there is significant interest in composting and pelletizing.

6. LESSONS LEARNED

- In areas of intensive livestock production in Europe, U.S.A. and Canada waste management and associated environmental considerations are becoming increasingly key public policy issues.

- Approaches to livestock waste management practices, legislation, regulation and policy are extremely dynamic at the present time. Changes result from new research findings, applied experience, industry economics and integration with other environmental and land use planning policy.

- B.C. is not alone in searching for innovative ways to address the problems associated with livestock waste management and receiving environments.

- There is no one model elsewhere that can be considered as a prototype for addressing livestock waste management issues in the Lower Fraser Valley. However, experience elsewhere should help with developing a "made in" the Lower Fraser Valley livestock waste management planning policy.

- Governments, agencies and farmers are struggling with intensive livestock waste management issues, but with so many areas of concern and such a diverse and complicated system, the best solutions to its problems remain to be found.

- Actions taken elsewhere, to date haven't necessarily remedied the problems, but rather attempted to abate the problems while searching for other answers.

- Any consideration of off-farm central processing of livestock waste must be exposed to rigorous economic and technical analysis as a result of unfavourable experiences elsewhere.

- A priority must be given to educate the producer, government resource manager and the public.

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