

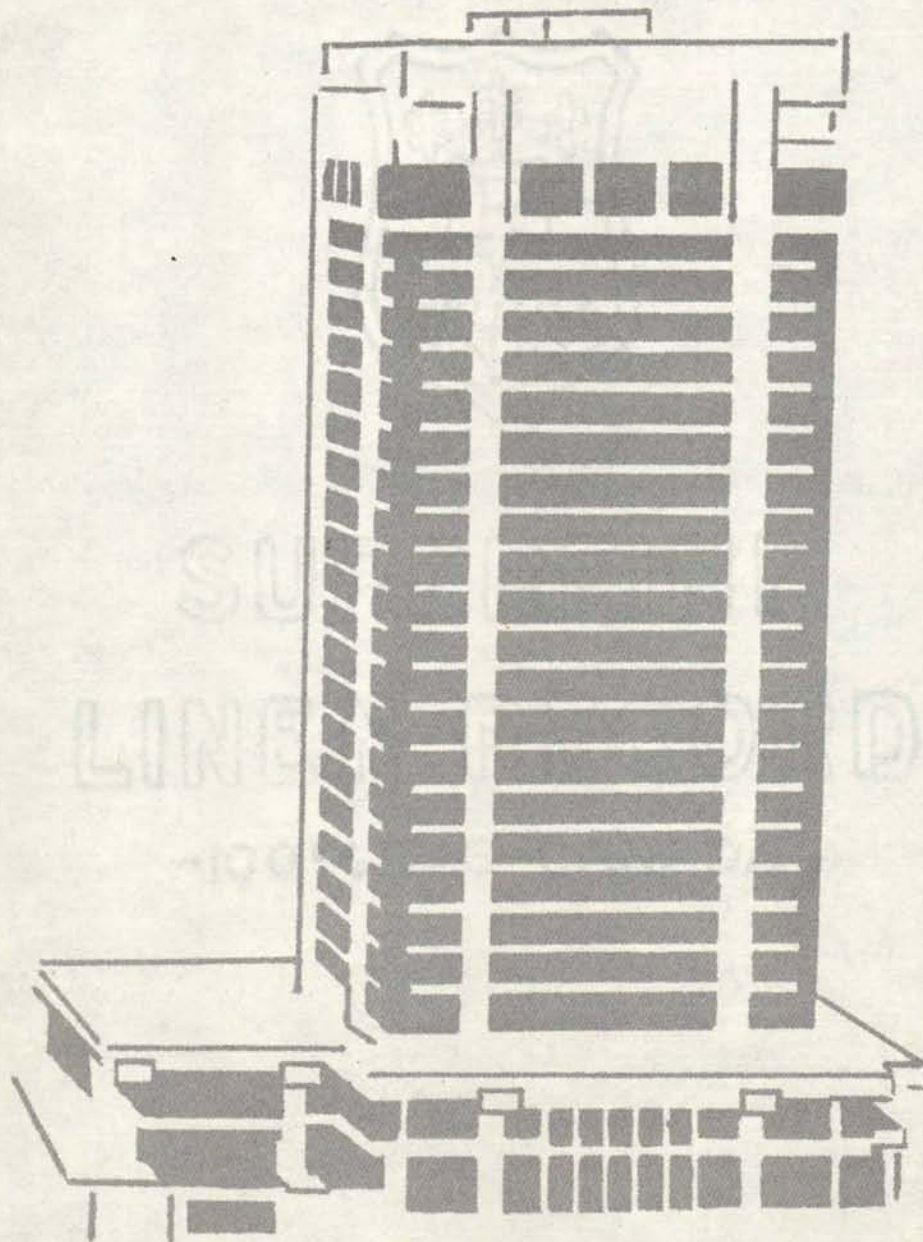


Consumer and
Corporate Affairs

Consommation et
Corporations

Management Consulting Division

METRIC CONVERSION IMPACT ON
CONSUMER & CORPORATE AFFAIRS



place du portage
hull canada

Sept. '74

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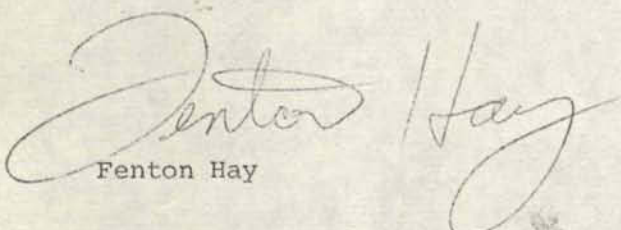

Fenton Hay

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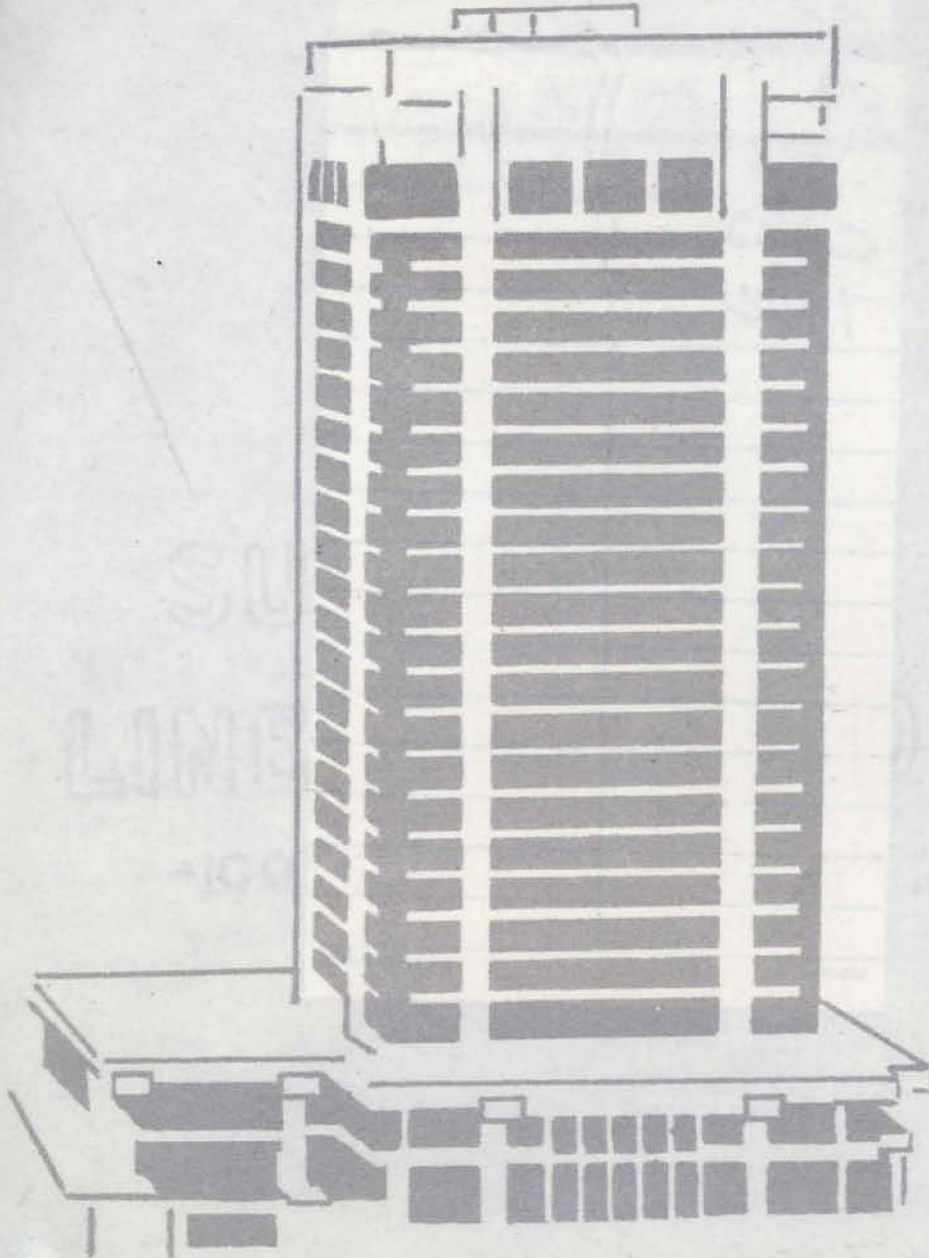
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1. EXECUTIVE SUMMARY

Metric Conversion will have a substantial impact on the Bureaux of Field Operations and Consumer Affairs. Estimated additional man years required for the 1976-77 peak year of conversion are in excess of 60. The 1975-76 requirement is 42 man years and staffing action should begin as soon as possible to allow for a normal acquisition time, technical training etc. and the possible necessity of language training.

The total estimated equipment cost is more than \$940,000 between 1975 and 1985 with 2/3 of this coming before 1980. The 1975-76 estimate is \$360,000. Conversion schedules for various industrial sectors are not fixed at this time and this will make it necessary to refine present estimates as more accurate information becomes available.

Because such a large number of devices will be converted over a short period of time, it is impractical to inspect all converted devices immediately following conversion. To cope with this difficulty the application of statistical sampling together with strong control and enforcement measures is recommended. This involves inspecting small samples of each device class in all districts in order to accurately locate "problem" areas. The information gathered in this way will provide the basis for subsequent allocation of "control" resources so that effective remedial action may be taken.

Since current training methods require at least one year to fully prepare an inspector, a program combining classroom training and field experience is recommended instead. It is anticipated that this would reduce the training time from a period of one year to three months. Based on the manpower requirements stated above, the potential saving to the department resulting from this approach is \$450,000 or 45 man years.

To oversee the implementation of metric conversion within the department, it is recommended that a permanent metric group be established and that it consist of members from those areas of the department which will be most heavily involved with conversion. (Most Federal departments have already established such groups.)

At the district level, it is recommended that district conversion committees be formed to coordinate implementation locally. District inspectors are in a position to serve on this group as they are in constant contact with traders, device manufacturers service organizations etc.

To refine the estimates presented here it is recommended that the present study group remain intact for several months by which time a permanent group will have been formed. Liaison with various industrial sectors will be maintained during this interim period.

Total project requirements are summarized below for the years 1975 to 1980.

	MANPOWER		
Year	Field Operations Man Years	Consumer Affairs Man Years	Equipment \$000
75-76	42 MY	3 MY	\$306
76-77	60 MY	1 MY	215
77-78	33 MY	-	23
78-79	15 MY	-	21
79-80	8 MY	-	22.5

2. INTRODUCTION - RESPONSIBILITIES DURING METRIC CONVERSION

(a) CCA and the Metric Commission

As a result of the findings set forth in the White Paper on Metric Conversion in 1970, the Metric Commission was established with the following purposes and powers:

"The Commission is established for the purpose of advising the Minister on plans for conversion to the metric system, and for such purpose the Commission may

- (1) prepare -- an overall program for conversion to the metric system which will ensure that any programs for such conversion in the different sections of the Canadian economy are phased and coordinated.
- (2) furnish, publish and disseminate information concerning conversion to the metric system.

The Commission shall advise the Minister on the need for legislation or any other action that may be required to facilitate conversion to the Metric system."

A clear understanding of the responsibilities of the Metric Commission as they relate to the Department of Consumer and Corporate Affairs is necessary to avoid duplication of effort. In view of the responsibilities delineated above, and the result of numerous discussions with Metric Commission officials, the recommendation of this group is that "this department assume no responsibilities for Metric Conversion which carry its role beyond that defined by existing program. Specifically, no additional responsibility should be assumed in the areas of consumer education or

overall coordination of metric conversion unless a specific request to do so is issued by the Metric Commission."

(b) The Interdepartmental Committee on Metric Conversion

A primary responsibility of this group is to examine those areas in existing legislation which will be strongly affected by conversion and to recommend appropriate action to be taken. A large portion of this task is already complete and there is no need for this study group to perform any part of this function.

A second important responsibility of ICMC is to coordinate conversion for the federal government as a whole and for that purpose it will be necessary to liaise closely with that group in the future. CCA has had a departmental representative on ICMC for some time and no additional action need be taken at this time.

(c) Impact on Department

The departmental areas most strongly affected by metric conversion will be Field Operation Bureau and the Bureau of Consumer Affairs. Other functional bureaux anticipate little or no internal involvement.

In the following sections, policy recommendations for all areas concerned are presented together with the resulting manpower and equipment requirements for metric conversion. Protection of the consumer against fraudulent

activities within the framework of existing departmental programs is the criteria underlying these recommendations. Since a clear specification of policy is essential to the estimation of manpower and equipment requirements it should be emphasized that any deviation from the criteria presented may result in a different estimate of what is required for policy implementation.

3. INSPECTION POLICY AND MANPOWER REQUIREMENTS

(a) Bureau of Field Operations - Weighing and Measuring Device Inspectors

Present indications are that for many of the industrial segments with which this department is concerned metric conversion will involve large scale conversion of weighing and measuring devices over a fairly short time period. Increased pressure on service organizations to complete the task within difficult time constraints will result in a high probability of consumer fraud and strong control mechanisms will be necessary for effective protection of consumers. This control at the design phase will be exercised through Consumer Standard's Directorate and is discussed in a later section. Control at the implementation phase of device conversion will be maintained by the Bureau of Field Operations through a program of inspection and enforcement similar to that presently in existence.

(i) Inspection Policy

Conversion schedules presently available indicate that inspection of 100% of devices immediately following conversion would require at least 105 additional man years during the peak year of conversion. Requirement after the peak year would diminish rapidly leaving a large amount of surplus manpower in which considerable resources would

have been invested. Besides the unnecessary waste, and associated staffing problems imposed by this approach it is the conclusion of this study group that considerably more benefit would accrue to the consumer if the approach recommended here were adopted.

The policy for inspection of converted devices recommended here is based on well established techniques of statistical quality control. This involves inspecting small samples of converted devices at various times and locations in order to gather information which would pinpoint problem areas during conversion according to criteria established by management (e.g. high error rates). Having accurately located problems, additional "control" resources may be allocated and strong corrective and enforcement measures applied where needed. Strong enforcement through "control" inspections and legal action (sealing of devices fines etc) is regarded as the key element necessary for effective consumer protection. While the inspection of a device may act as a deterrent, the recent national pilot study on weighing and measuring devices indicated that no firm conclusion can be drawn regarding the effect of inspection on error rates for individual device classes. It is for these reasons that Statistical quality control is recommended here.

(ii) Application of SQC

The manner in which sampling is carried out and which quality control information is used will require some managerial discretion and good judgement at the district level. To maintain homogeneity of sample character it is recommended that sampling be performed according to device class. A finer breakdown (e.g. each device class within each service organization) is not economically feasible because of the very large number of samples that would be required. Sampling in this way is also analytically attractive since average device inspection times are available on a class by class basis. In applying this technique a small sample of converted devices would be inspected from each class in each geographical district every month. The inspection procedure would be identical to that currently in use. By making use of the existing weights and measures information system framework this data may be collected and massaged on a national basis. Quality control information developed in this way may be reported to all district inspectors for precise identification of problem areas. It should be noted that a computerized reporting scheme of this type can,

with minimal additional effort, identify problem areas on a finer breakdown than permitted by the sampling scheme. For example, although sampling is done on the basis of device class, additional information is reported on inspection certificates, and reports may be arranged to identify problem areas according to multiple criteria, e.g. error rate by class by maker instead of just error rate by class. This capability, when coupled with the knowledge of the district inspector in the field should provide adequate information on which decisions for allocation of control and enforcement resources may be based.

Control inspections, because they will report the same data as normal inspections may be used to determine whether or not the additional control and enforcement measures are achieving their desired results. Devices which are not inspected in the monthly sample and which do not give any indication of being a problem area would not be inspected until the normal scheduled inspection date (sometime within the two year cycle for most devices).

Although recommended sample size will be minimal in most cases, the present conversion schedule indicates that in some cases not enough

devices will have been converted to gather a sample of proper size. In those cases it is recommended that field staff inspect all devices until a sample of adequate size has been gathered. This is particularly true for classes of devices which will be converted over a long time period.

Certain theoretical requirements must be fulfilled to guarantee an unbiased sample in each case. However, considerable operational flexibility may be enjoyed within these theoretical constraints. High efficiency during the inspection operation may still be achieved by careful scheduling of inspections. At the district or regional level, no in-depth comprehension of statistical analysis is necessary. Each inspector may be given several rules of thumb which guarantee satisfaction of these theoretical constraints and which are easy to comprehend and apply. There is one instance in which some modification of inspection policy is desirable. This concerns the situation when several devices are converted and available for inspection at a single location. As this is an opportunity of increasing consumer benefit at very little additional cost

it should not, in general, be overlooked. This must not, however, occur at the expense of collecting samples for other device classes.

Statistical sampling techniques are not new to CCA and have been effectively used for some time. While achieving a significant reduction in manpower requirement, no loss in consumer protection will occur if effective enforcement techniques are persistently applied.

(iii) MANPOWER REQUIREMENTS

An accurate estimation of Manpower Requirement involves information from many different sources. Not all of the necessary information is available at this time. This situation will be partially rectified with the advent of the ad hoc request capability of the weights and measures information system (October 74) and subsequently as firm conversion schedules from various industrial sectors become available. For this reason, the estimates presented here will have to be continually refined as conversion progresses. Plans for achieving this update are outlined in a later section. For the purpose of the present calculation this information gap will be bridged by assumptions based on the best available information.

Manpower estimates for the sampling operation described in the preceeding subsection are based on, statistical sampling theory, estimated device populations by class and their distribution within each industry, the conversion schedules of each industry, and the average inspection time per device.

The groundwork and methodology outlined here will not change as additional information becomes available. The sample size for each class of devices to be inspected must be determined first. This is primarily a management decision based on the compromise between the desired accuracy of the quantity being measured (e.g. % devices in error) and cost of inspecting a sample of that size, necessity of early error detection etc. In general the inspection cost and accuracy both increase with increasing sample size. Once the sample size is set, the average inspection times for each device class may be retrieved from the weights and measures information system and used to determine what manpower will be required to gather each sample.

Having determined these quantities, appropriate inspection support and administrative

factors may be drawn from the weights and measures information system and from program forecasts and applied as necessary.

Estimating manpower requirements for "control" inspections, however, requires a knowledge of the variation of error frequency with the number of control inspections for devices converted to the metric system. Although, this information is not yet available, the recent national pilot study on weighing and measuring devices suggested that "control" inspections utilize about 25% of the available inspection manpower and the remaining 75% be relegated to all other inspections. Since this concept received subsequent senior executive approval it is also employed here to determine manpower requirements for "control" inspections relative to the requirement for the sampling operation described above.

It is also necessary to know how the manpower must be distributed over each year of conversion. This depends on the conversion schedules adopted by various sectors of the Canadian economy.

Unfortunately, at this time the only sector which has reported a firm schedule is the grain industry which anticipates complete conversion by August

1977. Although, actual conversion schedules are not yet available, recommended conversion schedules are. The Metric Commission's Task Force on weighing and measuring devices in Canada has recommended conversion schedules to the Metric Commission and various concerned industrial sectors. This detailed analysis gives full consideration to the availability of service technicians and parts and the economic feasibility of device conversion or replacement at any particular stage of the normal device lifetime. It also stresses the need for a coordinated and properly phased approach by the industries particularly those which are highly interrelated.

The critical nature of the factors considered in the Task Force study is such that little discretionary leeway is available to these industrial sectors for scheduling. Therefore, it seems likely that the recommended schedules will be followed.

Given this assumption, the only additional information required is the distribution of devices by class and trade. This will be available from the weights and measures information system in early November 1974. For the

purpose of this calculation it is assumed that all device classes follow the same conversion schedule as the aggregate of devices. The weakness of this assumption is recognized and the reliability of the calculation will be improved as information becomes available. The assumed schedule for the present calculation is:

YEAR	% CONVERTED
75-76	25
76-77	36
77-78	20
78-79	9
79-80	5
80-81	3

The results of this calculation are presented below for each year of conversion and for several sample sizes. Included in the calculation are allowances for vacation, sick leave, training, etc. Clerical staff is allocated according to the ratio 1:38 as in program forecast.

SAMPLE SIZE	1975-76 MY	1976-77 MY	1977-78 MY	1978-79 MY	1979-80 MY
10	42(40)	60(58)	33(32)	15(15)	8(8)
15	47(45)	68(66)	38(37)	17(17)	9(9)
20	52(50)	75(73)	42(72)	19(18)	10(10)
ALL DEVICES	73(71)	105(102)	58(57)	26(25)	15(15)

Note: Numbers in parentheses are number of inspectors required.

A sample size of less than 10 is not recommended in the early phases of device conversion since early detection of devices in error is required for maximum benefit to the consumer. It may, however, prove practical to reduce this sample size at a later stage (when some experience has been gained with converted devices) and to shift part of the inspection force to control inspections.

Staffing down after conversion may be achieved by several methods. Employees (or some percentage of them) may be hired on a casual basis. Absorption into present staff may be achieved through attrition and normal staff turnover (together 27%).

(b) Bureau of Field Operations - Electricity, Gas and Water, Meter Inspections

Since electricity meters already indicate in metric units, metric conversion will have little or no impact on this branch of Field Operations.

The utility companies will probably undergo a soft conversion first, i.e.; the invoicing system will be converted to metric units while meters continue to indicate in the avoirdupois system. Individual meters will be physically converted when they are called in for overhaul at the time of expiration of their seal period, generally on a six to ten year time cycle. Hence no conversion will occur which is out of phase with the current device replacement schedule. For this reason, it should not prove necessary to inspect devices out of phase with the current inspection schedule as is the case with other weighing and measuring devices. Therefore, no additional manpower will be required for inspection of gas or water meters.

However, field inspectors must be trained and equipped to inspect in metric in time to cope with conversion. This is discussed elsewhere in this report.

(c) Bureau of Field Operations - Other Inspectors

Other inspectors such as those concerned with "Factory Pac" and "Retail Pac" are not concerned, in general, with the inspecting of devices and therefore, will not experience

any metric-conversion-related increase in workload. Hence no additional manpower requirement is anticipated for conversion. Training and equipment are discussed in other sections of this report.

(d) Bureau of Consumer Affairs - Standards Directorate

(i) Approval Policy and Manpower Requirement

Metric conversion will add appreciably to workload in the Metrology and Laboratory Services Branch. The Branch is responsible for providing both program and technical guidance to the field, for working directly with industry on formal approvals of new devices and on informal approvals of conversion schemes for existing devices, and for periodic calibration of field standards and of standards submitted by industry for calibration. For the reasons detailed below, additional strength will be required during the period of metric conversion.

A metric conversion engineer at the ENG 4 level is required beginning 75-76 to ensure proper continuity of attention to the planning and implementation of metric programs in the laboratory and in the field. A good deal of detailed planning remains to be done for internal CCA programs; intensive participation

is required in the development of conversion plans for the scale and meter industries and for the industries which are the principal users of these devices; and implementation will bring its own succession of problems to be dealt with. Branch officers have not to date been able to give proper attention to metric conversion, but the time which has been spent cuts heavily into the discharge of continuing responsibilities. This conflict of role is foreseen in the recommendation of the Metric Commission: each organization should appoint a metric conversion officer. The Metrology and Laboratory Services Branch is a key organization in metric conversion.

The effectiveness with which it converts, and provides technical guidance on conversion to others, will have a major impact on the schedule, cost and pay-back of the national program of metric conversion. (This position was recommended in the 1974 submission of the Branch for Program Forecast).

An ENG 3 is required for the Gravimetric Section beginning 75-76. The present approvals staff- one EG8, one EG7 and one ENG 4 who is also responsible for the approvals laboratory

and the need, under section 8 of the Regulations, to re-issue some 600 approval notices before January 1, 1974. The metric conversion program will add to this a very heavy workload. In a number of instances, devices in metric variants of those already approved will have to be tested before formal amendment to the approval notice - not necessarily prior to 1976 - and in most other instances, there will have to be informal approval of schemes for conversion of devices already in use. (This position was recommended in the 1974 submission of the Branch for Program Forecast).

A GL 6 is required in the Machine Shop in 1976-77 to cope with the large volume of conversion work which cannot reasonably be contracted out. The calibration scales of beel provers for gas meter calibration is a case in point. There may prove to be a large number of other conversions, cut-down of 5- and 1- gallon test measures, for instance, which can best be handled by the laboratory machine shop. (This position was recommended in the 1974 submission of the Branch for Program forecast. The justification was on

the basis of an upswing in workload resulting from new product testing programs in the Product Safety Laboratory; the volume of metric conversion work was not at this time foreseen).

One EG-ESS-4 as an absolute minimum is required in the Calibrations Laboratory in 75-76 to handle the initial and repetitive calibration of inspectors' weight kits. It is proposed in this report that 180 weight kits be purchased in 75-76 and 120 kits in 76-77. Each weight kit requires 2 man-days of calibration time, both for initial calibration and for calibration once each year. These sets will represent an additional workload, since the present avoir-dupois weight kits cannot be retired for some years, probably not before about 1985. In addition to weight kits, there will be 62 complete trimmer weight sets for trucks, 200 trimmer weight sets for the inspectors and 120 volumetric kits. There will be a substantial further workload resulting from modification of volumetric measures and provers. (This position was not listed for the 74 Program Forecast.)

4. EQUIPMENT REQUIREMENTS

The recommendations which follow for conversion of existing equipment and for acquisition or replacement of existing equipment for metric conversion in the Department are based on the assumptions listed below:

- (1) The conversion of industrial scales will begin in significant volume in fiscal 75-76. Initial conversion will be in the grain industry which has established a completion state of August 1977. Industrial scale conversion will peak early in 1978-79 with a graduated tapering off through 80-81.
- (2) The conversion of retail food scales will begin on a test-area basis early in 76-77 and will be up to full volume by the last half of 76-77, continue through 77-78 and be largely completed by mid 78-79.
- (3) Postal scale conversion will lead retail scale conversion by about 9 months and extend over a two year period.
- (4) Conversion of other types of retail scales will be less well scheduled and will cause a taper off through 79-80.
- (5) Industrial liquid meter conversion will begin in 76-77, peak in the latter part of 77-78 and be largely completed during 78-79.

- (6) In the absence of concrete plans from the industry, it might be assumed that gasoline dispensers will be converted on the same scale as industrial class liquid meters. But inflationary trends in gasoline prices may well lead to prices beyond the capacity of the present computer heads in several years and lead to a panic program of conversion during 1976-77. The first schedule is assumed for present purposes. New manufacture beginning in 75-76 will incorporate snap-conversion gearboxes. This will speed up and simplify conversion and shorten the overall time span.
- (7) Gas meters will be converted at the time of routine overhaul beginning in 76-77. Once a given utility embarks on a program of conversion virtually all inspection will require to be in reference to metric standard.

Following is data on equipment needs, with data of acquisition or conversion tied into the schedule outlined above. Costs are in 1974 dollars.

(a) Weight Trucks

These will initially carry their present complement of 1000 pound block weights and weight baskets of 50 lb weights (or in the case of WT-3, 2500 pound block weights). To fit them for dual service in both systems of measurement, they will carry on additional two 50 lb weight (empty weight basket can be used as a scaled weight of 200 lbs.); trimmer

weights which when added to two 50 lb weights per 1000 lb block weight will enable testing to be done by 500 kg increments up to 9,500 kg of known test load; 5 trimmer weights which, when added to 50 lb weights, will enable testing to be done by 25 kg increments to 500 kg. The cost of providing this dual system capability on 12 weight trucks (assuming 2 additional 50 lb weights per truck can be allocated from present stock) would be \$4020 in 75-76.

Any additional trucks ordered in the future should be equipped with metric weights, 500 kg and 20 kg, 500 kg equals approximately 1100 pounds which is a "round" quantity for testing purposes. Appropriate conversion factors can be used to check avoirdupois scales. Work load for weight trucks will be approaching its peak in early 77 at about 20-25% over present levels. This will require 2 additional trucks each at \$45,000 one in 75-76 and one early in 76-77.

Ultimately, the present complement of 12 weight trucks will have to be converted either by replacement of their avoirdupois weights with metric weights, or by modification. As detailed below, the 50 lb weights can be reworked at a cost of \$10 each, a reasonable amount relative to the \$30 replacement cost. Reworking of 1000 lb block weights however, will cost \$200 per weight and will involve fastening a steel plate to the bottom of each weights. This approach has inherent technical drawbacks and is not

favoured. Preferred would be new 500 kg weights to international standard 01ML design at a cost of \$550 per weight. Assuming further that six 50 lb weights can be allocated from stock to each truck, the total cost would be \$133,200. This cost includes for each truck, 9900 for 18 block weights of 500 kg ea, \$200 for reworking of 20 weights from 500 lb to 20 kg, \$200 for one weight basket and \$800 shipping costs for weights. This conversion operation may be distributed over several years beginning after conversion of industrial scales is complete (probably in 1981).

(b) 50 Pound Weights

There are approximately 15,555 now in use. Initially, these would continue to be used to permit inspection of avoirdupois scales. With each truck load of weights, 5 trimmer weights in the 50 lb series described under item 1 and 5 trimmer weights in the 1000 lb series would be required to permit testing in 25 kg increments up to 11,500 kg with an appropriate number of 50 lb weights. Thus 50 complete sets are necessary in 75-76 at a total cost of \$16,750.

Each inspector on itinerant inspection when medium duty industrial scales are to be done carries ten 50 lb weights. During the period of metric conversion, he will have to inspect metric scales as well as avoirdupois, and

will need a kit of 4 trimmer weights to permit testing up to 250 kg. Allowing for 200 sets in 75-76, the cost will be \$28,000.

In order to cope with peak load, additional weights will be required and these should be purchased to OIML standard design. 1800 weights of 20 kg size are required in 75-76 at a cost of \$56,880 and 700 in 76-77 at a cost of \$22,320 including, in each case, an allowance to cover shipping costs.

Ultimately, 15,315 weights now in use and not covered in item (a) above, will have to be converted. This may begin following the last year of conversion (1981) and extend over several years at a cost of \$202,200 (including shipping costs).

(c) Inspectors Weight Kits

These can be either converted or replaced. Under the conversion option, the 233 avoirdupois weight kits now in use would initially remain unchanged and each would be supplemented with a list comprising a set of gram weights from 1 g to 200 g and trimmer weights to increase 1 lb weight to 500 g and 5 lb weights to 2.5 kg. The estimated cost of each trimmer kit is \$207. Ultimately, the trimmer weights would be scrapped, the one lb weights of the avoirdupois set would be scrapped and replaced with 500 of weights and the four 5 pound weights would be machined

down to 2 kg and supplemented with a fifth 2 kg weight. The cost of this operation would be \$230 per set bringing the total cost per set to \$437. Any kit converted would no longer be available for occasional avoirdupois inspections. Further, the total number of kits would have to be increased to allow for the additional inspectors required for conversion and these new kits would be to a non standard compromise design.

The preferred option is the purchase of standard design weights in kits extending from 1 g to 5 kg with a total capacity of 16,721 kg. The avoirdupois kits would remain in service or available for service as long as necessary, and each set, avoirdupois and metric, would be straightforward in use with no need to keep track of trimmer weights.

One supplier quotes a price of \$410 for a 1 mg to 14x1 kg set. Estimated price for a simplified set to CCA specifications would be \$325 complete with case. The supplier quoted above quotes a delivery of 10 sets per month. With some simplification in set specification and with investigation of alternative sources of supply, it should be possible to obtain a delivery of 15 sets per month. 300 sets will be required: this allows one set for each of the 240 weights and measures and factory prepackaged goods inspectors, one set for each of 10% of

the product inspectors, and a 15% reserve to allow for "turn around" time on annual calibration. 180 sets should be acquired in 75-76 (at 58,500) and 120 in 76-77 (39,000) at a total cost of \$97,500.

(d) 30 Pound Cast Iron Weight

There are now 291 of these in service. They should remain in use for the present to bridge the gap between the 30 pound weight kits and 50 lb weights. They are not practically salvageable to make the 10 kg weights which are required to bridge the gap from the 16 kg weight kits to the 20 kg, cast iron weights. Acquiring 180 new 10 kg weights in 75-76 (\$4860) and 120 more in 76-77 (\$3240) will cost a total of \$8100.

(e) Inspectors Kit Balances

These have been equipped for some time with metric beams. However, additional balances will be required for peak inspection periods, 35 in 75-76 (\$13,300) and 15 in 76-77 (5,700) for a total cost of \$19,000.

(f) Short Weight and Other Portable Inspection Scales

Additional scales of this type will not be required. Some of existing scales will be converted and others replaced. Estimated allowance for this is \$12,150 in 76-77.

(g) Linear Measures

The 50 standard tapes and utility tapes in the inspectors kits must be replaced. Estimated costs amount to \$2,000 in 75-76.

(h) Volumetric Provers

These devices which are installed in trucks, trailers, are portable or fixed, can initially, in most cases, use removable weighted displacers to decrease volume from the round nominal capacity in gallons to the nearest full litre of nominal capacity. There are presently 109 provers of 50 gallon or higher capacity plus a few of smaller size. The estimated cost of providing provers with the capacity to inspect in both systems is \$2,000 and will be required for 75-76.

Ultimately, and preferably progressively over the period of metric conversion, existing provers will have to be converted to round metric capacities and (except for the last to be converted) removable displacers provided to convert back to round gallon capacities where necessary. Several alternatives are available. For example, the height of the cylindrical portion of the provers may be increased so that a 100 gallon prover would have its capacity increased to 500 litres. This option would be nearly three times as expensive as the recommended option, permanent installation of appropriately sized displacers

so that a 100 gallon prover, for instance, would have its capacity decreased to 450 litres. Allowing for installation of displacers, shipping (2 ways) and provision of removable displacers for conversion back to gallons, the total estimated cost is \$40,000 which can be equally distributed over 76-77, 77-78, 78-79 and 79-80.

The work load of post-conversion calibration of bulk meters will occupy 7 inspectors full-time for at least an 18-month period. This will require 4 additional bell provers 500 litre capacity, truck mounted at a cost of \$37,000 in 75-76 and 3 in 76-77 at a cost of \$25,500. These cost estimates include shipping, installation, and provision of removable displacers.

(i) One and Five Gallon Test Measures

These can initially be adopted for inspecting converted gasoline dispensers by use of removable displacers to reduce the volume of a 5 gallon measure from 22.73 to 22.70 litres and to reduce the volume of a 1 gallon measure from 4.546 litres to 4.50 litres. Allow for 303 five gallon measures and 273 one gallon measures in 76-77 for a total cost of \$5,760.

With the purchase of 5 litre and 20 litre measures already contemplated, no additional stock will be required for the peak work load of conversion.

Ultimately, the one-gallon and 5-gallon measures will have to be converted to or replaced by 5 litre and 20 litre capacities. The 5 litre capacity equates to 1.1 gallon and the 20.1 capacity to 4.4 gallon. Converting in this way for 5-gallon measures will cost \$35 each while purchase of new 5 litre measures will be \$100 each plus \$25 for shipping case. Conversion will not be particularly urgent provided removable displacers are available as described above. Conversion costs may be spread over several years at \$10,000 in 77-78, 78-79, 79-80 and 80-81 and \$4,730 in 81-82 respectively.

(j) Volumetric Kits

These are carried by a percentage of the weights and measures inspectors, by the factory prepackaged goods inspectors and by the product inspectors. A total of 103 have been issued, complete replacement will be required at a cost of \$175 for basic kit plus \$150 for a 5 litre test measure complete with case which is coated for use with corrosive liquids. Kits will be required for roughly half the inspectors added to strength for metric conversion allowing for 60 kits in 75-76 and 60 in 76-77 will cost a total of \$39,000.

(k) Bell Provers

These will be converted on a schedule coordinated with conversion in each gas utility. Each of 79 provers

in the field will require new chrome plated brass calibration scales at a cost of \$27 each for materials and \$185 for labour at commercial rates. It is considered, impractical, however, to have this work done commercially since each scale must be calibrated. It would be preferable to hire an extra employee for the laboratory shop to cope with this and other conversion projects. The estimated cost of materials would then be about \$2,200 in 76-77. Automated provers require conversion of automation auxiliaries. The cost for 18 provers will amount to \$9,000 in 76-77.

(l) Dead Weight Testers

These will require having their weights re-machined and recalibrated at a cost of about \$300 for each of 19 sets, \$5,700 must be allowed in 76-77.

(m) Flow Measuring Transfer Provers

These will require rescaled and recalibrated pressure gauges and recomputation of new constants for each prover. Manufacturers estimated costs are \$500 per prover. The total cost of 3 provers will be approximately \$1,500 and these will be required in 76-77.

(n) Low Pressure Flow Provers

These will also require new scales for pressure gauges and recomputation at an estimated cost of \$400 per prover, 12 provers required for 76-77 will therefore cost about \$4,800.

(o) Manometers

These will require new scales at an average cost of \$25 per manometer. The total cost will be \$775 and these will be required in 76-77.

(p) Barometers

These cannot be converted using new scales since most instruments are of a design no longer produced. Conversion charts at little or no cost will be constructed at Standards Laboratory.

(q) Pressure Gauges

These will require new scales at a cost of \$25 per instrument. Conversion of 58 gauges in 76-77 will cost \$1,450.

(r) Thermometers

172 will be required in 76-77 at a total cost of \$2,064.

(s) Length Standards

Those in use in the gas inspection service will typically be used with conversion charts. However, \$2,000 should be allowed in 76-77 for replacement of those which are used very frequently.

(t) Equipment for Mass Laboratory

Standards Branch advises that \$1,000 should be allowed in 77-78 for various miscellaneous equipment items in the

Mass Laboratory including, for example, one large platform scale.

As more 500 kg block weights come into service on weight trucks, the laboratory will require a master standard. Local standards will also be required in each of the five regions. Estimated cost for these is \$3,000 in 80-81.

(u) Volumetric Laboratory

Existing provers will require conversion and new provers in sizes compatible with new equipment in the field must be acquired. Both portable and primary standards are required. "Gallons" provers in use in the field and in industry have been in multiples and sub-multiples of 50 gallons, and will normally be converted to multiples and sub-multiples of 225 litres. New provers will be in multiples and sub-multiples of 250 litres and it is important that the volumetric laboratory have standards in corresponding sizes so that calibration "drops" can be a single drop or an integral number of drops. The associated costs are summarized in Table 1 below.

V O L U M E T R I C L A B O R A T O R Y

EQUIPMENT ITEM DESCRIPTION	CONVERT	PURCHASES	COST 75-76	COST 76-77	COST 77-78	COST 78-79
50 and 100 gal. seraphin provers	x		\$1000			
250 litre 500 litre provers		x		\$5000		
50 gal. galvanized provers	x		\$ 500			
250 litre galvanized provers		x		\$5000		
100 gal. galvanized portable prover	x		\$ 250			
500 litre galvanized portable prover		x	\$1500			
100 gal. stainless steel prover	x			\$ 250		
100 gal. stainless steel and sanitary provers	x			\$ 500		
600 gal. fixed epoxy lined prover	x				\$1000	
Miscellaneous test measures	x			\$1000		
Totals:			\$1750	\$11500	\$1750	\$1000

(v) Gas Laboratory

All types of equipment for this lab have been discussed in previous sections. Conversion should preferably occur in 76-77 and the associated costs are as follows:

Bell provers (3 at \$112)	\$ 336
Dead weight testers (4 at \$300)	1200
Flow measure transfer prover	500
Flow pressure flow provers (3 at \$400)	1200
Manometers (15 at \$25)	375
Pressure gauges (9 at \$25)	225
Thermometers (6 at \$12)	<u>72</u>
Total in 76-77	\$3908

(w) Machine Shop

This will eventually require conversion of lathe and milling machine at a total cost of \$2500 in 79-80.

The total cost of all equipment is summarized for each year of conversion below according to the item identification above.

COST

ITEM	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84
a.	49,020	45,000	-	-	-	33,300	33,300	33,300	33,300
b.	101,630	22,320	-	-	-	50,575	50,575	50,575	50,575
c.	58,500	39,000	-	-	-	-	-	-	-
d.	4,860	3,240	-	-	-	-	-	-	-
e.	13,300	5,700	-	-	-	-	-	-	-
f.	12,150	-	-	-	-	-	-	-	-
g.	2,000	-	-	-	-	-	-	-	-
h.	37,800	35,500	10,000	10,000	10,000	-	-	-	-
i.	5,760	-	10,000	10,000	10,000	10,000	4,730	-	-
j.	19,500	19,500	-	-	-	-	-	-	-
k.	-	11,214	-	-	-	-	-	-	-
l.	-	5,700	-	-	-	-	-	-	-
m.	-	1,500	-	-	-	-	-	-	-
n.	-	4,800	-	-	-	-	-	-	-
o.	-	775	-	-	-	-	-	-	-
p.	-	-	-	-	-	-	-	-	-
q.	-	1,450	-	-	-	-	-	-	-
r.	-	2,064	-	-	-	-	-	-	-
s.	-	2,000	-	-	-	-	-	-	-
t.	-	-	1,000	-	-	3,000	-	-	-
u.	1,750	11,500	1,750	1,000	-	-	-	-	-
v.	-	3,908	-	-	-	-	-	-	-
w.	-	-	-	-	2,500	-	-	-	-
TOTALS:	306,270	215,171	22,750	21,000	22,500	96,875	88,605	83,875	83,575

TOTALS = GRAND TOTAL = 940 920 (rounded off)

Hence, the next two years will require the greatest outlay for equipment with a gradual taper off until conversion is completed (1980). Further substantial outlay will be required during the immediate post conversion period as dual measuring capacity is no longer useful and full metric capacity becomes necessary.

5. TRAINING REQUIREMENT

(a) New Staff - W & M Device Inspectors

Presently, the training of a weighing and measuring device inspector requires a minimum of one year before the incumbent is considered fully qualified to perform inspections on all devices on his own. The training method presently used is of the "grandfather" type where novice inspectors accompany more experienced inspectors to obtain actual experience until they are fully trained. This is inefficient and time consuming.

Moreover, in view of the normal time requirement for staffing, a considerable reduction in technical training time will be necessary in order to be prepared for conversion as it arrives. For this reason it is recommended that a training program consisting of intermittent classrooms and on site training be developed. Although no formal program of this type currently exists, the approach has recently been tested in the Ontario Region. It appears to be a more efficient means of training inspectors and resulted in a considerable reduction in total training time. In the case of metric conversion, considerable economic benefit will accrue to the department through savings in salaries since inspectors may be hired at a later stage in the conversion program.

Because of existing expertise within the department it is not anticipated that this classroom approach will result in any substantial increase in manpower requirements or acquisition of new staff for its development. Preparation of training literature, lectures, schedules, and acquisition of equipment for demonstration are the major activities to be considered. It is estimated that a concerted effort by several experienced individuals over a 6-week period would be sufficient for the development of a training program.

For planning purposes, classroom training may be divided into three segments. The first would present technical information for device inspection, e.g. inspection techniques, equipment, device operation, etc. This will probably be accomplished through three one-week training programs separated by three-week intervals of field experience.

The second segment would present the legal training information and policy with which inspectors must be familiar. The techniques of situation analysis and a presentation of general inspection guidelines could deal with this in three or four days. This segment could probably be subdivided and covered in part during each session of 1st segment.

The final segment would acquaint inspectors (both new and present) with the metric conversion program in general. These individuals, because they interface directly with segments of the public, will be called upon to disseminate

various information of a general nature relating to metric conversion. For this reason they must be kept abreast of current developments in the conversion program. This can be accomplished by a one or two day seminar as an introduction followed by continual distribution of literature dealing with recent developments as conversion progresses. The final segment should be given just prior to conversion to achieve maximum effectiveness.

If this approach is adopted, it is estimated based on the Ontario Region's brief experience, that the increase in efficiency of training would be sufficient to reduce total training time to three months. By delaying the time at which staff for conversion is hired, the resulting potential saving to the department is \$450,000 and 45 MY. This does not include the saving which will result from freeing up time of current staff involved in training. The success of this program hinges on the full cooperation of all involved. Preliminary reaction from the field indicates that this approach is favoured.

If present conversion schedules are accurate, the training program for metric conversion will be necessary only for the 1975-76 fiscal year, and the early part of 76-77. By that time, most of the new staff required for metric conversion will have been hired to cope with peak conversion. No

additional staff will be hired after that as the required conversion inspection effort will decline for the remainder of the program.

Based on estimates of new staff requirements, the present magnitude of each district associated travel cost, etc. it appears the most economical and efficient means of assembling incumbents for training purposes may be achieved through establishing a number of training centres at various district headquarters across the country. This will minimize travelling costs and result in a low student teacher ratio giving trainee's the opportunity to derive maximum benefit from the program. Ontario Regional Headquarters reported to this study group that a low teacher/student ratio was highly desirable because of the technical nature of the material to be mastered. Although they indicated a 1:1 ratio seemed necessary, it is felt that a more formal program could achieve equivalent results with a 6:1 student to teacher ratio. This criteria coupled with the assumption that new staff will be regionally distributed in proportion to the current distribution leads to the conclusion that training programs may be run at nine locations.

Trainees will return to the field between sessions and this will allow one instructor group to alternate between three locations. Operating in this way three instruction groups could complete the task in twelve weeks.

The table below indicates the proposed distribution of centres within each region.

Region	% of W & M Inspectors	Est.# New Inspectors (On total of 59)	Est.# Training Locations
Atlantic	10	6	1
Quebec	27	16	2
Ontario	36	21	3
Prairie	19	11	2
Pacific	8	5	1

(b) Present Staff

In preparing present field inspection staff to cope with metric conversion, more slack time is available. Existing inspection procedures and techniques will remain unchanged. Familiarization of inspectors with the SI system of units can readily be accomplished by a combination of lecture and discussion sessions and some home study provided sufficient documentation is made available. This has been discussed in the previous subsection. This should require about two days of training per inspector and can be most economically accomplished by first training DI at each regional HQ and having each DI report results in informal lectures in his own district. This will establish district inspectors as integral parts of the network which will serve the function of information dissemination to the trader segment during metric conversion.

Estimated travel costs for DI's are presented in the table below.

W & M

DI (a)	Travel	21 x 60 =	1260
	Accom.	21 x 13.75 x 2 =	<u>578</u>
			\$1838

6. TIMING AND IMPLEMENTATION PLAN

The network diagram below indicates the date of occurrence, criticality of milestone activities and overall time frame for the initial implementation phase of plans presented in this study. Information contained here is based on the estimates developed by this group and on the intended conversion schedules of various industrial sectors. Since the latter is crucial in determining peak year estimates for inspection staff and since very few industrial conversion schedules have been developed at this time, it will be necessary to subject this plan to continual scrutiny and refinement until all schedules are firmly set. While overall project requirements are not expected to vary greatly from the estimates presented here, their distribution by year may. Moreover, the data used by this group to prepare manpower estimates presented here was based on the limited data retrievable from the existing information system. With the ad hoc request capability which will be available within the next few months, these estimates may be improved considerably.

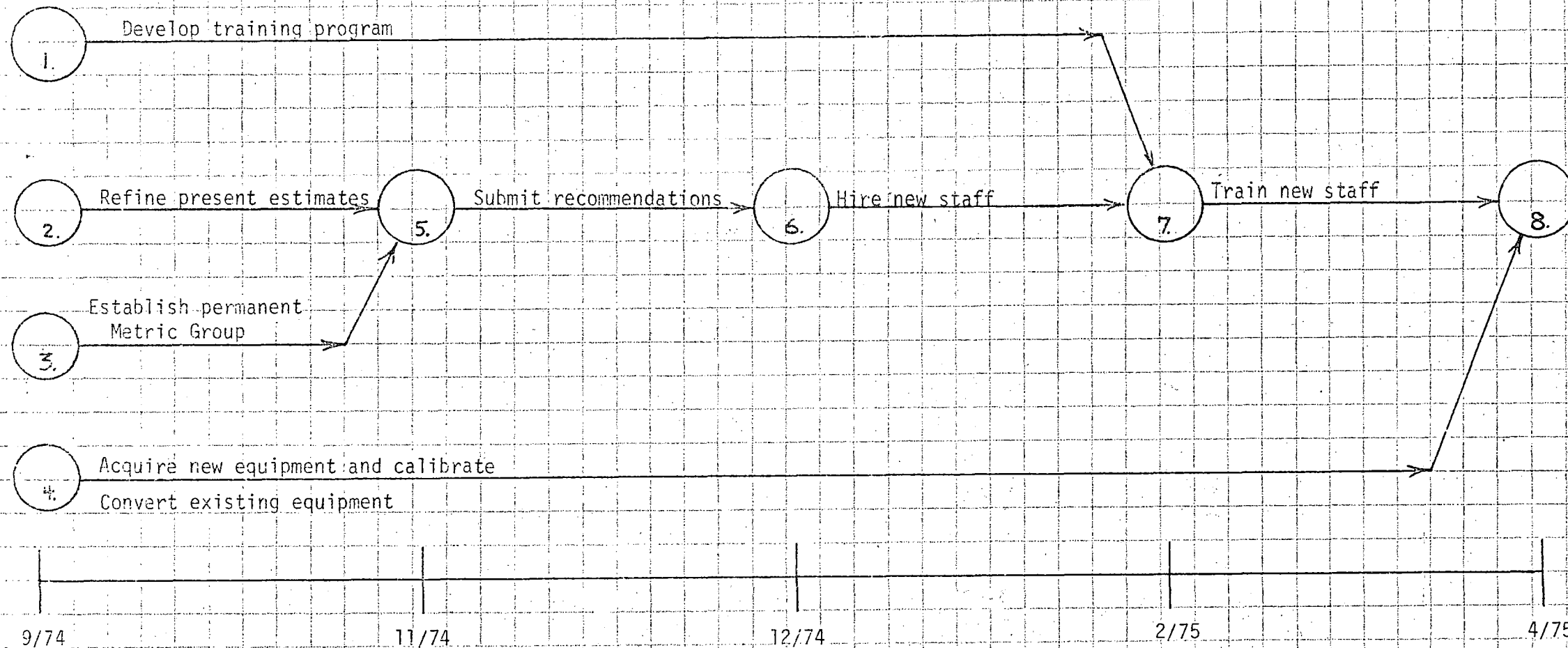
In recognition of the need to develop a detailed implementation plan based on a more accurate information base than is presently available, it is recommended that this study group remain intact for a period of up to four months until this task

can be completed. At that time it will be necessary to establish a permanent group which will coordinate the detailed implementation for the department.

This group will also advise senior management of significant developments related to metric conversion as they occur, assess their impact on the department and recommend appropriate action to be taken. Central coordination of implementation can only be achieved through the development of detailed conversion plan as conversion progresses. Developing this detailed plan and monitoring the progress of internal conversion is regarded as a prime function of the permanent group.

At the district level, it is expected that these functions will be fulfilled by District Inspectors. These individuals will have a sufficient information base to work from since they will be receiving continual information on progress toward conversion and because they are in continual contact with traders, device manufacturers and various service organizations. It is recommended therefore that district committees be formed to coordinate local conversion activities. Central coordination and timely and accurate dissemination of conversion information are essential for the district conversion groups to operate effectively.

IMPLEMENTATION: INITIAL PHASE MILESTONE ACTIVITIES



INTRODUCTION

The purpose of this memorandum is to document the terms of reference and study approach for the Working Group on Metric Conversion for the Department of Consumer and Corporate Affairs. These terms of reference relate to investigation and planning phases. Detailed schedules and operational procedures will be enclosed as part of a subsequent study.

OBJECTIVES

To determine the role which Consumer and Corporate Affairs will play in the metric conversion program and develop plans indicating equipment, manpower and financial implications for the Department in a time frame consistent with that of the Metric Commission.

TERMS OF REFERENCE

- . Determine the responsibilities for metric conversion to be assumed by this Department.
- . Determine the interface between Consumer and Corporate Affairs and the Metric Commission in order to avoid overlap of responsibilities and to ensure consistency with Metric Commission plans.
- . Determine the role that Consumer and Corporate Affairs will play in the dissemination of information on metric conversion for consumer and trader education.
- . Investigate alternative inspection procedures following metric conversion, develop plans and determine resource and equipment implications.
- . Develop plans for education and training of field force.
- . Develop a system to monitor the extent of conversion to the metric system and take necessary steps to ensure its compatibility with existing weights and measures information system.

- . Develop plans for approval of metric devices and indicate capital and resource requirements for Department.

STUDY APPROACH

A study team is to be assembled from those areas in the Department which will assume an active role in metric conversion. The proposed composition of this team is:

<u>Name</u>	<u>Organization</u>	<u>% of Time Required</u>
J. Armstrong	Standards Directorate	20-25%
J. Buchanan	Consumer Research	" "
P. Michaud	Field Operations	" "
H. McIlroy	Consumer Affairs	10%
F. Hay	Management Consulting	100%
G. Jarry	Information & Public Relations	
W. Staples	Field Operations	

In his respective area each group member will be responsible for:

- 1) Determining his organization's role in metric conversion.
- 2) Defining the activities for fulfilment of that role.
- 3) Determining alternate methods of performing activities necessary for conversion.
- 4) Investigating financial, personnel and equipment implications of each alternative method.

In addition to providing analytic support for all of the above activiteis, Management Consulting will have thhe responsibility of coordinating the planning and for synthesizing results to develop an overall plan for the Department.

A schematic breakdown of these responsibilities appears as Appendix 'A'.

APPENDIX A

SCHEMATIC ILLUSTRATION OF PROJECT RESPONSIBILITIES

<div> <div>ORGANIZATION</div> <div>ACTIVITY</div> </div>				
	M C S	GROUP MEMBERS	SENIOR EXECUTIVE	
1. Determine respective role of organization.	A	P	X	<div> <div>LEGEND:</div> <div>P - Perform</div> <div>A - Advise and/or assist</div> <div>X - Approve</div> </div>
2. Define activities/goals for conversion.	A	P		
3. Determine alternative methods of performing activities & achieving goals.	A	P		
4. Develop cost and resource estimates for each alternative.	P	P		
5. Select optimal method and develop plan.	P	P		
6. Coordinate planning.	P	A		
7. Synthesize results to develop departmental plan.	P		X	
8. Liaise with senior executive and submit recommendations.	P	A	X	

DATE DUE
DATE DE RETOUR

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