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TECHNICAL, ADMINISTRATIVE, LEGAL, AND FINANCIAL ASPECTS OF GARBAGE AND REFUSE DISPOSAL

by

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* The authors were designated to prepare the introductory statement on the Technical Discussions to be held at the XII Meeting of the Directing Council. Before preparing their statement, they visited some of the principal cities of Mexico, El Salvador, Honduras, Brazil, Venezuela, and Cuba in order to become acquainted with the particular problems of the Latin American countries. The authors studied the administrative methods applied, the procedures utilized, and the financial systems in effect.

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INTRODUCTION

In the consideration of garbage and refuse disposal practices of any area, it is necessary to emphasize the profound relationship of water supply and sewage and excreta disposal facilities to the general pattern of good public hygiene. This is immediately apparent in any discussion of the over-all environmental sanitation problems associated with garbage and refuse in the Middle and South American countries and frequent reference will be made in this paper to the inter-relationships of these three environmental factors.

It is also necessary to emphasize that in speaking of garbage and refuse disposal, there must be included not only matters of final disposal but also practices involved in the fields of refuse storage, collection, and street cleaning, with all the incidental services included among which are: mobile water supply, public markets, dead animals, promiscuous dumping, etc.

Because of differences in administrative, legal and fiscal situations encountered from country to country in the field of refuse and street cleaning practices, the recommendations at the conclusion of this report will be primarily directed toward establishing approaches to the problems,

with an attempt to concentrate on subjects having universal application in the operational and technical field, and, of even more importance, to strive for general acceptance and implementation of uniform policies and procedures that will surely tend to place these vital health activities on a higher plane, professionally, financially, and administratively.

THE PROBLEM

The environmental sanitation of any community depends primarily upon three major functions of Sanitary Engineering, namely, water supply and distribution, sewage disposal, and the prompt removal and disposal of the daily accumulations of solid wastes, including garbage and other miscellaneous refuse. While a priority can be easily established with respect to the relative importance of each of these functions (and it is incontrovertible that without water there can hardly be any life itself), all of them are essential to proper environmental sanitation. Recognizing that there can hardly be any cleanliness without water, it is certain that its availability does not of itself guarantee clean living. Nor does the collection and proper disposal of human excreta complete the cycle for healthful and hygienic environment. Under modern conditions of urban development, only where all three activities are dealt with in a satisfactory manner can one say that the community has fully met its fundamental environmental sanitary obligations.

In a recent PAHO report (April, 1960)* the following quotation is of especial significance:

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* Health in the Americas and the Pan American Health Organization

"In many countries and other areas of the Americas the major causes of death are those related to environmental factors. In seven countries the leading cause of death was the group entitled "gastritis, enteritis, etc.," which includes the diarrheal diseases for which the etiologic agents are either not known or not stated. Diarrheal diseases are important causes of death in infancy and early childhood. ********** ********** In the countries of Middle America the rates are very high as well as in several countries of South America. In two countries the death rates exceeded 1,000 per 100,000 population, which means that more than 1 out of each 100 children under 5 years of age die each year from diarrheal disease. These high rates are over 60 times the comparable death rate for the United States."

In large cities, particularly, the daily production of solid wastes invariably represents a bulk handling problem of great magnitude. Length of haul for collection vehicles is therefore a matter of prime economic importance. As cities expand in population and area, available dumping sites are usually difficult to establish within reasonable distance from the central core, and in fact are generally located at or outside the perimeter of the more densely populated areas. Such conditions invariably justify careful engineering studies to determine the economic advisability of establishing plants at strategic locations within the city for the purpose of reducing materially (particularly in the case of combustibles) the quantities to be disposed of finally by landfilling. Such plants should, of course, be capable of dealing with combustible yard refuse, street sweepings, tree debris, and other refuse subject to volumetric reduction. The more nuisance-free the disposal operation the easier it is to locate such facilities more strategically. This principle applies to sanitary landfills versus open dumps, as well as incinerators versus composting plants, (particularly where such composting plants involve large sites for salvage and/or windrowing operations).

In planning future sewage systems, and to the extent that present systems can absorb the load, the introduction of putrescible wastes (i.e. garbage) into sewers after grinding should be considered as an ideal sanitary method for the handling of this type of solid waste. A partial utilization of this method to deal with special conditions at markets, restaurants, etc. is obviously of great benefit to on-site sanitation at such places. An additional noteworthy on-site disposal method of dealing with the problem of combustible wastes particularly is the utilization under proper regulatory controls of commercial and industrial incinerators.

In the final analysis, the best and most efficient and sanitary systems of refuse collection and disposal and street cleaning require a reasonable amount of cooperation and an acceptance of basic responsibilities on the part of the citizens of the local community. It has been said that a city is only as clean as its people wish it to be. Improper storage practices, promiscuous dumping, littering of public and private space, and general indifference to matters related to cleanliness and good personal hygiene, are all factors which considerably influence the ability of a community to solve the problem.

TECHNICAL CONSIDERATIONS

1. Climate and Physical Characteristics

It is well-known, of course, that special conditions related to climate and topography exist in many large cities of Central and South America. The vital relationship of such conditions to environmental sanitation and their effect upon existing methods and problems of refuse collection and disposal and street cleaning are perhaps not so well-known.

In cities lying near the equator particularly, it is, of course, worth noting that temperature conditions create fly and insect breeding problems of unusual proportions, and that the efficiency and extent of the refuse collection and disposal services rendered are of vital significance in any eradication program.

It was somewhat surprizing to find, by comparison with conditions in more temperate climates, the absence of any serious rat harborage problems, and in fact a relatively small population of rodents generally. Landfill infestations were reported to be of minor consequence, which might be accounted for to some extent by the scavenging activities of flocks of buzzards which were invariably present in large numbers on all refuse dumps.

The influence of the "rainy season" in these areas cannot be overlooked. During such periods - usually 4 - 5 months duration, from June to October - heavy downpours tend to scour out previously contaminated rivers, streams, and small water courses; much debris is washed down from mountain sides and subsequently cleaned up, and the refuse itself reportedly becomes moisture-laden at times to the point of being quite a different material to handle for both collection and disposal.

Extremely rugged topography in many cities also heavily influenced and complicated the extension of fundamental and essential sanitary services of water, sewage and refuse collection, particularly in the face of the tendency of so many families to insist upon a questionable privilege of erecting their own shelters (apparently in most cases without regard to building codes) and literally clinging to the sides of hopelessly inaccessible mountain slopes. The special problems of hygiene and sanitation thus created are veritable sanitary engineering nightmares, and despite heroic efforts in some instances to deal with the existing conditions, obviously no satisfactory solution will be forthcoming without broad changes in policy. This particular problem is, of course, deeply rooted

in considerations unrelated to topographical conditions, and much concern was indicated regarding the need for some long-range approach based on socialogical and economic programs, as well as by the imposition of disciplines, governmentally enforced. In densely populated urban areas in particular it is not seen how the latter approach can be avoided in the interest of the general public health of the community.

2. Retail Markets - Public and Private

In most cities food markets were a continuing problem for the cleansing agency due to the large quantities of putrescible wastes generated. While some progress in some cases had been made by the installation of new markets, unfortunately the on-site provisions made for dealing with this special problem of refuse were generally inadequate. In addition to the permanent markets, there existed a number of roving open-stand push-cart type groups utilizing sidewalk and curb areas to sell their wares, and moving from day to day to different locations. In São Paulo, for instance, it was reported the street cleaning agency had to give special service to over 300 different locations weekly.

3. Refuse Storage and Frequency of Collection

Another consideration of importance (with one exception - Venezuela) is the frequency of uniform daily service based primarily upon the inability to enforce or even require metal receptacles for storage of refuse on the premises. Another apparent reason for such frequent service to householders was the uniform tendency on the part of all cities to include services to markets, apartments, restaurants and commercial and industrial establishments generally within the scope of the services rendered by the Collection Agency.

Any reduction of service frequencies to householders would, of course, in these climates, require rigid enforcement of regulations relating to covered storage containers. The inaccessibility of some areas to trucks, further complicates the problem. This, to a degree, is overcome by the use of mule-drawn vehicles. Special efforts were being made to deal with this problem in most cities, although, the lack of public cooperation, and the rather general neglect of police enforcement of minor ordinances related to litter, etc. was immediately apparent, and serve to place severe requirements on the public cleaning services for manpower and equipment to keep abreast of the load. Difficult access to long-haul dumping areas over rough roads as well as a dearth of skilled mechanics and part procurement problems, all serve to make this a problem of special significance. Efforts to improve facilities for equipment maintenance were generally in evidence, and in some cases the operating fleet was being given quite competent attention despite the severe service requirements.

4. Special Economic Factors

It is a fundamental fact that local conditions in this sphere play a most important role in determining the methods and techniques utilized in providing the services of refuse collection and disposal and street cleaning.

On the question of economics, it was immediately apparent that salvage of saleable items of paper, cardboard, rags, bottles, tin cans, etc. was a uniform practice, even if in slightly varying degrees, throughout Latin America. This salvaging started in most cases with the individual

housekeeper, who put aside such items for the periodic visits of the buyers (in most cases push-cart operators), and this was followed generally by further salvaging of the balances of such items not so conserved at the household, by the collectors of refuse and the persons permitted to salvage on landfills. This practically standard practice so influenced the quality and quantity of refuse to be collected and disposed of that it would be more accurate to define the general problem as one more nearly connected with the disposal of organic wastes only (i.e., garbage).

Exceptions to the above practices were found in some areas, where markets for such salvageable items were scarce, and in a number of cases it was noted that efforts to salvage on landfills constituted such an interference with operations that the practice was prohibited. On the basis of observations, and applying such data as was available the unit weight of refuse being handled varied from approx. 600 to 900 lbs./cu.yd. and the B.T.U. value from about 2500 to 4000 B.T.U./lb. In general, these values were found to be more affected by salvage in Central America than in South America and Cuba, where in some instances commercial wastes particularly were more combustible, lighter in weight, and on the higher side in B.T.U. content.

A physical analysis, by weight, of the refuse of Havana, Cuba, was reported as follows:

THE REFUSE OF HAVANA (ANALYSIS)

Paper	(Cardboard	4.10%)	17.00%
	(Craft	4.35%)	
	(Newspapers	8.00%)	
	(Other kinds of paper	0.55%)	

Glass	(Containers, 25-300 cm^3 150,000 units-0.90%) (Containers, 300 cm^3 or over 80,000 units-1.30%) (Containers and other useless glass -0.80%)	3.00%
Leather:		1.00%
Bones:		1.50%
Combustible (wood, sawdust, etc.)		8.00%
Iron	(Cast 0.5%) (Wrought 0.6%) (With steel 0.1%) (With tin 3.8%)	5.00%
White rags		0.25%
Colored rags		0.35%
Organic material (vegetable and animal)		30.00%
Metals (cooper, zinc, etc.)		0.01%
Rubble (bricks, etc.)		3.00%
Miscellaneous (films, plastics, etc.)		0.89%
Humidity		30.00%

Composting

Almost without exception was considered of great economic importance as a means of conservation and potential source of revenue, and it was apparent that in many instances the subject was so controversial, and so preoccupied the minds of public health and other officials, that it represented a distinct interference to final solutions involving other methods of disposal. Many responsible public officials expressed more than a passing interest in this method, and in fact, several compost plants were being planned or placed under contract.

In the larger cities particularly, where critical landfill site conditions were the rule, and where haul to such fills were inordinately long, obviously prompt solutions will be required. Such solutions should be based upon careful engineering studies of the over-all long-range problem, without

being influenced by pre-conceived notions that "industrialization" is a panacea that can be applied uniformly to all situations. Nothing could be further from the truth; and this should be obvious based upon existing practices and experience not only in Latin America, but in other countries as well. This preoccupation with a questionable disposal method has resulted in numerous delays in the execution of good refuse disposal programs.

ADMINISTRATIVE, FINANCIAL AND LEGAL SITUATION

Recognizing the importance of political, legal and fiscal policies on a public service of this type, attempts were made to obtain information which described these policies and the relation of the intergovernmental structure (city, state, nation)to these policies. The study revealed noticeable uniformity in a number of these policies. In all but one city, for example, the lowest political entity, the city, is legally responsible for refuse collection, street cleaning, and refuse disposal. The exception is Havana, Cuba, where the National Ministry of Health is responsible for the performance of these functions for the entire country. It was indicated, however, that the Health Ministry is considering the advisability of giving operational responsibility to the cities.

In the matter of regulation promulgation, there is also a noticeable uniformity since this is generally the responsibility of a state or federal health agency. However, responsibility for enforcing regulations is usually vested in either the health, police, or cleansing agency, or a combination of these.

In other legal and fiscal matters there exists a pattern which is related to the degree of autonomy enjoyed by the municipality. Most of the cities surveyed are dependent upon the state or national governments for budget approvals and other fiscal matters including taxing powers. In the

few cities which enjoy considerable autonomy, legal and fiscal problems were found to be considerably less complicated. The municipality could budget and regulate as it saw fit. In one case, the cleansing department was empowered to enforce regulations.

The methods of obtaining funds for the solid waste sanitation operation do vary. Some cities apply a service charge or tax for this service. Others use general tax revenues. In all but two relatively autonomous cities there is an interchange of funds between the city and state or Federal government. Generally the federal or state government contributes a considerable amount to the municipal government and is responsible for approval of the municipal budget. This relationship enables the higher government to exercise considerable control over municipal operations. However, regardless of the source or budgetary control, in all instances most of the funds used for refuse collection come from the Municipal General Fund.

To some extent legal and fiscal information was obtained in the related sanitation fields, water and sewage. It is very interesting to note that in both of these fields there is a decided trend towards federal, state, or authority type operations with service charges being used to pay for either the operation or the total cost including capital investment financing.

There is some peculiar manipulation of funds, such as a small quantity of Public Health funds being used in one city to help clean up promiscuous dumping, but these pecularities are not significant.

Many of the cities surveyed were national capitals and were therefore administered by personnel appointed by the federal government. In these instances the federal government exercised considerable control over the entire municipal operation. The other cities did experience more direct citizen concern and, coincidentally, considerably more local political pressures.

In general, legal, political, and fiscal responsibility was rather clearly defined in all cities surveyed (except Rio de Janeiro which was undergoing a major governmental change at the time of the survey), but, except for Venezuela, it was unfortunately apparent that a "second class" status was accorded the solid waste sanitation functions.

Although in virtually all instances the individuals responsible for operation of the refuse and street cleaning functions were extremely competent, they lacked adequate, trained, professional assistance, thereby tremendously hampering their operations. To further hinder this function, it was found that many important decisions concerning refuse were made by legislative and administrative personnel without consulting with the chief of the refuse service. One outstanding example of this poor approach occurred quite recently in a major city. The legislative body passed a municipal ordinance designating that all future refuse disposal plants were to be "industrialization" or "composting" plants. This decision had been reached without any of the legislators bothering to examine the currently used methods or seeing advice from the chief of the operation. The chief, who was impressive as being quite expert in the field of solid waste sanitation, was firmly convinced that "industrialization" or "composting" is a method of disposal ill-suited for the needs of his city. A second example of the effect of "second class" status is the approach being tried in another city. In this case an agency completely unrelated to health, sanitation, or public works, is spending time and money trying to develop a refuse salvage and composting plant without the help and advice

of the sanitation experts. Again, their experts are opposed to this plant. Although experimentation of this type may be desirable and healthy, it should be conducted under the direction and control of the agency responsible for the refuse function.

1. Relationship of Water and Sewer Service to Refuse

Due to explosive growth in urban population and area expansion a number of cities visited were in the business of furnishing water to suburban sections by truck haul to tanks located around the perimeter of the City. Again, in the case of São Paulo some 500 tanks were being so serviced.

In many instances the maintenance of storm water drainage and the control of weed growth along unimproved roadways was a function of some magnitude for street cleaning forces.

Although generally solid waste sanitation was found relegated to a position of secondary importance, it was gratifying to find that water treatment and distribution and sewage collection and disposal were in the forefront among the important public services. Most of the cities visited have extensive water and sewer programs now under way. And, in most instances, responsibility for administering these programs rests with either a state or federal agency, or an authority. A strong tendency was in evidence to pay for part or all of the water and/or sewer service from direct use or service charges. And we also learned that many of the programs were recently inaugurated.

As previously stated potable water and proper sewage collection and disposal is vital to the health and welfare of a community, but one must also recognize the importance of refuse collection and disposal and street cleaning on the health of people. In Venezuela extensive studies were being conducted

by the Division de Malariologia, Dirección de Salud Pública, Ministerio de Sanidad y Asistencia Social to determine the effect of proper refuse collection and disposal on fly breeding and, consequently, on health. These studies have been prepared in report form and substantiate the importance of a proper refuse service on public health. The studies strongly emphasize the fact that proper refuse collection and disposal should be recognized as a service seriously affecting the health of the community and tends to justify the belief that it should be treated with the respect accorded water and sewage.

2. Administration, Organization, and Operation of Services

Attempts were made to obtain statistical data from all of the cities visited and this information is appended hereto and forms a part of this report. The data reveals that most of the cities visited were large metropolitan centers of considerable area and population. Furthermore, it is significant to note that the organizations involved in refuse work were, as usual, found to employ large forces of manpower and equipment, resulting in relatively large expenditures of public funds.

The survey revealed a general soundness of organization of sanitation agencies. With respect to its position in the municipal organization, in large cities the sanitation service was generally performed by a bureau or division of a major health or public works department, and in smaller cities by an agency directly responsible to the major or public works director. Exceptions existed in San Salvador which contracted for collection and disposal of refuse; in several Venezuelan cities which contracted with the Federal Public Health Department for complete refuse service, and in Cuba where the Federal Ministry of Health is responsible for refuse service for all communities.

Within the refuse agency itself, there was generally found a very sound organization established for street cleaning and refuse collection

services. The organization was usually divided into districts based upon the population and area served, and each district was laid out into routes for the collection and street cleaning functions. In some cities sanitation vehicles were properly housed at the various district headquarters, whereas in a few of the others all vehicles were garaged at a single headquarters which resulted in considerable lost time and transportation expense for vehicle movement. In some cases over-centralization of equipment repair facilities was a significant hindrance to vehicle availability, and in one instance accounted for an average of 19 vehicles out of 48 being out of service.

One of the major problems in most cities appeared to be the lack of adequate staff personnel. This produced a detrimental effect on overall planning, particularly as it concerns the need for and location of refuse disposal facilities. This was further complicated by the lack of knowledge on the part of responsible officials where to seek for expert advice in planning and developing refuse programs.

A properly planned refuse program is based upon the premise that the refuse agency is obligated to clean streets and collect and dispose of refuse in a sanitary, efficient manner consistent with the size and physical characteristics of the community. With respect to organization, the street cleaning and refuse collection practices observed were generally set at a high level. However, with respect to refuse disposal, with few exceptions, the planning and operation functions were deplorable. Only one of the cities surveyed appeared to have a workable sanitation disposal plan for

present and future operations. This situation is completely inexcusable in view of the relationship between the costs of refuse collection and disposal. It is recognized that sanitary refuse disposal costs vary from 5% to 25% of the total cost of collection and disposal, and that often overall costs can be reduced by strategically locating disposal plants near refuse collection centers. However, despite the economics, some cities hauled refuse for distances in excess of 25 kilometers one way.

The survey revealed a marked hesitancy on the part of municipal officials to seek technical advice in the field of street sanitation. There is a popular misconception throughout the world that this service can be performed by any intelligent person. Actually, there are only a handfull of consulting engineers who are well versed in this field, but it is often desirable to call upon these consultants for advice. One municipal engineer advised us that he studied the refuse disposal problem for years before deciding how to proceed. Based upon the results of his studies, it would appear that he not only spent excessive time on the study, but he came up with an answer of questionable value.

The survey revealed some unusual personnel practices. Generally, salaries for street cleaners and refuse service employees were extremely low. However, administrative ingenuity, which provided such fringe benefits as premedical and dental care, food commissaries, free haircuts and shoe repair service, and the privilege to salvage during refuse collections, helped to partially offset low salaries.

On the other hand, ingenuity could not offset the inadequate equipment and repair facilities that existed in a number of cities. These drawbacks

were aggravated by the usual governmental purchasing practices which, in some instances, resulted in vehicles of many different manufacture being used by the refuse agency. A poor practice, that of one agency designing a facility for the sanitation agency without consultation, resulted in a poor garage layout which would result in considerable lost time in daily operations.

There was one administrative practice that presented extremes in effectiveness and that was record-keeping. In a number of cities most records were kept in the administrator's head, but in Rio de Janeiro, and in the cities served by the Venezuela Public Health Department it was amazing to note the extensiveness and completeness of the records. In both of the latter instances, the administrators produced any and all records as requested, and an examination of the sources of information revealed their accuracy.

EVALUATION OF PRESENT PRACTICES

In the areas of administration and organization there appears to be a good understanding of refuse collection and street cleaning practices, but, with few exceptions, a dearth of records. Generally there is a marked scarcity of trained personnel which results in many drawbacks as mentioned above. Present staff limitations no doubt are partially due to the relatively low salaries paid. This approach is usually costly since competent staff people often save considerably more than their salaries. The unwillingness to hire consultants to assist in evaluating organization and operations is a shortsighted and expensive approach. Even if experi-

enced, competent personnel are available on a staff, it is usually desirable for municipal officials to retain expert advice as needed for particular problems if sanitary, efficient operations are to be maintained.

Present collection and street cleaning operations are generally good, with a few exceptions, for the areas served. However, it appears that many hard to reach areas are ignored, despite the fact that these are the areas which have the greatest need for the cleansing service. With respect to refuse disposal, only one sanitary landfill and two small incinerators were seen that could be considered acceptable from a sanitation standpoint. These account for disposal of less than 5% of the refuse disposed of in the cities surveyed. Considering the relatively small cost of refuse disposal and recognizing the importance of proper disposal from a health standpoint, it is disgraceful that these conditions exist. It appears that expert advice would be helpful in refuse disposal.

Despite the many differences in fiscal policies that exist from city to city, it seems that this has little effect on the service performed. Although, many administrators did complain about lack of funds, the source of budgetary control responsibility was not significant. The one major control factor that did affect service was local politics, and if the service could be removed from politics, similar to water and sewage in many cities, it would help tremendously in the solution of many administrative and technical problems.

RECOMMENDATIONS

The tasks of refuse collection and disposal and street cleaning together with all the miscellaneous activities which are usually assigned to such

organizations in large communities, involve the utilization of substantial numbers of plants, buildings, garages, large quantities of mobile equipment of diverse types, and considerable manpower. Because of these factors, however, it is well-known that such agencies are universally subject to great political pressures and interference, and in many instances represent a catch-all for the employment of politically sponsored low-grade personnel. The allocation of sufficient funds for the various activities, and in particular, commensurate compensation for staff employees, is complicated by the very mundane nature of the function.

On the other hand, efficient administrative and management techniques, as well as adequate engineering and mechanical staffs, are a primary requisite for good results. Until this is thoroughly understood and appreciated at all levels of Government very little progress can be made.

The following recommendations, in addition to representing topics for discussion, are directed primarily toward establishing broad avenues of approach that it is hoped will tend to strengthen and stimulate action in general along these lines:

(1) A most interesting and salutary approach to raising the status of the technical and administrative levels of the refuse function was found in Venezuela. Here the Federal Ministry of Public Health established a program wherein the planning, administration and operation of these services would be undertaken by the Division of Mariology under "agreements" with municipalities. The high calibre of personnel thereby assigned to this work immediately demonstrated the extreme value of

"depth of staff", and the results achieved over a period of years were observed to be extremely gratifying.

IT IS RECOMMENDED, therefore, that similar programs on a National, State or Municipal level, geared to the existing local situation in other Latin American Countries, be considered for the purpose of improving the administrative and technical staffing of the organization performing the function of municipal refuse collection and disposal.

(2) As indicated above, one of the primary elements for consideration would appear to be the requirement for strengthening the administrative and staffing functions of the agencies engaged in these public services. This can hardly be accomplished under present inadequate salary schedules for top echelon personnel.

IT IS RECOMMENDED that serious consideration be given to two additional concurrent approaches to this problem:

(a) By recommending prompt consideration by all Federal, State and Local Authorities to the need for commensurate salary schedules so as to induce more sanitary and public health engineers to undertake work involving the administration and operation of vital municipal sanitary engineering services. (While this has been done to some extent in Water and Sewer Services it is notably lacking in Refuse).

(b) By investigating ways and means of inducing graduate sanitary and public health engineers, for the sake of gaining vital experience on the firing line, to undertake an internship of one

or even two years in either the administration and/or operation of one of the three fundamental sanitary fields of Water Supply, Sewage or Refuse Service. (This type of project must, of course, be implemented by finding special means of compensating such individuals to justify their acceptance of such assignments).

(3) IT IS RECOMMENDED that the importance of obtaining competent, unmotivated, and carefully selected consulting engineering services, in technical matters related to refuse disposal particularly, be emphasized on every possible occasion, and that the PAHO be prepared to assist communities in the screening and selection of qualified, competent consultants when the occasion arises.

(4) IT IS RECOMMENDED that, where feasible, the three basic Sanitary Engineering functions of Water, Sewage and Refuse be served by a single agency and financed by service charges. This type of autonomous and coordinated control would be particularly suitable for the planning, financing and execution of programs dealing with the overall environmental sanitation problems of the urban centers particularly.

(5) A number of competent officials were found to be struggling with the problems of administering large organizations involved with many troublesome questions relating to legal and fiscal matters, public relations, personnel management, equipment procurement and maintenance and long-range disposal problems. On the other hand, the evidence indicated that no forum existed for periodic or annual meetings for such officials to air and discuss these problems with colleagues in other countries, or to share their knowledge by any publications devoted to the subject.

IT IS THEREFORE RECOMMENDED that prompt action be taken to establish some such medium in Latin America and that such officials be encouraged to establish an organization for this purpose similar to those in Europe and North America.

(6) IT IS RECOMMENDED that the PAHO sponsor and support a program designed to emphasize to some extent at least the administrative and technical aspects of refuse collection and disposal and street cleaning, in the sanitary engineering and public health courses in Latin American Universities generally.

(7) IT IS RECOMMENDED that the PAHO investigate the possibilities of stimulating an increase in the quantity of literature on this subject (both periodicals and texts) available in Spanish and Portuguese. It is realized that this must be done on a cooperative basis, and in a very selective manner, but the need was expressed and a substantial market exists.

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A D D E N D U M

TECHNICAL, ADMINISTRATIVE, LEGAL, AND FINANCIAL ASPECTS OF GARBAGE AND REFUSE DISPOSAL

Data on Garbage and Refuse Disposal Practices in Middle and South America

Table 1

Populations and Areas of 19 Cities in the Americas, for which Information on Refuse Disposal Was Received, 1960

Country	City	Estimated population (a)	Area (square kilometers)
Argentina	Buenos Aires	4,000,000	2,000
	Resistencia	76,123	40
Bolivia	La Paz	350,000	51
Brazil	Rio de Janeiro	3,200,000	...
	Santos	250,000	27
	São Paulo	3,750,000	1,600
Colombia	Medellin	600,000	83
Cuba	Havana	1,200,000	300
Ecuador	Guayaquil	430,000	39
El Salvador	San Salvador	242,000	16
	Santa Ana	70,000	4
Honduras	Tegucigalpa	100,000	...
Mexico	Guadalajara	538,372	67
	Mexico City	5,000,000	404
Paraguay	Asunción	280,000	85
Peru	Huacho	20,000	1.5
Uruguay	Durazno	19,500	...
	Montevideo	1,000,000	...
Venezuela	Valencia	125,000	50
	Sucre	300,000	84
	Maracaibo	358,000	300
	Maracay	98,000	40
	Puerto Cabello	48,000	10
Grenada	St. George	88,806	
Trinidad	Port-of-Spain	94,000	11
	San Fernando	35,600	7

(a) These estimates of population received in reply to the questionnaire for this survey usually refer to 1959 or 1960.

... Not stated.

Table 2

Type of Cities Surveyed and Source of Their Operating Funds

Source of funds	Number of cities		
	Total	Federal Districts or national capitals	Other municipalities
Total	26	8	18
National	1	1	-
Local	13	a) 3	b)10
National and local	10	a) 3	a) 7
Not stated	2	1	1

a) Service charges were reported in one city.
b) Service charges were reported in five cities.

Table 3

Distribution of the 19 Surveyed Cities in the Americas by Municipal Departments[a] Operating Services for Refuse Collection and Disposal, 1960

Department	Number of cities	
	With collection service	With disposal service
Total	26	26
Public works	11	10
Health (a)	8	8
Police	1	1
City-department not specified	4	4
Not a city department-by contracts	2	3

(a) Only one municipality did not have the legal responsibility for refuse collection and disposal; in this city the responsibility was placed on Ministry of Health.

Table 4

Quantity of Refuse Collected Per Day in 19 Surveyed Cities of the Americas by Population of City, 1960

Population of city	Quantity of refuse per day (tons)					
	Total	Under 100	100-499	500-999	1000-1999	2000 and over
Total	25	8	10	3	2	2
Under 100,000	9	7	2	-	-	-
100,000-999,999	10	2	8	1	-	-
1,000,000 and over	6	-	-	2	2	2

Table 5

Nineteen Surveyed Cities in the Americas Distributed by Quantity of Refuse Collected Per Day and Major Methods of Disposal

Quantity of refuse per day (tons)	Total	Open dump	Dumping in water	Compost plant	Incinerator and open dump	Incinerator only	Incinerator and landfill	Sanitary landfill
Total	25	8	3	2	1	1	1	3
Under 100	9	5	1	1	-	-	-	2
100-499	10	2	2	1	-	-	-	5
500-999	3	2	-	-	-	1	-	-
1000-1999	2	-	-	-	-	-	1	1
2000 and over	2	-	-	-	1	-	-	1

Table 6

Total Costs and Per Capita Costs of Services for Refuse Collection and Disposal in 19 Cities of the Americas for a Recent Year

Country and city	Population	Total (U.S. dollars)			Per capita (U.S. dollars)		
		Collection	Disposal	Street cleaning	Collection	Disposal	Street cleaning
Argentina							
Buenos Aires	4,000,000	$ 968,500	$966,500	$1,717,400	$ 0.24	$ 0.24	$ 0.43
Resistencia	76,123	...	...	...	...	...	...
Bolivia-La Paz	350,000	47,500	...	...	0.14	...	...
Brazil							
Rio de Janeiro	3,200,000	$ 1,883,700		...	$ 0.59		...
Santos	250,000	573,900		...	2.29		...
São Paulo	3,750,000	...	...	...	...	...	...
Colombia-Medellin	600,000	...	...	...	...	...	...
Cuba							
Havana	1,200,000	$ 2,941,200				$ 2.45	
Ecuador							
Guayaquil	430,000	367,000	111,700	...	0.85	0.26	...
El Salvador							
San Salvador	242,000	152,810	-	76,512	0.63	-	0.32
Santa Ana	70,000	a) 33,364	-	...	a) 0.48	-	...
Honduras							
Tegucigalpa	100,000	...	...	...	...	...	...
Mexico							
Guadalajara	538,372	...	...	...	...	...	...
Mexico City	5,000,000		2,000,000			0.40	
Paraguay-Asunción	280,000	...	80,000 (16% of area and 30% pop.)				...
Peru							
Huacho	20,000	13,200	...	...	0.66	...	...
Uruguay							
Durazno	19,500	...	...	...	...	...	...
Montevideo	1,000,000	784,000	483,000	...	0.78	0.48	...
Venezuela-Maracaibo	358,000	823,000	72,500		2.30	0.20	
Sucre	230,000	843,000	41,700		3.67	0.18	...
Maracay	98,000	180,000	20,700		1.84	0.21	
Puerto Cabello	48,000	88,400	9,870		1.84	0.21	
Valencia	125,000	239,000	13,800		1.91	0.11	
Grenada							
St. George	88,806	15,600	-	...	0.18	-	...
Trinidad							
Port-of-Spain(a)	94,000	280,000	22,300	194,000	2.98	0.24	2.06
San Fernando	35,600	147,000	7,700	99,700	4.13	0.22	2.80

(a) Includes street cleaning.
- None
... Not stated

Table 7

Haulage Distance to Refuse Disposal Points in 5 Cities in the Americas, 1960

Country	City	Distance in kilometers
Brazil	Rio de Janeiro	25
	Santos	11
	São Paulo	13
Cuba	Havana	15
Mexico	Mexico City	16

Table 8

Manpower and Machine Power for Services of Refuse Collection and Disposal in 19 Surveyed Cities in the Americas, 1960

Country and City	Population	Manpower			Machine power
		Collection	Disposal	Street cleaning	
Argentina					
Buenos Aires	4,000,000	...	...	...	1,079 carts 252 trucks
Resistencia	76,123	...	...	...	80 hand carts, 2 closed vehicles, 12 carts, 1 large cart-horse drawn, 1 open tractor trailer
Bolivia-La Paz	350,000	108	...	...	8 trucks
Brazil					
Rio de Janeiro	3,200,000	8,000	455	...	120 trucks - city (50 compactors) 80 trucks - rented 500 wagons
Santos	250,000	...	10	...	...
São Paulo	3,750,000	4,360	200	600	450 trucks, 450 wagons
Colombia-Medellin	600,000	139		278	
Cuba					
Havana	1,200,000	...	...	...	2 bulldozers (for disposal only)
Ecuador					
Guayaquil	430,000	...	...	...	...
El Salvador					
San Salvador	242,000	56	10	157	14 six ton trucks Grinder, conveyor, front end loaders
Santa Ana	70,000	20	-	35	5 trucks
Honduras					
Tegucigalpa	100,000	35-40	-	...	10 open and closed trucks, 1 dump truck
Mexico					
Guadalajara	538,372	...	...	...	...
Mexico City	5,000,000	1,070		2,178	400 trucks, 18 mechanical street brooms, 1 flusher, 4 shovel cranes, 4 bulldozers, 1 front end loader
Paraguay-Asunción	...	40		60	12 trucks, 1 trac.
Peru-Huacho	20,000	...	4	...	2 trucks
Uruguay					
Durazno	19,500	...	...	...	Carts and trucks
Montevideo	1,000,000				Some open trucks and some closed trucks
Venezuela-Sucre	230,000	166	5	...	2 tractors, 37 trucks
Maracaibo	358,000	212	10	...	2 tractors, 1 crane, 47 trucks
Maracay	98,000	52	7	...	1 tractor, 1 earth-mover, 15 trucks
Puerto Cabello	48,000	24	3		1 tractor, 1 crane, 1 payloaper with 1 truck, 6 trucks
Valencia	125,000	88	3		1 tractor, 22 trucks
Grenada-St. George	88,806		35		3 trucks
Trinidad					
Port-of-Spain	94,000	...	17	...	Closed trucks, 1 D. U. Bulldozer, 1 small Ferguson Tractor
San Fernando	35,600	...	9	...	Closed trucks, 1 D. U. Bulldozer

... Not stated