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COSTA RICA
PRIVATE SOLID WASTE MANAGEMENT PROJECT

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COSTA RICA
PRIVATE SOLID WASTE MANAGEMENT PROJECT
INTRODUCTION

This advisor was contracted by I.C.M.A./U.S.A.I.D. to travel to Costa Rica to assess the feasibility of developing a municipal landfill to serve seven (7) cities in the west central area of the province of Alajuela.

The advisor has made three (3) visits to Costa Rica involving this project. These visits were on: 1) May 7-18, 1990; 2) June 20 - August 31, 1990; and 3) September 15-22, 1990.

The following is a report on the advisor's activities by chronological order. At the end of each section are attached copies of documents the advisor reviewed, developed or assisted in developing during different phases of the project. None of these documents are in final draft form because the advisor has not received final drafts from the project coordinator(s).

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May 7-8, 1990

This initial trip involved on-site visits to all the existing open dump sites in the municipalities of Grecia, Atenas, Naranjo, Valverde Vega, Palmares and Alajuela. On each visit a visual general appraisal was conducted to assess the current condition, size, problems and future potential as a future landfill site. These visits were conducted by RHUDO/CR personnel including Xavier Vela, Oscar Delgado, Heriberto Rodrigues and Joe Arington, RHUDO/CA and this advisor.

Various meetings were held with the Assistant Director and staff members of the Instituto de Fomento y Asesoria Municipal (IFAM), the Costa Rican project coordinator for the proposed project. These meetings were to inquire as to information, organizational structure, financial capabilities and staff support that would be provided toward the project.

Additional meetings were held with a member of INCAE, the Central American Institute for Business Administration, to plan and organize workshops for the targeted municipalities to discuss purpose of project, review and discuss technical recommendations and receive their required approval on policy actions and strategies.

The remainder of the visit was devoted in assisting Joe Arington (RHUDO/CA) to develop the attached Project Identification Paper.

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JUNE 20 - AUGUST 31, 1990

A. Information and Education

The first four weeks of this visit consisted basically of informing and educating Costa Ricans and staff on available technology and systems to handle solid waste.

This included participation by this advisor in a seminar and workshop under the direction of INCAE, the Central American Institute for Business Administration to: 1) discuss the purpose and importance of the project; 2) review and discuss technical recommendations; and 3) review project alternatives and approve required strategies, policies and programmatic actions. The seminar and workshop was attended by mayors, city councilmen and national government officials.

This advisor gave a presentation on the various technologies that can be used in the final treatment of refuse which include: 1) landfilling; 2) waste-to-energy; 3) recycling; 4) composting; and 5) landfill gas recovery. A video program and slides were used as aids to make this presentation.

As a result of the seminar and workshop, the mayors from the municipalities of Grecia, Atenas, Naranjo, Valverde Vega, Palmares, San Ramon and Alfaro Ruiz requested that this advisor and two staff members from the Instituto de Formento y Asesoria Municipal (IFAM) visit the above cities to educate the city managers and staff on solid waste

technology. After these staff meetings, this advisor and the two IFAM staff members were asked to attend city council meetings at each of the municipalities and to meet with neighborhood and various interest groups. The same information and education program was presented at all these meetings. The program was received well at most gatherings and most fears and opposition to siting a landfill in these communities were eliminated (there remained opposition at two neighborhoods due to financial interests by private parties).

All meetings were well attended and participation was excellent. Most meetings lasted 3-4 hours, some into late night hours. After each meeting, mayors, councilmen or neighborhood groups took us to private homes for late supper or midnight snacks, where we received excellent feed-back on the importance and interest to make the project a reality. Prior to these meetings, IFAM had not been able to get five of the seven participating municipalities to sign an agreement allowing the siting of a regional landfill in their jurisdiction (this agreement was crucial before U.S.A.I.D. would fund the project). Within one month after the meetings, all seven municipalities signed the agreement.

B. Data Gathering and Field Work

The next four weeks consisted of gathering, verifying and analyzing data for the project.

The long investment in educating the municipalities netted great results when this advisor and IFAM staff approached each municipality on solid waste data such as: collection routes, number of collection vehicles, number of solid waste personnel, operating costs, service fees, tonnage, and other statistics. The municipalities were outstanding in their cooperation. IFAM was able to update all past statistics and data and to acquire new information never released by the municipalities to them before.

All of the municipalities' record keeping systems were reviewed and with the assistance of IFAM's technical staff and other resources, we were able to help each municipality acquire or repair computers and train staff to operate them. In addition, we were able to convince all seven of the municipalities to adopt the same record keeping systems. IFAM provided the software and training. This will allow for better record keeping as well as uniform data gathering for project monitoring and evaluation of costs, efficiency, services, etc.

Each of the municipalities participating in the regional project was asked to nominate potential sites for the landfill. Six possible sites were nominated by five of the municipalities (One municipality, Alfaro Ruiz, was too remote from the others to locate the landfill. The other, Palmares, did not have land other than the small open dump already used up.). This advisor and the staff from IFAM visited each site and appraised the site as to: size,

location, accessibility, wind direction, distance from airplane routes, soil conditions, surface water locations, distance from water wells, rivers, springs, aquifers, drainage, seismic faults and possible market value. Topographic surveys were conducted on two sites to determine possible volumes and size of area. The other sites will be surveyed by IFAM staff and hydrological soil analysis, geological and other required studies will be conducted on each of the five sites before a final selection is made. (A landfill site selection rating sheet is included on page 21 of Annex F.)

C. Preparation of Project Paper

The final weeks of this visit were devoted to work with USAID/RHUDO/CR staff, IFAM staff and Joe Arington/RHUDO/CA in developing the Project Paper for Private Solid Waste Management.

This advisor developed Annex F (Technical Analysis), and Annex I (Environmental Assessment) and assisted in the development of III, Project Description, Annex J (Scope of Work) and Annex H (Analysis Financiero). The advisor also reviewed the entire project paper and made suggestions and comments where he thought they were needed.

D. Additional Activities for U.S.A.I.D.

1. This advisor reviewed the attached proposed project for E.A.R.T.H. Visited the school at Guacimo and made recommendations to the project engineer on how to

develop a landfill for the school, the type of equipment needed to operate the landfill, how to develop a waste characterization program for recycling, programs for implementing a waste recycling project, how to develop a composting operation using the waste from the school's cafeteria, the cattle pens and the school's banana plantation.

This advisor is presently assisting the school with the problem of the plastic bags that are used to protect the bananas until they are harvested. A company in San Antonio has conducted chemical tests to see if any insecticide residue is left on the bag after harvest. Indications are the residue is non-toxic and the company is working on a possible market for the bags in Japan.

2. This advisor was asked to assist IFAM in evaluating the solid waste problems confronting the Southern Costa Rican cities of Golfitos and Corredors on the Panamanian border. Meetings were held with the City Managers from these two cities and two sites were evaluated for possible landfill sites. IFAM was given criteria by this advisor on how to design a regional landfill site with recycling capabilities for these municipalities.

3. The mayor of San Jose also asked that this advisor meet with him and his staff to assess the solid waste problems confronting the metropolitan area of San Jose.

Discussions on this issue were held with the mayor, his staff, IFAM's staff and members of RHUDO/CR.

4. The advisor was also invited to assist IFAM in conducting a one-day environmental seminar for the province of Alajuela. The seminar was attended by the governor of Alajuela, national legislators and about eighty (80) middle and high school teachers.

   The seminar was well received and resulted in the formation of a national environmental association for teachers to lobby the Costa Rican legislator on environmental issues and policies.

E. Activities on Personal Time

1. At the INCAE seminar and workshop during my presentation on technologies for treating solid waste, I suggested that Costa Rica was ideal for making compost from solid waste because such a high percent (90-95%) was organic matter; however, the Assistant Minister of Health for Costa Rica rebutted my suggestion and told the participants to forget about composting because it would never work in Costa Rica due to high humidity.

   One of the participating officials came to me after the seminar and requested that I visit his farm in Turrialba (one of the hottest and most humid areas on the Atlantic side of Costa Rica) and assist him in setting up a composting operation. We visited Turrialba and assisted the farmer to set up a

composting operation using waste from coffee, sugar cane, saw mills and from a quail farm.

2. Assisted a private businessman interested in developing a solar energy product manufacturing plant in Costa Rica by introducing him to a solar energy project manufacturer in San Antonio, Texas. The Costa Rican businessman has visit San Antonio and apparently worked out an agreement with the manufacturer in San Antonio for exchange of technology and patent fees.

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SEPTEMBER 15-22, 1990

This visit was basically devoted to making a final review and comments on the entire Project Paper. Approximately three (3) days of this visit was devoted to meetings on this task.

The final days on this visit were spent in assisting and participating in a two day seminar on the solid waste problems facing the metropolitan area of San Jose. (This issue had been discussed with the mayor of San Jose at the previous visit.) Major participants which included national government officials, municipal government members from the surrounding municipalities, IFAM and U.S.A.I.D. personnel.

At the seminar the advisor made the recommendation to develop a regional authority which would operate as an independent, self-financing, enterprise fund responsible to an independent board appointed by the metropolitan municipalities. The suggestion was well received (other consultants had made the same suggestion). The consensus was to study the recommendation and proceed with developing a detail plan with the assistance from IFAM and the Ministry of Health.

NOTE: The main obstacle to adopting this plan is the problem itself, the present administration of San Jose. <All the other metropolitan municipalities are in agreement that the present personnel operating the regional solid waste functions are not capable of doing a proper job. However, politicians in San Jose are supporting their appointees.>

ICMA (Mike & Steve) have assisted in this project by providing metropolitan mayors and councilmen with ordinances from U.S. cities on enterprise funds, service fees, etc.

Activities on Personnel Time

1. This advisor visited the farm in Turrialba at the request of the owner and was shown a very successful composting operation. The owner plans to double the operation by the end of this calender year.
2. At the seminar, the advisor was approached by a private Cost Rican businessman to assist him and a priest, that works with Cost Rican orphans, to acquire information on plastic recycling. The advisor is currently working on this and trying to find this group markets for the sales of recycled plastic.

ANNEX F

TECHNICAL ANALYSIS

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ANNEX F

TECHNICAL ANALYSIS

Accelerated urban growth in Costa Rica over the past decade has substantially increased the need for improved and expanded solid waste collection and treatment services. This annex sets out the basic technical criteria which will be used by IFAM[1/] during project implementation to guide required improvements in municipal solid waste collection systems as well as for the design, construction and operation of a sanitary landfill. It also describes the process and results of preliminary studies of alternative proposed sites for the model sanitary landfill to be developed.

I. CRITERIA FOR MUNICIPAL SOLID WASTE COLLECTION SYSTEMS

Even as IFAM estimates that less than half of the 1,500 metric tons of daily waste generated nationally are collected, solid waste collection and disposal typically constitutes the single largest deficit item in municipal budgets and produces the highest amounts of overdue and uncollectible charges. This section sets out criteria to be utilized during project implementation to improve the efficiency and effectiveness of existing solid waste collection systems in each participating municipality. It is estimated that coverage of collection services can be increased by between 20 to 25 percent through their application.

A. General

1. Purpose, scope, and applicability

   (a) The purpose of this part is to establish minimum criteria for Municipal Solid Waste Collection systems. These minimum criteria ensure the protection of human health and the environment.

   (b) These criteria apply to owners and operators of municipal solid waste collection systems.

   (c) The owners or operator of a municipal solid waste collection system must comply with any other applicable rules, laws, regulations, or other requirements.

1/ While only IFAM is explicitly referred to in this Annex as being responsible for the application of project standards and criteria, the fullest possible participation of other national authorities responsible for specific aspects (e.g. Ministry of Health, SENARA, and A y A) is implied and expected.

B. Routing

1. Existing policies that directly affect routing and collection efficiency should be reviewed, evaluated, and changed. Policies which primarily relate to levels of service, include:

   Point of collection (distances from street to storage)
   Frequency of collection
   Type and weight limits of storage
   Garden waste collection
   Bulky waste (furniture, ect.) collection
   Separated versus combined collection

2. Existing methodologies that directly effect routing and collection efficiency should be reviewed, evaluated, and changed. Methodologies, or on-the-route practices include:

   Crew size
   Type and capacity of collection vehicles
   One-side versus two-sides-of-the-street collection
   Fixed lunch site and time
   Collection by drivers
   Incentive programs
   U-turns and vehicle backing
   Completely filling vehicles before going to disposal site.

3. Macro-routing determines the assignment of daily collection routes to existing disposal sites. The objective is to optimize the use of the disposal facilities in terms of the daily and long-range capacities and operating costs of the facilities, while minimizing the round trip haul time (and hance the hauling costs) from the collection routes to the disposal sites.

   (a) Information essential to macro-routing includes:

   Haul times from routes to the various disposal sites
   crew size
   vehicle capacity
   expected arrival time
   queue time
   service times of site
   short and long-range capacities of site
   location of sites.

4. Districting and route balancing determines a fair day's work and divides the collection areas into balance routes so that all work crews have equal workloads. This is achieved through a careful evaluation of how the collection crew spends its time.

5. Micro-routing looks in detail at each daily collection service area to determine the path that the collection vehicle should follow as it collects from each service on its route.

   (a) The objective is to minimize the driving time on the collection route through minimizing the haul distance (i.e., street segments that have no services or that are traversed more than once), backing of vehicles, u-turns, left turns, collection on major streets during rush hour traffic and other delay times.

(b) All the information required for routing can be recorded on community maps.

(1) Record on the community map(s) the number and type (residential, apartment, commerical, institutional, industrial) of services per street segment for each side of the street. The remaining street segments with no services on them are non-collection segments.

(2) Identify all one-way, dead-end, and heavily traveled streets. Indicate which corner-lot residents (if any) should be asked to place their waste on a specific street segment.

(3) Indicate, for each street segment or service area, whether the crews are to collect one or both sites of the street on a pass.

(c) Rules for micro-routing

(1) Routes should not be fragmented or overlapping. Each route should be compact, consisting of street segments clustered in the same geographical area.

(2) Total collection plus haul times should be reasonably constant for each route in the community (equalized workloads).

(3) The collection route should be started as close to the garage or motor pool as possible, taking account heavily traveled and one-way streets. (See rules 4 and 5)

(4) Heavily traveled streets should not be collected during rush hours.

(5) In case of one-way streets, it is best to start the route near the upper end of the street, working down it through a looping process.

(6) Services on a dead end streets can be considered as services on the street segments that they intersect, since they can only be collected by passing down that street segment. To keep left turns at a minimum, collect the dead end streets when they are to the right of the truck. They must be collected by walking down, backing down, or making a u-turn.

(7) When practical, steep hills should be collected on both sides of the street while vehicle is moving down hill for safety, ease, speed of collection, and wear on vehicle, and to conserve gas and oil.

(8) High elevations should be at the start of the route.

(9) For collection from one side of the street at a time, it is generally best to route with many clockwise turns around the block.

Rules 8 and 9 emphasize the development of a series of clockwise loops in order to minimize left turns, which generally are more difficult and time-consuming than right turns.

(10) For collection from both sides of the street at the same time, it is generally best to route with long, straight paths across the grit before looping clockwise.

(11) For certain street block configurations within the route, specific routing patterns should be applied.

C. Criteria for Collection System Operations

1. Collection requirements.

All putrescible animal and vegetable waste materials should be collected at least once per week.

2. Vehicles and equipment.

All collection vehicles should have written instructions with diagrams for each collection route, where to dump and procedures to follow in case of accidental spillage.

(a) All collection vehicles should be water tight to prevent the spillige of liquid on routes.

(1) All collection spillages should be cleaned by the operator/crew as soon as possible. All spillages areas should be washed down as soon as possible after clean-up.

(b) All collection vehicles should have a pre-flight check list for operators to check before vehicle leaves garages or motor pool each morning.

(c) All collection vehicles should be in good operating condition and pass safety inspection every morning before leaving garage or motor pool.

(d) Safety procedures for operation of packing mechanizim, backing-up and making u-turns should be adopted and enforced.

(e) Safety procedures for labors riding outside vehicles during collection should be adopted and enforced.

(f) A schedule to stagger collection vehicle arrivals at the landfill should be adopted and enforced. (A staggered schedule allows the landfill operator to spread and compact the waste material more efficiently and to keep the site under better environmental control. It also reduces congestion and elimination of long costly waits by collector crews.)

(g) All collection vehicles should be washed and disinfected a minimum of twice per week.

D. Criteria for a Record Keeping system of Solid Waste Collection System

1. A basic system of record keeping for collection system should be adopted and enforced. See attached forms for guidelines at end of this annex.

E. Criteria for Cost Accounting of Solid Waste Collection System

1. A basic system of cost accounting and record keeping should be adopted and enforced. See attached forms for guidelines at end of this annex.

II-CRITERIA FOR MUNICIPAL SOLID WASTE LANDFILLS

The project will represent the first attempt to install a technically and environmentally sound approach to the treatment of solid waste. This pilot demonstration effort with participating municipalities will allow other municipalities and the central government to assess both the costs and the benefits of proper solid waste treatment. This section sets out basic criteria to be used for site selection, design and operation and maintenance of the sanitary landfill(s) to be developed under the project. Annex I provides more detailed environmental criteria for the development and operation of project sanitary landfills.

A. General

1. Purpose, Scope, and Applicability

(a) The purpose of this part is to establish minimum criteria, for municipal solid waste landfills. These minimum criteria ensure the protection of human health and the environment.

(b) These criteria apply to owners and operators of municipal solid waste landfills.

(c) These criteria apply to all municipal solid waste landfills.

(d) Municipal solid waste landfills failing to satisfy these criteria are considered open dumps.

2. Definitions

Unless otherwise noted, all terms contained in this part are defined by their plain meaning. This section contains definitions for terms that appear throughout this part; additional definitions appear in the specific sections to which they apply.

"Active life" means the period of operation beginning with the initial receipt of solid waste and ending at completion of closure activities.

"Active portion" means that part of a facility or unit that has received or is receiving wastes and that has not been closed.

"Aquifer" means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs.

"Closed unit" Means any solid waste disposal unit that no longer receivers solid waste and has received a final layer of cover material.

"Commercial solid waste" means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

"Existing unit" means any solid waste disposal unit that is receiving solid waste, excluding residential and industrial wastes.

"Existing unit" means any solid waste disposal unit that is receiving solid waste and has not received a final layer of cover material.

"Facility" means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

"Ground-water" means water below the land surface in a zone of saturation.

"Household waste" means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (Including single and multiple residences, hotels and motels, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

"Industrial solid waste" means solid waste generated by manufacturing or industrial processes that is not a hazardous waste. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: Electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/ foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone; glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

"Landfill" means an area of land or an excavation in which wastes are placed for permanente disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile.

"Lateral expansion" means a horizontal expansion of the waste boundaries of an existing landfill unit.

"Leachate" means a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.

"Municipal solid waste landfill" means any landfill or landfill unit that receives household waste. This landfill also may receive other types of wastes, such as commercial waste, nonhazardous sludge, and industrial solid waste. Such a landfill may be publicly or privately owned.

"New unit" means any solid waste disposal unit that has not previously received solid waste. A new unit also means lateral expansions as defined in this section.

"Open burning" means the combustion of solid waste without:

(1) Control of combustion air to maintain adequate temperature for efficient combustion.

(2) Containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and

(3) Control of the emission of the combustion products.

"Operator" means the person responsible for the overall operation of a facility or part of a facility.

"Owner" means the person who owns a facility or part of a facility.

"Run-off" means any rainwater, leachate, or other liquid that drains over land from any part of a facility.

"Run-on" means any rainwater, leachate, or other liquid that drains over land onto any part of a facility.

"Saturated zone" means that part of the earth's crust in which all voids are filled with water.

"Sludge" means any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of the treated effluent from a wastewater treatment plant.

"Solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges.

"Solid waste disposal unit" means a discrete area of land used for the disposal of solid wastes.

"Waste management unit boundary" means a vertical surface located at the hydraulically downgradient limit of the unit. This vertical surface extends down into the uppermost aquifer.

3. Consideration of other laws.

The owner or operator of a municipal solid waste landfill unit must comply with any other applicable rules, laws regulations, or other requirements.

B. Location Restrictions

1. Airways

A municipal solid waste landfill unit that may attract birds and is located within 10,000 feet (3.048 meters) of any airport runway used by turbojet aircraft or within 5.000 feet (1.524 meters) of any airport runway used by only piston-type aircraft shall not pose a bird hazard to aircraft.

2. Floodplains.

(a) A Municipal solid waste landfill unit located in the 100-year floodplain shall not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.

(b) For purposes of this section:

(1) "Floodplain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, that are inundated by the 100-year flood.

(2) "100-year flood" means a flood that has a 1-percent or greater chance of recurring in any given year or a flood of a magnitude equalled or exceeded once in 100 years on the average over a significantly long period.

(3) "Washout" means the carrying away of solid waste by waters of the base flood.

3. Wetlands.

(a) Municipal solid waste landfill units shall not be located in wetlands, unless the owner or operator can make the following demostrations.

(1) There is no practicable alternative that would have less adverse impact on the wetlands and would have no other significant adverse environmental consequences;

(2) The landfill will not:

(i) Cause or contribute to violations of any applicable water quality standard.
(ii) Violate any applicable toxic effluent standard.
(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat.

(3) The landfill will not cause or contribute to significant degradation of wetlands;

(4) Appropriate and practicable steps have been taken to minimize potential adverse impacts of the landfill on the wetlands; and

(5) Sufficient information is a available to make a reasonable determination with respect to these demostrations.

(b) As used in this section, "wetlands" means those areas that are inundated or satured by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevlence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to, swamps, marshes, bogs, and similar areas.

4. Fault areas

(a) New units of a municipal solid waste landfill shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time.

(b) For the purposes of this section:

(1) "Fault" means a fracture along which strata on one side have been displaced with respect to that on the other side.

(2) "Displacement" means the relative movement of any two sides of a fault measured in any direction.

(3) "Holocene" means the most recent epoch of the Quarternary period, extending from the end of the Pleistocene to the present.

5. Seismic impact zones.

(a) At a new municipal solid waste landfill unit located in a "seismic impact zone," all containment structures, including liners, leachate collection systems, and surface water control systems, must be designed to resist the maximum horizontal acceleration in lithified material for the site.

(b) As used in paragraph (a) of this section, "seismic impact zone" means an area with a 10 percent or greater probability that the maximum horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 250 years.

(c) As used in paragraph (a) of this section, the "maximum horizontal acceleration in lithified material" means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 90 percent or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

6. Unstable areas

(a) The owner or operator of a municipal solid waste landfill unit located in an unstable area must demostrate to IFAM that engineering measures have been incorporated into the unit's design to ensure the stability of the structural components of the unit. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(b) As used in this section, "structural components" means liners, leachate collection systems, final covers, run-on/run-off systems, and any other component necessary for protection of human health and the environment.

(c) Units of a municipal solid waste landfill located in unstable areas that cannot make the demonstration specified in paragraph (a) of this section must close.

C. Design Criteria

1. All municipal solid waste landfill units must be designed with liners, leachate collection systems, and final cover systems, as necessary, to ensure that the design goal established under paragraph (2) of this section is met in the aquifer at the waste management unit boundary, or an alternative boundary, as specified by the IFAM under paragraph (4) of this section.

2. IFAM must establish a design goal for all MSWLF units. This design shall, at a minimum, achieve a ground-water carcinogenic risk level with an excess lifetime cancer risk level (due to continuous lifetime exposure) within the 1x10-4 to 1x10-7 range.

3. When establishing the design necessary to comply with paragraph (1) of this section, IFAM shall consider at least the following factors:

(a) The hydrogeologic characteristics of the facility and surrounding land;

(b) The climatic factors of the area;

(c) The volume and physical characteristics of the leachate;

(d) Promixity of gound-water users; and

(e) Quality of ground water.

4. IFAM may establish an alternative boundary to be used in lieu of the waste management unit boundary. The alternative boundary shall not exceed 150 meters from the waste management unit boundary and shall be located on land owned by the owner or operator of the MSWLF. The establishment of the alternative boundary shall be based on analysis and consideration of at least the following factors:

   (a) The hydrogeologic characteristics of the facility and surrounding land;

   (b) The volume and physical and chemical characteristics of the leachate;

   (c) The quantity, quality, and direction of flow of ground water;

   (d) The proximity and withdrawal rate of the ground-water users;

   (e) The availability of alternative drinking water supplies;

   (f) The existing quality of the ground water, including other sources of contamination and their cumulative impacts on the ground water;

   (g) Public health, safety, and welfare effects; and

   (h) Practicable capability of the owner or operator.

   (i) All municipal solid waste landfill units must be equipped at closure with a final cover system that is designed to prevent infiltration of liquid through the cover and into the waste.

D. Operations and Maintenance

1. **Fire Protection.** An adequate stockpile of earth reasonably close to the active disposal area and sufficient on-site equipment for movement of that earth shall be provided at sites. Accidental fires shall be promptly extinguished. The potential for accidental fires shall be minimized by proper compaction and earth cover.

2. **Unloading.** Unloading of solid waste shall be confined to as small an area as practical. An attendant shall be on duty during operating hours at sites to direct unloading of solid waste. Where an attendant is not provided, appropriate signs must be used to indicate where vehicles are to unload. The use of forced access lanes, identified by ditches, dikes, fences, or other means, may be used in lieu of signs and may be required by IFAM for the prevention of indiscriminate dumping where signs and/or other methods have proven ineffective.

3. **Access Control.** Uncontrolled access and dumping of unauthorized materials shall be prevented. Waste unloading shall be closely monitored to assure that only allowable wastes are accepted. Any anauthorized wasted shall be removed from the site and taken to an approved disposal facility.

4. **Control of Windblown Material.** Windblown material shall be collected and returned to the active disposal area as necessary to minimize unhealthy, unsafe, or unsightly conditions. A portable fence or other suitable means shall be employed to confine windblown material resulting from unloading, spreading, and compaction operations to the smallest area practical.

5. **Easement Protection.** All pipeline and utilily easements shall be clearly marked with posts which extend at least six feet above ground level, spaced at intervals no greater than 300 feet. No solid waste disposal shall occur within such easements and associated required buffer zones and in no case shall solid waste disposal occur within 25 feet of the centerline of any utility line or pipe unless otherwise authorized by IFAM. Where on-site access roads, drainageways, or levees cross such easements, the site operator is responsible for obtaining the concurrence of the easement owner.

6. **Boundary Buffer Zones.** Unless otherwise authorized by IFAM, a minimum separating distance of 50 feet shall be maintained between disposal operations and the boundary of the site to allow area for visual screening, surface drainage facilities, flood protection facilities, and a safety margin for methane gas and leachate migration. In no case shall this zone be narrower than that necessary to provide safe passage for firefighting or other emergency vehicles. IFAM encourages the establishment of a greenbelt along the property line. In all cases, the site boundaries as defined in the permit shall be clearly marked. If the site boundaries are not fenced, posts which extend at least six feet above ground level shall be placed at each corner and along each boundary at intervals no greater than 300 feet. The site operator of each existing permitted site shall submit a property description of the site and mark the boundaries in accordance with this section.

7. **Materials Along Route to Site.**

   (a) The site operator shall authorize only persons operating vehicles which comply with the following requirements to dispose of waste at the site.

      (1) All vehicles and equipment used for the collection and transportation of municipal solid waste shall be constructed, operated, and maintained to prevent loss of liquid or solid waste material and to minimize health and safety hazards to solid waste management personel and the public.

      (2) Collection vehicles and equipment shall be maintained in a sanitary condition to preclude odors and fly breeding.

      (3) Collection vehicles not constructed with an enclosed transport body shall use other devices such as nets or tarpaulins to preclude accidental spillage.

(b) Where the site operator fails to enforce these requirements, he shall be responsible for prompt cleanup of all waste materials spilled along and within the rights-of-way of all public access roads serving the site.

8. **Screening of Deposited Waste.** Screening shall be provided to minimize the visibility of deposited waste materials where the department determines a need for such screening or where permit or design requirements so dictate.

9. **Disposal of Large Items.** Special provisions shall be made for the disposal of large, heavy, or bulky items which cannot be incorporated in the regular spreading, compaction, and covering operations.

10. **Burning.** Burning of solid waste is prohibited.

11. **Vector Control.** Conditions favorable to the production or harboring of vectors shall be minimized through proper compaction and covering procedures. Approved chemical controls shall be employed when necessary.

12. Site Access Roads.

    (a) All-weather roads shall be provided within the site to the unloading area(s) designated for wet-weather operation. The tracking of mud and trash onto public roadways from the site shall be minimized.

    (b) Dust from on-site and other access roadways shall be prevented from becoming a nuisance to surrounding areas. A water source and necessary equipment or other approved means of dust control shall be provided.

13. **Salvaging and Scavenging.** Salvaging shall not be allowed to interfere with prompt sanitary disposal of solid waste or to create public health nuisances. All salvaged materials shall be removed from the site at such intervals as necessary to prevent an excessive accumulation of the material at the site.

14. **Endangered Species Protection.** The facility and the operation of the facility shall not result in the destruction or adverse modifications of the critical habitat of endangered or threatened species, or cause or contribute to the taking of any endangered or threatened species.

15. **Gas Control.** Methane and other decomposition gases shall not be allowed to migrate laterally from the landfill site so as to endanger structures, vegetation, or occupants of adjacent properties. Any structures subsequently constructed on the landfill site should contain provisions for the venting of decomposition gases to preclude their accumulation in explosive or toxic concentrations beneath or within the structures. The concentration of methane generated by the solid waste site should not exceed 25% of its lower explosive limit in on-site structure (excluding gas control or recovery system components) and it shall not exceed its lower explosive limit at the property boundary. The lower explosive limit is the lowest percent by volume of a mixture of methane which will propagate a flame in air at above 25 grades C and atmospheric pressure.

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16. **Abandoned Water Wells.**

(a) The site operator shall immediately notify IFAM in writing of the location of any and all existing abandoned water wells situated within the site upon such discovery during the course of site development. The site operator shall, within 30 days of such a discovery, provide IFAM with written certification that all such wells have been capped, plugged, and closed.

17. **Compaction, Intermadiate Cover, and Final Cover.**

(a) Solid waste shall be spread and compacted evenly by repeated passages of suitable compaction equipment, such that each layer of solid waste is thoroughly compacted to a thickness of approximately two feet.

(b) Intermediate cover shall be six inches of well compacted earthen material not previously mixed with garbage, rubbish, or other solid waste to prevent the blowing of waste materials and to prevent insect and rodent problems.

(1) Intermediate cover shall be applied as follows:

(i) Where daily cover is required, all solid waste deposited each day shall be provided with intermediate cover by the end of the working day.

(c) The entire surface of each completed portion of the fill shall be provided with final cover within 30 days unless inclement weather would prevent the application of any cover material.

(1) The final cover shall consist of no less than two feet of soil.

(i) The first 1 1/2 feet or more of cover, see paragraph (2) of this subsection, shall be of clayey soil, compacted in layers of no more than six inches to help minimize the water infiltration potential. Other types of soil may be used with prior approval.

(ii) The final six inches of cover shall be of suitable topsoil which will sustain the growth of vegetation, and shall be seeded or sodded during the first growing season following application of final cover to help minimize erosion.

(2) Final cover grades shall not exceed 6.0%--six feet vertical (v) to 100 feet horizontal (h)--unless an erosion control plan has been developed by the owner/operator and approved by IFAM. Disposal of solid waste above natural ground level is prohibited unless pursuant to an engineering Site Development Plan approved by IFAM.

(3) Erosion of cover shall be repaired by restoring the cover material, grading, compacting, and seeding it as necessary. Such periodic inspections and restorations are required during the site operational life and for a minimum of five years after closure.

(4) The on-site ponding of water upgradient of deposited waste shall be prevented, unless IFAM is assured that such ponding does not pose a potential leachate generation threat.

18. **Odor and Air Pollution Control.**

(a) Any ponded water at the site shall be controlled to avoid its becoming a source of obnoxious odors. In the event objectionable odors do occur, appropriate measures, such as chemical treatment, shall be taken to alleviate the condition.

E. Final Use of Site

The final use of the proposed landfill site is a planned regional recreation area. It is believed that in approximately 20 years the proposed landfill site will be surround by urban areas of some density.

1. **Site Completion and Closure Procedures.**

(a) At least one year prior to completion of disposal operations or abandonment of a site, the site operator shall notify IFAM and provide an updated closure schedule for the cessation of waste acceptance and completion of the closure of the site.

2. **Post-Closure Maintenance.** For at least the first five years after closure, the site operator shall maintain the right-of-entry and periodically inspect his closed site and correct as necessary any problems associated with erosion of cover material, vegetative growth, leachate or methane migration, and subsidence or ponding of water on the site. If any of these problems persist for longer than the first five years, the site operator shall be responsible for their correction until IFAM determines the problems have been adequately resolved.

3. **Post -Closure Use of Landfilled Areas.**

(a) Because of the potential hazard to public health, groundwater, and the environment if closed landfilled areas are disturbed, IFAM retains regulatory control over any activities which may affect the integrity of the landfill cover, drainage, liners, or monitoring system. Activities such as relocating waste from a closed landfill, extracting materials for energy, or material and gas recovery shall not be undertaken unless prior approval is obtained from IFAM.

(b) Although IFAM approval is not necessary for post-closure uses of landfills, IFAM believes the information found in paragraphs 1 - 8 of this subsection should be considered.

(1) Enclosed ground level and underground structures should be avoided due to the potential for explosive concentrations of methane gas.

(2) Examples of uses for landfills not requiring enclosures are agricultural lands, parks, playgrounds, golf courses, and open parking or storage areas.

(3) The ponding of water, excessive irrigation, or plowing to a depth below the topsoil should not be allowed unless there is assurance that percolation of moisture into the buried waste will not occur.

(4) Concentrated loadings should be avoided to prevent uneven settlement.

(5) If enclosed structures are built, means must be provided for natural ventilation to prevent the accumulation of the potentially explosive methane gas. An example would be structures which use an open first level for parking, etc., to allow natural ventilation.

(6) The effectiveness of landfill cover and the bottom liner of barrier must not be disturbed when structures are built, particularly when pilings are used.

(7) Consultation with IFAM may be desirable prior to initiating certain activities to determine the types of wastes deposited, depth of waste cells, previous maintenance problems, etc.

(8) Such things as underground utilities that cross one or both of the site boundaries should be avoided. If they cannot, a properly located and gravel-packed gas vent should be placed at each property boundary crossed to prevent methane gas migration along the pipeline, etc., to off-site structures.

F. Criteria for Evaluating Operations and Maintenance of Landfill.

1. Inspection of sites by regulating authorities

(a) Landfill site(s) should be inspected by IFAM personnel a minimum of every 15 days to ensure that operation/owner of landfill site is complying with all the design, operation and monitoring criteria.

2. Criteria Check List

The following criteria check list can be used in evaluating proper landfill operations and maintenance:

(a) Landfill Entrance

Informational and directional signs posted?
Appearance and cleanliness acceptable?
Entrance secured when site not operating?
Security guards when site not operating?

(b) Personnel

Attendent present when site is in use?
Scale house properly manned?
Safety equipment available and in use?

(c) Disposal Area

Spotter directing traffic at working face?
Unloading area clearly marked?
Public and municipal/commercial operations separated?
Is working face as small as possible?
Litter fences in use?
Refuse burning?
Oder problems?
Dust or litter blowing
Daily cover applied?
Refuse compaction sufficient?
Final cover and vegetation in place?

(d) Salvage Practices

Scavanging prohibited?
Separate salvage area established?
Salvage area free of litter and vermin
Salvage materials promptly removed?

(e) Water Quality

Working and filled areas graded to prevent ponding?
Run off from adjoining areas diverted from site?
Adequate leachate collection system?
Leachate treatment performing as designed?

(f) Vector Controls

Any rodent problem?
Any bird problem?
Any insect problem?

(g) Monitoring Program

Gas and groundwater observation and sampling wells installed?
Gas and groundwater monitoring schedule established?
Monitoring data on file?

(h) Fire Protection?

No smoking rules in force?
Water available at working face?
Stockpile soil available?
Fire extinguishers on all equipment?
Radio or telephone on site?

(i) Housekeeping

Appearance and cleanliness acceptable?
Site pleasing to the eye?
Access roads and entrance litter free?
Site free of scattered litter?

(j) Documents

Permit or license on display?
Development plans available?
Operational plans available?
Operating cost records on file?
Daily records of incoming vehicles and volume and type of waste?

G. Environmental Monitoring Criteria

Reference Environmental Annex I

H. Criteria for Selection and Procurement of Landfill Equipment

1. Selecting the right machine for size of landfill

The most important step in constructing and operating an efficient, effective landfill is machine selection. Landfills must have nearly 100 percent machine availability. Refuse can't wait. It has to be spread, compacted and covered every day!

(a) The sanitary landfill will require appropriate and adequate machinary to:

Prepare site
Spread and compact trash
Excavate and transport cover
Spread and compact daily and final cover
Do utility and clean-up work

(1) Waste spreading and compaction machines dispose of the waste at the site. Track-types tractors and steel-wheeled compactors are the primary machines for such use.

(2) Cover excavating and transportation machines provide daily, intermediate and final cover and do earthmoving functions at the landfill. The landfill may assign cover work and earthmoving functions to a track-type tractor for short hauls of 0-300 feet or wheel tractor-scraper for long hauls of more than 300 feet.

(3) Site preparation, utility work and clean-up can be assigned to track-type tractors and wheel tractor-scrapers.

(b) Total population served and total daily tonnage of landfill governs choice of equipment.

(1) If an area of about 100,000 - 150,000 population generates about 200 tons daily, the landfill criteria should consider a track-type tractor, a steel-wheel compactor and a wheel tractor scraper of medium weight and horse power.

2. Support Machinary

(a) Support machinary such as light pick-up trucks, water spray truck/fire truck should be obtained as needed.

III. Preliminary Studies of Proposed Sites

The preliminary studies of the proposed sites consisted of the following activities.

A. Visits to all proposed sites and all participating municipalities.

1. Since all of the municipalities involved in this project had expressed great concern about the inefficiency of their solid waste collection systems and unsatisfactory methods of solid waste disposal, IFAM conducted a series of visits to each of the cities to explain the real concept of sanitary landfills and the scope of the proposed project.

2. Each municipality was provided with a series of handouts reflecting the minimum criteria as to what a sanitary landfill should encompass.

3. The municipalities were asked to submit at least five potential site locations which would then be visited and evaluated by IFAM engineers and technicians, using basic existing data reference to geology, hydrology, soil analysis and other pertinent criteria.

4. Two seminars were conducted by IFAM for mayor, city councils and city managers to discuss, question and develop a consensus on the proposed project.

5. Following the second seminar, six of the municipalities and the municipal league of Western Alajuela invited 2 members of IFAM and the ICMA consultant to USAID to make presentations at each city's council meeting on waste collection systems and waste disposal methods in the U.S.A. and Latin America.

6. Next, on site visits and primary evaluations of each of the proposed sites were conducted.

(a) The site proposed by Grecia had already been analysed and approved; however, there exists some controvery on that site so they have submitted another location which has not been visited.

(b) The site proposed by Valverde Vega appears adequate in size; however, it appears that the development of the access roads would be too costly. Also, the property is an excellent producting coffee finca which would make the purchase price very high.

(c) The site proposed by San Ramón, an abandoned gravel pit, appears adequate in size. But San Ramón is the farthest location of all the municipalities and this would incur high transportation costs.

(d) The site proposed by Naranjo is centrally located, appears to be of adequate size, and has good access roads.

B. Review of existing technical data on proposed sites

1. Hydrology

Existing well logs were obtained from Servicio Nacional de Aguas Subterraneas, Riego y Avenamiento (SENARA) for all the proposed site locations. These logs appear to have some good basic data as to the location of water wells, depth of wells, depth of static water levels, major aquifer locations, and some core samples of soil profiles. These documents need further study and analysis.

2. Geology

The well logs obtained from (SENARA) also appear to contain some basic data on the geology of the proposed sites. IFAM engineers, and technicians will visit other public agencies in the following weeks to obtain more information on this item.

3. Topography

A preliminary topographic survey has been conducted on the proposed site at San Ramón. All other sites will be surveyed in the next few weeks. In addition, aerial maps are going to be obtained from the Ministry of Transportation of all the proposed sites.

C. Prioritization of Sites

1. A prioritization matrix has been developed to evaluate each site. (See attached) This matrix will be filled in as each of the studies is complete for each site.

ATTACHMENT No. 3

Estimated Costs for Present System

Nov. 6, 1990

City of Guayaquil

* Estimated total population 1990	2,044,000
** Estimated waste generated per day/person	.6 kilograms
Estimated total tons/day	1226
Estimated ton collected / day	490.4

Estimated cost/ton of waste collected

*** Estimated total direct costs (1990 City Budget)	S/.4,986,164,564
**** Estimated total indirect costs (1990 City Budget)	S/.1,932,000,000
Estimated total 1990 Budget for department	S/.6,918,164,564

Estimated total waste collected for 1990 178,996 Tons

Estimated Cost per Ton of wasted collected:

$$S/.\ \frac{6,918,164,564}{178,996\ \text{Tons}} = S/.\ 38,650 = \$44.58/\text{Ton}$$

* Oct. 1990 study by Dr. Gomez
** Oct. 1990 report by Dr. Gomez
*** City of Guayaquil 1990 Budget
**** City of Guayaquil 1990 Budget. Ing. Díaz
***** Nov. 6, 1990, S/. 867 to $1 U.S.

ATTACHMENT No. 4

PLAN DE EMERGENCIA DE ASEO URBANO PARA LA CIUDAD DE GUAYAQUIL.

Este plan abarcará tres fases de una duración de 30 días que s describe a continuación:

FASE I.

Limpieza de basura acumulada en calles, vías, plazas y avenidas

Se ha dividido a la unidad en dos zonas: zona A y zona B y cac zona a su vez ha sido subdividida en subzonas, tal como se indic en el plano adjunto y que a continuación se explica:

1. Zona A: Ha sido dividida en 10 subzonas.

2. Zona B: Ha sido dividida en 14 subzonas.

Se debe mencionar que las subzonas de la zona A son mayores qu las subzonas de la zona B, por considerarse que la zona A tier acumulada menor cantidad de desechos sólidos que la zona B.

Se recomienda que cada subzona esté servida por 3 volquetas de m3 de capacidad cada una y que laborarían durante 30 días. Cad volqueta contará con un chofer y una cuadrilla de 6 personas.

La limpieza de mercados, ferias y grandes acumulaciones d desechos sólidos sería realizada por otro equipo de volquetas cc ayuda de cargadores.

FASE 2.

Esta fase se la realizaría al mismo tiempo que la fase 1 y está dirigida a recoger la basura producida diariamente con el equipo de recolectores existentes en el Departamento de Aseo de Calles.

Se ha dividido a la ciudad para esta operación, en dos zonas:

Zona A: Desde el eje central de la calle Portete hacia el Sur.

Zona B: Desde el eje central de la calle Portete hacia el Norte.

Cada zona tendría tres días de recolección por semana:

Zona A: Lunes, miércoles y viernes, desde las 7H00 hasta las 22H00.

Zona B: Martes, jueves y sábados, desde las 7H00 hasta las 22H00.

Cada recolector tendría un chofer y una cuadrilla de 4 hombres.

Fase 3:

Se recomienda realizar una campaña de difusión de los horarios de recolección y áreas de servicio a ser cubiertas, por medio de la radio, periódico y televisión, con el objeto de que la ciudadanía saque la basura a las calles en los días y horas de servicio.

PRIVATE SOLID WASTE MANAGEMENT

PROJECT PAPER

(515-0264)

I.	Summary	PDO	Reviewing
II.	Background	PDO	Reviewing
III.	Description	PDO	Reviewing
IV.	Implementation	PDO	Reviewing
V.	Analysis Summary	PDO	Reviewing
VI.	Conditions Precedent	PDO	Reviewing
ANNEX A	Logical Framework	PDO	Reviewing
ANNEX B	Approval Memorandum	GDO	Will draft
ANNEX C	Host Country Request	PDO	Reviewing
ANNEX D	Project Checklist	PDO	Will draft
ANNEX E	Institutional Analysis	PDO	Reviewing
ANNEX F	Technical Analysis	PDO	Reviewing
ANNEX G	Social Analysis	PDO	Reviewing
ANNEX H	Financial/Economic Analysis	PDO	Reviewing
ANNEX I	Environmental Analysis	PDO	Reviewing
ANNEX J	Consultant Scope of Work	PDO	Reviewing
	Pagination, Table References and Final Editing	GDO	

SANITARY LANDFILL PROJECT												
CHARACTERISTICS	LOCATION OF PROPERTY											
	NARANJO			GRECIA			VALVERDE VEGA			SAN RAMON		
	GOOD	FAIR	POOR	GOOD	FAIR	POOR	GOOD	FAIR	POOR	GOOD	FAIR	POOR
Size of property												
Accessibility												
Haul distance												
Distance from urban centers												
Utilities												
Direction of prevailing winds												
Precipitation												
Distance from airport												
Topography												
Distance form rivers												
Natural drainage												
Free from flooding												
General Hidrology												
Water springs												
Potable water wells												
Geology												
Free from fault areas												
Free form sismic impact zones												
Soil Analysis												
Adequate cover material												

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STANDARD FORMS

FOR

RECORD KEEPING: SOLID WASTE COLLECTION

WEEKLY LABOR RECORD

FORM 1

DISTRICT: _____

DATE: ____/____/____

SIGNATURE: _____

Employee ident.	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Individual totals	Note causes of absences, extra hours to be paid, etc.
	Job*	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.		
Totals	X		X		X		X		X		X					XXXXX XXXXX

Instructions: Supervisor to complete this form daily. List all employees separately including temporary help. "Hrs." refers to hours worked daily. "Job" refers to the job description.* At the end of each week, forward one copy to the payroll

DAILY COLLECTION ACTIVITY REPORT

FO
2

Time out _____ Mileage out _____

Time in _____ Mileage in _____

Driver:

Loader:

Loader:

Remarks:

Time start	Time finish	Weight	Route #	Nonproductive time	
				Hrs.	Cause
Total weight					

Date: _____

Truck # _____

Crew # _____

Net time _____

Net miles _____

Gas purchased (gal.) _____

Check if abnormal:

- Eng. temp. [ ]
- Oil press. [ ]
- Ammeter [ ]
- Packer [ ]
- Brakes [ ]
- Lights [ ]
- Other [ ]

Check if relevant and report to supervisor:

- Personal injury [ ]
- Automotive accident [ ]
- Property damage [ ]

Instructions: The driver is to complete this form each day. "Time out" and "Mileage out" are to be completed when the truck leaves the garage in the morning. "Time in" and "Mileage in" are to be completed at the end of the day when the truck is back at the garage. When the truck reaches the first route, the time is noted in the "Time start" column and the route designation is also noted. When the truck is full or the route is left for any reason, "Time finished" is entered. Upon returning to the same route or another (after a trip to the disposal site), the next "Time start" entry is made. At the disposal site, the net weight of wastes collected is entered. Accidents, injuries, or any equipment malfunctions are to be noted in the boxes provided and a detailed explanation given in the "Remarks" box

FORM 3

COMPLAINT NOTICE

Date received: ____/____/____ Time received: _____ ☐ AM ☐ PM

Name: _____

Street: _____

Type of complaint: _____

_____

_____

Date action taken: ____/____/____

Action taken: _____

Copy to be completed by supervisor or operational foreman of employees involved.

Route: _____ Loader: _____

Driver: _____ Loader: _____

FORM 4

REPAIR AND MAINTENANCE RECORD

TRUCK IDENTIFICATION: _____ PERIOD: from _____ to _____

Date	Odo. mileage	Type service or repair	Hours down	Labor hours	Parts description	Labor cost	Parts cost	Outside charge	Overhead (rate × labor hours)	T
Totals	X	X			X					

COLLECTION EQUIPMENT INVENTORY

FORM 5

DATE. ____/____/____

Type	Identification number	Capacity (cu yd)	Model no.	Model year	Manufacturer name	Date of purchase	Purchase price	Salvage value	Estimated life	(FOR USE BY ACCOUNTING DEPARTMENT ONLY) Annual depreciation	Monthly depreciation	Status code*
Total	X	X	X	X	X	X		X	X			X

Instructions: To be filled out by accounting department or supervisor. "Estimated life" should be based on supervisor's estimate of remaining life. "Monthly depreciation" may be on a straight-line or accelerated basis.

TOTAL COLLECTION FACILITY INVENTORY

FORM 6

DATE: ____ / ____ / ____

(FOR USE BY ACCOUNTING DEPARTMENT ONLY)

Facility	Description	Date put in use	New cost	Estimated total life	Other comments	Annual depreciation	Monthly depreciation
Land						XXXXX	XXXXX
Buildings							
Garages							
Roads							
Lights							
Fences							
Surveys							
Other							
Totals	X	X		X	X		

Financing data — Equipment and facilities

Bond type	Face value	Premium or discount	Interest rate	Yearly interest	Monthly interest

Instructions. To be completed by supervisor or accounting department if they have data available. "Estimated total life" should be based on remaining life as estimated by the supervisor. Depreciation may be either on a straight line or accelerated basis.

FOR
7

CREW PERFORMANCE EVALUATION REPORT

DISTRICT _____ WEEK OF: _____

Crew ident.	Total hours	Total hours on route	Tons collected	Tons/hour on route	Injuries		ø Complaints		Weighted route difficulty	Ac to o-
					This week	Year to date	This week	Year to date		
Totals		X		X					X	
Average										

Instructions: To be completed by the accounting department. "Weighted route difficulty" should be based on past performance of all crews on each route: i. e., if, on the average, "route A" takes twice as long to service as "route B," then enter 2 for crew that did route A and 1 for crew that did route B. To determine "Adjusted tons/hour on route," multiply "Tons/hour on route" by "Weighted route difficulty." This is more representative of crew performance, adjusted for route differences.

OPERATIONS SUMMARY REPORT

FOR
8

PERIOD: _____ from _____ to _

	Factor	Amount for this period	% Variance from	
			Budget	Budget last
Totals	Tons collected			
	Total operating cost			
	Total operating cost/ton			
	Collection labor cost ton			
	Equipment operating cost ton			
	Overhead cost ton			
	Number of accidents			
Route Service Cost Center	"Cost Center" cost ton			
	% Time on route			
	Tons, direct labor hours on route			
Hauling Cost Center	"Cost Center" cost ton			
	Tons, number of trips to disposal site			
	% Time hauling			
	Average miles, hour			
Repairs and Maintenance Cost Center	"Cost Center" cost ton			
	Repairs and maintenance cost equipment hour			
	% Time equipment down			
	Parts cost			

FORM 9

VEHICLE PERFORMANCE EVALUATION REPORT

GARAGE _____ PERIOD: from _____ to _____

Equipment ident.	Total miles	Hours down	Hours down / Total hours	Repairs and maintenance cost	Oil and gas cost	Repair and maintenance/hour	Fuel cost/hour	Total cost/hour	Total co
Totals	X		X			X	X	X	
Averages									
Budget									

TOTAL COLLECTION COST SUMMARY

FORM 10

DISTRICT: _____

PERIOD: from _____ to _____

Data	For this period	Budget period	Year to date	Budget-year to date
Tons of refuse collected				
Total operating cost				
Total financing and ownership cost				
Total cost				
Operating cost/ton				
Financing and ownership cost/ton				
Total cost/ton				

Instructions: To be completed periodically by the accounting department from data available in Operations Summary Report (Form 8) and the capital cost reports (Collection Equipment and Facility Inventory, Forms 5 and 6). Copies sent to the city manager (or his equivalent).

STANDARD FORMS

FOR

COST ACCOUNTING: SOLID WASTE COLLECTION

Worksheet #1
SALARIES AND WAGES OF PERSONNEL

☐ Municipal ☐ Contract ☐ Franchise

Column 1 NUMBER OF EMPLOYEES	Column 2 TITLE OF POSITION	Column 3 FRACTION OF TIME SPENT ON CONTRACT ORGANIZATION OR RESIDENTIAL COLLECTION DUTIES	Column 4 ANNUAL EXPENDITURE PER PERSON-YEAR($)	Column 5 TOTAL
	SUPERVISORY PERSONNEL			
	Commissioner of P.W.			
	Division Manager			
	Supervisor			
	Dispatcher			
	Foreman			
	Other (specify)			
	OPERATIONS PERSONNEL			
	Truck Driver			
	Collector			
	Other (specify)			
	SUPPORT PERSONNEL			
	Secretary			
	Clerk			
	Relief Personnel			
	Janitorial Staff			
	Temporary			
	Summer Staff			
	Other (specify)			

TOTAL OVERTIME PAYMENT:$

TOTAL SALARY AND WAGE COSTS:$

Worksheet #2
FRINGE BENEFIT COSTS

☐ Municipal ☐ Contract ☐ Franchise

Column 1	Column 2	Column 3	Column 4
	NO. OF EMPLOYEES COVERED (FULL TIME EQUIVALENT)	EXPENDITURE ($PERSON-YEAR)	TOTAL
SOCIAL SECURITY	_____	_____	_____
INSURANCE:			
A. Health and hospital	_____	_____	_____
B. Dental	_____	_____	_____
C. Life	_____	_____	_____
D. Disability	_____	_____	_____
E. Workmen's compensation	_____	_____	_____
F. Unemployment compensation	_____	_____	_____
RETIREMENT FUND	_____	_____	_____
UNIFORMS AND CLEANING	_____	_____	_____
SAFETY EQUIPMENT (e.g., gloves, shoes, etc.)	_____	_____	_____
LONGEVITY OR BONUS PAY	_____	_____	_____
	TOTAL FRINGE BENEFIT COSTS:		$_____

Worksheet #3
OTHER OPERATING EXPENSES

☐ Municipal ☐ Contract ☐ Franchise

Column 1	Column 2	Column 3	Column 4
	TOTAL ANNUAL EXPENSES ($)	% APPLICABLE TO RESIDENTIAL SOLID WASTE COLLECTION (USE DECIMALS)	TOTAL ($)
I. VEHICLE OPERATION AND MAINTENANCE			
A. Tires	_____	_____	_____
B. Fuel	_____	_____	_____
C. Oil	_____	_____	_____
D. Lubrication	_____	_____	_____
E. Maintenance labor. . .	_____	_____	_____
F. Parts and materials. .	_____	_____	_____
G. Other vehicle operating expenses (such as utilities for maintenance	_____	_____	_____
H. Total (if not available by category.	_____	_____	_____
II. DIVISION OFFICE EXPENSES			
A. Telephone			
B. Utilities			
C. Office supplies			
D. Rent			
E. Communication equipment			
F. Other _____. . . .	_____	_____	_____
III. BILLING (IF APPROPRIATE) .	_____	_____	_____
IV. INSURANCE			
A. Vehicles:			
1. Collision	_____	_____	_____
2. Liability	_____	_____	_____
3. Other _____ . .	_____	_____	_____
B. Personnel:			
1. Liability	_____	_____	_____
2. Bonding	_____	_____	_____
C. Property:			
1. Fire	_____	_____	_____
2. Theft	_____	_____	_____
3. Other _____ . . .	_____	_____	_____
D. Damage claims paid . .	_____	_____	_____
SUB-TOTAL (To Next Page):			

Worksheet #3 (Continued)
OTHER OPERATING EXPENSES

☐ Municipal ☐ Contract ☐ Franchise

Column 1	Column 2	Column 3	Column 4
SUB TOTALS (Carried Forward:)			
V. INTEREST			
VI. CONTRACTUAL SERVICES			
VII. OTHER CONTRACTUAL SERVICES (Not applicable to municipal collection)			
VIII. MISCELLANEOUS/OTHER OPERATING COSTS NOT INCLUDED ELSEWHERE			

Worksheet #3A
CONTRACTUAL SERVICES SUPPLEMENT

☐ Municipal ☐ Contract ☐ Franchise

1. Total annual contract amount (This may be entered on worksheet 3, column 2, Part VI) _____
2. Less cost for non-residential collection _____
3. Less cost for disposals _____
4. Annual contract amount for residential collection _____
   NOTE: Line 4B, the amount used to compare in National Statistical Tables _____
5. Less moneys remitted to city _____
6. Contractual services cost for residential collection contractor _____
   (This may be entered on worksheet 3, column 4, Part VI and the percentage calculated and entered in column 3)
7. Average monthly wage paid to a crew member by the contract firm _____

Worksheet #4
VEHICLE DEPRECIATION COSTS

☐ Municipal ☐ Contract ☐ Franchise

Column 1	Column 2 +	Column 3 +	Column 4 =	Column 5	Column 6
TYPE OF VEHICLE	NUMBER OF VEHICLES	ACQUISITION COST ($) PER VEHICLE	% OF TIME USED FOR RESIDENTIAL REFUSE COLLECTION	TOTAL	(.2 x col.5)

TOTAL VEHICLE DEPRECIATION COSTS $_____

Worksheet #5
OVERHEAD COSTS

☐ Municipal ☐ Contract ☐ Franchise

Column 1 NAME OF OVERHEAD AGENCY	Column 2 SALARIES AND WAGES	Column 3 EXPENSES OTHER THAN SALARIES AND WAGES
MAYOR/MANAGER		
FIN., COMPTROLLER, BUDGET, TREAS. .		
CLERK		
LEGAL ATTORNEY		
GENERAL SERVICES		
DATA PROCESSING		
PURCHASING		
PERSONNEL		
CITY COUNCIL		
. . . . .		
. . . . .		
TOTAL:	$	$

A. OVERHEAD ADJUSTMENT

1. Total overhead salaries ... (1)

B. FRINGE ADJUSTMENT

2. Fringe benefits for above...(2)

3. Other overhead costs for RSWC

4. TOTAL OVERHEAD COSTS: (1+2+3)

Worksheet #6
PUBLIC COLLECTION COST SUMMARY

☐ Municipal ☐ Contract ☐ Franchise

1. Total personnel salaries and wages from Worksheet #6	_____
2. Total fringe benefits from Worksheet #7	_____
3. Other operating costs from Worksheet #8	_____
4. Vehicle depreciation from Worksheet #9	_____
5. Total Overhead costs from Worksheet #10	_____
TOTAL COST (6+7+8+9+10)	$_____

6. Total number households served	_____
7. Total number tons/yards collected annually	_____
8. Average monthly wage for a crew member	_____

Worksheet #7
PRIVATE COLLECTION: GENERAL COSTS

1. NAME OF FIRM _____

2. SERVICE OPTION FREQUENCY _____

3. NUMBER OF HOUSEHOLDS SERVED _____

4. ANNUAL CHARGE PER HOUSEHOLD _____

5. ANNUAL CHARGE ALL HOUSEHOLDS _____

6. APPROXIMATE TONS OR YARDS COLLECTION ANNUALLY FROM ALL HOUSEHOLDS SERVED (NO. 3)

7. APPROXIMATE ANNUAL COST TO FIRM TO DISPOSE OF THIS AMOUNT (NO. 5) _____

8. ANNUAL TOTAL COLLECTION COST, LINE 5 LESS LINE 7 _____

9. MONTHLY WAGE AVERAGE FOR A CRFW MEMBER _____

Worksheet #8
PRIVATE COLLECTION COST SUMMARY

	BACKYARD		CURBSIDE	
	Once/Week	Twice/Week	Once/Week	Twice/Week
1. TOTAL NUMBER HOUSEHOLDS SERVED				
2. TOTAL ANNUAL TONS/YARD COLLECTED				
3. TOTAL ANNUAL COLLECTION COST				
4. AVERAGE MONTHLY USAGE FOR A CREWPERSON				

NOTES: (1) Group all the worksheets together for each particular type of service option; (2) Under the proper column for the service option, fill in row 1 by summing item three for all worksheets (regardless of firm); (3) Fill in row 2 by summing item six for all worksheets; (4) Fill in row 3 by summing item 8 for all worksheets; (5) Fill in row 4 by *averaging* item 9 for all worksheets.

Worksheet #9
OVERALL LOCAL COLLECTION COSTS

1. ARRANGEMENT TYPE: MUNICIPAL, CONTRACT, PRIVATE _____

2. POINT OF COLLECTION: BACKYARD OR CURBSIDE _____

3. FREQUENCY OF COLLECTION: ONCE A WEEK, TWICE A WEEK _____

4. NUMBER OF HOUSEHOLDS SERVED _____

5. AVERAGE ANNUAL PER HOUSEHOLD TONS: ONE, TWO _____

6. AVERAGE MONTHLY WAGE FOR CREW MEMBERS: 4, 5, 6, 7, 8, 9, 10 HUNDRED DOLLARS _____

7. AVERAGE ANNUAL PER HOUSEHOLD DOLLAR COST (ACTUAL AMOUNT) _____

8. DOLLAR AMOUNT RANGE LISTED IN APPROPRIATE NATIONAL STATISTICAL TABLE: _____

   FROM $_____ TO $_____

9. INFLATED DOLLARS $_____ $_____