

Border Environment Cooperation Commission

Comprehensive Municipal Solid Waste Management in Naco, Sonora

I. General Criteria

1. Type of Project

The project consists of the construction of a sanitary landfill for comprehensive solid waste management in Naco, Sonora, including the installation of the necessary equipment and the closing of the current dumpsite.

2. Location of Project

The project is located within the municipality of Naco, in the State of Sonora. The study area includes the city of Naco, a municipal seat within the 100 km. border area, as shown in the figure below. To the north lies Naco, and Bisbee, also in the state of Arizona, is very close. The estimated population of Naco in 2000 was approximately 4,896 inhabitants; it is expected to grow to 7,996 inhabitants by 2020.



3. Description of Project and Tasks

In 1999, the city of Naco received funding from the State of Sonora's Ministry of Urban Infrastructure and Ecology (SIUE) to conduct a comprehensive solid waste management study, which culminated with the Final Design Project of the Naco Sanitary Landfill. The study evaluated

the conditions of the city's cleaning system, identified the necessary work to provide an efficient and timely service to domestic, commercial and industrial users who generate non-hazardous waste, and assessed different alternatives for final disposal sites for the construction of a sanitary landfill.

The project developed by the SIUE was sent to the BECC to continue with the certification process. Once the project had been reviewed, the need to draft the financial analysis was seen, and technical assistance was approved in May 2002. Subsequently, it was determined that there was a need to close the current municipal garbage dumpsite as well as to draft the Environmental Impact Statement, since the study prepared by the SIUE does not call for these items. This technical assistance work was authorized and executed at the end of 2002.

In 2003, progress on the project came to a standstill because of difficulties with purchasing the land and the entry of new state and municipal administrations that year. In late 2003 work on the project was resumed by the new municipal administration, and the BECC once again began coordinating with the new municipal and state authorities; the local authorities in Naco, with the support of the BECC and the state government, established an agreement with the representatives of Ejido Naco to formalize the process for the purchase of the land needed for the new sanitary landfill. In addition, the BECC granted technical assistance for the review, updating, and adaptation of the executive project for the sanitary landfill and of the financial analysis, in order to adapt the project to the community's possibilities and conditions.

The proposed tasks and actions will allow the municipality of Naco to greatly reduce health problems by properly managing non-hazardous solid waste, while at the same time optimizing the resources that it currently earmarks for the city's cleaning system.

4. Components of the Project

- A.** Selection of a suitable site that is large enough for the construction of a new sanitary landfill, the design project of which was prepared by the State government's SIUE.
- B.** Modernization of the collection system, to allow non-hazardous domestic, commercial and industrial waste to be collected in an efficient and timely manner.
- C.** The proper closing down of the current dumpsite, to definitively eliminate the problems caused by it and any potential source of human health problems or environmental pollution.
- D.** Construction of a new sanitary landfill, in compliance with the State of Sonora's human health and environmental standards and requirements.

5. Compliance with International Treaties and Agreements

The project will improve health and environmental conditions on both sides of the border and complies with the corresponding agreements signed by Mexico and the United States. The proposed tasks will be carried out exclusively in Mexico and will have no effect on the United States.

II. Human Health and the Environment

1. Human Health and Environmental Needs

The objective of the proposed project is to improve the environmental and human health conditions in the community of Naco, Sonora, through tasks and actions to improve the municipal solid waste management and disposal systems. This will allow the collection service to continue to be provided in all areas of the city. Similarly, it is important to stress that a sanitary landfill will be constructed in compliance with current norms and it will include leachate, run-off and biogas control systems.

The current disposal method does not comply with existing norms and clearly creates a source of pollution and potential public health risks. The disposal site does not have the necessary controls to minimize environmental impact, such as leachate, surface run-off and biogas monitoring. Similarly, the operation of the dumpsite does not include the daily compacting and covering of waste, which causes the dispersion of trash, foul odors, the proliferation of harmful fauna and occasional wildfires with international repercussions, since the smoke generated reaches the neighboring city of Naco, Arizona. The study showed that the solid waste was disposed of at an open-air dumpsite, which became a source of pollution both in the immediate area and in surrounding areas, possibly as far away as 0.5 km. from the disposal site, due to the foul odors and the flies.

2. Environmental Evaluation

The State's General Ecology Department required a General Environmental Impact Statement (EIS).

The advisory opinion based on the Environmental Impact Statement was issued by the SIUE's Department of Ecology on September 11, 2003.

3. Compliance with Applicable Environmental and Cultural Laws and Regulations

As noted above, the Sonora Department of Ecology has issued a ruling approving the Environmental Impact Statement, thereby satisfying Mexican environmental requirements. The EIS did not identify any potential impact on archeological or cultural resources. The tasks will be carried out on a piece of land to be acquired by the municipality, with a reservation of ownership rights requiring it to be used exclusively for the sanitary landfill.

An Official Land Release Letter was issued by the National Institute of Anthropology and History (INAH) on October 10, 2001, stating that there is no possibility of impact on archeological, historical or cultural resources.

III. Technical Feasibility

1. Appropriate Technology

The proposed technology is acceptable and sufficient for Naco's physical and socioeconomic conditions and it is described below for each one of the system's components.

The sanitary landfill was designed in accordance with a generation study conducted at the current dumpsite between June 18 and 20, 2000, in order to determine the amount of solid waste brought to the dumpsite each day.

The results lead to the conclusion that, all together, in Naco an average of 4,468 kg of domestic solid waste are collected each day, and 4,763 kg are brought to the open-air site, 345 kg of which are brought directly to the site by services not controlled by the municipality.

The field studies and studies of the collection routes created by municipal public services indicate that an estimated 95% of the waste generated each day is collected and the remaining 5% is deposited in unauthorized ("clandestine") garbage dumps or sites.

The solid waste generated by small businesses—mostly paper and cardboard—is collected by municipal public services, whereas commercial waste from supermarkets is brought to the site either by the same services or through private contractors. In general, the approximate total weight of the waste brought to the site is 150 kg.

Solid industrial waste—an average of 300 kg of mostly paper and cardboard per week—is disposed of two to three times per week.

Hospital waste—also mostly paper and cardboard—is brought three times a week, and its weekly average weight is 150 kg.

The nature of the solid waste generated by private parties varies greatly, and its approximate total weight is 120 kg/day.

Municipal solid waste is currently disposed of at open-air sites each day, without any control. The current dumpsite covers an area of approximately 1.0 ha. and has no heavy machinery to move and spread out the solid waste.

The following table shows the different sources of solid waste generation, as well as the average daily weight of the waste disposed of at the current open-air garbage dump.

Table 1. Quantity of Solid Waste According to Source of Generation

Source of Generation	Average Daily Weight (kg)
Municipal Domestic	4468
Industrial	43
Commercial and Services	128
Hospitals	21
Private Parties	103
Streets ⁽¹⁾	—
TOTAL ⁽²⁾	4763

(1).- Included in domestic municipal waste.

(2).- Total weight converted to seven days per week.

After the amount of solid waste generated was determined, the waste was sorted to determine its composition, which can be broken down into three groups: organic matter, recyclable and non-recyclable, the average percentages of which, by weight, for the towns in the State of Sonora are:

Organic matter	=	=24%
Recyclable		=7%
Non-recyclable		=39%

Collection System

The Naco city government currently provides the collection service to the town's entire population; the service is divided into three routes and is provided daily, from Monday through Saturday. For solid waste collection a total of five vehicles is used—three three-ton dumptrucks and two half-ton pickups. All five collection vehicles currently in service are open-type vehicles and are owned by the city government. The three-ton dumptrucks make two trips per day, Monday through Friday, and one trip on Saturday; the half-ton vehicles make an average of 1.5 trips per day from Monday through Saturday.

The project gives priority to the operation of the new sanitary landfill and, above all, to the closing of the current dumpsite.

Closing the current final disposal site (open-air dumpsite)

It is essential to take steps to close the current dump site so as to eradicate the problems currently seen. Hence, along with closing the current dumpsite, an attempt will be made to minimize to the utmost the pollution caused by the wind, leachates and surface run-off.

The site must be leveled, with a minimum slope of 2%, suitable for rain runoff. Once the site is leveled, the wells will be installed to ventilate the biogas. Lastly, the areas that have been affected with substances that have soaked into the soil, such as the leachates, must be treated.

Once the site has been closed, long-term maintenance must be carried out, primarily in the leachate control system, which requires continuous attention so as to ensure its proper operation.

In response to complaints from the authorities of the neighboring U.S. towns of Naco and Bisbee, during November and December of 2002 there was an intense campaign to provide the current dumpsite with a cover of inert material so as to avoid, to the extent possible, fires like the ones that for two consecutive years have occurred this time of the year at the dumpsite. Machinery from the

state government and the International Boundary and Water Commission has been used for this purpose.

This work greatly reduced the actions required for the closing, as noted above.

Final disposal

The construction of a sanitary landfill for final solid waste disposal is proposed, on a piece of land slightly larger than six hectares. This location was chosen after an analysis of alternatives consistent with the urban municipal development plan.

The possible final solid waste disposal sites have several limitations that will strongly affect the selection of the site location, which must be within Naco's city limits: to the east and west are Naco's current domestic-wastewater treatment systems; the north is demarcated by a physical and political boundary—the international border line between Mexico and the United States; to the south there are no restrictions—indeed, Naco is currently growing towards the south.

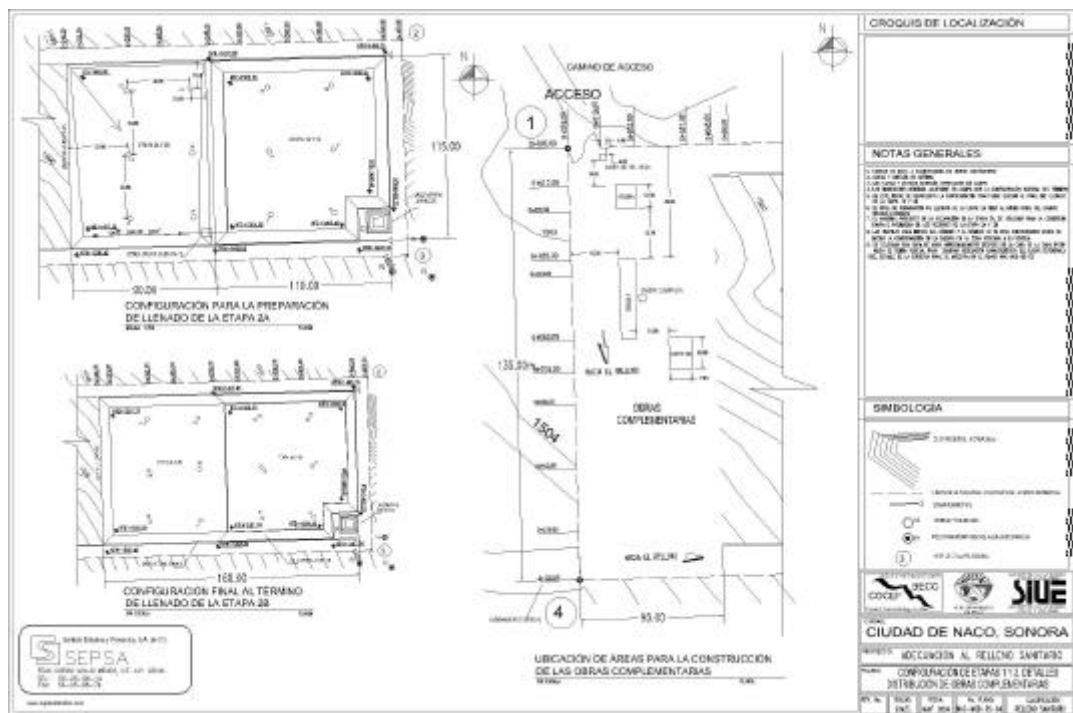
The following figure shows the proposed site for the location of the new sanitary landfill, based on Naco's current and projected future growth. The town council negotiated with the authorities of Ejido Naco, which surrounds the town of Naco, on the transfer of the ownership of the selected land, in order to get ownership must to secure the investments required for the building of the new sanitary landfill. Moreover, the selected site complies with the current Mexican regulation (NOM-083-ECOL 1996) on the selection of the sites for municipal solid waste disposal in terms of:



The proposed location of the Naco sanitary landfill is 4.5 km. to the south of the present city limits, 100 m to the east of the Ferrocarril del Pacifico railway, 500 m (by the shortest route) from the gas pipeline from Agua Prieta to the PEMEX Compressor Station, and 800 m from the latter, which has been in service for two years and will be relocated 500 m to the west of the current station. Hence, the distance between the new gas compressor station and the sanitary landfill will be 1300 m.

The proposed project includes the sanitary landfill and the complementary required work, such as the access road, exterior and interior roads, scales, security booth, perimeter fence, and leachate lagoon, as shown on the General layout Blueprint of the sanitary landfill project, along with all the components and their location.

The proposed facilities would allow waste to be stored in the smallest possible area and to cover it with layers of earth and to compact it each day so as to reduce its volume. Moreover, the plan takes into account problems that might be caused by the liquids and gases produced at the landfill because of the decomposition of organic matter.



The landfill will begin operations with a 110 x 115 m cell that will provide sufficient capacity for waste disposal at the dumpsite during the next 10 years.

Method of Operation of the Sanitary Landfill

The method of operation was determined based on the site's topography and the proximity and the quantity of material available at the site. Regarding the operation of the Naco sanitary landfill the trench method is recommended, which allows the existing land to be fully utilized.

The construction of the sanitary landfill, including its complementary work (access road, interior and exterior roads, scales, security booth, perimeter fence, etc.) will be based on the Official Mexican Standard NOM-084-ECOL.1994.

The proposal calls for the sanitary landfill to operate in the first stage only as a trench that will have sufficient capacity for the first four years and, subsequently, to use the same equipment that will be operated at the landfill to excavate the rest of the trenches as they are needed, since the capacity of the equipment and the volume of trash generated will leave enough time each day for the completion of these tasks.

For the final cover of each trench, a minimum coverage of 60 cm thick is recommended; this layer basically has the same function as the intermediate layer but must be suitable for sowing plants or reforestation and must be compacted into layers 15 cm thick. The upper layer of soil removed from the site must, preferably, be stored and reserved for use in placing the top layer of cover. Because the soil will be reforested, it should not be tightly compacted. Special care must be taken in selecting and sowing the plants, because of the potential effect of gases generated in the solid-waste cells.

The daily operation procedure of the landfill is detailed in the Operations Manual appended to its final design project.

The mechanical equipment to be used in the sanitary landfill was determined in consideration of the physical characteristics of the site, the volumes to be operated at it, and the ways in which the materials will be handled. And as a minimum initial investment, the purchase of a crawler tractor is recommended, to clear the land, to obtain material for the intermediate and final cover, as well as to move the material from the storage site to the daily work site.

Installations of this type and the construction tasks must be properly managed during the service life of the facilities, since this will determine the quality of the service they provide and the very duration of the sanitary landfill.

In addition, an Environmental Monitoring Manual has been prepared as part of the executive project.

Security Precautions

Normal and Emergency Exits

The work areas and the property must have normal and emergency exits to allow the workers to evacuate in no more than three minutes, and the exits must not have obstacles.

Fire Extinguishing Equipment

The sanitary landfill must have fire extinguishing equipment commensurate with the degree of risk and the class of fire that could be caused by the products, substances or byproducts that are stored, managed or transported at the site (class A and B fire, low risk). These extinguishers will be portable and will bear the warnings set forth in the corresponding Official Mexican Standard in effect; they must be protected from the elements and placed in a visible, easy-to-reach, unobstructed location where the temperature is not above 50 °C or lower than 0 °C.

2. Compliance with Applicable Design Norms and Regulations

The sanitary landfill's final design project has been prepared by the Ministry of Urban Infrastructure and Ecology of the Sonora State Government, which is responsible for regulations regarding this type of work in the state; therefore, the proposed sanitary landfill complies with the requirements established in Mexican regulations.

IV. Financial Feasibility and Project Management

1. Financial Feasibility

The project to improve Naco's collection and final solid waste disposal system consists of two stages—construction and operation.

The first stage, which is scheduled to take less than a year, includes the construction of the first cell of the sanitary landfill and the complementary work such as paving the access road to the site, the fencing off of the land, the construction of operation booths, the installation of the scale, as well as the purchase of the collection equipment, the purchase and placement of the containers that make the system more efficient, and the equipment to operate the sanitary landfill itself. In addition, the open-air garbage dump where the solid waste is now deposited will be closed.

The operation stage, which comprises the rest of the service life of the project, consists of the enlargement of the cells as necessary, using the capacity of the sanitary landfill's operation equipment, as well as collection of the city's solid waste and the replacement of the purchased equipment.

The city's general socioeconomic and solid-waste-generation data during the first stage of the sanitary landfill's service life are shown in the following chart:

Baseline Data:

Overcrowding Index	4.28
Generation of Overall Waste, Average (kg/inhabit/day)	0.576

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Estimated Population (Inhab)	5,401	5,535	5,672	5,813	5,957	6,105	6,257	6,412	6,571	6,734	6,902
Nº of Dwellings in Upper Income Level	0	0	0	0	0	0	0	0	0	0	0
No. Dwellings in Middle Income Level	1,262	1,293	1,325	1,358	1,392	1,426	1,462	1,498	1,535	1,573	1,613
No. Dwellings in Lower Income Level	0	0	0	0	0	0	0	0	0	0	0
Total Number of Dwellings	1,262	1,293	1,325	1,358	1,392	1,426	1,462	1,498	1,535	1,573	1,613
No. of Businesses	70	72	74	75	77	79	81	83	85	87	89
Total Waste (kg/day)	3,111.0	3,188.2	3,267.1	3,348.3	3,431.2	3,516.5	3,604.0	3,693.3	3,784.9	3,878.8	3,975.6

To meet the community's waste- and management-disposal needs, the necessary studies were conducted and the final design project was proposed. The following table shows the costs for the construction stage included in the project's certification.

General Investment Program

(million pesos)

Investment in Fixed Assets:	
Land	\$0.3
Site preparation: (incl. supervision)	\$2.1
Investment in Operations Equipment	\$2.5
Total Investment in Fixed Assets	\$4.9
VAT on Initial Investment	\$0.7
Total Amount of the Investment	\$5.6

The conducting of tasks and the purchase of equipment proposed for this project is based on the financing method shown in the following table:

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Projected Origin of the Investment Funds

(million pesos)

Gvt. Contribution State/Municipal	\$2.8
NADB Contribution	\$2.8
Total	\$5.6

Regarding equipment, the Municipality will receive from the U.S. Section of the International Boundary and Water Commission the donation of a crawler tractor; hence, once the donation is made, it could lower the cost of the project.

To cover the costs of Operation and Maintenance of the solid waste management System equipment, as well to finance the reserves needed to ensure its Operation and Maintenance, equipment replacement and renovation, the City 's Administration will establish sufficient budget provisions to allow for these costs. These budget provisions will include sufficient resources to pay for existing solid wastes operational costs as well as additional resources for the new solid waste system.

Adequate use of the new sanitary landfill will require hiring of additional personnel. This personnel will be required both for the operation of landfill equipment as for the appropriate management of the office in charge of solid wastes. Furthermore, the use of additional equipment will require an increase in the budget assigned to fuels and equipment maintenance.

Preliminary estimates show that costs for Operations and Maintenance could eventually duplicate from the existing budget of approximately 520,000 pesos a year. For this reason, the Municipality will implement the necessary budget adjustments to increase the amount designated for solid wastes management .

Even though the Municipality is not considering to charge a fee to users for the initial operation of the system. Once the proposed technical-administrative improvements are in place. The Municipality could consider the development of a gradual rate structure could be considered, in order to generate resources to sustain proper operational conditions. The rate structure could consider to start with a rate only for commercial and industrial users. Once the rate structure is properly developed the Municipality could consider implementing rates for domestic users.

2. Project Management

The project includes the reorganization of the Public Municipal Services Unit's Cleaning Department, for the administration of municipal solid waste sweeping, collection and final disposal. To this end, the city government will request the NADB for support through its Institutional Development Support Program (IDP). In addition, the municipal government has received an offer from the utility that operates the Agua Prieta, Sonora, sanitary landfill to train the operators of the Naco system.

V. Sustainable Development

1. Definition and Principles

The Border XII environmental program developed by Mexican and U.S. authorities defines sustainable development as economic and social development that is based on the conservation and protection of the environment and the rational use of natural resources and that takes into account present and future needs as well as the present and future impact of human activities.

The Sanitary Landfill Project for the municipality of Naco, Sonora, complies with the definition of sustainable development as economic and social development that is based on the conservation and protection of the environment and the rational use of natural resources and that takes into account present needs without compromising the possibility of future generations to meet their own needs.

In compliance with **Principle No. 1**, which states that human beings are the focus of all sustainable development concerns and have the right to live healthy and productive lives in harmony with nature, the construction and operation of the sanitary landfill and complementary tasks will clearly encourage a decrease in the illnesses caused by the municipal solid waste mismanagement and disposal.

This project fulfills **Principle No. 2**, which sets forth present and future generations' right to develop and to do so in line with environmental needs is fulfilled in this project insofar as it calls for cleaning the environment of Naco and ensures its protection for use by future generations.

By introducing the comprehensive management of municipal solid waste and its disposal in a sanitary landfill, the project addresses **Principle No. 3**, which entails environmental protection as an integral part of the development process; moreover, this work ensures the preservation of the aquifers at the present uncontrolled municipal solid waste disposal sites.

Through **Principle No. 4**, the parties state their interest in participating in any activity related to this solid waste management project. This principle is being fulfilled through the implementation of a broad community participation program that has made it possible for various social sectors and different environmental, social and economic agencies to become involved, thereby bringing about balanced planning and better resource utilization.

2. Institutional and Human Capacity Building.

The tasks included in the project will help strengthen the Naco municipal government in the following areas.

- Urban sanitation coverage capacity will increase to 100% of the population.
- The municipality's revenue will increase through the gradual application of a rate schedule that will allow for a higher surplus to meet new financial commitments and future investment requirements.
- In addition, and parallel to this project, the municipality will implement a work program for non-hazardous industrial solid waste management.

The utility directly responsible for the Cleaning Service will be reorganized in accordance with the following guidelines:

- The selection of personnel in accordance with the needs and coverage of the cleaning service required by the town of Cananea and based on the professional and/or technical level required as well as the number of operators per shift.
- Definition of employees' specific responsibilities and the areas in which they must be trained to ensure that they perform and operate the system correctly and maintain the equipment and tools in good condition.
- The staff will be selected from among the current employees of the Public Services Department who fulfill the specified requirements and whose experience can be used once they receive the proper training.

3. Conformance with Applicable Local/Regional Conservation and Development Plans

Sonora State Government Urban Development Plan, 1996-2001

Paragraph C of Section 3.2.4 of this plan, which addresses Ecology and the Environment, sets forth the need for infrastructure for non-hazardous solid-waste management in the municipal seat.

Urban Development Program in the Municipality of Cananea

The sanitary landfill project for the city of Naco is part of and satisfactorily complies with the proposed policies for the conservation, regeneration and proper use of the environment set forth in this program, which is the urban ecological framework set forth by the municipal government.

4. Conservation of Natural Resources

The improvement in urban sanitation services and the construction of the sanitary landfill will have a positive affect on overall sanitation in Naco and will lead to decreased solid-waste discharges into the channel of the Punta de Agua river and adjacent streams, thereby avoiding the possible pollution of the region's aquifer.

At the community level, the Public Participation Committee is expected to promote a reduction of waste generation among the various sectors of the population, through a more efficient utilization of resources.

This could involve inviting local schools to help raise their students' awareness regarding resource conservation and reduced waste generation, thereby changing consumption patterns in the home.

Because of the town's socioeconomic traits, scavenging, reuse and recycling of solid waste are not common practices, since the remuneration from these activities is much lower than what is offered by other sources of employment.

5. Community Development

The project's impact on the community's development will be seen in both the short and long term: in the short term, it will promote an awareness of the need to keep the city clean, since the service will consist of the sweeping of streets and public areas and will establish regular, efficient collection to avoid sources of infection in streets, river channels and ravines. Similarly, the construction of the sanitary landfill will eliminate various currently uncontrolled sites for solid-waste disposal, including industrial waste, and an area will be set aside for this purpose. The short-term effects on

the community will translate into health benefits for the population, principally among children, who are, naturally, in direct contact with their surroundings.

The long-term effects on community development require cooperation between the town residents and the municipal government, who may join forces and establish small organizations to reuse various elements contained in the solid waste and/or use the biogas generated in the sanitary landfill itself—all within the legal framework established by the municipality.



VI. Public Participation

Thursday, February 6, 2003, the first Public Meeting of the project for Naco, Son. (RS 349), was held. The objectives of the Public Meeting were satisfactorily fulfilled; a Citizens' Committee expressed interest in dealing with the solid-waste issue in the municipality, although it had doubts regarding the viability of charging for the cleaning service.

ATTENDEES:

Approximately 40 persons attended the meeting, including neighborhood representatives and service users.

CONDUCTING OF THE MEETING:

The mayor welcomed and inaugurated the meeting; The BECC's representative established the objective, scope and mechanics of the meeting; for his part, the Municipal Auditor gave a PowerPoint presentation of the project to the community.

The question and answer session was very productive, and the Chairman of the Citizens' Committee coordinated the 12 participations from the attendees.

The Second Public Meeting is pending,. This meeting is scheduled for June 25th, 2004.

Available Documents

1. Final Design for Closure of Existing Dumpsite . SEPSA, through a contract with BECC in 2002
2. Final Design for Construction of a Sanitary Landfill in Naco, Sonora, including financial analysis. SEPSA, through a contract with BECC in 2002
3. Environmental Impact Statement (M.I.A.). SEPSA, through a contract with BECC in 2002
4. M.I.A's approval for the . Construction of a Sanitary Landfill in Naco, Sonora, from Secretaría de Infraestructura Urbana y Ecología del Gobierno del Estado de Sonora, september 11, 2003
1. Upadting and adaptation of Final Design for the Construction of a Sanitary Landfill in Naco, Sonora, SEPSA, through a contract with BECC in May, 2004