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Community Management of Waste Recycling: The SIRDO

Story by Marianne Schmink

Introduction

At the beginning of 1978, a group of families were awaiting access to low-cost housing in Mérida, a city on Mexico's southeastern coast. Typically such low-cost, subsidized housing consists of a three-room core unit with water, electricity and drainage. The waiting list for houses with the conventional type of drainage used in the region, consisting of an absorption well and septic tank, was long. There were some units, however, equipped with a new drainage system, called SIRDO (Integrated System for Recycling Organic Wastes). This system was 20-40% less costly than the conventional one and posed fewer risks of environmental contamination. Families interested in living in the experimental block where the SIRDO was to be installed could be given housing right away. Those who accepted the offer were compelled to do so by their urgent need for housing. Although the drainage system was explained to them, for most it was still very unfamiliar when they moved in. They had no way of knowing then that they were to become leaders in the adoption and dissemination of this new technology.

Three years later, families in another community located in the crowded Valley of Mexico were seeking a solution to growing problems of waste management. Upon learning of the SIRDO, they visited the Mérida pilot project and subsequently decided to try the system in their own neighborhood. Despite many differences, these two groups have faced similar challenges in learning to manage the technical, economic and social aspects of a new, community-based technology. Women have played a crucial role in this process and, in so doing, have strengthened their own standing within their families and communities. They also have become the principal managers of a system that both improves sanitary conditions and offers possibilities for community-based income-earning activities. This is the story of these women and their communities, and the changes brought about through the introduction of this new technology.

The Setting: Mérida

The city of Mérida is located in the north-western corner of the state of Yucatán, on the peninsula by the same name that juts out from Central America. Mayan Indians occupied the Yucatán Peninsula, the state of Chiapas, and the highlands of Guatemala for centuries before the Spanish conquest and the region retains strong traces of this heritage. Captured by the Spanish in 1542, by 1600 Mérida had emerged as the region's political, economic and cultural center. From the colonial period through World War I, the city grew in size and importance based on the traditional *hacienda* (large estate) system of agricultural production that grew up around it. From the mid-nineteenth to the early twentieth century during the boom of the production of henequen (a fiber similar to sisal used for making rope, twine, rugs, etc.), Yucatán was the richest state in Mexico and palatial homes lined Mérida's main boulevard. But a small elite controlled this wealth while the majority of the state's population was subsistence farmers or indentured workers on the *haciendas*. Beginning in the 1930s, henequen production began to decline and the region's economy entered a long period of depression that forced more and more reliance on Government programs.

Today the city continues to depend on the production of foodstuffs by peasants in outlying areas, while the urban economy is based on commerce, tourism, and other services. Industry is dominated by small-scale, informal enterprises that are a legacy of the artisan workshops that grew up to service the henequen processing industry. Henequen is still the largest industrial sector but continues to decline; most manufacturing is of basic consumer goods such as food, drink, and clothing. Because of the city's weak economic base, and continued rural-to-urban migration, under- and unemployment are growing problems. Mérida's approximately 400,000 inhabitants constitute about one-third of the state's population, and this proportion has been steadily growing. Many of these migrants have

settled in the poorest, southern zone of the city where the housing project with the SIRDO is located.

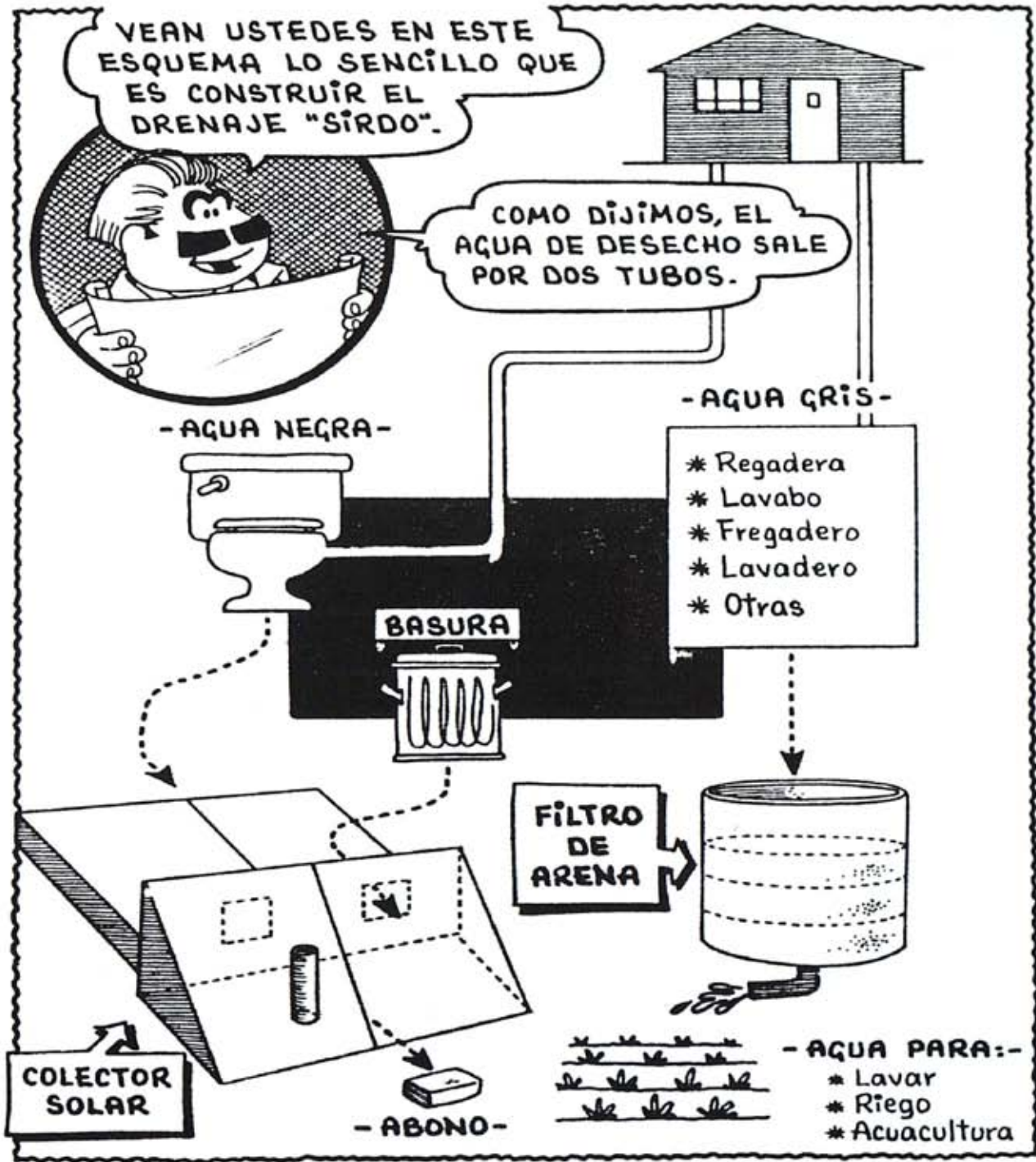
What Is the SIRDO?

The SIRDO system has been under development by the Alternative Technology Group (GTA for the Spanish *Grupo de Tecnología Alternativa*) in Mérida since 1978. GTA is a small group founded by architect Josefina Mena in order to develop technologies for recycling organic wastes in urban areas. The SIRDO is designed not only to manage urban wastes, but also to include in this process the potential for income and employment generating activities. The system is based on intensive labor inputs in all phases from construction through maintenance, and production. Its characteristics enable cooperative community management for day-to-day operation.

Basically the SIRDO system works as follows. Each house is connected to the community system by two pipes that sep-



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arate the "gray waters" (those containing detergents flowing from bathroom, sink and laundry) from the "black waters" coming from the toilet. After filtering, 80 percent of the "gray waters" can be reused for irrigation. The "black waters" are channelled into a tank where sludge is separated from the water. The sludge is spread out in an aerobic decomposition chamber and is

then mixed with household garbage. In this chamber solar drying evaporates the water and within a year's time the sludge is transformed into a nutrient-rich fertilizer. The treated "black waters" in the meantime pass into garden beds where vegetables and flowers may be grown; they may also be channelled into ponds to support aquaculture.

The SIRDO system is unique because it requires an amount of careful control at the various stages of the decomposition process that make it impossible to implement within a large, municipal-level system. On the other hand, it is too costly to be installed on a single-house basis. Therefore it is ideal for community-level management and operation. GTA carefully adapts each SIRDO facility to a specific site and monitors it over time to assure proper functioning.

Introducing the SIRDO in Mérida

Between January and May of 1980, the GTA built the first two SIRDO units in Mérida with financing from a Government agency charged with assisting low-income populations in acquiring lots for housing that include basic services. The agency's central office was interested in the new technology, and the regional office in Mérida somewhat reluctantly revised its housing program to accommodate the new drainage system. Apart from offering lots with water and electricity, the agency financed the drainage system and connected it to core houses—the basic three-room unit to which families could later add more rooms. Original plans called for installation of houses and drainage in 28 blocks near the southern edge of the city. In fact only one block was provided with the SIRDO.

At the end of 1980, the agency granted housing to two dozen families in the experimental block. Little by little they began to occupy their lots. In most of the families the men were employed in services, small-scale commerce, or crafts. The vast majority were self-employed, and more than half earned less than the prevailing minimum wage. Most of the women had no regular employment, but since marital unions are often somewhat unstable, many had worked at some point in their lives, either as primary or supplementary supporters of their families. Those women who did hold jobs generally worked as domestics or in the small-scale sale of food and other items. Only one woman worked in a factory. The

families had three children on average, and most of the adults were literate but had not continued their education beyond the primary school level.

The GTA presented a series of orientation talks in August, 1979, about the SIRDO which the families attended somewhat skeptically. The drainage system began to function, but there were many problems in its initial phase of operation. Users complained of flies, unpleasant odors, and leakage. In addition, changes had to be made in the housecleaning routine. Acid products could not be used for cleaning because they would damage the chemical balance in the decomposition chamber. The system also required that organic garbage be separated from plastics, glass, and metals which could not be dumped into the chamber. For these reasons, many community members were resistant to the system despite the assurances they received from GTA as to its advantages. But soon the odors began to disappear and other problems were resolved. Interestingly the children were the first to begin collaborating with GTA staff. They participated in maintenance tasks such as separation of garbage and dumping of organic wastes into the chamber. They even painted wall murals that showed how to use the system. The children's enthusiasm encouraged many of the women to begin to cooperate as well. In May of 1981, a few community women started meeting to allocate tasks on a cooperative basis. They also formed a committee to guard the system against vandalism by those opposed to the SIRDO.

Strong opposition to the SIRDO was encountered at both sites where the system was initially introduced. As in many other countries, in Mexico the provision of urban land and services is influenced by political considerations. Typically, community leaders or groups recognize the need for housing sites and/or services and organize residents to make demands to politicians in the ruling Government party. In response, Government agencies seek to establish a "patron-client" relationship with these leaders by offering to subsidize urban

services in exchange for their political backing. Usually the community receiving the services is required to contribute labor and money to the project as well. Private companies also profit from contracts for these public works projects. Through such "clientelistic" politics, all parties can stand to gain.

It is perhaps not surprising then that a community-managed system such as the SIRDO might initially be perceived as a challenge by those having an interest in the established way of doing things. Community members with close ties to benefactors worry that their position may be weakened by such community initiatives. Some Government officials may be resistant because they think such projects will make the urban population less dependent on state support and thereby increase their political independence. And private firms may resent the loss of profits from large public works contracts. Added to the potential resistance of those with vested interests in the status quo is the natural skepticism that tends to surround the introduction of any new technology and where environmental benefits can only be demonstrated through an educational program.

There is, however, increasing support among some Government officials for new service delivery systems and technologies such as the SIRDO because they stimulate community self-help and are lower in cost than traditional systems. This position has grown stronger in Mexico as the Government has become less and less able to afford costly investments such as conventional drainage systems. Furthermore, the SIRDO has generated strong interest because of its role in reducing the risks of environmental contamination and in educating the urban population about these concerns. So despite some incidents and harassment, the experiment went forward.

In October of 1981, to the astonishment of the residents of the experimental block, the first harvest yielded nearly a ton of fertilizer. Community members now needed to organize the labor required to remove the fertilizer from the chamber and to process it

for use or sale. This increased the workload and required greater organization on the part of the community. Thus the idea of forming a cooperative was born. After seeking information and technical advice from several sources, the residents voted to name their new cooperative *Muchuc-Baex*, a Mayan term meaning "let's get together." The fertilizer itself was named *tierra bonita* (pretty earth). By January 1982, the Cooperative *Muchuc-Baex* was legally constituted with 18 members, 14 of them women.

Doña Lucero is a woman in her late 20s who comes from a lower-middle class background. She is trained in accounting and holds a full-time job. She is articulate and can both write and type (the only Cooperative member with this skill). She has two children. Her husband is a carpenter. Because of her leadership abilities and abiding interest in the SIRDO and the Cooperative, she has been its president since the beginning.



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The Cooperative's first economic activity was the sale of the fertilizer. This required modest capital to purchase plastic bags, labels, stapler, a scale and a few other essential tools. The GTA offered several small loans during this initial period to assist the Cooperative and was later repaid in fertilizer.

Members set to work extracting the fertilizer from the chamber, mixing it with earth, and putting it into one-kilo bags for sale. Initially the mocking remarks of neighbors ("crazy women playing with shit") discouraged some women from participating in these tasks. Others, however, persevered and by the end of 1982, the Cooperative was selling its fertilizer in two main supermarkets in the city, bringing in a small, but symbolically important income to the group.

By September 1983, the GTA had delegated most of the responsibility for maintenance of the system to the community, the neighborhood's children had written and performed their own play recounting the history of the Cooperative, and *Muchuc-Baex* had reaped four fertilizer harvests! The quality of the fertilizer was evident both in kitchen gardens of the members and through tests carried out by the local agency of the federal agricultural ministry (SARH). To promote its fertilizer, the group used photographs of Doña Lola and the giant cucumber she had produced in her garden.

Doña Lola is the only Cooperative member who speaks Maya as a first language. She comes from the henequen-growing zone outside Mérida. Abandoned by her first husband, Doña Lola moved to Mérida with her second husband, Don Alvar, who had been a peasant leader in their place of origin. He works as a garbage collector for the city. Both of them were interested in the SIRDO from the very beginning, attending all the talks given by the GTA before they moved into the experimental block. Don Alvar was interested in waste management because of his job. Doña Lola was interested because she has always cultivated her own kitchen garden to supply the family



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with vegetables. She saw the system as a way of improving her production and has taken a leading role in experimenting with the fertilizer in her own garden plot. The giant cucumber is but one example of her success.

Operating the System

With technical assistance from the GTA, eight Cooperative members operate and maintain the SIRDO. In general, the men carry out the heavier, periodic cleaning jobs for which they receive nominal payment. The tasks associated with day-to-day operation, which are not too time consuming, are taken care of by the majority of the neighborhood's women who do not hold jobs outside the home. The maintenance tasks are periodically rotated among members on a voluntary basis. The technical requirements of the SIRDO are spelled out in the "Biotics Manual" provided by the GTA which serves as a reference guide for community managers.

While Cooperative members are now convinced of the advantages of the SIRDO, they also recognize that some problems exist. Their housing development was not designed with the system in mind, and its piping and treatment sites occupy physical space that is in short supply; nor is there any work area for the maintenance operations such as cleaning of filters. Other aspects also could be improved: the cement covers for the gray waters filters, for example, are so heavy that women generally have to rely on men to help remove them; and there is a need for equipment, such as gloves and masks, to protect workers from the fine dust raised during the sifting and mixing operations.

The Fertilizer

To insure its economic feasibility, the Cooperative's current need is to widen the market for its fertilizer. Thus far they have produced four harvests of about one ton each—about half the maximum capacity of their two units. Most earnings to date have been re-invested in production (e.g., purchase of earth for mixing) although small

amounts have been distributed to members based on the amount of labor contributed. In the future they hope to improve their enterprise through the purchase of a machine to mix the fertilizer and construction of a warehouse for storage.

At this initial stage, the Cooperative is willing to sell below real costs in order to build a market for its product. The good results achieved in their own gardens have given them confidence in their product and the patience to wait for demand to grow in the long run. Currently most sales are to middle class urban dwellers who use the fertilizer for gardening. Cooperative members hope they eventually can get it into the hands of farmers to improve the quality of their overworked soil. Fertilizer could even be exchanged for foodstuffs needed by members' families; however as yet they have not found a mechanism to link them directly to peasant producers in their region.

New Perspectives

Aside from the potential economic return from fertilizer sales, Cooperative activities take on a larger meaning for the community. From the beginning, membership has been made up almost entirely of women, although several of their husbands regularly help with specific tasks. In some cases, husbands have tried to impede their wives' participation, but the women recognize the value of their collective activities and continue to participate in the organization.

Doña Betty, her husband Don Tito, and their children are all active in the cooperative. Doña Betty is illiterate and has ten children; she has never held a formal job. Don Tito is a baker. They arrived in the experimental block in November, 1981, and began to take a personal interest in the SIRDO when they witnessed, by chance, an act of sabotage against the system. The people who had closed the valves later threatened them with a beating if they



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revealed their identities. The incident passed, but the couple became involved more directly in the Cooperative afterwards. For a time Don Tito was afraid of his wife's involvement and even forbade her to attend Cooperative meetings. Shortly after the first fertilizer harvest, they had a fight over the issue. Doña Betty made a decision to resist her husband. While she had allowed him to prohibit her from other activities in the past, she saw the importance of her participation in the Cooperative. "This," she told him, "you cannot take away from me; it is helping me to develop as a person." Now there are four members of the family actively involved in the Cooperative.

To these women the SIRDO provides a basis for community solidarity that surpasses the importance of the future income they hope to generate. The Cooperative's president, Doña Lucero, puts it this way:

Most people (in the Cooperative) are not thinking about money. Before, I lived in one place for eleven years without knowing my neighbor's name. After I moved here, I lived for three years without knowing my neighbors. If I don't know my neighbor and there is an emergency in the middle of the

night, I can't call on her—nor can she call on me. This is the greatest value of the Cooperative. Here we are more sisters than neighbors. If I don't have money to eat, I'm not ashamed to ask Doña Candita for two hundred pesos or for some leftover *tortillas* (flat corn cakes that are a staple of the Mexican diet). The drainage system has done this. If it did not exist, I can assure you that I would be here all these years without knowing my neighbors' names.

Community women stress that mutual aid is now a practice that extends to virtually all aspects of their daily lives. Cooperative members work together in other activities as well, including the collection of inorganic garbage for resale and the wholesale buying of vegetables from peasant producers. In 1981 they built a recreational park for their children and convinced the state to donate playground equipment.

Doña Candita was born on the island of Cozumel, off the coast of the Yucatán Peninsula. When her first husband abandoned her, she lived with her mother for a time. A few years later her husband returned and proposed that they be reunited. He took her with him to live in Mérida. But he continued to drink heavily and to beat her on occasion. Finally she decided to separate. She found work preparing snacks like tamales, antojitos and empanadas to sell to cafeterias in the city. She would spend the morning making them in her home and then deliver them to her customers in the afternoon. In this way she managed to support her five children, all of whom have been able to finish their schooling. Doña Candita herself can read and write only with difficulty.

Later she married again, but began to have the same problems with her second husband. Finally she told him she no longer wished to live with him. When she moved into the experimental block, she moved alone. This was the beginning of a new, more independent phase in her life. At first she did not become involved in the SIRDO. But as she watched the Cooperative take form, she was impressed by the hard work of the other women and of GTA staff. So she plunged in and was elected the Coopera-



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tive's treasurer. From this position she has become involved in new experiences that have increased her own self-confidence as well as her effectiveness in working with the Cooperative.

In February 1982, the GTA arranged for Doña Candita to be invited to a meeting of housing authorities in another state interested in the SIRDO. Two years later, she attended a national level meeting on housing sponsored by federal and state agencies. She described for them the Cooperative's experience with the SIRDO. During five days, she was the only community representative at the Mexico City meeting. This experience increased her awareness of the importance of what the Cooperative was doing. She returned to Mérida determined to convince local authorities and Cooperative members of the need to maintain their commitment to the SIRDO. She has also taken on an active and influential role in Cooperative decisions.

In her forties, Doña Candita is the eldest of the Cooperative members. Her son, Miguel, is also an active member. His interest stems from his course of study in engineering. The Cooperative has relied on

his expertise to oversee the system's operation and maintenance.

The Second Setting: The Valley of Mexico

A more recent pilot SIRDO project in an urban community in the Valley of Mexico has drawn on the lessons learned in Mérida. This zone, including Mexico City and its surroundings, accounted for about 20 percent of the total Mexican population, or roughly 13 million persons, in 1978. While the population of the zone continues to grow at an annual rate of about five percent, the volume of wastes produced has grown at the astounding rate of about 30 percent per year! By 1984, this amounted to approximately 13,000 tons of waste per day in Mexico City, of which about one-third were organic materials. On average, each resident of the city produces one and a half kilos of waste products each day. An estimated 70-80 percent of these wastes are not systematically recycled and pose a threat of

contamination to the environment. Approximately 10,000 persons work informally in the city's dumps or in the streets separating wastes according to their resale value, selling items for about one peso per kilo (U.S. \$1 = apx. 167 pesos) to middlemen who in turn sell to industries for three or four pesos per kilo. Alternative waste-management systems like the SIRDO therefore appear to be well suited to this environment.

The history of the community where the second SIRDO pilot project is located is distinct from the Mérida neighborhood. Located near the northern margin of the city, the community is managed by a cooperative, begun in 1956, with more than 1800 low-income families. The Cooperative first negotiated the purchase of an area for settlement, then took charge of dividing it into lots, opening streets, and assisting residents to construct houses. Later it oversaw the installation of the community's own water system and electricity and the building of schools, green areas and other facilities. All this has made the community a desirable neighborhood in comparison to other less organized areas in the Valley of Mexico.

By 1976 the problem of waste disposal had become apparent. The community was inhabited by about 18,000 persons who produced about 240 tons of waste per month. About one-third of this quantity was collected by trucks; the rest was deposited by residents in ravines, green areas, or vacant lots. Open-air drainage also collected in the ravines. As these deposits led to contamination, the community began to explore ways to resolve this growing problem.

The first option was a conventional, waterborne drainage system, the cost of which had been estimated at 26 million pesos in 1972 (about U.S. \$1 million). The community was able to raise only two percent of this amount over the next eight years. In 1979 a new estimate by the municipality placed the cost of this system at 44 million pesos, without calculating direct costs which would raise the sum to nearly 60 million (more than U.S. \$2 million). By this time the Cooperative had managed

to raise two and one-half million pesos, or about four percent of the total cost. Given the impossibility of paying for the conventional system, the Cooperative began to seek alternative solutions. This is when it came into contact with the GTA in Mérida.

Early in 1982, forty members of the Cooperative visited Mérida and attended a meeting of the Cooperative *Muchuc-Baex* in order to become familiar with the SIRDO. Shortly thereafter, Cooperative members voted in a general assembly to use the money collected for the conventional drainage system to finance installation of a pilot SIRDO, with technical assistance from the GTA and other groups in Mexico City. Community members explored financing for the project's various stages. The pilot system would serve 84 families settled on 40 lots surrounding a natural pond, as well as a secondary school with about 80 students. Experiments with aquaculture were to be carried out in the lily pond.

Introducing the SIRDO: Progress and Conflict

At the outset, only about 20 percent of the population favored the new technology; another half were doubtful or did not understand how it worked. The remainder were opposed. Nonetheless construction went ahead over a period of 27 weeks and the pilot system was inaugurated in December, 1982. Twenty-two community members contributed their own labor; the direct costs of construction came to two and one-half million pesos (about U.S. \$55,000). In order to assist in preparing the community for the new technology, members of the *Muchuc-Baex* Cooperative developed a seven-lesson course for users, promoters and technicians. Adults and children attended this course.

Immediately after the pilot system began to function, two more sections of the community requested consideration for the next SIRDO. One group formed a committee of 24 persons and named a treasurer on each block to collect funds to finance the project. The GTA began to prepare designs



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for these two areas. A Technical Council consisting of Cooperative representatives, technical advisors and state and municipal government personnel was formed to oversee the new installations.

While these plans were getting underway, however, those opposed to the new system were also organizing. They formed a Council for Municipal Collaboration and tacitly opposed construction of the new SIRDO. They put pressure on the municipality causing it to withdraw its offer of support for the SIRDO and instead to promise to construct a traditional drainage system at a cost of 300 million pesos (about U.S. \$3 million). The atmosphere became unpleasant as a director of the local primary school prohibited two teachers from taking their students on a site visit to the SIRDO as a field lesson on the environment, and the dome on the gray waters filter and the grating on the chimneys of the decomposition chamber were broken by vandals. In 1983 the anti-SIRDO group was able to win control of the Cooperative's directorship, but the community itself remained divided over the issue.

In contrast to the experience in Mérida, membership in the Valley of Mexico Cooperative averages only about 30 percent women. Since Cooperative statutes permit only one member per family, representation is usually by the male head of the household. One woman reported being prohibited from taking her absent husband's place at a Cooperative meeting. In contrast, the Mérida Cooperative is based on individual membership which permits women to have a greater voice in collective decisions. As one woman put it: "Sometimes I think one way and my husband thinks differently. But both votes count." Despite the limits to their direct participation in the Cooperative, however, the women in the Valley of Mexico have found ways to exert their collective power in matters related to basic community services, including the SIRDO.

The Cooperative's new leadership soon felt the women's pressure when the community's water system failed. For weeks the women bore the brunt of hauling water

long distances and deteriorating sanitary conditions. A small group of women, who previously had not even known each other, called a meeting to discuss solutions to the water problem. Systematically they organized neighbors in each zone within the neighborhood until they succeeded in ousting the Cooperative's directorate and calling for new elections. They also succeeded in forming a commission to oversee the work of the Cooperative's Directorate. Six of the nine commission members are women.

Once the water problem was resolved, the commission turned its attention to other community problems including road paving, green areas, and drainage. When the municipal authorities showed up and began to dig up the neighborhood streets to put in the promised conventional drainage system, the women resisted. Individual women faced the construction teams saying, "you will not dig in front of my house!" They were backed up by a large group of women who informed the officials that, "If you arrest her, you will have to take all of us." The installation of the conventional system was stopped. The women then pressed for a paved road which would enhance the installation and operation of the SIRDO.

During the first year following its installation, the SIRDO's primary merit was an improvement in the environmental condition: fewer flies and rats now that garbage and sewage no longer accumulated in the ravine behind the houses. However since only a small proportion of the neighborhood's houses were connected to the system, other sources of contamination still existed.

As in Mérida, the appearance of the first harvest of fertilizer provided the needed incentive for greater involvement by the users. The fertilizer was tested by the state water and sanitation company after the residents used their ties to advisors to the state governor (who favors the SIRDO) to elicit its assistance. The tests initially showed some germs remaining, so the residents corrected this problem by further drying and the addition of more organic matter. By May of 1984, the tests had



improved.

In the meantime, the SIRDO users began to organize themselves for the tasks of producing the fertilizer and planning new productive activities. In March 1984, about 20 families connected to the system had formed a more formal user's group called the "Community of SIRDO Users" which began to meet on a weekly basis. One community resident, a medical doctor, also began to train eight young men from the group to maintain the system and collect garbage. Given the large number of users at this site, and the greater distances from the houses to the chamber, this division of labor was more attractive than the communal system used in Mérida. The users agreed to pay these young people a small wage, based on the Mexican minimum wage, for an estimated two to four hours work per week. In order to cover this expense and start-up costs for other activities, members agreed to contribute 500 pesos (about U.S. \$3.00) to the group every two weeks.

Soon the user's group decided to adopt a more formal organizational structure with elected officers and six specialized commissions. The General Director and Secretary are men, the Treasurer is a woman, and each of the six commissions is the responsibility of one woman. The group also named three advisors for technical, social, and administrative matters. These are professional people who live in the experimental block.



Each commission began to develop its own set of activities. Commission I is in charge of operation and maintenance of the pilot SIRDO. Its principal task is to supervise the young trainees who operate the system. Commission II is preparing for the production and sale of the fertilizer, which has been named ABOSIRD *Tierra Nueva* (New Earth). They have spent about U.S. \$50 for a two-color, silk-screened logo which will be printed on the plastic bags containing the fertilizer. The initial plan is to distribute most of the fertilizer to SIRDO users and to sell the rest to cover production costs. Already the group has been approached by other community residents who want to buy the fertilizer for their own gardens. A market survey is also planned to set an appropriate price for the product.

The other four commissions have more long-term objectives which are expressed by the group's motto: "For a Self-Sufficient Urban Community." Commission III is in charge of planning productive activities related to the recycling of plastics, metal and glass. The group hopes to move towards recycling most of the neighborhood's inorganic, as well as organic, wastes. As a first step, commission members consulted an expert in plastics recycling from Mexico's National University who is experimenting with a technology to convert waste plastics into useful products such as the plastic tubing used for plumbing and for construction of SIRDOs.

Commission IV has the task of developing horticulture projects. Its members began by planting a small experimental plot of carrots, radishes, squash, onions, tomatoes and herbs next to the chamber. Two biologists from the local university have provided advice, as well as seeds, on a voluntary basis. The first garden was planted without the use of fertilizer in order to compare it with later yields. The group now plans to expand the plots to other areas surrounding the SIRDO. They also plan to plant fruit trees nearby, beginning with trees that have already been grown successfully in the area, such as peaches, pears and avocados. To irrigate these crops, the group is building a large holding tank for recycled gray waters from the SIRDO, with a pump to allow year-round irrigation. The goal is to have 400,000 square meters of land producing food for the community's 23,000 inhabitants on a regular basis.

With assistance from biologists, Commission V is developing plans for future aquaculture projects using treated black waters from the SIRDO. Plans call for

creation of four tanks for the various stages of water treatment; 6,000–10,000 trout will be raised in the fourth tank. Infrastructure and community training necessary to operate such a project is estimated to cost U.S. \$12,000, which must be raised from outside sources. Initially the fish would be consumed within the community and then hopefully, with increased production, sold for a profit.

The sixth commission has the delicate task of overseeing waste management in homes and caring for the environment. These tasks are primarily social and educational. Committee members oversee the composition of garbage dumped into the SIRDO chamber and, when necessary, suggest corrections. Another task of this committee is to contact the 28 families living in the SIRDO area who are still not connected to the system. They encourage these families to clarify their views on the SIRDO and either decide to be connected or waive their rights so that families on nearby blocks, who have expressed an interest in using the system, may do so.



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Growth and Change

All these new activities reflect a greater sophistication on the part of the SIRDO users as to the need for effective public relations within the community. SIRDO users also have learned not to be aggressive in their opposition to the conventional drainage system favored by some community members. Instead of proclaiming themselves *sirdistas*, they now advise neighbors to base their decision on an analysis of the relative merits of the two systems. They are confident that the conventional system will never be completed due to its high cost and that the SIRDO will gradually win over community residents as the income-generating activities take shape and environmental conditions improve. Within the community there are already about 200 families who wish to have SIRDOs installed on their blocks.

SIRDO users also point out that the system has brought about more unity and communication among residents of the experimental block than had previously

existed. Solidarity has been fostered by their everyday communal labor, their work on the commissions and their weekly meetings. The SIRDO and its related activities have greatly increased women's visibility within the community and their confidence in handling community affairs. While men continue to dominate formal decision-making positions in the community, women have increased their power through informal pressure groups such as the water commission. Women represent more than half of the membership of the SIRDO users' group; they have the greatest involvement in the day-to-day operation of the system, and they head all the working commissions created by the users' group. While they have not yet reached the level of confidence and independence achieved by the women in Mérida, the women of the Valley of Mexico are emerging as a political force through their involvement with the SIRDO.

Economic Potential

The potential economic return from the SIRDO depends on the development of

productive activities by community members. The GTA has calculated that 50 to 80 full-time jobs could be generated at the Valley of Mexico site once fertilizer, aquaculture, and agricultural production are well underway. The cost of producing the fertilizer can be reduced by more than half if maximum use is made of community labor. The Mérida experience has demonstrated that a kilo of fertilizer which sells at U.S. 70-80 cents, can be produced for less than an estimated U.S. 5 cents per kilo. Material costs to produce four tons of fertilizer accounted for only U.S. \$250 per year. Given the demand for low-cost fertilizer in all parts of the world, including Mexico, there is a clear economic incentive to maximize fertilizer production.

Expansion

Six years after the first pilot project in Mérida was installed, the SIRDO has achieved national visibility and credibility in key sectors of the Government, the press, and the academic community. The nation's three principal newspapers carried out a support campaign called "Operation SIRDO" beginning in June, 1984, that focused on the system as the solution to problems of environmental contamination in Mexico's cities. Scientists from a variety of Government and academic institutions have been drawn into activities such as plastics recycling, aquaculture, horticulture, and testing potential uses for the fertilizer once GTA's educational effort convinced them that they should apply their technical knowledge to the problems of low-income communities. The GTA has also enlisted the aid of allies within the Government in order to neutralize opposition to the system from other official sectors. In Mérida, for example, the new state governor and federal-level housing officials put pressure on regional authorities who were opposed to the system, with the result that the state government agreed to share with the community the costs of some needed repairs to the system.

By 1984 the GTA was building SIRDOs not only for grass-roots groups, but also for the Government and the private sector. The

state oil company, PEMEX, intends to build ten SIRDOs a year in its new developments in order to protect the environment from contamination. The federal urban development and ecology agencies are beginning to work with the GTA in several communities and would like to build as many SIRDOs as possible during the next year. University students will be trained to work with communities where these systems are installed.

With growing acceptance of the SIRDO come new challenges for GTA. Current initiatives include creation of workers' cooperatives to produce parts for the SIRDO, thus providing employment for community people who have participated in construction of the systems. The parts would be sold to both the public and private sectors.

The Changing Role of Technical Assistance

As responsibility for operating and maintaining the systems is gradually handed over to the community, GTA's role becomes one of outside technical advisor. The process is all part of GTA's goal to design a system that would alter the relationship between user, technology and the environment in order to foster collective action as an alternative to passive dependence on governments that often lack either the will or the resources to respond to local demands. In both Mérida and the Valley of Mexico, this transfer has entailed periods of tension as community members begin to assert their independence by reaching decisions contrary to the advice of GTA. After these experiences, GTA modified its strategy of technology transfer in order to reduce the potential for technical mistakes. Before introducing the system, GTA now forms a community Health Committee and a Production Cooperative to be responsible for decisions related to the system's productive activities. A small number of community members are trained to operate and maintain the system within the technical limits established by GTA.

The two pilot experiences in Mérida and the Valley of Mexico demonstrate some

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of the problems and potential involved in introducing new technologies. Community acceptance of an innovation like the SIRDO involves overcoming technical, social and political obstacles. Because of their involvement in managing household and community wastes, the priority they give to a safe environment, and their need for new sources of income, women play an important role in promoting an understanding and acceptance of a new technology such as the SIRDO. Their participation in such new activities catalyzes their collective organization. Their effectiveness increases their visibility and defines their voice in community affairs. Finally, the potential of the system to generate income through the sale of fertilizer (and eventually fruits, vegetables and fish) may offer women a greater opportunity for economic independence as well.

Lessons Learned

1. The introduction of a new technology depends on both technical and social processes. This requires the long-term commitment of community members. Technical aspects of even sophisticated systems can be readily understood if appropriate participatory training methods are used. In the case of the SIRDO technology, the unique ecological features of each site demand the active collaboration of community members to adjust the technology to the local environment. Planning and organizing the productive activities associated with the system are even more complex challenges which require communities to assess their priorities and the competing demands on their time and resources. It is therefore important that technicians be realistic in their understanding of the delicate process of technology transfer.

2. The nature of community participation in waste management, or any new technology, is a process that changes over time. Learning to operate and maintain the system, and educating skeptics about its merits, took place during the first year. The first harvest of fertilizer placed even greater demands on cooperative members, but also provided a tangible incentive for

greater involvement. Recognition of these different phases in the process will help communities to prepare for their growing management responsibilities and will help instill the patience to overcome residual skepticism.

3. Women and the community must see an immediate benefit in adopting a new technology. The SIRDO's immediate benefit is an improvement in physical sanitation, which is of greatest interest to women. While the system has the potential to be a community-based income-generating activity, this is not an immediate advantage. Therefore economic potential should not be overemphasized at the outset. Instead the environmental advantages should be stressed and mutual cooperation encouraged. Women's participation in the management of critical community services can increase their influence in community affairs and in relations with outside authorities. In Mérida, the need to operate and maintain the SIRDO, and to handle fertilizer production, gave rise to a new cooperative structure dominated by women which developed a strong sense of solidarity among women who previously had not known each other. It also increased their independence and confidence in dealing with husbands and other family members. In the Valley of Mexico, a strong, pre-existing cooperative structure, dominated by men, initially impeded women's access to formal, decision-making power. However, the SIRDO stimulated the creation of new, less formal organizations in which women have expanded their community influence. Their growing consciousness of the effectiveness of collective action has spread to other areas of community concern such as water management.

4. The cooperative structure enhances the ability of the population to address other community problems and to view them in a longer-term perspective.

5. Learning to make collective technical decisions builds confidence and analytical abilities among cooperative members. The use of recycled wastes to increase the community's self-sufficiency provides a dramatic lesson about conservation of resources and environmental protection.

5. New technologies must be modified as the requirements of women's participation in their operation becomes clear. Since women, and young people, generally take charge of household waste disposal and sanitation, and are less apt to be employed outside the community, they are the ones who are able to devote the necessary time to operating and maintaining a system such as the SIRDO. The system should be adjusted in such a way that they can carry out day-to-day activities without outside assistance. (For example, some parts of the original system had to be reduced in weight so that women and children could handle them.) Children's participation provides a unique educational opportunity; not only do they learn about environmental protection, but they can be trained to carry out tasks such as routine lab testing of fertilizer.

6. Responsibility for managing the system must gradually be transferred to the community, with sufficient outside technical assistance to insure proper maintenance. The introduction of a new technology requires a strong initial infusion of help from outside experts while community members are gradually trained to take over operation. As they take on greater responsibility, community members must build sufficient confidence to make decisions independent of, or even contrary to, the advice of outside technicians. Eventual mistakes are a part of the process of learning to collectively evaluate and discuss decisions. However, continual outside assistance will still be needed to address new technical problems as they arise.

Appendix

Parts of this description were taken from the project report entitled *Documentación y Evaluación de Experiencias Tradicionales y Alternativas para el Manejo de Residuos Urbanos en Zonas de Bajos Ingresos en el Valle de Mexico* by Fernando Ortiz Monasterio, Josefina Mena, and Angel Parada, October 1983. The report was written for the Mexico City working group entitled *Mujer y Ciudad*, part of the Population Council/USAID project on "Women, Low Income Households and Urban Services in Latin America and the Caribbean" of which Marianne Schmink is the co-manager. For more information on the project, contact: Judith Bruce, The Population Council, One Dag Hammarskjold Plaza, New York, NY 10017.

Information about the SIRDO can be obtained from: *Grupo de Tecnologia Alternativa*, Calle Alamo 8-16 Col. Los Alamos, Jardines de San Mateo, Naucalpan, Edo. de Mexico, 53230 Mexico (Telephone 393-7414).

Other sources of background information on the disposal and recycling of wastes include the following:

Appropriate Technology for Water Supply and Sanitation: Meeting the Needs of the Poor for Water Supply and Waste Disposal, by Fredrick L. Golladay. Washington, D.C.: World Bank Technical Paper, 1983.

Food, Fuel, and Fertilizer from Organic Wastes. Report of an Ad Hoc Panel of the Advisory Committee on Technology Innovation, Board on Science and Technology for International Development, Commission on International Relations, National Research Council. Washington, D.C.: National Academy Press, 1981.

Low-Cost Technology Options for Sanitation. A State-of-the-Art Review and Annotated Bibliography, by Witold Rybczynski, Chongrak Polprasert, and Michael McGarry. Ottawa, Canada: International Development Research Centre.

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