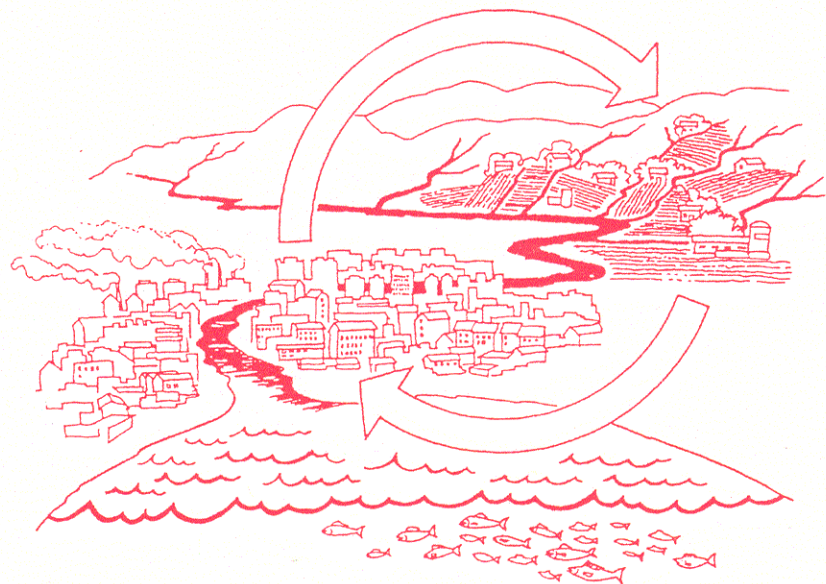


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# LARGE-SCALE DRY SANITATION PROGRAMS

## PRELIMINARY OBSERVATIONS AND RECOMMENDATIONS FROM URBAN EXPERIENCES IN MEXICO



May 2001

*HDRU Series No. 01- 6*

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**Large-Scale Dry Sanitation Programs –Preliminary Observations and  
Recommendations from Urban Experiences in Mexico**

Dissertation Research Field Report  
Activities and Results August 1999 - December 2000

by

Ana Cordova

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## ACKNOWLEDGEMENTS

This research has been funded by: Consejo Nacional de Ciencia y Tecnología (CONACYT); InterAmerican Foundation; North American Consortium for Sustainable Community Development; International Water Management Institute (IWMI); Delta Kappa Gamma Society International; and by several programs at Cornell University, including College of Agriculture and Life Sciences, Einaudi Center for International Studies, Research Training Grant for Conservation and Sustainable Development, Ford Seminar on the Environment and Development, and the Latin American Studies Program.

I also thank IWMI, the Ecological Sanitation Taskforce in Mexico (REDSECO), and the promoters and participants of the various experiences studied for their logistical and intellectual support.

The Human Dimensions Research Unit, in the Department of Natural Resources at Cornell University, and particularly Dr. Barbara A. Knuth, have been instrumental in the publication and final revisions of this report. Margie Peech provided secretarial assistance.

The illustration on the cover of this report comes from: Esrey, S.A., J. Gough, D. Rapaport, R. Sawyer, M. Simpson-Hebert, J. Vargas and U. Winblad. 1998. Ecological Sanitation. Swedish International Development Cooperation Agency (SIDA). Stockholm.

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## REPORT OVERVIEW

This study focused on characterizing program implementation, barriers and opportunities in selected, urban, large-scale dry sanitation program sites throughout Mexico. This **Field Report** presents a description of research and the preliminary results available at an intermediate stage –at the end of the fieldwork, but before the completion of the systematic data analysis. The document has three purposes: 1) to provide a general overview of the research; 2) to provide communities, practitioners and policy-makers with concise information, of practical relevance, in a time-frame shorter than the publication of final results; and 3) to anticipate the types of other materials that will be produced from this research.

The distribution of this **Report** is one way of thanking individuals, organizations and agencies for the support that they provided to me in the field and to promote an active exchange of information that will set the basis for collective discussion and learning about the implementation of dry sanitation programs in Mexico. I hope this document will motivate those who are already working in this area to continue with their efforts and stimulate to action those who have not yet contemplated dry sanitation as an option to be considered in the delivery of public services, environmental protection, and water management in cities.

Another compilation of preliminary results, which complements what is presented in the **Field Report**, can be found in:

Córdova y Vázquez, A. 2000. “El Saneamiento Seco como Estrategia para Reducir la Huella Hídrica de las Ciudades”. En Scott, C.A., P. Wester y B. Marañón-Pimentel (editores) Asignación, productividad y manejo de recursos hídricos en cuencas. IWMI, Serie Latinoamericana No.20. México, DF, México: Instituto Internacional de Manejo del Agua (IWMI). pp 155-171.

*English Translation available upon request.*

The findings and recommendations presented in this **Report** are preliminary in nature, and may be modified in the final analysis.

## BACKGROUND

**Dry sanitation** is a modern adaptation of the ancient practice of managing excreta without the use of water, and therefore without sewage. It implies: a) waterless toilets; b) the on-site treatment of excreta; and c) the production of a safe and effective soil amendment. Its benefits include saving large quantities of water, reducing water pollution, reducing the volume of excretas, killing off pathogens, and retaining nutrients that can later be applied to agricultural crops.

The selection as a research topic of dry sanitation in urban areas stems from two personal interests. First, I am interested in strategies that lead cities to reduce their ecological footprint –that is, strategies that reduce the negative impact of cities on the natural resources and areas that sustain them<sup>1</sup>. Second, in view of the lack of resources that water utilities and local governments have to provide drinking water and sewerage to all the urban and peri-urban populations, I was interested in studying alternatives that would address those needs of marginalized urban populations and that would offer them a healthier and more dignified quality of life. Dry sanitation addressed both concerns, embodying an intersection between the protection of natural resources and the attention to human needs.

- a) Through dry sanitation, homes, and consequently cities, can save up to 40% of indoor domestic water use. These water savings can then be redirected to providing drinking water to a greater (current or future) urban population or be left in natural water reservoirs for habitat and environmental services.
- b) Dry sanitation reduces significantly the nutrient load of water discharged from homes and from cities, thus reducing pollution to natural water bodies or reducing the investment needs for appropriate wastewater treatment infrastructure.
- c) Dry sanitation allows fiscal resource savings for the provision of sanitation, because in most cases it is less expensive to implement a dry sanitation program than to invest in a sewage system and treatment plant for excreta management.
- d) Dry sanitation addresses social problems of urban water management found in many developing countries by 1) providing a dignified and safe means of excreta management in areas without sewage access and 2) liberating water used in the transport of excreta to provide drinking water to urban neighborhoods that do not have a public supply.

Dry sanitation has been implemented in rural areas of many countries and urban areas of some. Urban populations have different needs compared to rural settlements. Because of their high human population density, urban areas require greater support infrastructure for the success of this technology. Mexico is one of the countries with the largest and most numerous urban experiences. Studying experiences in Mexico is likely to provide insight into improved implementation of urban dry sanitation.

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<sup>1</sup> The concept of “ecological footprint” was coined by Mathis Wackernagel and William E. Rees and is further developed in their 1996 book *Our Ecological Footprint: Reducing Human Impact on the Earth* (Gabriola Island and Philadelphia: New Society Publishers).

Dry sanitation need not be considered an option contrary or opposed to waterborne sewage (although in the future it could become an attractive alternative). It is not suggested that all current sewage systems be dismantled to substitute for this new technology. For now, dry sanitation should at least be considered as a complementary sanitation option for those cases where:

- a) local governments and water utilities are not in financial or organizational conditions to build sewage and wastewater treatment systems or to maintain this infrastructure in good operating conditions;
- b) septic systems or other on-site sanitation systems are consistently failing to function properly and are allowing nutrients and pathogens to leach into the groundwater;
- c) local water scarcity is so intense that it is no longer reasonable to use water as a means of transportation for excreta, at the expense of other important needs; or
- d) where dysfunctional or obsolete sewage systems need to be completely replaced or new housing developments are being planned and economical and environmental savings can be achieved by avoiding the use of water for sanitation.

### RESEARCH FOCUS

This research was focused on the development, implementation and follow-up aspects of dry sanitation *programs*, and not on the technical aspects of toilet design or on the evaluation of environmental impact measured through an analysis of physical environmental parameters around the cities studied. The emphasis has been on the implementation of the programs, the opinions and motivations of the promoters and users, as well as the identification of barriers and opportunities related to the development of the programs. Questions to be addressed through this research include:

- What are the needs of a dry sanitation program that are specific to cities, characterized by large scale and high density?
- What is the level of implementation that these programs currently have in Mexico?
- How can the success of a dry sanitation program be measured?
- What factors have been associated with program success?
- What have been the problems and difficulties, and how have they been resolved, or how can they be resolved?
- What are the most relevant variables to foster program continuity?
- Based on the observations in the cities studied, what are the programmatic or operational aspects that have not yet been addressed and how should they be addressed?
- What are the prospects of continuing to promote this type of program in Mexican cities?



## METHODS

The field work of this research was conducted from August 1999 through December 2000. First, it was necessary to identify what dry sanitation experiences existed in Mexico, because many of the experiences were not reported in any document of public access, or were only known to the people of the community where they had taken place. Through snowball sampling and interviews with a large number of practitioners in various parts of the country, I identified diverse dry sanitation experiences in Mexico, both urban and rural, and large and small scale.

Of the experiences identified, I selected the largest-scale and most-recent urban cases to research in greater depth. Six sites were studied: Acapulco, Guerrero; Ciudad Juárez, Chihuahua; Cuernavaca (and Tepoztlán), Morelos; León, Guanajuato; Puerto Morelos, Quintana Roo; and Xochimilco, Mexico City. I made one to three visits to each site to become familiar with the program, the communities, and the toilets, and to interview the various people involved in the promotion of each of the dry sanitation programs. Additionally, in all the sites except Acapulco –due to time and resource limitations–, I implemented a quantitative survey with users of the dry toilets.

I designed a survey questionnaire based on questionnaires used in previous research and on the preliminary results of my first round of visits to the sites. This questionnaire was reviewed by community dry toilet users and expert promoters from several programs. Their comments were valuable contributions to improve both the wording as well as the content of the final version. At each site, I consulted or helped construct a directory of homes with dry toilets from which I then randomly selected homes for application of the survey. The questionnaire had more than 180 question items about a diverse array of users' experience with the toilets and with the program implementation. The duration of each interview was approximately 45- 60 minutes. The survey was applied to approximately 300 users, distributed amongst the five sites, representing about 25-30% of the user population at each site. This **Field Report** does not include statistical data compiled from the survey effort. Statistical data will be available in a later report.

This **Report** reflects data collected based on the collective site visits; personal observations; and discussions with program implementers, promoters, and toilet users. It is intended to convey ideas to those who may wish to use insights from this project when developing new projects or modifying existing programs.

## **ANTICIPATED RESEARCH PRODUCTS**

As part of this dissertation research, the following products are anticipated:

1. A directory of urban dry sanitation programs in Mexico –for future research reference, and to generate channels of communication and future learning amongst the various experiences.
2. A diagnostic assessment of the current state of urban dry sanitation in Mexico –to identify achievements and gaps and establish a basis from which to make future contributions.
3. An operational definition of the most relevant variables in the success and continuity of dry sanitation programs and the development of a model that will identify predictors for program success –as a theoretical contribution to the study of urban dry sanitation policy.
4. A set of guidelines and basic information that may be used by an institution, local government, or community interested in implementing a large scale urban dry sanitation program –to fill the information gap that exists on this topic in Mexico; to clarify common doubts about this technology and facilitate its adoption and implementation; and to reduce the learning curve investment of new experiences.

## **PRELIMINARY RESULTS**

A first account of preliminary field results has been presented in Córdova y Vázquez, 2000. Below, additional observations specific to the six sites studied are presented. Specific data pertaining to toilet models, user income, type of settlement, program promoters, and program status of the six sites studied are presented in Tables 1 and 2 (pp 7-11).

### **General Observations**

1. Most of the programs have been initiated by well-intended people or organizations, who sought to address and resolve a problem or set of problems. The motivations of these people and organizations have been predominantly public health or environmental protection, but the provision of housing was also a motivation at least in one site.
2. The promoters of the programs studied have been community-based organizations, non-governmental organizations, local governments, dry toilet producers, international agencies and a university. There has been participation (especially in financial contributions) from private foundations, international agencies and individual private companies.

3. In many programs the promoting person or organization did not know much about dry sanitation at the beginning of the experience, and in many cases the promoters began their program knowing of only one dry toilet model.
4. In several programs, after 2-5 years, the technical support to users had discontinued completely, or had decreased significantly, for a variety of reasons.
5. The variables in which the programs differ include: dry toilet model, cost of the toilet to the user, user training techniques, technical support or follow-up to user needs after toilet installation, and management of the toilet end-product.
6. Most of the programs have confronted similar sets of problems and have incurred the same learning curve. In some cases, this has led to the abandonment of the program before having been able to overcome the obstacles, or just at the moment in which they were beginning to be overcome.
7. In most cases, the receiving population did not participate as a group in the decision to introduce dry toilets in their community, nor did they participate later in discussing the problems that arose or in seeking solutions.
8. Both very satisfied and unsatisfied users could be found in all programs. Additionally, perfectly functioning toilets and toilets in very bad conditions or with many problems were also found in all programs.
9. It seems that neither the specific toilet model, nor the cost of the toilet to the user, are in and of themselves factors that determine good toilet operation or satisfactory adoption by the user. The analysis of the user survey will aid in identifying what implementation aspects of the program and what characteristics of the users are most important in predicting the success of a program.
10. Most urban dry sanitation programs have been implemented in irregular settlements where the local authority has not been willing to provide public services (in order to discourage human settlements in high risk areas or areas of ecological reserve), or simply have not been able to provide such services to urban and peri-urban populations that are growing rapidly. There are, however, also several cases in which dry toilets have been installed in residential areas and in high-income level homes.

**Table 1. Urban Dry Sanitation Program Characteristics: Toilets and Income Data**

Site	Project Initiation	# Toilets Installed <sup>1</sup>	Approx % of Toilets Functioning in 2000	Toilet Model <sup>2</sup>	Approximate Cost per Unit –in pesos (year) and [Total US dollars] <sup>3</sup>	Costs Borne by User	User Income Level
Acapulco	1997	257	40-50%	SES-Aca	2,900 (1999) + 1,500 labor and administrative costs. [480 dlls]	Roof, Door	Low and Very Low
Cd. Juárez <sup>4</sup>	1999	300	90%	SIRDO	4,100 (1999) + 360 installation costs. [450 dlls]	No Cost to Users	Low and Very Low
Cuernavaca/Tepoztlán <sup>5</sup>	1985	50-200 (not censused)	Not determined	SES-Cuer	Variable, from 3,000 (2001) + 2,000 labor. [520 dlls]	Total Cost	Low, Middle, High
León	1996	600	95%	SES-León	Not determined <sup>6</sup> (estimated similar to cost of SES-Cuer and SES-Aca)	Labor and House Payment	Low (“interés social”)
Riviera Maya <sup>7</sup> , Quintana Roo	1993	30	Not determined	Nahi Xix	Variable, starting at 10,000 (1999) includes some admin. costs. [1,100 dlls]	Total Cost	Low, Middle, High
Puerto Morelos, Quintana Roo	1999	43	75%	Nahi Xix	10,000 (1999) includes some adm. costs [1,100 dlls]	Walls, Roof, Door	Very Low
Xochimilco	1999	166	70- 75%	SIRDO	4,100.00 (1999) does not include administrative costs [450 dlls]	No cost to users	Low and Very Low

**Notes to Table 1**

- (1) This refers to the number of toilets installed in *urban or peri-urban areas*. Some of the programs (Acapulco, Cuernavaca/Tepoztlán and Quintana Roo) also installed toilets in rural areas, and those toilets are *neither* accounted for nor *analyzed* in this study.
- (2) A description of each model follows:
- **SES-Aca.** SES stands for “Sanitario Ecológico Seco” (Dry Ecological Toilet). It is a Mexican adaptation of a Vietnamese model –double chamber, desiccating toilet with a urine-diverting toilet seat—developed in Cuernavaca in the 1980’s. **SES-Aca** models were installed in small outbuildings in the yard. Construction materials for the room were cement and cinderblock. Toilet seats were ceramic.
  - **SIRDO** is a registered trademark, and stands for “Sistema Integral de Reciclamiento de Desechos Orgánicos” (Integral System for Organic Waste Recycling). The toilet functions as a composting toilet with urine evaporation. The booth and processing chamber are made of fiberglass or rotomolded plastic. They are prefabricated and installed in the yards, as outbuildings. SIRDO’s can be relocated if a family no

### Notes to Table 1, continued

- longer wants them, or moves to another living space. Some users had converted their SIRDO's into more permanent structures by removing the fiberglass booth, and building a larger brick or wooden room around the processing chamber.
  - **SES-Cuer** are regular SES's. Toilet seats may be fiberglass, cement or ceramic. In many cases the SES's were built in a bathroom that was inside the house. The processing chamber is always cement, but the materials of the toilet room itself or the outbuilding varied (bamboo, brick, adobe, cement, etc.). Many of these SES's were in beautiful bathrooms with decorative tiles and matching toilet seat colors.
  - **SES-León**, are double-chamber, desiccating toilets but they do not have urine-diverting seats. Instead, urine drains out from the bottom of the chambers through a hose. These SES's were built outside the homes. Toilet seats were cement; outbuildings were cement and cinderblock. Toilet seat chutes in these SES were too narrow to be as effective and clean as SES-Aca and SES-Cuer.
  - **Nahi Xix** is Mayan for "House of Residue". The Baños Ecológicos Nahi Xix (Ecological Toilets Nahi Xix) are an adaptation of the Swedish model Clivus Multrum, developed by ReSource Institute for Low Entropy Systems. These are composting toilets that drain the urine (and water) through a filter on the bottom of the inclined composting surface. These toilets can accept small quantities of water, so they can be connected to micro-flushing toilet seats. This model can also compost kitchen organic waste in the same processing chamber. These have been built both inside and outside the homes. Processing chambers have been cement; outbuildings or rooms can be of various materials. Toilet seats can be ceramic or fiberglass. Toilet rooms are typically very beautifully decorated with creative tile designs.
- (3) Calculation of cost per unit varied by program. In some cases, administrative and labor costs were calculated separately from materials or toilet set (superstructure, seat and processing chamber) costs. In other cases these expenses are consolidated into the final price. Administrative or program costs can include installation (of the prefabricated SIRDO's), hired labor, promotion and/or training. In the programs studied, follow-up costs were not accounted for in cost per unit calculations --one reason why programs had such difficulty ensuring follow-up. Where data were available, this table breaks down the cost per unit into the different components. Where the toilet room is part of the home construction (i.e. not an outbuilding), such as in Cuernavaca/Tepoztlán and Riviera Maya, the size, beauty and sophistication of the toilet room and toilet seats vary widely. In these cases, the table indicates "variable" and the minimum starting cost. Due to the fluctuation in the value of the Mexican peso, the year in which the cost was estimated is included, and a conversion to US dollars calculated. For 1999 the conversion rate used is 9.15 pesos/dollar; in 2001, 9.60 pesos/dollar.
- (4) By mid-2000, another urban program began in the ANAPRA neighborhood, with Cuernavaca-style SES. Informants indicated that 60+ toilets have been installed there. This program was not included in this study because it began too late to be scheduled into fieldwork. Program organizers are in communication both with CITA in Cuernavaca and with UTEP in El Paso, TX.
- (5) This "site" comprises various neighborhoods and/or municipalities in the metropolitan area of Cuernavaca, in addition to the nearby city of Tepoztlán and its surroundings. This is the only non-formal program studied. Due to its diffusion-style nature there is currently no census of installed toilets and no formal accounting of toilet status. Hence it is not possible to provide a percentage of toilets that are functioning. However, promoters estimate that the functioning toilets constitute a high percentage.

**Notes to Table 1, continued**

- (6) Costs are undetermined because users contributed the labor to build their homes, and building materials were donated by local businesses and the city government. However, it is reasonable to estimate that the price per unit would be in the range of the other SES's. Not using a urine-diverting toilet seat could reduce the price somewhat, but likely not significantly.
- (7) Both Quintana Roo projects have been managed by the non-profits ReSource and Kum Lanab, but differ as follows: Riviera Maya "site" includes the toilets that these organizations have installed in various locations along the Quintana Roo coast, where users have typically been middle to upper income residences or hotels. The Puerto Morelos "site" refers to a specific program that these organizations undertook in collaboration with UNICEF and which was targeted to very low income families with children.

**Table 2. Urban Dry Sanitation Program Characteristics: Promoter, Settlement and Status Data**

Site	Principal Promoters	Complementary Promoters	Promoter Motivations	Type of Settlement	Program Stage in October 2000
Acapulco	Local Government (Municipal Health Council), UNICEF	State Government (State Health Services), State and Municipal DIF (Family Integral Development), Local Businesspeople; CONALEP (Public Vocational School), Nursing School No.2 of the Autonomous University of Guerrero; Federal Health Ministry (SSA)	Public Health, Children, Bay Water Quality Protection	Irregular, high risk areas (riverbeds)	Suspended since the change in administration in December 1999.
Cd. Juárez	University of Texas in El Paso Center for Environmental Research Management; Paso del Norte Health Foundation; and 3 Juárez Community Based Organizations: Centro de Asesoría y Promoción Juvenil, AC (CASA); Desarrollo Juvenil del Norte, AC; Organización Popular Independiente, AC	Fundación Masacreñas, Aqua21, UT Houston School of Public Health at El Paso	Provision of Water and Sewage Services; Public Health	Irregular and in process of regularization, high risk areas (riverbeds), rocky terrain	Follow-up at least until 2001. Began a cost and operation comparison program between several dry toilet models. Performed microbiological analysis of toilet final product.
Cuernavaca/ Tepoztlán	Non-Governmental Organizations: Centro de Innovación en Tecnología Alternativa AC (CITA), Tecnologías y Sistemas Ecológicos SC de RL (TESEC), Espacio de Salud AC (ESAC), Centro de Encuentros y Diálogos (CED); and innovative individuals	Schools and Community Workshops	Water Quality and Environmental Protection, Health, Community Development, Self-governance	Regularized Urban settlements with and without sewage service; Irregular peri-urban without sewage; semi-rural	Continues. In general, it is not an institutional program. There does not tend to be formal, structured follow-up, but users usually know someone who can give them advice and technical support.

**Table 2, continued**

<b>Site</b>	<b>Principal Promoters</b>	<b>Complementary Promoters</b>	<b>Promoter Motivations</b>	<b>Type of Settlement</b>	<b>Program Stage in October 2000</b>
León	Local Government (housing and social development areas)	Local Businesspeople, Local Inhabitants, Local Government (environment area)	Provide housing to inhabitants of irregular settlements in high risk areas (riverbeds).	Urban low income housing development, regularized, in an area originally far away from the city water and sewage system	Sewage lines were introduced to the development in 2000. Household connections had not yet been made. In the meantime, the dry toilets continued to be operated, the end-product was collected, and a certain level of technical assistance was still provided by the local government
Riviera Maya, QR	Non-Governmental Organizations: US-based ReSource (Resource Institute for Low Entropy Systems), and local Lum Kanab	Local NGO Grupo Ecologista del Mayab AC, and the Puerto Morelos, QR Community	Protection of Water Quality and Coral Reef	Homes and hotels in developments that are adjacent to coasts, lagoons and underground water bodies (aka "cenotes")	Technical assistance is given to whoever requests it.
Puerto Morelos, QR	ReSource, Lum Kanab, UNICEF		Protection of Water Quality and Coral Reef, provision of sewage services, Children	Regularized urban and peri-urban, without sewage services	Toilets are checked and the product is collected. Funding is being sought to finance the walls and roofs for the families who had not been able to pay for them.
Xochimilco	Local Government, Community-Based Organization: EPA (Equipo de Promoción Ambiental)	Toilet Producer: Grupo de Tecnología Alternativa AC (GTA)	Protection de of groundwater and Xochimilco canals	Areas in process of regularization or in ecological reserve zones	Concluded with the change in administration in December 2000. Follow-up provided to those who sign a maintenance contract with EPA. There were possibilities that the new administration would continue.



## RECOMMENDATIONS

Observations during 15 months in the six sites studied result in several basic recommendations. These recommendations are preliminary and therefore there may be modified in the final analysis stage. However, for the benefit of the programs that are currently functioning or those that might begin before the publication of final results, they include:

1. A **user follow-up program** (training, resolving doubts, technical assistance) **should be contemplated and budgeted before beginning** a dry sanitation program. A follow-up program should be in place **during at least 2 years** from the time of toilet installation **or the time it takes to collect the first batch of solid toilet product** (whichever occurs later). The lack of follow-up is perhaps the most frequent problem I have encountered.
2. **Complete and fully functional toilets** should be delivered **soon** after the users' request. Toilets under these conditions will have **greater probability of good and continued use**. When the toilets are delivered without roofs, walls or other functional components, their probable use or careful use by owners decreases rapidly. Good toilet use is intimately related to user motivation, interest and care.
3. **The person or family receiving the dry toilet should be trained** in its correct use. Poorly functioning toilets because of lack of user knowledge reduce user motivation and interest and give the technology a bad reputation.
4. The **sources of funding for all project phases should be contemplated and ensured before beginning** a dry sanitation program. (This has not been the case in practice, mostly because program promoters were not aware of the non-construction phases of the programs).
5. The **budget** of a dry sanitation program **should include elements in addition to materials and building expenses. Promotional, educational and follow-up components** must be contemplated **in timing, budgeting and personnel calculations**.
6. A dry sanitation program should be initiated only after considering the array of existing dry toilets and **determining which model is best adapted to user possibilities and needs**. Similarly, it is advisable not to promote the large-scale installation of toilets until the **particular model to be promoted has been tested in the specific climatic and cultural conditions** in which it will be used.
7. A **feedback system** between promoters and toilet designers and its users should be in place, in order to **constantly improve** both **toilet design** as well as **program implementation** (promotion, training, financing, technical support, product collection or management, etc.).

8. Program promoters should **foresee, from the beginning of the program, how all steps involved in toilet use will take place** during the expected toilet lifetime. Especially in urban areas, **obtaining cover or texture material for the toilets and disposal/management of the product** are not necessarily straightforward steps or steps within the possibilities of the users.
9. **Programs initiated by local governments and/or** dependent on a highly **motivated** charismatic **individual** should be particularly **careful to make provisions for ensured continuity**. Although all programs are **vulnerable to a loss in continuity**, these two types of programs seem particularly susceptible – those promoted by local governments may experience changes in administration, short administration periods and political pressures associated with the provision of sewage services; and programs that depend on a highly motivated and charismatic individual may dwindle rapidly, upon their departure from the program. This does not mean that local governments and motivated individuals should not initiate dry sanitation programs, but it implies that they should make provisions for continuity.

Although these recommendations may seem intuitive they have not been followed in most of the cases studied. Lack of attention to these program features has cost much time, energy and good will, leading to abandonment by program promoters and/or toilet users of the studied programs.

### **EFFECTIVE STRATEGIES**

Following is a list of innovative strategies that have been developed at various sites to address some of the problematic issues in dry sanitation program implementation. These may be ideas that can be developed further in other sites.

1. To ensure adequate follow-up with users: In Xochimilco, users may sign a for-fee maintenance contract with a local organization that provides them with regular visits and technical assistance. In Juárez, the promoting institution secured additional grant funding for follow-up to be provided for at least one year beyond the installation of toilets.
2. To encourage user adoption: In Quintana Roo and Morelos, toilet promoters pay individualized aesthetic and technical attention to the adaptation of the toilet (and toilet room) to each home. In many cases these promoters are involved with users before their house is built, or before the end of house construction. In Xochimilco dry sanitation has been contemplated as a requirement in the land use regularization process (the process of formalizing urban use of land that was previously zoned for rural use).

3. To address end-product management issues: In León the local government provides free curbside pick-up of toilet end-product twice a month. In Quintana Roo, the promoters collect the liquid product of the toilets (solid end-products have not yet been produced, since the model that is used there can take up to 7 years to produce the first batch).
4. To make dry sanitation part of larger policies: In Acapulco, the program was directly connected to health care provision and epidemiological studies. In León, dry sanitation was part of an integral housing-provision strategy.

### CONCLUDING REMARKS

Large-scale dry sanitation programs have the potential to address a variety of problems that urban areas face today: increased needs for water supply; dwindling sources of water; lack of economic resources to adequately treat domestic wastewater; lack of resources to provide water and sanitation services to rapidly growing urban and peri-urban populations; and public health risks due to lack of adequate water and sanitation provision.

Mexico has a large number of dry sanitation experiences, including some of the largest-scale urban experiences in the world. A study of the strengths and weaknesses of these experiences can provide insight on successful dry sanitation implementation, not only in Mexico, but in other countries as well. This document reports preliminary observations and recommendations based on 15 months of field research in 6 urban sites in Mexico. Research focused on program implementation opportunities and barriers. Programs varied with respect to their degree of continuity, user adoption, and strategies they had developed to address various aspects of program implementation.

Many program weaknesses were due to inadequate planning and lack of understanding of the set of steps necessary to carry out a dry sanitation program. Most programs began operating with little or no information from other experiences, information that might have saved them precious time, effort and resources. This **Report** has been prepared to help practitioners who are designing or already implementing large-scale urban dry sanitation programs. It reviews some of the frequent pitfalls and makes recommendations that may lead to greater program effectiveness.