F I E L D R E P O R T

PLANNING FOR URBAN ENVIRONMENTAL HEALTH PROGRAMS IN CENTRAL AMERICA

The Development of Water and Sanitation-related Environmental Health Indicators and the Survey of Existing Data in Three Countries

WASH Field Report No. 420
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WATER AND SANITATION for HEALTH PROJECT

Sponsored by the U.S. Agency for International Development
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Prepared for the Bureau for Latin America and the Caribbean,
Bureau for Research and Development,
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by

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and
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RELATED WASH REPORTS

Environmental Health Assessment: An Integrated Methodology for Rating Environmental Health Problems. Technical Report No. 91. October 1993. Prepared by Eugene Brantly, Robert Hetes, Barry Levy, Clydette Powell, and Linda Whiteford. (Available in English and Spanish.)

Final Project Monitoring Report 1992–93: Water and Sanitation for Health and Ecuadorian Development (WASHED). Field Report No. 428. September 1993. Prepared by Daniel B. Edwards and Mercedes Torres.

Planning for Urban Environmental Health Programs in Central America: The Development of Water and Sanitation-Related Environmental Health Indicators and the Survey of Existing Data in Three Cities. Field Report No. 404. September 1933. Prepared by Gail Rothe.

Environmental Health Assessment: A Case Study Conducted in the City of Quito and the County of Pedro Moncayo, Pichincha Province, Ecuador. Field Report No. 401. August 1993. Prepared by Gustavo Arcia, Eugene Brantly, Robert Hetes, Barry Levy, Clydette Powell, José Suárez, and Linda Whiteford. Joint paper with PRITECH.

Water Supply and Sanitation in the Health Sector of the Asia Region: Information Needs and Program Priorities. Technical Report No. 36. February 1986.

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ACRONYMS

A.I.D.	U.S. Agency for International Development (Washington, D.C.)
ANDA	*Administración Nacional de Acueductos y Alcantarillados* (Salvadoran national water and sewerage agency)
JICA	Japanese International Cooperation Agency
LAC	Bureau for Latin America and the Caribbean (unit of A.I.D.)
PAHO	Pan American Health Organization (unit of World Health Organization)
R&D	Bureau for Research and Development (unit of A.I.D.)
SANAA	*Servicio Autónomo Nacional de Acueductos y Alcantarillados* (Honduran national agency for water and sewerage)
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development (overseas missions)
WASH	Water and Sanitation for Health Project

EXECUTIVE SUMMARY

This report has been prepared for the Bureau for Latin America and the Caribbean/Health (LAC/Health) and the Bureau for Research and Development/Health (R&D/Health) of the U.S. Agency for International Development (A.I.D.). The purpose of the report is to use available data to document water supply and sanitation-related environmental health problems in urban areas of Central America and to make recommendations for follow-up actions for the bureaus.

The provision of water supply and sanitation facilities has been and continues to be an important component of health programming in developing countries, based on the proven links between access to these services and health outcomes. However, in spite of gains in recent years in the provision of services, the anticipated improvements in health outcomes may be negated by the deteriorating quality of water sources and living conditions. Increases in urbanization and industrialization are main causes for the decline in environmental conditions. These trends, in turn, have led to the rapid growth of peri-urban, or informal, areas of cities where overcrowding, proximity to industries and waste dumps, and lack of services have caused particularly severe environmental contamination. Therefore, in addition to the traditional health risk in developing countries of endemic and epidemic disease, the population also faces an increased risk of chronic disease and acute toxic effects. Governments, external funding agencies, and local planners need to be able to set priorities for health interventions. The first step, however, is to document the problems.

The specific purposes for this task were to

- Identify environmental health problems by geographic area and sector for the purpose of making a broad assessment of relative health risks across sectors and cities, and
- Assess follow-up data collection efforts based on the availability and quality of the data collected.

The task was carried out in two stages. First, a set of environmental health indicators was developed that would rapidly and accurately characterize the urban environment. The selection of indicators was based on identifying the data needs for a quantitative environmental health assessment. The indicators fell into seven areas: water supply, sanitation and wastewater, solid waste, hazardous waste, water pollution, food hygiene, and morbidity and mortality. In addition, a special effort was made to collect disaggregated data, i.e., data broken down between the formal areas of the city and the informal, or peri-urban, areas.

Second, a data collection field trip was undertaken in March and April of 1993 to the selected cities: Guatemala City, Guatemala; Tegucigalpa, Honduras; and San Salvador, El Salvador. No effort was made to collect original data; only secondary data were used.

Approximately one-quarter of the data sought was actually collected. In some cases, it is fairly certain that no data exist. More often, data exist but are inaccessible for political reasons or they exist in a form not useful for this study. As a result, a regionwide quantitative assessment of environmental health problems was not possible.

It was also impossible to document the differences between the formal and informal sectors of the city due to the lack of representative data. Little information exists on the health status of the peri-urban population in comparison to the core urban area and rural areas. In many cases, official health statistics for urban areas may not include the unofficial residents of informal sectors. The reluctance or inability of governments to provide for the informal sector, in combination with the fairly recent pressures of population and industrialization, results in an almost total lack of data for this population.

However, the quantitative data that were collected were supplemented with anecdotal evidence and localized studies to provide a general sense of the potential health impact from environmental contamination. Sizable portions of urban populations and downstream water users are being exposed to human, industrial, solid, and hazardous wastes. Conservative estimates are that:

- Five to 10 percent of urban populations have no sanitary facilities whatsoever; human wastes contaminate the areas where people live, work, and play.
- Thirty percent of urban populations use latrines which, because of their concentration, may be a source of groundwater contamination.
- Sewage is not treated, but simply removed from one area of the city to another, often to surface waters used for drinking.
- Hazardous wastes from industries and hospitals are not treated or disposed of in a separate manner from other solid wastes. An estimated 1,200 tons are produced monthly in Guatemala City alone, and its ultimate destination is not known.
- Wastes from hundreds of industries in the formal sector and probably thousands of small home industries in the informal sector are apparently not regulated.
- Half of all solid wastes—hundreds of tons each day—is left uncollected near homes and provide a habitat for disease vectors such as flies and rodents. The other half is disposed of in unsanitary landfills that provide no controls for the prevention of leakage into groundwaters.
- Studies that have focused on identifying and characterizing the urban poor reveal that major differences exist in health outcomes between the formal and informal sectors. Differences in morbidity and mortality reinforce the anecdotal evidence of the critical nature of the health status of peri-urban communities.

Based on these findings, it is recommended that A.I.D. should, in general:

- Link data collection efforts in any project to a management information system with clearly defined data needs.
- Support programming efforts in peri-urban areas throughout the region. With the explosive growth of peri-urban populations and the unique conditions posed by their tenuous legal standing and increased industrialization, the traditional rural–urban dichotomy may not be adequate as a framework for addressing health needs.
- Strengthen democratic processes, such as the decentralization of control and financing of water and sanitation services, that reinforce responsive and competent local governments. Representative governments will be more likely to allocate costs of services fairly and penalize polluters.

In more specific terms, A.I.D. could carry out one or more of the following:

- In the short term, A.I.D. could investigate the underlying causes for the lack of data needed for environmental health assessments. The task would include reviewing the political environment; the legal and regulatory framework; the intra-and inter-institutional arrangements of the relevant national and municipal agencies; and the role for private, nongovernmental organizations. This could be followed by the implementation of a system for institutionalizing the demand for data, such as a geographic information system that could link the various service sectors and government levels.

- In the medium term, A.I.D. could carry out a rapid assessment, applying and refining the methodology of the environmental health assessment used in Quito, Ecuador, in 1992. The selection of one or more cities to be assessed could be based on national priorities, USAID mission objectives, or activities and goals of other external support agencies. A relative risk assessment across and within countries would not be possible; results would only be useful within the limited geographic area of the study. As in the Quito study, the collection of primary qualitative data from focus group discussions could compensate for the lack of quantitative data. A local government agency or nongovernmental organization could provide ongoing monitoring.

- In the long term, A.I.D. could pursue the original objective: to obtain sufficient information for a regionwide prioritization of environmental health problems. It must be recognized that the level and sophistication of data required for an environmental health assessment for the region will not be available quickly or cheaply. The most efficient method may be an assessment that makes no effort at institutionalizing local monitoring. The information would lead to better planning for A.I.D. and the potential for leveraging of funding from other external support agencies, but these data would not necessarily be at the level of detail required at the local level for programming and decision-making.

Chapter 1

INTRODUCTION

1.1 Background

The links between water and sanitation services and health outcomes are clearly established: clean water and the proper disposal of human excreta prevent the spread of waterborne diseases such as diarrhea and cholera; improved water sources can lead to the control of vectors for diseases such as malaria; and improvements in sanitation are found to have significant benefits for nutritional status. As a result, the provision of water supply and sanitation services has been a major component of health programming in developing countries. In the seven countries of the Central American region, in the past decade approximately 6.6 million people gained access to water supplies and 11 million to sanitation (WASH Field Report No. 404). In a region of 30 million people, this represents substantial progress.

In addition to the provision of water and sanitation services, there have been significant gains in the sector in understanding the roles of institutional development, community participation, hygiene education and behavioral changes, financial sustainability, and technical innovations. These areas are critical to the use and sustainability of systems and, ultimately, to improvements in health.

Despite gains in the provision of services, the deteriorating quality of water sources and living conditions may be negating the anticipated improvements in health outcomes. This realization has led to a review of the water and sanitation sector within the broader environmental health context. Moreover, there is an urgent need, given the limits on funding, for governments and external donors to set priorities for health interventions. This need has led to the effort to develop analytical methods that can rank the relative importance of existing health hazards.

Two related activities of the Water and Sanitation for Health Project (WASH) predate the current attempt to assess environmental health conditions: one in Tegucigalpa, Honduras, in 1991 and the second in Quito, Ecuador, in 1992. The WASH task in 1991 was requested by the U.S. Agency for International Development's (A.I.D.) Bureau for Latin America and the Caribbean and was undertaken to identify key indicators for monitoring improvements to the health-related environment and to identify environmental health hazards. The project included a data collection field trip to Tegucigalpa. A risk assessment of environmental health problems was not possible because of a lack of quantitative monitoring data. A second methodology was then employed to assess the environmental practices and services of the city, identify major environmental problems, and estimate the size of the population exposed to these problems. The poor quality of existing data undermined the attempt to assess environmental health problems. Nevertheless, the experience from this project was useful to an initial assessment of the environmental health sector in a major city of Central America.

In 1992 a second, more rigorous, effort was made to carry out a quantitative risk assessment, this time for the city of Quito. The specific objectives were to

- Develop methods for conducting environmental health assessments,
- Identify significant environmental health hazards, and
- Provide information for setting priorities in the environmental health sector.

Once more, limitations of the data made it impossible to conduct a comprehensive risk assessment; however, the available data were complemented by newly collected ethnographic data to provide a

reliable picture of environmental health problems. The results showed that outdoor air pollution and food contamination were the apparent leading sources of environmental health risk in the city at large; in addition, in the informal sectors,[1] hazards in the workplace and from wastewater presented substantial health risk. In terms of adapting a risk assessment methodology for developing countries, this study demonstrated that the inclusion of ethnographic data was extremely useful.

1.2 Rationale

The rationale for the current task is essentially the same as for the Tegucigalpa and Quito studies and is based on three fundamental ideas:

- The expected impact of two broad social and demographic trends, namely, the urbanization and industrialization in developing countries that will lead to increased contamination of the environment, particularly in urban centers;
- The rapid growth and unique characteristics of peri-urban areas that suggest that populations in these areas will bear the major burden in terms of negative health outcomes; and
- The need of governments, donors, and planners to set priorities for health interventions.

1.2.1 Industrialization and Urbanization

The rapid, and in many cases unregulated, growth and industrialization of third world economies pose new health risks to third world populations. The production and improper disposal of industrial wastes, particularly hazardous materials, will increase. In addition, employment in industries in both the formal and informal sectors will rise. These trends will lead to an increased risk of exposure to many toxins and to chronic diseases. In addition, as per-capita incomes rise, so too will per-capita solid waste production. Already in most cities in developing countries, one-third to one-half of solid waste generated remains uncollected. The waste accumulate in streets, vacant lots, and drainage areas, providing an ideal environment for the reproduction of disease vectors such as insects and rodents.

As the centers for economic growth, cities in developing countries will continue to grow faster than rural areas. In the seven countries of the Central American region, the average annual population growth rates between 1985 and 1990 for urban areas were approximately double the rates for rural areas. In effect, urban areas are already absorbing two-thirds of the population growth; of this amount, one-third is rural migrants.

1.2.2 The Peri-urban Area

Most of the growth of cities is occurring in the informal or peripheral areas, rather than in the core or formal sector of the city. Already, between one-quarter to one-half of the urban population of developing countries lives in informal settlements. In Tegucigalpa, according to population projections by the Government of Honduras, the greater metropolitan area of Tegucigalpa will grow 7 percent annually between 1985 and 2000; the center will grow by only 2 percent, whereas the periphery and exterior zones combined will grow by 9.9 percent.

[1] Informal city sectors are defined as having one or more of the following: illegal squatter settlements; few or no public services; little or no infrastructure; substandard housing; and inhospitable land, such as steep hillsides, flood plains, or proximity to solid waste dumps. Several different terms—peri-urban areas, *barrios marginales, asentamientos populares urbanos, colonias illegales*—are used for these areas. The different terms are used interchangeably in this report.

The impact of this growth can be roughly estimated for the water supply sector. According to population projections, in the 15-year period between 1985 and 2000, the city will grow by over one million new inhabitants; most of these additional inhabitants—930,000—will live in the *barrios marginales*. By comparison, in the 12-year period between 1980 and 1992, water supply services were provided to only 700,000 urban inhabitants in the entire country. The pressure on the national water authority and the potential for an increase in water-related diseases will be enormous.

The failure to provide sanitation and wastewater services to the informal sector population may be still more serious in terms of health impact. The local environment will become increasingly contaminated from industrial and human wastes. The absence of the most basic sanitary facilities for a sizable portion of the population, the concentration of latrines, and the haphazard disposal of untreated municipal and industrial wastes will increase the risk of exposure to disease-causing agents for the metropolitan area as a whole.

Moreover, the settlements in peripheral areas commonly are located on poor-quality land that may increase health risks (such as near waste dumps) and preclude the extension of services (such as on hillsides). Yet the key difference between the formal and informal sectors of the city is not their physical characteristics, location, or level of services. The essential difference lies in the illegal and marginalized nature of the informal settlements. Fundamental differences between urban and peri-urban areas explain some of the reluctance of municipal authorities to provide services or acknowledge the presence of informal settlements (table 1).

Table 1

URBANIZATION PROCESSES IN URBAN AND PERI-URBAN AREAS

Conventional Urbanization Process	Urbanization in Peri-Urban Areas
Land use rights are legally transferred (usually sold).	Individual families or a large group of families needs housing.
The land use is changed (usually from agricultural to residential).	Unserviced but affordable land is acquired, either through invasions or through informal purchases.
The land is subdivided into plots or parcels.	Individual houses are built, usually with rustic building materials; these houses usually do not meet building standards and have no provision for basic sanitation.
The land is registered in the new owner's name.	Families use their new home base to enter into the informal economy and start accumulating capital.
The land is developed by installing basic urban services such as water, sewage and drainage, roads, and electricity.	The houses are incrementally improved according to household priorities and available capital; this stage may include the construction of an improved latrine.
A house is built on the land.	Communities become organized and demand that municipal authorities provide them with basic urban services such as electricity, roads, water, and sewage.
The house is put on the market and sold.	After infrastructure is installed, land is legalized and registered by municipal authorities.
The house is occupied by a family.	

Source: WASH Technical Report No. 86, July 1993.

In part because of the reluctance or inability of governments to provide for the informal sector, but also because of the fairly recent pressures of population and industrialization, little information exists on the health status of the peri-urban population in comparison to the population of core urban and rural areas. In many cases, official health statistics for urban areas may not include these unofficial residents, masking the situation in peri-urban areas.

Studies that have focused on identifying and characterizing the urban poor reveal that major differences in health outcomes exist between the formal and informal sectors. Table 2 summarizes the findings of some of these studies for Latin America. Higher mortality rates, lower life expectancies, and poorer nutritional status characterize the peri-urban population in comparison to the formal sectors of the city and, in some cases, to rural areas as well. These differences in morbidity and mortality reinforce the anecdotal evidence of the critical nature of the health status of peri-urban communities.

In fact, the traditional rural–urban dichotomy used extensively in programming for developing countries may no longer be valid. With the explosive growth of peri-urban populations and the unique conditions posed by their tenuous legal standing and increased industrialization, governments must consider and plan for a third sector that encompasses peri-urban populations.

Table 2

INTRA-CITY DIFFERENTIALS IN MORTALITY AND MORBIDITY

In Porto Alegre, Brazil, the infant mortality rate among residents of shantytowns is three times as high as among the non-shantytown residents. The neonatal mortality rate is twice as high, and the post-neonatal rate is more than five times as high.

In Sao Paulo, Brazil, the infant mortality rate can vary by a factor of four, depending on the district. In the core area, it is 42 per 1,000 live births; in one of the poor peri-urban municipalities, the rate is 175 per 1,000. Infant deaths from enteritis, diarrhea, and pneumonia on the city's periphery are twice as high as in the core area.

In Quito, Ecuador, the infant mortality rate for upper class districts is 5 per 10,000 live births; for the infants of manual workers in squatter settlements, the rate is 129.

In Guatemala City, stunting is more prevalent among children of low socioeconomic status than those of high socioeconomic status.

Of 1,819 infants with diarrheal disease in Panama City, 46 percent came from slums, 23 percent from shanties, and none from better housing.

Source: Adapted from Hardoy, Cairncross, and Satterthwaite (1990) and Bradley et al. (1991).

1.2.3 Need to Prioritize

In the planning and funding of health programs, there is a need for analytical methods that may be used to prioritize both health hazards and interventions.

Establishing links between the health benefits derived from different types and levels of services is one method for helping set priorities. The findings from several recent studies point out these areas with particular application to the urban environment (table 3). More work is required to confirm these findings and their implications for peri-urban areas.

Further development of the methodology of the environmental health assessment is critical for ranking health hazards. The methodology, however, has fairly extensive data needs. Reliable data are needed on environmental concentrations and dose–response relationships of pollutants, disease prevalences, and information on the population at risk. An acknowledgement of the need for such data served as the basis for the current study of Central America.

Table 3

DIFFERENTIAL HEALTH BENEFITS FROM DIFFERENT TYPES AND LEVELS OF SERVICES

Improved water services are consistently associated with decreased risk of stunting in children in urban areas; this relationship is less consistent in rural areas. Therefore, improvements in water supply may have greater impact in urban areas.

The association between poor sanitation and risk of stunting is stronger and more consistent than is the association between poor water services and risk of stunting. Therefore, improvements in sanitation may be more important than improvements in water supply.

The interaction between water supply and sanitation suggests that health benefits may not be obtained with improved water supplies in areas where the overall level of sanitation is low (i.e., where the overall level of environmental contamination is high).

The community level of sanitation may be more important than the individual household access to improved sanitation. For example, children with no individual access to a toilet but living in a community with a high level of sanitation coverage have no increased risk of stunting when compared with children with individual access to a toilet but living in a community with a high level of sanitation coverage.

Access to latrines in urban areas may not reduce environmental contamination by human wastes. Unlike more dispersed rural populations, high population densities found in peri-urban areas and the number of closely spaced latrines can overwhelm the carrying capacity of the soil and pollute groundwater.

Source: Adapted from WASH Field Report No. 352; WASH Field Report No. 398; WASH Technical Report No. 86; and Esrey (1993).

1.3 Purpose and Scope

The Bureau for Latin America and the Caribbean/Health (LAC/Health) and the Bureau for Research and Development/Health (R&D/Health) of A.I.D. requested a review of existing information on water supply and sanitation-related environmental health problems in selected urban areas of Central America (see appendix A).

The specific purposes for this task were to

- Develop a list of relevant indicators for the rapid and accurate assessment and ongoing monitoring of environmental health problems,
- Gather the selected data,
- Identify environmental health problems by geographic area and sector for the purpose of making programmatic decisions at the level of a broad and initial assessment of the relative health risks across sectors and cities, and

- Assess follow-up data collection efforts based on the availability and quality of the data collected in the review.

The review was seen as a first step in assessing the urban environmental health situation; therefore, no effort was made to collect new data. The three cities chosen for the survey were Guatemala City, Guatemala; San Salvador, El Salvador; and Tegucigalpa, Honduras.

Chapter 2

METHODOLOGY

2.1 Developing the Indicators

The first part of the review consisted of developing a set of indicators that would rapidly and accurately characterize the urban environment. The indicators were identified in several stages. First, a list was developed to identify all of the data that would ideally be needed to perform a detailed quantitative environmental health assessment or risk assessment. This list was intended to identify all types of data helpful in assessing environmental health. The indicators included sources of environmental pollutants and toxic agents; environmental dispersion, fate, and transport; environmental concentrations and exposure; dose–response relationships; and public health statistics.

Many of the types of data sought can be obtained only through extensive monitoring and data collection. Furthermore, a number of factors, such as age, sex, heredity, underlying disease, overall nutritional or immune status, dose, and duration of exposure, affect a person's susceptibility to many environmental diseases. The infectious dose is known for only a few human pathogens, and then only for normal, healthy adults. Therefore, most diseases do not have sufficient data with which to develop dose–response relationships.

A second step was then used to narrow the list of potential indicators. This consisted of a review of diseases and critical exposure determinants, focusing on some of the environmental diseases in Latin America associated with either food hygiene or water supply and sanitation. In general, diseases that are best suited as indicators are those that are easily and reliably diagnosed, severe enough to require medical attention, and reliably associated with poor environmental conditions. Four potential data sources of disease incidence were identified: clinical records, key observations, surveys, and focus group interviews. For both food hygiene and water supply and sanitation, the critical determinants of exposure routes and their impact on disease incidence were identified and ranked as possible indicators.

In the third step, a review of the existing comparative risk studies from developing countries helped identify still other indicators. Comparative risk studies attempt to quantify the incidence and cause of a broad range of environmental health problems and to rank them according to their overall impact. Only two studies have been conducted that have attempted to rank environmental problems in developing countries: one in Bangkok, Thailand, and one in Quito, Ecuador. The review focused on identifying the critical data on which quantitative estimates of risk were based in the two studies. This information was used to further refine the set of candidate indicators.

Based on these three efforts, a list of environmental indicators was proposed and then reviewed by LAC/Health and R&D/Health, with contributions from the World Bank, World Resources Institute, and A.I.D.'s Office of Housing and Urban Programs, two groups experienced in developing urban environmental indicators. The list was further revised by WASH and is summarized in table 4.

To assist in the data collection effort, the list of indicators was transferred to seven data sheets according to sector (see appendix B):

- Water supply
- Sanitation and wastewater
- Solid waste

Table 4

SUMMARY OF ENVIRONMENTAL HEALTH INDICATORS

Basic Area Data

Population
Number of households
Median annual income
Legal status (incorporation into the city)

Water Supply

Access
  Type of water consumed (tap, vended, surface, well, rainwater)
  Percentage of total population consuming each type
  Quality of each type of water
  Per capita quantity consumed of each type of water
  Cost to consumer of each type of water
Financial sustainability of municipal water system
  Percentage of operating costs covered by user fees
  Percentage of water unaccounted for (leakage)
Health impact and the state of infrastructure
  Qualitative judgments
Regulatory overview

Sanitation and Wastewater Drainage

Access
  Type of sanitation facilities used (sewage, latrines, none)
  Percentage of population using each type
Industrial, commercial, and medical wastewater disposal
  Percentage treated
Financial sustainability of the municipal sewage system
  Percentage of operating costs covered by user fees
Health impact and the state of infrastructure
  Qualitative judgments
Regulatory overview

Water Pollution

Industrial and domestic wastewater
  Volume and percentage treated
Impacts on city water supply and downstream users (e.g., for irrigation)
  Qualitative assessments
Regulatory overview

Solid Waste

Source of waste (household, commercial, industrial, and medical)
Volume of each source
Composition of each source (percentage organic, recyclable, hazardous)
Disposal system by source
  Collected or not
  Percentage private, public, formal, informal
Financial sustainability of the system
  Percentage of operating costs covered by user fees
Health impact and the state of infrastructure
  Qualitative judgments
Regulatory overview

Hazardous Waste

Industries
  Total number
  Type and volume of wastes generated
  Method of disposal
Regulatory overview

Food Hygiene

Percentage of population with refrigerators
Food inspection
  Quality
  Frequency
  Coverage
Regulations
  Existence
  Enforcement

Morbidity and Mortality

Infant mortality rate
Under-five mortality rate
Morbidity rates for water- and sanitation-related diseases

- Hazardous waste
- Water pollution
- Food hygiene
- Morbidity and mortality

The data sheets were developed on the assumption that in each of the three cities, citywide data could be disaggregated for the formal and informal sectors. The motivation for disaggregating the data was based on the knowledge that the relatively high reported rates of coverage for urban water and sanitation services mask the severe conditions in peri-urban settlements of the city.

2.2 The Data Survey

To carry out the survey, four WASH consultants—one each in Guatemala City, San Salvador, and Tegucigalpa, and one coordinating the data collection effort—collected the data over a three-week period in March and April of 1993. From the relevant municipal and national agencies and international organizations the consultants received a variety of published and unpublished information for the selected indicators (see appendix C). With this information, the consultants then compiled the data sheets for the seven sectors. All three in-country consultants provided additional qualitative information based on interviews with various local professionals and their own experiences.

Chapter 3

DATA COLLECTION ISSUES

3.1 Introduction

The information collected in the survey, both quantitative and qualitative, led to a number of important findings about environmental conditions and their potential health impact in the three cities. The results are presented and discussed in chapter 4. This chapter addresses two issues related to the difficulties of data collection and the poor quality of the data that have important implications for any future effort in this field.

3.2 Data Availability and Quality

Data accessibility, or more accurately, inaccessibility, was the main constraint to achieving the objectives of the study. Only approximately one-quarter of the data sought was actually found. The reasons for the inaccessibility are describd below.

- *Data do not exist.* In some cases, such as for hazardous waste in San Salvador, it is fairly certain that no quantitative data exist.

- *Data are not accessible for political reasons.* In other cases, such as water quality, the data exist but are unavailable. Information exists on water quality regulations, testing schedules, and minimal acceptable standards. In addition, it appears that water is being tested regularly in all three cities. However, the test results have either not been processed in a manner that facilitates access or, quite possibly, the results are too sensitive for release. Moreover, it is unclear if and how these data are used internally.

- *Data are poorly documented.* Poorly documented reports with unclear or missing units, sources, and dates are a common problem.

- *Data exist, but with widely different values for the same indicator.*

- *Data are reported for an ever-shifting base.* Per-capita calculations are made on an ever-shifting base, which changes with different estimates of city populations, different geographic boundaries of the city, and overlapping jurisdictions reported by various government agencies. For example, the greater metropolitan area of Guatemala City includes the *municipio* (municipality) of Guatemala and usually includes the *municipios* of Mixco, San Miguel Petapa, Villa Nueva, Villa Canales, Santa Catarina Pinula, and Chinautla, but may include up to 17 *municipios* in all. The greater metropolitan area of Guatemala has a population over two million; the *municipio* of Guatemala has about one million. Data were also collected in this study from Mixco, Villa Nueva, and San Miguel Petapa, which have much smaller populations of 23,000; 36,000; and 8,000; respectively. However, these figures are only for the populations that fall under the *cabecera municipal* (municipal capital). By comparison, for Mixco, the Ministry of Health counts 363,928 people, which includes residents of the *cabecera municipal*, other villages, land developments, *fincas* (farms), and so on. To complicate the situation still further, some of the land developments in greater Mixco are served by the municipality of Guatemala.

- *Data are not in a usable form.* Data are kept in raw form, or have not been processed or analyzed. In many cases, too much data is worse than too little. Data collection efforts in the relevant

sectors are many and varied, producing an overwhelming amount of data. However, most of these data likely have no useful function, and cannot be used to link environmental conditions to health impact, the ultimate use in this study. The lack of strategic planning with links to a management information system with more clearly defined data needs and uses is more evident in all sectors than the need for more data collection.

- *Data do not include informal sector populations.* This factor probably led to the greatest bias in estimates regarding population and is discussed further below.

3.3 The Informal Sector

It is well documented that the urban population is growing faster than the rural population in Central America. Moreover, most urban growth is taking place in the informal sector of the cities, where precarious land sites, proximity to landfills and industries, and lack of sanitary facilities increase the risk of exposure to disease-causing agents. More problematic than the lack of official data is the high probability that peri-urban populations are outside the official data collection system. This is partly a problem of the recent growth of peri-urban areas, although there are many older marginal settlements. It is partly a problem of determining the geographic boundaries of the city and defining low-income areas. Probably most important, however, is the fact that these populations are illegal and unofficial and hence are not recognized by many of the agencies that are collecting information.

In this survey, the attempt to disaggregate citywide information was thwarted by discrepancies in the data of various local, departmental, and national agencies, as well as the nearly total lack of information on informal urban areas. Guatemala City data were collected from four *municipios* in the greater metropolitan area; however, this disaggregation was not particularly useful in separating data from formal and informal sectors since all *municipios* contain some marginal populations.

Data from some recent studies identified during the data collection effort allowed a rough estimate of the size of the informal population, although it is unclear how representative these studies are. Not surprisingly, the estimates vary from study to study and from one government agency to the next. In a 1991 study by the Japanese International Cooperation Agency (JICA) of solid waste for the 25 zones of Guatemala City plus Mixco, Villa Nueva, Villa Canales, Santa Catarina Pinula, and Chinautla, 12 percent of the total 1.5 million population were classified as living in slums. On the other hand, a 1990 survey by the Pan American Health Organization (PAHO) of the *municipio* of Guatemala estimated that over 500,000 people were residents of 187 settlements classified as marginal. Recent population estimates calculate 1,095,677 for the *municipio* of Guatemala City and 2,018,180 for the greater metropolitan area. Using the larger figure, the proportion of the population living in the informal sector is one-quarter; using the lower base, it is one-half.

In 1990, Tegucigalpa had an estimated 599,000 inhabitants dispersed among 310 *colonias*. Of these, 170 *colonias* (43 percent) had substandard housing and could be classified as marginal areas. No data for San Salvador could be used to estimate the city's informal population.

The data indicate that the size of the informal sector in Central American cities is as high as one-quarter to one-half of the total urban population. Given both the size of the informal sector and the sector's poor environmental conditions, the lack of official data is revealing. Where no information exists, no problem can be documented and no solutions formulated. Government systems, based as they are on developed-country models where informal sectors are much smaller, are simply not prepared to respond to the informal sector's enormous problems.

Chapter 4

FINDINGS

4.1 Introduction

The task, simply, was to document the water and sanitation-related environmental health problems in three cities using existing data for the areas listed in table 4. Approximately 25 percent of the data sought were actually collected; the percentage varied substantially among categories and across cities. The availability of the data collected can be summarized as follows:

- *Basic area data.* Data for population, number of households, and so on were usually available; the problem was that several, sometimes conflicting, estimates exist for the same indicator.
- *Water supply and sanitation.* The greatest percentage of data was collected for the water supply and sanitation sectors.
- *Solid waste and hazardous waste.* Some information was available for these sectors.
- *Water pollution and food hygiene.* Essentially no direct data were available for water pollution and food hygiene, although calculations for the contamination of water by human, hazardous, and solid wastes are presented.
- *Morbidity and mortality.* Some of these data exist, but not strictly for the metropolitan area under study. Health data are routinely collected and reported either for the department in which the city is located, which includes rural inhabitants, or for all urban areas in the country. As a result, no health data are presented.
- *Legal/Regulatory.* Legal or regulatory information is probably the most accessible, but received less priority in the data collection effort; as a result, no information is presented. The more difficult, but more useful, task would be to document the extent to which existing laws and regulations are enforced.

With so little representative data to work with, no quantitative environmental assessment of the three cities can be made. However, the quantitative data collected in this survey can be combined with the qualitative data and anecdotal evidence from WASH consultants and other experts and with the results of studies of selected neighborhoods. From these combined sources, sufficient information is available to begin to document environmental conditions in the three cities. The following sections present information for eight areas:

- Access to water supplies
- Drinking water quality
- Water quantity
- Access to sanitation services
- Solid waste
- Hazardous waste
- Financial sustainability
- Surface and groundwater pollution

These eight topics were chosen based on the availability of data, not on any ranking of potential health risks. The topics relate, in general, to the access to and quality of public and private services: water supply, sanitation, and solid and hazardous waste collection. These, in turn, may be used to estimate the population at risk of both infectious and chronic diseases due to the lack of basic sanitary services and the mismanagement of wastes. The information presented in the following sections should not be considered representative of the informal sector or the city as a whole, nor does the information provide the basis for a comprehensive assessment of urban environmental conditions. However, the data do lead to several important findings that further elucidate the environmental problems in urban areas and point the way to further work in this area.

4.2 Access to Water Supplies

The access to water by residents of urban areas of these countries is fairly high, according to official statistics. In the urban areas of Guatemala, 90 percent have access to piped (within at least 200 meters) or vended water; in Honduras, 88 percent; and in El Salvador, 86 percent (WASH Field Report No. 404). However, for the three cities studied, any disaggregation of these figures, either by area of the city or by type of service, presents a more complicated picture.

In the greater metropolitan area of Guatemala City, it is estimated that piped water is accessible to between 40 and 50 percent of the residents of the *municipio* of Guatemala City; in Mixco, 69 percent; in Villa Nueva, 75 percent; and in San Miguel Petapa, 100 percent. However, PAHO (1990) estimates that in the *municipio* of Guatemala City, only 15 percent of the households in the marginal areas have water connections. Sixty percent rely on public taps, and 20 to 25 percent depend on vended water.

In Tegucigalpa, the Honduran national agency for water and sanitation (SANAA) estimates the coverage of water supply at 99 percent. Of these, 80 percent have access to municipal water supplies, 17.5 percent have access to vended water, and the remainder obtain water from wells and unprotected surface waters. A SANAA survey of selected *barrios marginales* indicates that only 29 percent of families had access to piped water.

The United Nations Children's Fund (UNICEF), however, estimates that only 68 percent of the population of Tegucigalpa have access to safe water supplies. For the marginal areas, UNICEF estimates that only 55 percent obtain water from SANAA, leaving at least 200,000 people to rely on other sources, such as vended water and unprotected surface water. The main source of surface water is the highly polluted Choluteca River, which receives sewage and industrial discharges.

In San Salvador, 10 *municipios* in the greater metropolitan area of San Salvador are served by the Salvadoran national water and sewerage agency (ANDA). A reported 88 percent of the population in this area has water and sewage connections. Of the 190,874 water connections, 171,583 are for households and 746 are for *areas marginales* and presumably are public water taps serving many families.

Although official estimates of access to city water systems are high for cities as a whole, localized studies suggest that the marginal areas are severely underserved. Most residents lack individual household taps, and hundreds of thousands depend on vended water and highly polluted surface water. Even those with access to piped and vended water often receive supplies below international standards for quality and quantity.

4.3 Drinking Water Quality

Access to water involves more than proximity to a tap. The quality of the water consumed has a major impact on health. Yet water quality data were rarely available for city water systems. Anecdotal evidence suggests that the quality of water supplies, including the municipal water supply is

inconsistent. It is known, for example, that city water and sewer lines usually are laid close together, and that leakage from sewage lines contaminates water lines. Vended water is not guaranteed to be of good quality, and surface and groundwater sources may be worse.

In Tegucigalpa, some private water companies draw the water they sell in marginal areas from the surface waters where the city's untreated human wastes and almost all industrial wastes are dumped. The city's poorest groups also draw their drinking water directly from these contaminated surface waters. Not surprisingly, groundwaters are also contaminated. A bacteriological analysis of the groundwater indicated that over a six-month period, more than 80 percent of the monitored groundwater was highly contaminated.

Regardless of source, drinking water in all three cities is very likely to be contaminated; most, if not all, city residents consume poor-quality water at risk to their health.

4.4 Water Quantity

Water quantity is also important for maintaining health, for drinking and bathing and washing hands, which are routes of disease transmission. Water quantity is limited by distance to the water source; intermittent service of the municipal system, especially during the dry season; and by cost.

The only available data on water quantity were from Guatemala. The quantity of water consumption in Guatemala City was reported as 102 liters per capita per day (lpcd) at the municipal source, 25 to 35 lpcd for those in the marginal areas with piped water, and 12 lpcd for those buying vended water. Given that 20 lpcd is generally accepted as a minimum standard, those buying water could be classified as having inadequate access.

4.5 Access to Sanitation Services

Like access to water supply, the official coverage figures for access to sanitation services are fairly high: 70 percent, 88 percent, and 84 percent for the urban areas of Guatemala, Honduras, and El Salvador, respectively (WASH Field Report No. 404). Once again, these figures do not tell the whole story.

In the greater metropolitan area of Guatemala City, 54 percent of the population have access to sewage systems. Mixco reports that 52 percent of its population have access to a sewage system; 22 percent have no sanitation facilities whatsoever; presumably, the remaining 26 percent have latrines. In Villa Nueva and San Miguel Petapa, there are no sewage systems.

For the *barrios marginales*, however, only 21 percent of the households had sewage connections, according to a 1988 study conducted by the municipality of Guatemala City. An estimated 19 percent of the population in these areas have no sanitation facilities whatsoever, and the remaining 60 percent rely on latrines (PAHO 1990).

In Tegucigalpa, SANAA estimates that 74 percent of the population have access to the city sewage system, 19 percent have latrines, and 7 percent have no excreta disposal system. According to these figures, 188,500 people (26 percent of the population) do not have access to sewage disposal. However, these figures apparently do not include the marginal areas, since approximately 290,000 people (40 percent) inhabit the marginal areas, and none of these has access to the sewage system.

No data were located estimating the types of sanitation or coverage for the city of San Salvador.

4.6 Solid Waste

For all three cities, the information collected on solid waste management was either for public services or for private, formal services. No data were collected on the informal sector waste collection system, which could make a significant difference in estimates of solid waste production and disposal.

In Guatemala City, an estimated 65 percent of solid wastes are collected by the municipal collection system or private companies. The remaining 35 percent are disposed of in some 800 unofficial locations within the *municipio* or an estimated 2,000 unofficial dump sites in the metropolitan region as a whole. In the marginal areas, the percentages are reversed; only about 30 percent of solid wastes are collected.

According to other estimates, 53 percent of households in Guatemala City dispose of wastes at official dump sites, 35 percent at unofficial sites, and 12 percent at scattered locations. This means that almost half the estimated 1,000 to 1,500 tons per day are not disposed of at official sites.

Tegucigalpa produces almost 700 tons of trash per day, of which about 60 percent (by weight) is disposed of at the official site. The official site is a landfill six kilometers from the city that has no controls to avoid contamination of the soil and underground aquifers.

In San Salvador, the garbage volume in early 1993 could only be estimated because the old dump site was closed in June 1992, and the new site did not yet have a scale. In February 1993, the city produced 2,644 tons of solid waste daily, but the estimated amount collected was 500 tons (19 percent). Officials admitted that garbage trucks are too big for the narrow roads in the marginal areas. Therefore, solid waste is collected in these communities far less frequently, if at all.

While in the past most solid waste was organic and therefore highly degradable, a greater percentage is now inorganic or toxic. Only 38 percent of solid wastes in Guatemala are considered organic; as much as 33 percent may be hazardous. In Tegucigalpa, about half of solid waste is organic.

4.7 Hazardous Waste

Hazardous wastes are produced in all three cities. The source of these wastes includes large industries and medical centers as well as the small manufacturing concerns that are common to cities in developing countries. These wastes are probably disposed of along with solid waste or in wastewater, without special treatment. In fact, no hard data on hazardous wastes were available for either San Salvador or Tegucigalpa.

In Guatemala City, some data were available on the 353 industries, their type, number of employees, and estimated volume of annual liquid waste. Indirect methods were used to estimate the types of disposal for the hazardous wastes: 13 percent are dumped into the sewer system, 16 percent are treated, and the method of disposal of the remaining 71 percent is unknown.

4.8 Financial Sustainability

This survey sought information on both provider and user costs for water, sanitation, and solid waste services. Information on provider costs provides a basis for assessing the financial sustainability of the systems. If a large percentage of the system's operating and interest costs is covered by user fees, then presumably the system will be able to maintain and extend services. The information on consumer fees also relates to access: if fees are too high, the poorest groups cannot afford the costs and will continue to lack access.

The percentage of operating and interest costs recovered from user fees was reported for only two of the small *municipios* in Guatemala City and for Tegucigalpa. The cost-recovery figures reported by the water utilities are 22 percent for Villa Nueva, 100 percent for San Miguel Petapa, and 115 percent for Tegucigalpa. The figure for Tegucigalpa appears to be more a goal than an actuality.

Information on leakage in the city water systems was available for all three cities and could be calculated for the three smaller *municipios* of Guatemala City. These figures tend to undermine the credibility of the higher estimates of cost recovery. Water that is unaccounted for stands at 40 percent in Guatemala, 50 percent in Tegucigalpa, and 36 percent in San Salvador. Based on the difference in quantity of water produced at the municipal source and the tap, estimated losses for the *municipios* of Mixco, Villa Nueva, and San Miguel Petapa are 26 percent, 28 percent, and 50 percent, respectively. Whether the water is lost or stolen through illegal taps is not reported and is probably not known. The large amount of water for which no fees are collected reduces the cost recovery of the utilities, undermines their financial sustainability, and limits their ability to maintain and expand services.

Data gathered on the cost of water piped to the consumer suggests a wide range of costs across the cities, although it was not always clear if data were reported per connection, per family, or per person. Generally, vended water was more expensive per volume than piped water. For example, in Tegucigalpa, estimated monthly costs of municipal water range from $2 to $6, while vended water costs $9 per person per month. In general, families living in peri-urban areas that depend largely on vended water are paying more money for less water. In Guatemala City, the monthly cost for city water is $3.30. In marginal communities, according to PAHO's 1990 study, the cost is $0.40 per month per family for access to a public water pipe, but vended water costs from $4.50 to $7.50 per month per family, based on consumption of one 54-gallon barrel per family per day.

Those served by the city water system, generally the more affluent groups, pay less than those who buy vended water. Much of the vended water is sold by private companies at market rates. Therefore, if cost recovery by water utilities is less than 100 percent, those who consume city water are, in effect, subsidized. UNICEF estimates that Tegucigalpa's peri-urban population spends $11 million to $13 million a year on vended water. Inequities in cost as well as the inability of utilities to cover operating costs indicate the need for a reform of utilities' pricing structures.

4.9 Surface and Groundwater Pollution

There are four main sources of water pollution. Two are point sources from the untreated liquid waste from sewers and industrial waste pipes. Two are nonpoint sources from agriculture and from human waste and garbage. Data on overall industrial discharges were unavailable, although these were the primary data sought for an assessment of water pollution. Agricultural runoff may be the least important for urban populations, although there is no boundary between urban and rural environmental contamination. Waters contaminated by urban populations are used downstream for irrigation. These waters threaten the health of farm workers, people living in sirrigated areas, and consumers of farm products and fish. Moreover, pesticides used within the urban watershed can contaminate water sources and food products.

For other sources of contamination, rough estimates can be calculated of the volume or weight of human waste, solid waste, and hazardous waste for the greater metropolitan area of Guatemala City, which had the most complete data of the three cities in this study (figure 1). In all cases, the lowest estimates for overall waste production[2] were used (see appendix D). Nevertheless, the amount of

[2]Therefore, some individual estimates may appear exceptionally large. For example, a large estimate for the number of people with no sanitation facilities gave a smaller overall estimate for human waste production because the per-capita volume is the smallest for this group.

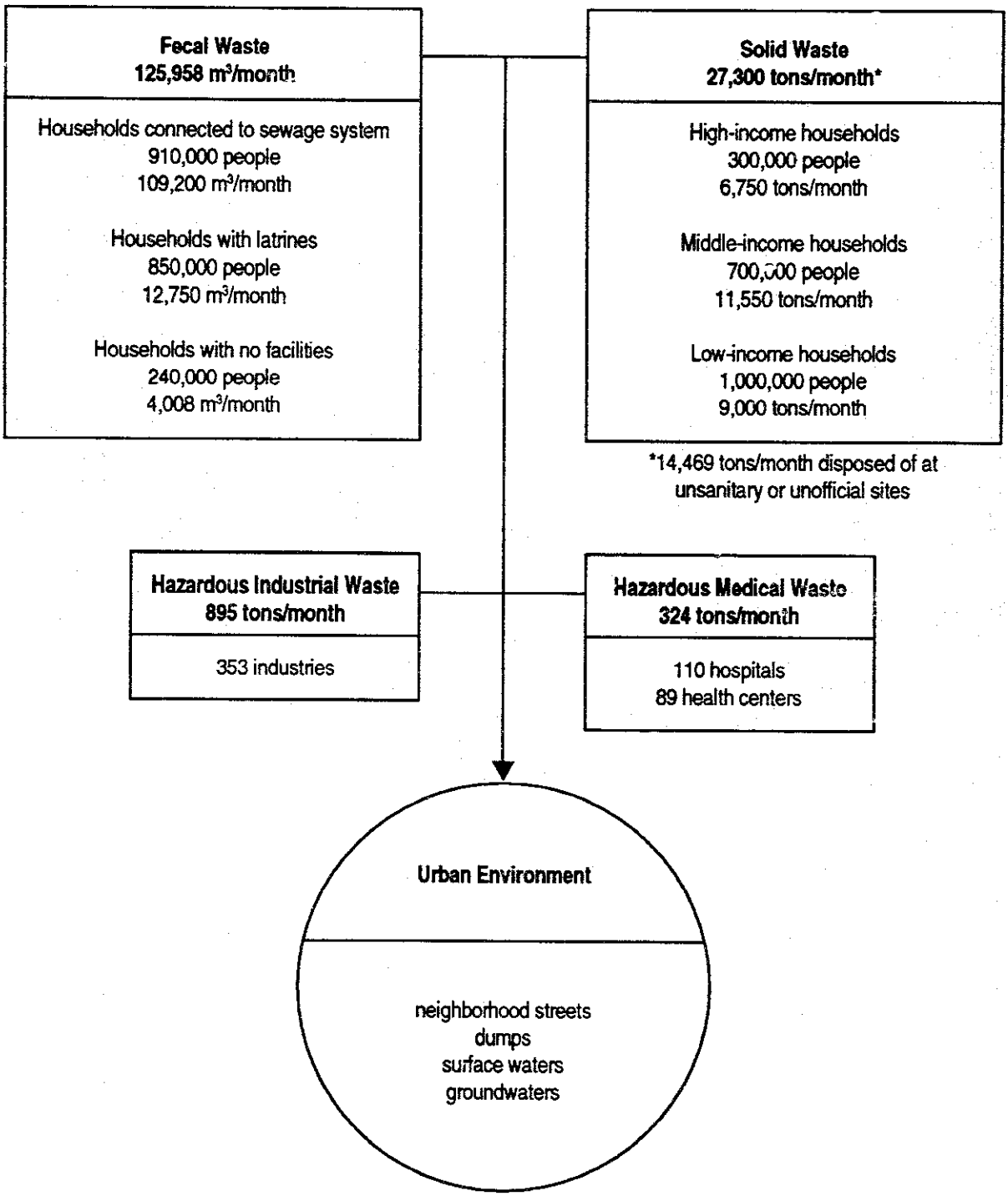

Figure 1

ESTIMATES OF ENVIRONMENTAL CONTAMINATION FOR THE GREATER METROPOLITAN AREA OF GUATEMALA CITY, GUATEMALA

waste flowing into the local environment on a monthly basis suggests a very high risk of exposure to disease-causing agents, especially in the poorest neighborhoods.

An estimated 126,000 cubic meters of human waste is produced monthly. Human excreta from the estimated 12 percent of the population (240,000 people) who have no sanitation facilities contaminates the areas where people live, work, and play. During the rainy season, the waste contaminates surface waters; during dry periods, it disintegrates into airborne dust.

With some 850,000 people in Guatemala City relying on latrines, the underground water source is likely to be contaminated. Where no services exist, latrines are the best alternative; however, the concentration of latrines in peri-urban areas may pose a major threat to groundwater sources. In areas where the population density is above 250 to 300 persons per hectare, human waste from closely spaced latrines can overwhelm the carrying capacity of the soil and pollute the groundwater.

For the estimated 910,000 residents who have access to sewage disposal systems, their human waste is removed from the immediate vicinity. None of the sewage is treated; the wastes are simply carried away from the formal sector for disposal at another site, where they may contaminate surface water and groundwater and expose local and downstream populations to disease.

Industries and hospitals produce 1,200 tons of hazardous waste per month. The most serious threat to water contamination may be the failure of cities to establish separate treatment or disposal sites for hazardous waste. Production of these wastes will undoubtedly increase over time, as will their concentration in local water sources. As a result, the potential health impact of untreated, improperly dumped hazardous waste will almost certainly increase over time. Moreover, the chronic health problems caused by toxins in the environment present very different public heath challenges from the traditional problems of infectious diseases.

This estimate is only for the formal sector, primarily registered industries and medical facilities. No data were available on the production of hazardous waste by home industries in the informal sector, such as tanneries. Given the size of the informal economy, the amount could be substantial. Nor were estimates of overall industrial waste production available. A very indirect estimate can be made from the estimate that hazardous wastes make up less than 4 percent of overall industrial wastes. Therefore, industrial wastes may constitute 25 to 100 times the amount of hazardous waste.

Approximately 27,000 tons of solid waste are produced monthly. Each month an estimated 13,000 tons of solid waste are disposed of near homes and schools, in streets, in ravines and vacant lots, or at what are termed unofficial sites. These wastes are a common source of disease vectors. Moreover, the runoff from these areas also contaminates surface waters.

The solid wastes collected and disposed of in the best manner available—collected and hauled to official dump sites—also pose a threat to water sources. The sites are rarely environmentally safe, sanitary landfills. This study made no attempt to collect data on the condition of the sites; however, they are often an additional source of environmental contamination.

The estimates for human, solid, and hazardous waste contamination of the environment should be considered an approximation only, although all efforts were made to underestimate rather than overestimate. Varying the population groups gave estimates 20 to 30 percent higher. Other sources gave estimates as much as double the values calculated here.

4.10 Summary

Although the data sought in this study were often unavailable, and when available, were often conflicting, the information collected can provide a rough estimate of the contamination to the urban environment, particularly water sources. Estimates from the sanitation and solid and hazardous

waste sectors provide substantial evidence for the impact of urban populations on their environment which in turn may lead to increased risks of a variety of negative health outcomes for local and downstream populations.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

The effort at data collection and the development of environmental health indicators were undertaken in the hope of using the information to identify the region's most important urban environmental health problems. The lack of available data precluded the fulfillment of this objective. Without these baseline data, it was also impossible to develop an ongoing monitoring system.

The failure to locate more than a fraction of the data sought was due to several general reasons:

- Data do not exist.
- Data are not accessible for political reasons.
- Data are accessible, but in a form that is not usable (e.g., data are kept in raw form and are not classified or analyzed).
- Data exist with widely different values for the same indicator.
- Data exist but are poorly documented (e.g., units, sources, dates, and so on are unclear or missing).
- Data are reported, but for different geographic areas of the city for each category.
- Data exist for the city but probably do not include the informal sector population.

Nevertheless, the study was worthwhile in two regards. First, the information that was collected, although less than anticipated, does provide a general sense of the potential health impact of environmental conditions in Guatemala City, San Salvador, and Tegucigalpa. The potential for contamination of the immediate home environment from human and solid wastes is enormous; thousands of people have no sanitation facilities whatsoever, and each day tons of garbage are left uncollected. A sizable proportion of the urban population, technically with access to water supplies, in fact consumes unsafe water. The risk of contamination of water sources undoubtedly is rising as greater numbers of people move to congested peri-urban areas; as hundreds of thousands in concentrated areas use latrines that are likely to contaminate groundwater; as cities fail to provide for the safe disposal of industrial and medical wastes; and as untreated sewage is removed from the formal sectors of the city and disposed of elsewhere. All these findings point to conditions in these cities that already present health risks to urban populations and undoubtedly will worsen as trends in urbanization and industrialization continue.

Second, the process of data collection revealed several fundamental obstacles to any further environmental health assessment. These obstacles, in addition to the inaccessibility of the data, include the absence of management information systems that would transform existing data into useful information and the lack of documentation of the urban informal sector where environmental contamination is most serious.

Although the original purpose of this task was to plan for programs for the region based on a ranking of environmental health problems, at this juncture, more limited follow-up actions are possible. In general, A.I.D. could:

- Link data collection efforts in any project to a management information system with clearly defined data needs.

- Support programming efforts in peri-urban areas throughout the region. With the explosive growth of peri-urban populations and the unique conditions posed by their tenuous legal standing and increased industrialization, the traditional rural–urban dichotomy may not be adequate as a framework for addressing health needs.

- Strengthen democratic processes, such as the decentralization of control and financing of water and sanitation services, that reinforce responsive and competent local governments. Representative governments will be more likely to allocate costs of services fairly and penalize polluters.

Specifically, A.I.D. could carry out one or more of the following:

- In the short term, A.I.D. could investigate the underlying causes for the lack of data needed for environmental health assessments. The task would include reviewing the political environment; the legal and regulatory framework; the intra- and inter-institutional arrangements of the relevant national and municipal agencies; and the role for private, nongovernmental organizations. This could be followed by the implementation of a system for institutionalizing the demand for data, such as a geographic information system that could link the various service sectors and government levels.

- In the medium term, A.I.D. could carry out a rapid assessment, applying and refining the methodology of the environmental health assessment used in Quito, Ecuador. The selection of one or more cities to be assessed could be based on national priorities, USAID mission objectives, or activities and goals of other external support agencies. A relative risk assessment across and within countries would not be possible; results would only be useful within the limited geographic area of the study. As in the Quito study, the collection of primary qualitative data from focus groups could compensate for the lack of quantitative data. A local government agency or nongovernmental organization could provide ongoing monitoring.

- In the long term, A.I.D. could pursue the original objective: to obtain sufficient information for a regionwide prioritization of environmental health problems. It must be recognized that the level and sophistication of data required for an environmental health assessment for the region will not be available quickly or cheaply. The best method may be an assessment that makes no effort at institutionalizing local monitoring. The information would lead to better planning for A.I.D. and the potential for leveraging funding from other external support agencies, but these data would not necessarily be at the level of detail required at the local level for programming and decision-making.

Appendix A

SCOPE OF WORK

LAC Bureau
WS&S Coverage and Environmental Health Indicators
Planning Document for Central America

January 26, 1993

Background

Human health depends to a large extent on environmental conditions, including the availability of adequate drinking water, sewage and excreta disposal services, and the reduction of biological, physical, and chemical pollution. In Latin American countries, rapid urbanization, economic development, and industrialization have brought with them environmental health problems. Increasingly scarce water resources are now contaminated by both chemical contamination from industrial effluent and agricultural pesticide runoff as well as by biological pollution from inadequate collection and management of human excreta, sewage, and solid wastes.

Throughout Central America, water supply and sanitation coverage varies considerably. Investment levels by donors to increase coverage likewise vary widely from country to country and over time. In planning new investments to address water supply and sanitation coverage deficiencies, it is important to know what the coverage levels are in a particular country and what funds are being committed by the different donor agencies to build new facilities and increase coverage. This information permits planners to focus limited resources on those areas of greatest need and where investments by other donors are lacking.

In recognition of the deficiency of useful planning information that relates committed and proposed funding to coverage needs, AID's LAC Bureau in 1986 commissioned WASH to prepare a report fulfilling this need. The report, entitled **Planning for Central America Water Supply and Sanitation Programs**, Field Report No. 209, was produced in 1987. The Bureau found the document useful and requested updates of the report in 1989 (F.R. 253), 1990 (F.R. 301), and 1991 (F.R. 334). The original Central American report served as a model for similar WASH efforts for the South American/ Andean Region, the Caribbean, Africa, and Asia.

In addition to the challenge of meeting basic water and sanitation coverage, over the past five years it has become increasingly evident that exploding urbanization has led to widespread environmental degradation, creating problems such as water pollution from industrial effluent and untreated municipal sewerage, and poor solid waste collection and management. In 1990, the LAC Bureau recognized the need for a systematic effort to identify indicators that could be used to measure progress at improving the health-related environment. The LAC Bureau requested WASH to develop appropriate indicators and gather selected data in order to assess and prioritize regional problems in the area of environmental health. The study was to review water, sanitation, solid waste, and related vector control issues, including such issues as water quality and sources of groundwater and surface pollution. In addition, the study was to identify donors and programs working to mitigate the ill effects of environmental deterioration as it affects health. The final WASH report was to identify key indicators for monitoring progress at improving the health-related environment, and detailing environmental findings, conclusions, and recommendations on priorities for relevant LAC Bureau programs.

WASH Task 225 was initiated in January 1991 in order to implement the study on environmental health indicators described above. Activities carried out under Task 225 to date have included

researching past experiences with environmental indicators in the U.S. and other developed countries, extensive discussions with the World Bank and other international institutions embarking on similar efforts in developing countries, and a case study data collection field trip to Tegucigalpa, Honduras (in June 1991). With concurrence from the LAC Bureau, work on Task 225 was suspended in November 1991 pending completion of *a new WASH task, Assessment Tools for Identifying & Prioritizing Environmental Health Problems,* Task 315, because the results of the risk assessment in Quito are a critical input to this effort. The Quito field work was carried out in June 1992. The Quito Risk Assessment report is expected to be finalized in January 1993.

WASH has a current commitment to collect secondary data on water and sanitation coverage to update the **Planning for Central America Water Supply and Sanitation Programs** report during 1993. WASH recommended and LAC agreed that the new round of data collection for Central America be expanded to include additional environmental health indicators identified through the work on Tasks 225 and 315 described above. In order to accomplish this, WASH will close the current environmental health indicators task (Task 225) and put the remaining funds in a new task that will produce an updated and expanded version of the **Planning for Central America Water Supply and Sanitation Programs** report.

Tasks

1. Identify key indicators that the LAC Bureau may monitor to determine whether health-related environmental conditions in individual cities are improving or deteriorating over time. Examples of environmental indicators that may be identified include:

1) environmental pollution indicators,

2) epidemiological data, and

3) major sources of environmental health problems (i.e., sources of pollution: industries, waste disposal, etc.).

The consultant(s) will consider results of recent work by WASH and other organizations in identifying the set of environmental health indicators to be addressed in this task.

The consultant(s) will examine the WASH environmental health assessment for Quito, Ecuador (Task 315), the learnings to date from WASH environmental health indicators task (Task 225), the evaluation of urban environmental indicators for RHUDO cities recently completed by the World Resources Institute for APRE/H; and surveys of urban environmental indicators conducted by the World Bank, PAHO, and others.

2. After the development of a draft list of key indicators, conduct a one-day workshop with participation from key players in AID (LAC/Health, LAC/Env, R&D/Health, APRE/H, etc.) and other organizations to achieve consensus on which indicators are the most appropriate and operationally practical to collect and monitor. A well designed set of indicators will reflect careful attention to the human health aspects of the problem or process being monitored and will account for the other requirements and constraints of the monitoring agency and the users of the data.

3. Collect and analyze existing data and prepare a report on: (a) water and sanitation coverage, and (b) additional WS&S related indicators of environmental health:

a. Update the data in the most recent **Planning for Central America Water Supply and Sanitation Programs** report (F.R. 334, August 1991) for each of the countries in Central America (including Belize and Panama) in each of the four sectors currently used in the report: urban water, urban sanitation, rural water, and rural sanitation. In addition, and if possible, urban water and sanitation data should be disaggregated between urban and peri-urban/informal sector areas.

Develop a brief discussion of the water and sanitation programs in each of the countries. Based on objectives for improving coverage that have been previously determined with the LAC bureau for past planning reports, determine the level of investments required to attain those objectives and present a funding analysis that compares committed funding from all donors with the levels of investment required. The report will also include a full discussion of the data, identify trends and policy related issues that affect increasing coverage (cost recovery, tariff structures, legislation, etc.) and summarize results and conclusions.

b. In addition to the coverage data described in 3.a, gather existing baseline data for the additional environmental health indicators identified in steps 1 and 2 above in selected cities in Central America and report on the status of health-related environmental conditions in these cities. This effort will also not involve collecting original data. To the extent possible, the consultants will obtain information from primary and secondary sources in the U.S., including a review of written materials and interviews with staff at the IDB, PAHO, the World Bank, World Resources Institute, and AID/APRE/H. The consultant will also request that USAID Missions collect and provide data for this task. If it is found that critical environmental health data do not currently exist, WASH will recommend a plan to LAC for collection of that data in the future.

Based on the data collected on the environmental health indicators, identify the region's most important environmental health problems and recommend priorities for follow-up action by the LAC Bureau and other donors. These recommendations should be based on information obtained during this task regarding the strategic objectives and programs of USAID missions in Central America, the policy and regulatory frameworks in effect in Central American countries that are relevant to the environmental problems being examined, and existing efforts to address such problems.

It will probably be necessary to send one or more persons on TDY to Central America to obtain data identified in 3.a and 3.b. Local professionals, NGOs, or institutes may also be contracted to provide services.

To the extent possible and reasonable the data gathered in 3.a. and 3.b. should be integrated and presented in a coherent manner that reflects the inter-relationship among the various environmental health data and indicators collected.

4. Work with the Regional Water and Sanitation Network for Central America (RWSN-CA) to identify and use existing efforts by national, bilateral, regional, and international agencies to collect data from which the designated indicators in 3.a and 3.b may be derived. A specific effort should be made to explore collaboration with the **Water Supply and Sanitation Sector Monitoring System** (WASAMS) currently being implemented by RWSN-CA members UNICEF and PAHO/WHO.

Propose to the LAC Bureau a plan whereby the AID/LAC Bureau and other donors can monitor the most important environmental health indicators for Central America, using data from various agencies and collecting original data where warranted. Explore the possibility of "housing" the collected data base in the RWSN-CA offices in Guatemala City as well as institutionalizing the process of ongoing data collection and monitoring as a collaborative effort of the RWSN-CA. If appropriate, this latter effort may include the joint development with the RWSN-CA staff of a computerized database that would allow for effective updating and manipulation of the data. This activity will also be piggy-backed with other on-going efforts by WASH to develop collaborative activities with the RWSN-CA.

Product

One report will be produced for this task. The report will be an updated and expanded version of the existing series of reports entitled, **Planning for Central America Water Supply and Sanitation**

Programs. As a minimum, the report will include all data and follow the same format as the existing reports. As described in section 3.a., one possible modification to the existing format is that urban data will be disaggregated between formal urban areas and informal sector areas. In addition, data, analysis, and discussion regarding additional environmental health indicators as described in section 3.b. should be integrated into this report. As in past reports, the final document should have a separate appendix for each country. Recognizing that certain environmental indicators will only make sense within an urban context, each country appendix may have a separate section on a key city or cities. The primary responsibility for drafting this report falls to the main consultant. Final editing will be carried out by WASH.

Personnel and Level of Effort

Activity	Personnel	Number of Days
Task 1 and 2	WASH specialist on risk assessment	10 days
	Input from other WASH staff and consultants during a one-day workshop	4 days
	Workshop facilitator	2 days
Tasks 3 and 4	Main consultant with general background in water and sanitation, analytical skills, data collection skills and experience, good writing skills, speak Spanish, and be competent with word processing and database programs	75 days
	Task Manager	10 days
	In country consultants who will gather secondary data	35 days (5 days each country)
	Information Specialist	5 days
Total		141

Schedule

Task 1: begin February 1, 1993 and end February 19, 1993. The date for the one-day workshop is to be determined.
General data collection should begin in early February. Specific environmental health data/indicators will be collected beginning February 22, 1993.
Draft of the final report should be ready in May 1, 1993.
Review of draft report by USAID Missions and LAC Bureau: May 1–May 30.
Revised final draft submitted to WASH for editing: July 15, 1993.

Appendix B

SURVEY INSTRUMENTS

The information and judgments in this assessment are to be used to monitor changes in indicator levels and to make program decisions regarding the allocation of funds or technical assistance to a sector, subsector, or geographical area. The assessment data are not to be used for program design or project design. Additional studies must be undertaken for those purposes.

A key factor in making the necessary survey instruments is to determine how many areas to study for each city. Enough areas should be defined to capture the differences that exist among different areas of the city, but not so many as to make data gathering collection and overly time consuming.

The use of maps to demonstrate the findings in pictorial form will be a great help in identifying risks to the population.

WATER SUPPLY DATA SHEET

(NOTE: TABLE DOES NOT INCLUDE NON-DOMESTIC W.S.)

DATA NEEDED	TOTAL FOR AREA		DOMESTIC SOURCES						
			MUNICIPAL		UNPROTECTED SURFACE WATER	WELLS NOT CONNECTED TO MUNICIPAL SYSTEM	VENDED WATER		STORED RAINWATER
	ACCESS*	NO. ACCESS*	AT SOURCE	AT TAP			PERMIT	NO PERMIT	
Basic Area Data									
No. Households/Population	H/P								
Median Annual Income (Households)	$/YR								
No. Businesses/Employees	B/E								
No. Industries/Employees	I/E								
No. Hospitals/Employees	H/E								
Incorp. Ind. City	YES/NO								
Population (No. covered-%)	%	%	%		%	%	%	%	%
System Operation									
Water Quality	-	-	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C
Water Quantity	-	-	lpcd*	lpcd**	lpcd**	lpcd**	lpcd**	lpcd**	lpcd**
Reliability	-	-	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C
System Sustainability									
% of Operating & Interest Recovered from Fees			%						
Avg. cost to User									
- Capital Costs			-	-	-	$	-	-	$
- Connection Fee			-	$	-	$	-	-	-
- Monthly Costs***			-	$/Mo	-	$/Mo	$/Mo	$/Mo	$/Mo
Unaccounted-for Water			%						
Area Water Supply Impact									
- Health	A,B,C								
- Infastructure (sewers)	A,B,C								
Regulatory Narrative	+		Describe any regulations that have to do with protection of, access to and usage of the water system. Also describe water quality standards and monitoring for both source and point of use.						

* Avg. Amount Available at Source

** Avg. Amount used in this area, by source. Provide data on range, if available

*** Cost per Household per month.

Access = Access to adequate W.S.

lpcd = liters per capita per day.

Explanatory Notes for the Water Supply Data Sheet

Water Quality

Evaluate water quality source and point of use separately using the following ratings:

A Water quality standards exist and are at least as stringent as World Health Organization (WHO) guidelines. Sampling type and frequency are also in accordance with WHO guidelines. Results of sampling show general compliance with standards and monitoring requirements.

B Water quality standards exist but are not complete or are less stringent than those recommended by WHO. Sampling frequency and procedures show some attempt to comply with suggested WHO practices, but are not sufficient. Results of sampling show that water quality is out of compliance with standards a significant percentage of the time.

C Water quality standards do not exist or are completely inadequate for protecting public health. Little or no sampling or monitoring of water quality takes place. Results of any sampling or known conditions indicate that water quality places population at risk for exposure to water-borne diseases or chemical pollutants.

Reliability

Evaluate reliability using the following ratings:

A The water system provides adequate quantities of water to meet the health needs of the population at all times. The system is subject to very few breakdowns, and confidence in the system is high.

B The water system does not always provide adequate quantities of water to meet the population's health needs. The system experiences breakdowns on occasion. Users have concerns about the system's reliability.

C The water system does not provide adequate quantities of water to meet the population's health needs. System breakdowns or periods without water are frequent. Users have little or no confidence in the system's reliability.

Health

Evaluate the health impact of the area water supply using the following ratings:

A The water system consistently provides water of sufficient quantity and quality to meet user demands and permit good hygiene.

B The water system is, on occasion, unable to provide water of adequate quantity or quality.

C The water system is consistently unable to provide water of sufficient quantity or quality to meet user demands or permit good hygiene.

Infrastructure

Evaluate the impact of the area water supply on infrastructure using the folowing ratings:

A The water system's design and operation contribute to adequate operation of other infrastructure, such as sewers, or has no negative effects, such as considerable lost or stolen water or leakage that creates a nuisance.

B The water system's design or operation is less than satisfactory for supporting other required infrastructure or having some negative impact.

C The water system's design or operation is insufficient to support other required infrastructure and is having severe negative impact.

SANITATION & WASTEWATER DRAINAGE DATA SHEET
SERVICE AREA A

DATA NEEDED	TOTAL FOR AREA		DOMESTIC WASTE				
			SEWERAGE		ON-SITE DISPOSAL		
	ACCESS	NO ACCESS	TREATED	UNTREATED	LATRINE	SEPTIC/ CESS POOL	NONE
Basic Area Data							
Median Annual Income (households)	$/Year						
No. Households/Population	H/P						
Domestic (No. Covered-%)	%	%	%	%	%	%	%
Non-Domestic (No. Covered-%) by type	%	%					
System Operation							
Failures (Freq/Infreq)	-	-	F-I	F-I	F-I	F-I	-
Drainage (yes/no)							
Combined Sewer (yes/no)							
System Sustainability							
% of Operating & Interest Cost Recovered from Fees				%			
Avg. Cost to User							
-Capital Cost			-	-	$	$	-
-Connection Fee			$	$	-	-	-
-Monthly Cost			$/Mo	$/Mo	$/Mo	$/Mo	-
Area Sanitation and Waste Water Impact							
Health	A,B,C						
Infrastructure	A,B,C						
Regulatory Narrative							

SANITATION & WASTEWATER DRAINAGE DATA SHEET
SERVICE AREA A

DATA NEEDED	NON-DOMESTIC											
	INDUSTRIAL				COMMERCIAL				HOSPITAL/MEDICAL			
	SEWERAGE		ON-SITE	NONE	SEWERAGE		ON-SITE	NONE	SEWERAGE		ON-SITE	NONE
	TREATED	UNTREATED			TREATED	UNTREATED			TREATED	UNTREATED		
Basic Area Data												
Median Annual Income (households)												
No. Households/Population												
Domestic (No. Covered-%)												
Non-Domestic (No. Covered-%) by type	%	%	%	%	%			%	%	%		%
System Operation												
Failures (Freq/Infreq)	F-I	F-I	-	-	F-I	F-I	-	-	F-I	F-I		
Drainage (yes/no)												
Combined Sewer (yes/no)												
System Sustainability												
% of Operating & Interest Cost Recovered from Fees												
Avg. Cost to User												
-Capital Cost	-	-	-	-	-	-	-	-	-	-	-	-
-Connection Fee	$	$	-	-	$	$	-	-	$	$	-	-
-Monthly Cost	$/Mo	$/Mo	-	-	$/Mo	$/Mo	-	-	$/Mo	$/Mo	-	-
Area Sanitation and Waste Water Impact												
Health												
Infrastructure												
Regulatory Narrative												

AREA CHARACTERISTICS
-DENSITY
-SOIL
-GROUNDWATER

Explanatory Notes for the Sanitation and Wastewater Drainage Data Sheet

Health

Evaluate the health impact using the following ratings:

A Basic health indicators are at levels comparable to the most advanced country in Central America.

B Basic health indicators are at levels comparable to average levels for all countries in the region.

C Basic health indicators are worse than average levels for all countries in the region.

Infrastructure

Evaluate the impact of infrastructure using the following ratings:

A Health-related infrastructure (e.g., water system, drainage, health facilities) is not negatively affected.

B Other health-related infrastructure may not operate effectively from time to time, posing a potential health risk.

C Other health-related infrastructure cannot operate effectively, posing a severe health hazard.

HAZARDOUS WASTE DATA SHEET—CITY WIDE

DATA NEEDED	CITY TOTAL	SIC* A	SIC B	SIC C
• No. Industries	I	X	X	X
• No. Employees	E	X	X	X
• Types of Waste Generated	—	T_1, T_2, T_3,**	T_5, T_7	T_2, T_5, T_{10}
• Estimated Liquid Volume Generated per year***	M^3/Day	X	X_2	X_3
• Regulations - Provide Narrative	A,B,C			
• Disposal				
- Unknown (%)	%			
- Sewer (%)	%			
- Treatment (%)	%			

*SIC #A = Textiles, Dyeing, [Groups 30, 49, 20]
SIC #B = Metal Plating [Groups 15, 9]
SIC #C = Pharmaceutical [Groups 1, 10]

**T_1 (Heavy Metals)
T_2 (Phenols)
T_3 (Chlorinated Organics)

***Based on SIC Classification and No. of Employees.

Explanatory Notes for the Hazardous Waste Data Sheet

Regulations

Evaluate regulatory status using the following ratings:

A Regulations on hazardous waste management are comprehensive and consistently enforced.

B Some regulations exist, are used to control some potential health threats from hazardous waste, and are at least occasionally enforced.

C No regulations exist to control the handling and disposal of hazardous wastes.

SIC Groupings

SIC A : (Industry classifications in this group; typical types of hazardous wastes generated from this group)

SIC B : Same

WATER POLLUTION DATA SHEET

DATA NEEDED	CITY TOTAL	COMMENTS
• No. Industries[1]	I	
• No. Employees[1]	E	
• No. of Industries[1] in each SIC Group	SIC A = # SIC B = #	
• Estimated Volume of Industrial Wastewater Generated	M^3/Day	
• Estimated Industrial Wastewater Treated (%)	%	
• Estimated Volume of Domestic[2] Wastewater Generated	M^3/Day	
• Estimated Domestic Wastewater Treated (%)	%	
• Impacts:		
- City Water Supply	A,B,C	
- Downstream Uses		
Water Supplies	A,B,C	
Irrigation	A,B,C	
Fish/Shellfish	A,B,C	
Regulatory Narrative		

[1]See Hazardous Waste Sheet
[2]Household and Commercial Wastewater

Explanatory Notes for the Water Pollution Data Sheet

City Water Supply

Evaluate the impact of water pollution on the city water supply using the following ratings:

A Wastewater discharges are treated to safe levels before discharge to potential water supply (surface or groundwater) or no wastewater is discharged to any source of city water supplies.

B Wastewater discharges cause some contamination of the water supply, but could be removed safely with standard water treatment techniques.

C Wastewater discharges cause gross contamination of supplies and/or cannot be treated to safe levels with standard water treatment techniques.

Downstream Water Supplies

Evaluate the impact of water pollution on downstream water supplies using the same ratings as for city water supply.

Irrigation

Evaluate the impact of water pollution on irrigation using the following ratings:

A There is no downstream irrigation or the wastewater discharges are treated to safe levels before discharge.

B Water is used for irrigation downstream of contaminated discharges, but discharges are at a level that could be removed safely with standard water treatment techniques or managed through selected irrigation practices.

C Water is used for irrigation downstream of discharges that cause gross contamination, rendering water unsafe for any type of irrigation.

Fish and Shellfish

Evaluate the impact of water pollution on fish and shellfish using the following ratings:

A There is no downstream fishing or shellfish industry that would be affected by contamination or discharges are treated to safe levels before release.

B Water is used for fishing or shellfishing downstream of discharges, posing an occasional threat to safe consumption of fish or shellfish.

C Water is used for fishing or shellfishing downstream of discharges, causing gross contamination and prohibiting safe consumption of fish or shellfish.

SOLID WASTE DATA SHEET
EXAMPLE FOR AREA A

	TOTAL AREA			OPTIONAL	HOUSEHOLD			COMMERCIAL			INDUSTRIAL			HOSPITAL/MEDICAL		
	W/COLLECTION		W/O COLLEC	BREAK DOWN	W/		W/O	W/		W/O	W/		W/O	W/		W/O
	DISP. AT OFFICAL SITE	DISP. AT UNOFFICAL SITE	SCATTERED DISPOSAL	Based on Existing Data or Projections of Esixting Survey Results	OFF. SITE	UNOFF. SITE		OFF. SITE	UNOFF. SITE		OFF. SITE	UNOFF. SITE		OFF. SITE	UNOFF. SITE	
BASIC AREA DATA																
No. Households/Population		H/P	H/P			X	X									
Median Annual Income (per Household)		$/YR														
No. Businesses/Employees		B/E						X	X	X						
No. Industries/Employees		I/E									X	X	X			
No. Hospitals/Employees		H/E												X	X	X
Incorporated Into city		YES/NO														
SOLID WASTE GENERATION																
Volume	TON/DAY	TON/DAY	TON/DAY		X	X	X	X	X	X	X	X	X	X	X	X
Composition																
-% Organic (wt.)		%				X			X			X			X	
-%Recycable (wt.)		%				X			X			X			X	
-% Hazardos (wt.)		%				X			X			X			X	
SYSTEM OPERATION																
% Formal (Vol)	%	-														
- % public	%	-														
- % Private	%	-														
% Informal (Vol.)	%	-														
SYSTEM SUSTAINABILITY																
% of Operating Interest Costs Recovered from Fees																
- Public Systems	%	-														
- Private Systems	%	-														
Average Cost to User ($/year, each unit)																
- Public Systems	$/YR	-														
- Private Systems	$/YR	-														
AREA SOLID WASTE IMPACT																
Health		A,B,C														
Infrastructure		A,B,C														
REGULATORY NARRATIVE		+														

HEALTH AND DEMOGRAPHIC PROFILE

	NATIONAL	URBAN		
		TOTAL	FORMAL	BARRIOS MARGINALES
MORTALITY (deaths/1000 live births) Infant Mortality Rate Under 5 Mortality Rate				
MORBIDITY (cases/100,000) Cholera Diarrhea Dengue Ascariasis Amoebiasis Typhoid Para-typhoid Trachoma Hepatitis A Malaria Hookworm				
NUTRITION (% of children below -2 S.D.) Underweight (wt/age; under 5) Stunting (ht/age; 2-5)				
DEMOGRAPHIC/OTHER Population density (persons/km^2) Maternal education (%) Urban growth rate (%) Population below poverty level (%) Population in informal settlements (%)				

FOOD HYGIENE DATA SHEET

Data Needed	City Total	Area A	Area B	Area C
• No Households/populations	H/P	X	X	X
• Regulations Standards				
-Exist	A,B,C			
-Enforcement	A,B,C			
• Food Inspection				
-Quality	A,B,C	X	X	X
-Frequency	A,B,C	X	X	X
-Coverage	V,R,S,P	X	X	X
• Population w/o Refrigerators (%)	%			
• Median Annual Income (Household)	$/Year	X	X	X
• Food Sold From Wastewater Irrigation	A,B,C			
• No Inspectors/1000 population	I/1000			

*Vendors, Restaurants, Suppliers, Processors

Appendix C

SOURCES

The following documents were used in the survey of existing data:

General

Bradley, David, Sandy Cairncross, Trudy Harpham, and Carolyn Stephens. 1991. *A Review of Environmental Health Impacts in Developing Country Cities.* Washington, D.C.: World Bank.

Esrey, Steven. March 1993. "Multi-Country Study to Examine Relationships Between the Health of Children and the Level of Water and Sanitation Service, Distance to Water, and Type of Water Used." Draft document.

Hardoy, Jorge, Sandy Cairncross, and David Satterthwaite. 1990. *The Poor Die Young: Housing and Health in Third World Cities.* London: Earthscan Publications.

Water and Sanitation for Health Project. September 1993. *Planning for Urban Environmental Health Programs in Central America: The Development of Water and Sanitation-Related Environmental Health Indicators and the survey of Existing Data in Three Cities.* WASH Field Report No. 404. Washington, D.C.: WASH.

———. July 1993. *The Unique Challenges of Improving Peri-urban Sanitation.* WASH Technical Report No. 86. Washington, D.C.: WASH.

———. June 1993. *A Comparison of the Health Effects of Water Supply and Sanitation in Urban and Rural Areas of Five African Countries.* WASH Field Report No. 398. Washington, D.C.: WASH.

———. December 1991. *A Comparison of the Health Effects of Water Supply and Sanitation in Urban and Rural Guatemala.* WASH Field Report No. 352. Washington, D.C.: WASH.

——— and PRITECH. November 1992. "Environmental Health Assessment: An Integrated Methodology for Rating Environmental Health Problems. A Case Study Conducted in Quito and Pedro Moncayo, Ecuador." Draft document.

Whittington, Dale, Donald T. Lauria, Albert M. Wright, Choe Kyeongae, Jeffrey A. Hughes, and Venkateswarlu Swarna. March 1991. *Willingness to Pay for Improved Sanitation in Kumais, Ghana: A Contingent Valuation Study.* Washington, D.C.: World Bank.

El Salvador

Diario Oficial, No. 317. 30 de octubre de 1992.

Diseno para Efectuar el Catastro de Establecimientos de Alimentos por Subprograma y Tipo. 1992. Ministerio de Salud Publica, Departamento de Saneamiento Ambiental.

Encuesta de Hogares de Propositios Multiples. 1989. Ministerio de Planificacion.

Informe Sobre la Consultoria en Optimizacion de la Desinfeccion y Vigilancia de la Calidad del Agua de Consumo Humano, Suministrada en el Area Metropolitana de San Salvador. 1992.

Reporte Epidemiologico. 1992. Division de Epidemiologia Ministerio de Salud Publica y Asistencia Social.

———. 1991. Division de Epidemiologia Ministerio de Salud Publica y Asistencia Social.

———. 1990. Division de Epidemiologia Ministerio de Salud Publica y Asistencia Social.

———. 1989. Division de Epidemiologia Ministerio de Salud Publica y Asistencia Social.

Resultados Preliminares de los Censos Nacionales de Pobacion y Vivienda. 1993.

Guatemala

Empresa Municipal de Agua de la Ciudad de Guatemala. 1986. Feasibility Study on the Ground Water Development Project for Emergency I.

———. 1976. Estudio de Factibilidad del Plan Maestro de Alcantarillado, Cuenca del Pacifico.

———. n.d. Informe Sobre Generacion de Desechos Peligrosos y Toxicos en Guatemala.

Herrera, Mayen, and Gustavo Adolfo. August 1992. *Informe Final de la Consultoria Sobre la Creacion del Consejo Nacional de Manejo de los Desechos Solidos de Guatemala.* Pan American Health Organization.

Japanese International Cooperation Agency. 1991. Study on Solid Waste Management in Metropolitan Area of Guatemala City.

Ministerio de Salud Publica y Asistencia Social and Pan American Health Organization. 1992. Situation de Salud Region Metropolitana.

Pan American Health Organization. 1990. Memoria sobre Los Estudios Realizados en Relacion con Abastecimiento de Agua y Saneamiento en Areas Urbanas Marginandas en Brazil, Colombia, Guatemala, Honduras y Peru.

———. 1990. Proyecto de Rehabilitacion del Abastecimiento de Agua de la Ciudad de Guatemala.

Plan Nacional de Agua Potable y Alcantarillado para los Centro Urbanos del Interior de la Republica. 1988. PLANAC.

Honduras

Aguirre, C. 1989. Perfil Ambiental de Honduras.

Brand, A., and B. Bradford. 1991. Rainwater Harvesting and Water Use in the Barrios of Tegucigalpa. United Nations Children's Fund and Agua para el Pueblo.

Campanelia, P., et al. 1981. Honduras: Perfil Ambiental del Pais.

Castellanos, J. 1992. Honduras: Indicadores Sociales de la Pobreza. Puntos de Vista.

Centro de Estudios y Control de Contaminantes, Ministerio de Salud Publica. 1993. Personal communication.

Direccion de Salud, Ministerio de Salud. 1991. Boletin de Estadistica e Informacion de Salud.

Gil, E. 1992. *Saneamiento Urbano Familiar.* Tegucigalpa, Honduras: Cooperative Housing Foundation.

La Tribuna. 25 March 1993. Situacion de Agua en Barrios Marginales.

Lizardo, R., and J. Moncada. 1993. Calculo del Depto. de Control de Alimentos. Ministerio de Salud.

Ministerio de Salud Publica. 1990. Salud en Cirfas, 1986-1989.

———. 1987. Encuesta Nacional de Epidemiologia y Salud Familiar.

———, Ministerio de Recursos Naturales, Servicia Autónomo Nacional de Acueductos y Alcantarillados. 1982. Normas de Calidad para Agua Potable.

Myton, B. 1993. Evaluacion de Impacto Ambiental del Proyecto de Ciudad San Mateo.

Pan American Health Organization. 1992. Tercera Reunion Centroamericana sobre Aseo Urbano.

Rodriguez, J. 1991. Perfil Ampliado del D.C., Sub Sector Desechos Solidos.

Servicio Autónomo Nacional de Acueductos y Alcantarillados. 1992. Estadistica Mensual de Facturacion.

———. 1991. Actualizacion del Plan Maestro, Informe Ambiental.

———. 1991. Actualizacion del Plan Maestro, Tomo II.

———. n.d. Master Plan, 1984-1992.

——— and United Nations Children's Fund. n.d. Gasto Familiar por la Compra de Agua en Barrios Marginales en Tegucigalpa.

———. n.d. The Water and Sanitation Sector of Honduras: Coverage and Investment Needs for the Decade.

United Nations Children's Fund. 1992. Medio Ambiente y Educacion Ambiental, Analisis de Situacion, Guatemala, El Salvador y Honduras.

———. 1990. Children in Honduras: The Situation Analysis of Women and Children in Honduras.

———. n.d. Proyecto Agua Para Todos.

———. n.d. Urban Example: Water Supply and Sanitation to Urban Marginal Areas of Tegucigalpa.

Appendix D

METHODOLOGY FOR FIGURE 1

In cases where more than one value is available or more than one estimate is calculated, the most conservative figure is used.

The total population of the greater metropolitan area is estimated at two million.

Fecal Waste

Three estimates for the monthly flow of fecal waste are made. For peri-urban areas, 21 percent of the population are connected to sewers, 60 percent use latrines, and 19 percent have no sanitary facilities (PAHO 1990). A breakdown for the same three levels of service is estimated at 70 percent, 25 percent, and 5 percent, respectively.

The production by volume of fecal waste is estimated at 0.12 cubic meters per person per month for those connected to sewers, 0.015 cubic meters per person per month for those using latrines, and 0.0167 cubic meters per person per month for those with no facilities (Whittington et al. 1991).

Estimates vary of the percentage of the population in peri-urban or core urban areas. Some suggest that 12 percent live in per-urban areas and 88 percent in core urban areas, while others suggest 25 percent and 75 percent, respectively, or 50 percent each. Estimates of fecal waste vary from 151,564 cubic meters (m^3) per month to 164,879 m^3 to 125,958 m^3. The last estimate is used in figure 1 and is calculated as follows:

Peri-urban population (50 percent) = 1,000,000

19 percent (190,000) have no sanitation facilities

60 percent (600,000) have latrines

21 percent (210,000) have sewage connections

Core urban population (50 percent) = 1,000,000

5 percent (50,000) have no sanitation facilities

25 percent (250,000) have latrines

70 percent (700,000) have sewage connections

Fecal waste total of 125,958 m^3/month

240,000 (no facilities) x 0.0167 m^3/month/person = 4,008 m^3/month

850,000 (latrines) x 0.015 m^3/month/person = 12,750 m^3/month

910,000 (sewage) x 0.12 m^3/month/person = 109,200 m^3/month

Solid Waste

Two estimates are made for the monthly production of solid waste. Per-capita trash production estimated by income level is 0.3 kilograms (kg) per person per day for low-income households, 0.55

kg for middle-income households, and 0.75 kg for high-income households (JICA 1991). Estimates vary of the percentage of the population at different income levels. Some suggest that 25 percent are low-income, 50 percent are middle-income, and 25 percent are high-income. Others suggest 50 percent, 35 percent, and 15 percent, respectively. Estimates of solid waste vary from 32,250 tons per month to 27,300 tons per month. The last estimate is used in figure 1 and is calculated as follows:

Low-income population (50 percent) = 1,000,000

Middle-income population (35 percent) = 700,000

High-income population (15 percent) = 300,000

Solid waste of 27,300 tons

(1,000,000 x 0.3 kg/day) x 30 days ÷ 1000 kg/ton = 9,000 tons/month

(700,000 x 0.55 kg/day) x 30 days ÷ 1000 kg/ton = 11,550 tons/month

(300,000 x 0.75 kg/day) x 30 days ÷ 1000 kg/ton = 6,750 tons/month

Of the total of 27,300 tons of solid waste per month, an estimated 53 percent (14,469 tons) is disposed of at official sites, 42 percent (11,466 tons) at unofficial sites, and 5 percent (1,365 tons) at scattered sites (JICA 1991).

An independent estimate of solid waste produced for 1985–88 is for 28,200 tons per month, of which 66 percent are collected and 100 percent are classified as being poorly disposed of (PAHO 1990).

Industrial Waste

Two estimates for the yearly production of hazardous waste are available: 10,745 tons/year (Empresa Municipal de Agua de la Ciudad de Guatemala n.d.) and 12,700 tons/year (PAHO 1992). The lower value is used in figure 1, which amounts to 895 tons per month.

Medical Waste

Only one estimate is available: 10,800 kg per day or 324 tons per month (Empresa Municipal de Agua de la Ciudad de Guatemala n.d.).