Turning Point

Environmental Health in Brazil

Budget titled *Demand, Availability, and Requirements for Sanitation Services*. The country also sees regional differences: the northern region has lower levels of coverage, while the richer south is best served.

Wastewater services are less developed even than drinking water supply services. Less than half (48%) of urban and only 3% of rural households in Brazil are connected to public sewers. Data from the 1991 federal census show that 17% of households use septic tanks and 16% have no means of sewage disposal. Even worse, according to data from SEDU and SEPURB, 80% of collected wastewater in Brazil does not receive any kind of treatment before it reaches waterways. The report indicates that US$14 billion is needed in investments to make water supply and wastewater treatment services available to all Brazilians. When considering population growth through 2010, the necessary investment goes up to US$22 billion.

Considerable sums are being invested already. An important example is the Tietê Project in the São Paulo metropolitan area. This area includes the city of São Paulo and 37 neighboring cities, with a population of 17 million people. About US$1.1 billion has been used to clean up the Tietê River, which contained high concentrations of nickel and cadmium from untreated industrial wastewater and coliform bacteria from household waste. Over the next two years, another US$400 million is to be invested in the project, which will provide wastewater treatment to 400,000 families and increase control of industrial emissions, according to Geraldo Julião dos Santos, a representative from the Basic Sanitation Company of the State of São Paulo, a state-owned water company that is funding the Tietê Project along with the Inter-American Development Bank. According to dos Santos, the project was created in 1991 due to intense popular demand.

The quality of river water in the state of São Paulo, Brazil's richest and most populous state, varies widely. According to a 1999 report, *Quality of Fresh Water in the State of São Paulo—1998*, published by the state Secretariat of Environment, only 50% of water samples from 129 points throughout the state's monitoring system represented what was rated as good quality water (the rating was based on nine parameters, including oxygen, total nitrogen, and fecal coliform content). According to the report, 35% of samples were classified as acceptable, bad, or very bad, while 15% were rated as excellent.

Lack of proper sanitation and poor quality of water have a considerable impact on health. According to a 1995 report from the Ministry of Planning and Budget titled *Assessment of the Sanitation Sector: Economic and Financial Study*, 32% of all hospital admissions in 1990 were due to diseases related to inadequate sanitation. This represents over 865,000 admissions. From 1987 to 1992, the Ministry of Health registered 4.5 million hospital admissions caused by sanitation-related diseases. The main group of diseases, labeled "poorly defined enteric infections," caused 92% of the cases. The remaining 8% comprised what are labeled as "other specific enteric infections" as well as typhoid fever, shigellosis, schistosomiasis, and amebiasis. Poorly defined enteric infections represented the main cause of death within this group of sanitation-related diseases

The many faces of water. As of 1995, 90% of urban households and only 17% of rural households had access to drinking water and wastewater treatment services. Today, many people still use rivers for purposes such as washing clothes (left) and waste disposal as well as drinking water. Others rely on water drawn from public reservoirs, such as these citizens of Soledad, in the state of Paraíba (above). To date, about US$1.1 billion has gone toward cleaning up the Tietê River (right), which for years was polluted with industrial contaminants and household waste.

Photos: (left, above) J. R. Ripper/SocialPhotos; (right) Odair Farias/SABESP

among children under five years of age—from 1985 to 1990 these diseases caused 102,000 deaths. Among children, other specific enteric infections caused 224 deaths, followed by shigellosis (69 cases), typhoid fever (45 cases), amebiasis (31 cases), and schistosomiasis (12 cases). The same report cites research showing that infant mortality in households with adequate sanitation is 21.9 per thousand, less than half of that found in homes with inadequate sanitation (59.0 per thousand).

Solid Waste: A Less Considered Problem

Unlike the need for clean drinking water and wastewater treatment infrastructure, the problem of production and disposal of solid waste hasn't yet received much attention from the Brazilian government. "Water and wastewater matters were considered priorities. Waste and sewerage were not," says Nadja Limeira Araujo, manager of the SEDU Solid Waste Project. "Garbage is environment's 'poor cousin,'" adds Angela Parente, a technical adviser in the Secretariat of Environmental Quality in the Ministry of Environment.

In Brazil, waste collection services are run by each of the country's 5,506 municipalities. Data from the 1999 National Survey by Household Sampling, conducted annually by the Brazilian Institute of Geography and Statistics, show that urban trash collection expanded from 63% of households in 1981 to 78% in 1990. The 1999 survey indicates that 80% of Brazil's 43 million households receive garbage collection services.

Available data about the amount of refuse generated are outdated. According to the Ministry of Environment, the most reliable data are from the National Survey of Basic Sanitation, last conducted by the Brazilian Institute of Geography and Statistics in 1989. According to this survey, the country produced around 96,000 tons of garbage daily, of which only 23% was placed in environmentally adequate dumps. The survey also showed that an average of 49% of trash was dumped in outdoor areas, often close to rivers or lakes. In the northern and northeastern regions, this rate was as high as 90%. Only 5% of the refuse was separated out for recycling and further processing. The survey will be conducted again in 2001.

According to Araujo, solid waste started to receive more attention from municipal and federal governments after the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992. A 1999 project by the federal government, for example, finances waste collection and disposal programs that promote a sustainable system for managing solid waste. And in July 2000, Brazil's National Council of Environment issued a new resolution requiring that batteries, which contain heavy metals such as lead and mercury, be recycled or stored in an environmentally friendly way. The consumer must return spent batteries to a retailer or other appropriate service provider, who will send them back to the manufacturer. The manufacturer must then either recycle or treat the batteries, or otherwise dispose of them in an approved manner. Manufacturers must also include warnings in battery packaging about health

and environment risks and the fact that spent batteries cannot be put in the garbage.

Despite such efforts, Parente believes that the problem of solid waste is getting worse. She says that new sanitary dumps are necessary, and that they should be installed in a way that their operation could be self-sustaining. "We should create conditions within an urban trash system that foster the sustainability not only of the dump but of all components of this system," she says. "These components include storage, collection, transportation, legal aspects such as how municipalities could apply fines, charging of taxes and tariffs, social aspects such as community involvement, environmental education, organizational structure, and the final destination—the dump itself. To have sustainability, it is necessary to think of an integrated management plan that includes all of the above."

Recent studies by the United Nations Children's Fund, conducted with Brazilian researchers and presented at the Second Meeting of the National Forum on Garbage and Citizenship, held 10–12 November 1999 in Brasília, suggest that about 45,000 Brazilian children live in dumps, where they can collect items to sell and scrap food to eat. Despite the grimness of this reality, there is an environmental benefit. Data from Business Commitment to Recycling (CEMPRE), a nongovernmental organization that promotes waste recycling, show that about 73% of Brazil's aluminum containers are recycled. According to CEMPRE, this is higher than the aluminum recycling rate in countries such as the United States (63%) and Germany (35%). About half of this recycling rate is due to people collecting material manually in streets and dumps. Other materials also have relatively good recycling rates, according to CEMPRE, such as glass (40%, compared to the United States at 37% and the United Kingdom at 24%).

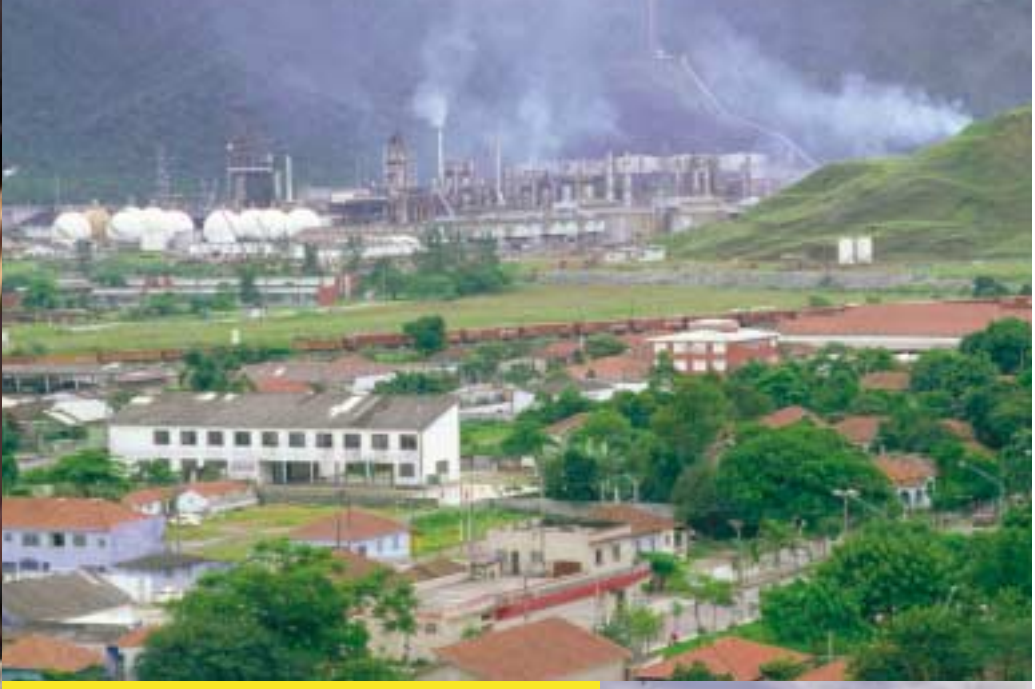
The state of São Paulo has a better trash collection system than other Brazilian states. About 90% of garbage is collected, and the state is continuously looking for ways to improve its operations, says João Fuzaro, executive assistant of the Directorate of Environmental Pollution Control at the Environmental Sanitation Agency (CETESB), the state environmental body.

Data from a 2000 CETESB report titled *State Inventory of Household Solid Waste: Short Report* show a positive trend. In 1997, 502 of the state of São Paulo's 645 municipalities disposed of garbage in inappropriate places, and only 27 used sanitary dumps. (The other 116 cities were not cited either because they were in a transitional situation or because they dumped their garbage in a neighboring city.) By 1999, however, the number of municipalities with inadequate disposal of garbage had decreased to 324, and 183 had started to use proper dumps.

Over the past 40 years, Brazil has generated about 14,000 cubic meters of nuclear waste, including material from nuclear power plants and medical use. Radioactive waste policies have improved in recent years, especially after the country's worst nuclear accident, in 1987. That year, scrap collectors found a metal canister of cesium-137 in an abandoned cancer clinic in Goiânia. The collectors picked it up, intending to sell the metal. When they opened the canister, they found the glowing cesium-137 inside, and showed it to relatives and neighbors. As a result of exposure to the radioactive substance, 4 people died and at least 200 were contaminated. Nuclear refuse is now disposed of in four depositories owned by the National Commission of Nuclear Energy. Currently, the Brazilian Federal Senate is considering a project that establishes regulations for construction of permanent deposit sites for radioactive waste.

Air Quality: An Incomplete Picture

Fernando Vasconcelos, manager of the Secretariat of Environmental Quality in the Ministry of Environment, says it is difficult to establish a national picture of Brazilian air quality because of a lack of adequate data. Some of Brazil's major cities and states have elaborate programs to monitor and control air pollution, but there is no centralized federal system for collecting data on air quality. According to Vasconcelos, the Ministry of Environment is considering several options for the implementation of a broad monitoring system that will provide useful data for licensing and decision-making processes.



Finding ways to cope. As many as 45,000 Brazilian children live in dumps, where they collect items to sell and eat (left). On the legislative front, continuous improvements aim to regulate industrial air emissions (above) and provide better waste management services (right).

Photos: (left) J. R. Ripper/SocialPhotos; (above) Pan American Health Organization; (right) PhotoDisc

Despite the lack of data, Vasconcelos affirms that air pollution is a problem, mainly in the major cities. He also says that efforts are under way to increase the monitoring of atmospheric pollutant emissions. For instance, Vasconcelos says, the Ministry of Environment is working to identify key industrial sectors in which pollutant emissions controls should be established, and to implement programs in those sectors.

The ministry aims to create specific regulations for each sector. For example, ministry officials are working with the Ministry of Health to set standards for pollution from the incineration of hospital refuse. Says Vasconcelos, "No licenses for new incinerators are being given because there is still no standard for the final emissions."

According to Axel Grael, president of the State Foundation of Environmental Engineering, the environmental agency for the state of Rio de Janeiro, the main problem in the Rio de Janeiro metropolitan region is particulate matter emissions, which can cause cardiorespiratory diseases, decreased lung function, and chronic bronchitis and asthma. "We have problems with inhalable particles smaller than 10 microns," he says. "We are now working on identifying sources of this material." In general, air quality in Rio de Janeiro is improving, according to Luiz Heckmaier, head of the foundation's Air Quality Division. Continuous measurements show that levels of carbon monoxide are below national recommended standards as determined by the National Council of Environment. On the other hand, says Heckmaier, hydrocarbons in the metropolitan area are eight times above the level recommended by the U.S. Environmental Protection Agency.

In the state of São Paulo, the two areas with the worst air quality are São Paulo's metropolitan region (with 5.5 million vehicles) and Cubatão, 44 kilometers southwest of São Paulo, according to a report titled *Report of the Quality of Air in the State of São Paulo 1999*, coordinated by Claudio Darwin Alonso, a chemist and manager of the Department of Environmental Quality at CETESB. Cubatão is home to several chemical and petrochemical industries, which boasted an economic growth rate of over 4% per year from 1970 to 1980; by 1985 these industries were responsible for 3% of Brazil's gross national product. However, this growth was accompanied by increased emissions of pollutants such as particulate matter and ammonia, which peaked in 1984 at almost 1,000 tons per day. At the time, ecological and medical problems caused by the pollution were frequently reported in the press. For instance, stories ran about dying vegetation and higher incidences of birth defects. Finally, in 1984, a plan to control acute episodes of pollution was implemented. It took 10 years to see reasonable results, but by 1995, CETESB was no longer declaring "emergency" or "alert" states for air quality. However, concludes the *Quality of Air* report, "Data observed in 1997, 1998, and 1999 indicate a decrease in concentrations [of pollutants] relative to 1994 and 1995, but they are still above legal standards."

As is the case in the city of Rio de Janeiro, the main cause of air pollution in metropolitan São Paulo is automobile emissions. Almost all parameters of particulate matter and vehicle emissions reach levels above accepted standards, with the exception of sulfur dioxide (which was within the World Health Organization suggested level of 125 micrograms per cubic meter over 24 hours). According to the *Quality of Air* report, however, industrial emissions in the metropolitan region, mainly of sulfur dioxide and particulate matter, are beginning to come under control.

In 1986, the National Council of Environment established the Motor Vehicle Air Pollution Control Program, which set stricter limits for emissions from cars and heavy vehicles. According to the Brazilian National Association of Automobile Manufacturers, about 45% of cars in Brazil are 10 or more years old and are responsible for 77% of carbon monoxide emissions. But in 1998, new cars made in Brazil produced an average of 90% less pollutants than those made in 1986, due to technological advances in engines and improved fuel quality. According to Vasconcelos, the Ministry of Environment is conducting a study to evaluate public health benefits that have resulted from the control of automobile emissions, with the first results due by the end of this year.

Brazil has had a unique experience with alternative vehicle technology: the country has experimented with a national program to substitute the much cleaner ethanol for gasoline. The National Ethanol Program was created 20 years ago, mainly to reduce the impact of rising international oil prices. It offered considerable economic incentives to automobile makers and growers of sugarcane (which is used to produce ethanol). The program seemed at first to be a great success: Eugênio Miguel Mancini Scheleder, director of the National Department of Energy Development in the Ministry of Mines and Energy, says in a 1998 report titled *Alcohol Fuel* that 96% of cars produced in Brazil in 1985 used ethanol as fuel. The program was very expensive to the government, which subsidized production of the ethanol. Lack of consistent promotion policies, debt among ethanol plant owners as the program faltered, and many other economic and political factors created a crisis situation in 1989, when too little ethanol was produced to satisfy demand. Although many cars built or retrofitted to run on ethanol still do so, most new cars run on gasoline.

The cost of insects. Cases of malaria, the disease afflicting this Yanomamö child (left), rose sharply in the 1970s and 1980s, with outbreaks largely affecting northern and northeastern cities such as Natal (above). Agricultural pesticides, of which Brazil is a major consumer, are often used without protective equipment, as on this sugarcane plantation in the state of Bahia (right).

Photos: (left, right) Ricardo Funari/SocialPhotos; (above) J. R. Ripper/SocialPhotos

The Threat of Disease

In addition to problems related to pollution, Brazil has also fought endemic diseases such as yellow fever, schistosomiasis, and malaria, and is also facing new challenges with other diseases that were once considered under control, such as dengue and cholera. Yellow fever, malaria, and dengue are transmitted by insect bite, while schistosomiasis is spread by contact with water contaminated with the parasitic worms that carry the disease. Cholera is spread by drinking water contaminated with the bacterium *Vibrio cholerae*.

The number of malaria cases in Brazil fell dramatically from an estimated 8 million cases in 1954 to 50,000 registered cases in 1970, as reported to the Ministry of Health. But during the 1970s and 1980s, a substantial increase in cases was noted, and since 1989, about 500,000 cases have been registered annually. According to Luiz Jacintho da Silva, head of the Superintendency of Endemic Disease Control, São Paulo's vector-borne disease control agency, this rise reflects an increased incidence of the disease in the Amazon region. During the 1970s and 1980s, the region received an influx of people working in agriculture, mining, and construction of roads and dams for hydroelectric power. "Stabilization of the incidence might be connected to the smaller number of projects in the region, due to economic recession," says da Silva.

Cholera and dengue differ from malaria in that the former are considered reintroduced epidemics, while malaria never ceased to be endemic. The first Brazilian cases of cholera were seen in 1991 in the Amazon region. At first, health specialists feared epidemics like those in Peru, where the first South American cases were identified. But the Brazilian outbreaks were limited to small cities in the northern and northeastern regions, and in a few large cities. "This suggests that sanitation conditions in Brazilian cities, although not satisfactory, were better than expected," says Carlos Augusto Monteiro, a professor of nutrition in the School of Public Health at the University of São Paulo.

The evolution of dengue is much more complex. The disease is spread by the *Aedes aegypti* mosquito, which was reintroduced to Brazil in 1976 after having been largely eliminated 20 years earlier. The first outbreak of dengue after that occurred in the northern region in 1982, with 12,000 reported cases. The disease spread throughout Brazil, especially after 1986. In the state of Rio de Janeiro between 1986 and 1987, 93,000 cases were reported, and in 1992–1993, there were almost 100,000 cases with 3 deaths.

In 1997, the Ministry of Health began a campaign to eradicate *A. aegypti* that lasted two years. Now, says da Silva, the govenrent is taking the tack that it is not possible to wipe out the vector, so it is doing what states such as São Paulo already do: monitoring areas with many mosquito-transmitted disease cases, teaching people about prevention and risk, and tracking the diseases closely.

Pesticides for an Agricultural Giant

Mosquitoes are not the only insects getting attention here; Brazil is a world leader in agricultural pesticide use. According to the National Union of the Agricultural Defense Products Industry, 288,000 tons of pesticides were used in the country in 1999. Júlio Sérgio de Britto, an assistant to the coordinator of the Department of Vegetable Defense and Inspection in the Ministry of Agriculture and Supply, says the amount of pesticides used reflects the size of the Brazilian agricultural sector. "When you look at it as a technology that enhances productivity, the use of pesticides is important," he says.

Brazil is the world's second largest soy producer and the leading producers of sugarcane, with approximately 25% of the world's crop. About one-third of the pesticides used in the country last year, approximately 86,000 tons, was applied to soybean fields. Citrus fruit and sugarcane production, in a similar manner, consumed 24,000 tons and 17,000 tons, respectively.

In spite of the large amount of pesticides used, Marcos Valadão, coordinator of pesticide control in the Ministry of Agriculture and Supply, says that Brazilian legislation regarding research, production, commercialization, use, and control of these products is very rigorous. "Production, importation, and use of a pesticide are only allowed after the product has been evaluated by the Ministries of Agriculture, Health, and Environment," adds de Britto. "Among other things, technicians consider the efficacy of the product, whether there is the need to use the product, and the risks it poses to the environment and human health."

Noncompliance with application laws results in penalties ranging from fines to up to four years in jail, but the Ministry of Agriculture and Supply admits that there is not enough enforcement by states. "Implementation of [regulation] is very weak in the country," says Alfredo Benatto, manager of the Toxicology Section of the National Agency of Health Surveillance. One kind of infraction that occurs is the sale of pesticides for use other than in a home (for instance, for farm use) without the prescription of an agronomist or a forest engineer. The prescription is proof that a certified technician visited and evaluated both the area and the species to which the product is to be applied. But according to Benatto, it is not uncommon for the agronomist to make a diagnosis and prescribe a product without visiting the site. In addition, stores may sell products without requiring a prescription. Benatto also says that frequently a product is bought in an appropriate manner, but the rural workers who apply it either receive no safety equipment from their employers or choose not to use such equipment.

Besides problems with pesticides in agriculture, the widespread use of these products by people in their homes and a lack of public information on the health risks of using them contribute to a high number of pesticide poisoning cases in Brazil. In 1998, pesticides caused 10,840 poisoning cases and 224 deaths. These numbers come from the National Poisoning Information System (SINITOX), run by the Oswaldo Cruz Foundation, a research, teaching, and health care facility in Rio de Janeiro. Created in 1980 by the Ministry of Health, SINITOX collects data from 32 health surveillance and research centers in 17 of the 26 Brazilian states, but experts say that its numbers are not realistic due to underreporting.

Another source for data is the Epidemiologic Studies in Toxicology Group, made up of toxicology centers from several Brazilian universities. According to Flávio Zambrone, director of the Poison Control Center at the State University of Campinas and a member of the group, 14% of poisoning cases are caused by pesticides. Of these, about 30% are related to occupational activities. Zambrone says that these data can be extrapolated to the whole country, except to the northern region (where there is little agriculture, since the area is occupied by the Amazon forest).

The situation seems to be improving, though. "Ten years ago, it was difficult to diagnose poisoning cases because exposure to pesticides was simply not associated with health problems," says Zambrone. He adds, however, that "we are now in an intermediary phase, in which doctors, consumers, and exposed people believe that everything is caused by these substances."

One source of substantial improvement is in research that might find ways to minimize the use of pesticides. In the 13 July 2000 issue of *Nature*, a network of São Paulo research centers published for the first time the genetic sequence of the bacterium *Xylella fastidiosa*, which plagues about one-third of orange crops in São Paulo, causing losses of US$100 million annually. *Leifsonia xyli*, a pathogen that attacks sugarcane, is also being studied. Such studies could have a huge economic impact.

Beyond the Turning Point

Better efforts at informing the public about environmental health issues and recent legislation such as the Environmental Crimes Law of 1998—which determines penalties for violations such as destruction of wildlife and illegal logging—are changing Brazil's environmental health situation. "These events improved the relationship between industry, consumer, and government," says Zambrone, adding that in the last five years, knowledge has increased about the environment, its protection, and its relationship to human health. Now that achievable standards are being set by the government, accepted by industry, and communicated to consumers, he says, there is finally a common language to discuss environmental health subjects.

It is difficult to predict whether Brazil's improvements in water and air pollution control, sanitation, disease treatment and prevention, and pesticide use will continue in the future. The biggest challenge will probably be to maintain and promote the sophisticated multiorganizational structure that has evolved in the past two decades. If this structure is indeed maintained, Brazil should have the necessary resources to make sound, effective decisions at future environmental health turning points.

Claudio Csillag