Preserving the Environment in Brazil: the role of CETESB

The Environmental Sanitation Technology Company (CETESB) of the State of São Paulo in Brazil has wide-ranging responsibilities for protecting the environment and ensuring safe water supplies and sanitation. It also has a role to play in helping Portuguese speaking African countries to develop their water and sanitation sectors.

Arleti Maria Bottesini Jorge

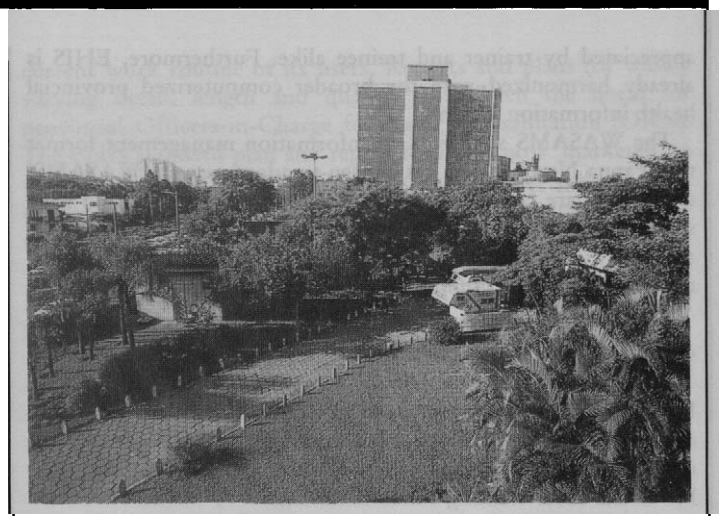

Figure 1. The CETESB headquarters in São Paulo.

The state of São Paulo is the most economically developed and most populous state in Brazil. Its population of 31,200,000 comprises some 20 percent of the total population of the country, and there are 626 municipalities in its area of 247,000 square kilometres. Within the state of São Paulo, the São Paulo Metropolitan Area, comprising the city of São Paulo and thirty-eight other municipalities, has an area of 8,000 square kilometres and a population of 15,199,000 – half the population of the state, and 10 percent of the population of Brazil.

In July 1968, the São Paulo State Government established the Technology Centre for Basic Sanitation, known as CETESB, to carry out laboratory tests, surveys, trials, and research and training in sanitary engineering. In the twenty-five years since then, CETESB has undergone various changes in its legal status, responsibilities and name, but has always retained the use of the same acronym.

Now known as the Environmental Sanitation Technology Company (Companhia de Tecnologia de Saneamento Ambiental), CETESB is subordinate to the Environment Department of the state government. Its responsibilities in respect of environmental sanitation, which are outlined below, are fulfilled through the work of its headquarters and nine regional units in the city of São Paulo and twenty-two regional units in the interior of the state.

CETESB now has 2,400 employees, of whom 70 percent are technical staff and 30 percent managerial and administrative personnel.

THE TASKS OF CETESB

As a tool for carrying out governmental policies concerning the environment, the tasks of CETESB include:

- establishing and carrying out pollution control plans
- keeping a file of polluting sources
- evaluating constantly the quality of air and water by collecting samples and doing laboratory analysis
- elaborating rules and technical specifications related to pollution control
- evaluating the performance of controlling equipment and waste treatment processes
- studying and suggesting to municipal leaders the rules they should abide by
- analyzing and approving systems for treating sewage
- qualifying and quantifying polluting loads
- carrying out tests on receiving surface waters, effluents and wastes
- developing, applying and transferring techniques for treating and recycling wastes
- checking the release of pollutants into the environment
- enforcing laws which impose fines.

In order to carry out these tasks, CETESB has been granted various legal powers, including the adoption of preventive and corrective measures related to the control of pollutants that may jeopardize public health, the flora, the fauna, and the natural resources of São Paulo State.

The Company has important powers in respect of preventing pollution. Projects for new building sites, as well the expansion and planting of industries in the state are submitted to CETESB for approval. CETESB analyzes the aspects that may jeopardize the quality of the environment, trying to minimize these risks by demanding changes in the original project or, when necessary, installing equipment for pollution control. Not only the nature and location of the undertaking are taken into account, but also the industrial process and the level of complexity of the operations. In areas where industrial development has already caused deterioration of the environment due to water, air, and soil pollution, corrective measures are developed to restore the quality levels that have been lost.

In addition to environmental pollution control, educational campaigns are developed to foster the participation of the population in improving environmental conditions. For instance, the campaign 'Leave your car at home' aimed at reducing the number of cars on the streets of São Paulo, mainly in the winter when the concentration of pollutants in the air worsens. 'Clean Roads' is another example of a campaign designed specifically for diesel-fuelled vehicles in order to eliminate black smoke from the air.

WATER QUALITY

CETESB maintains laboratories for carrying out analysis for water quality control and supervision programmes in public water supply systems. These laboratories analyze water samples from wells, springs, water towers and reservoirs. They also check the quality of waste water discharged after treatment and so ensure compliance with water quality regulations.

Examples include: a programme to control the quality of the

Figure 2. Laboratory analysis at CETESB.

Figure 3. The CETESB Water Quality Data Bank.

water for public supply in Greater São Paulo, and in the southern and northern coasts; simulation and interpretation of the quality of the water in the Paraiba River, for different conditions of wastes released; programmes for restoring the quality of the waters in the Jundiaí River and the Piracicaba River, and PRO-LIMP – a general programme for improving the quality of the water in the state of São Paulo.

CETESB provides technical assessments to water and sewer sanitation and municipal services companies concerning the size, establishment and operation of water quality control laboratories and the development of analysis and monitoring programmes.

A databank supports the programmes for pollution control and water quality control developed by CETESB. Different kinds of water analysis are registered, as well as quality standards accepted and recommended by national and international organizations of public health. CETESB also offers technical assistance and consultation for other organizations interested in developing similar databanks.

SEWERS AND SEWERAGE

CETESB provides technical assistance to sanitation companies involved in laying sewers in the ocean or under rivers. It carries out oceanographic investigations to determine where to place such sewers and to define the characteristics of the piping; undertakes analysis of the project and inspection of construction; and studies the dispersion of pollutants. It also monitors the areas that receive sewage via these pipes through the analysis of benthonic plankton.

Highly sensitive radioisotope techniques are used in such studies and in evaluating the performance of underwater sewers. Examples of such studies include: analysis and follow-up of works carried out in Manaus in the Amazon for laying underwater sewer pipes; oceanographic survey and research for the cities of Maceió, in the state of Alagoas, Fortaleza, in the state of Ceará, and Santos, in the state of São Paulo; and monitoring the waters in Santos Bay for a follow-up of the performance of underwater sewer systems in the area.

Other activities include a project for treating sewers through anaerobic digesters of upward flow and another for treating sewers in small communities.

TECHNICAL ASSISTANCE FOR BASIC SANITATION

CETESB also provides general technical assistance for basic sanitation in the countryside of the state of São Paulo and elsewhere in Brazil. It has been responsible for the analysis, inspection and technical follow-up of works and services in several expansion and improvement programmes for sanitary sewer systems and water supply systems in cities in the state of São Paulo which have been carried out by the Bank for National Housing. Services have been provided for qualifying welders and welding procedures, gammographic trials and sunlight control, at the site, in the rough water aqueduct of the Open River System in the Federal District. Specialized technical assistance has been provided during the various phases of ceramic pipe manufacturing for basic sanitation, and again in preparing technical specifications, elaborating bidding processes and hiring personnel for constructing five treated water reservoirs in Terezina, in the state of Piauí.

Assistance is also provided to sanitation companies in the elaboration of pollution control plans, the diagnosis and studies of basins, the classification of rivers, the introduction of monitoring programmes, and the elaboration of plans for the control and prevention of pollution in underground aquifers. CETESB was also responsible for elaborating the Environmental Sanitation Plan for the Metropolitan Area of Recife, in the state of Pernambuco. It has also monitored the performance of treating stations in several cities in Brazil, and carried out studies for their improvement.

HYDROLOGICAL AND HYDRAULIC STUDIES

Studies have been carried out on the quantitative aspects of hydric resources for studying and monitoring the quality of water, including hydrometry-fluviometry and pluviometry with studies at representative basins; studies of the dynamics of reservoirs and lakes; studies to balance the total mass of the water, flow direction, water mixing, percolation and irregular water escape, timing water flow and residence, and water renovation; studies of fluvial hydraulics, including measuring the outflow of rivers, timing the water flow, longitudinal scattering of pollutants, transportation of masses of

water; evaluation of the physical and hydrochemical characteristics of aquifers, localization and protection of areas with natural recharging, verifying the hydraulic relationship with surface and underground springs, subsoil pollution control, surface water monitoring, selection of more favourable areas for solid wastes (sanitary and industrial dirt fills), protection of mineral and thermo-mineral water sources, applied hydrogeologic photoanalysis (radar pictures, remote sensing, and aerial pictures); studies of the flow of solids in estuaries, harbours, rivers and the coast, efficiency of dragging; and studies about disappearing beaches and the progressive destruction of dikes.

OCEANOGRAPHIC INVESTIGATIONS

A variety of oceanographic studies and investigations are carried out, including the study of tides, direction and speed of currents, renewal of waters, salinity and temperature measurements and analysis of ocean water samples. Operations are conducted in meteorological stations to collect data concerning the intensity and direction of the wind, atmospheric pressure, temperature, relative humidity of the air, and pluviometric precipitation. Studies are also carried out to correlate these various parameters.

AQUATIC COMMUNITIES

Bioecological and limnological surveys of aquatic communities (phytoplankton, zooplankton, benthos, ichthyofauna, photosynthesizing pigments) are carried out in the oceans, coastal areas, reservoirs and lakes in terms of programmes for water use (supply, recreation, fish culture). Studies of fish mortality and the analysis of fish, shrimp, and crustacean samples with suspected contamination from heavy metals and organic compounds are also undertaken. Ichthyofaunistic studies have been performed in the Paraná River (Itaipú Binacional), the Barra Bonita Reservoir, and the estuary-lagoon complex in Iguape-Cananéia.

ECOLOGICAL CHARACTERIZATION

Studies are carried out to determine the ecological characterization of bodies of water, including lagoons and estuaries and the rivers Mogi-Guaçu and Pardo, the Sorocaba and Atibaia estuaries and Santos Bay, in order to determine the contamination levels and provide a basis for the preservation and adequate use of these environments.

WATER POLLUTION

CETESB scientists undertake studies of water pollution in lagoons and estuaries and the ocean, including characterization of the quality of the water. The influence of pesticides and heavy metals on the quality of the water, sediments, and water organisms in rivers and reservoirs, and the self-purification of pollutants are also investigated. Other studies deal with the damage caused to undeveloped coasts and mangroves by oil, together with mitigating actions and monitoring of such areas. Research has been done on estuary mixtures and bacterial decay in the waters on the coast of Fortaleza, in the state of Ceará. Studies have also analyzed the impact of mercury in waters where gold is extracted.

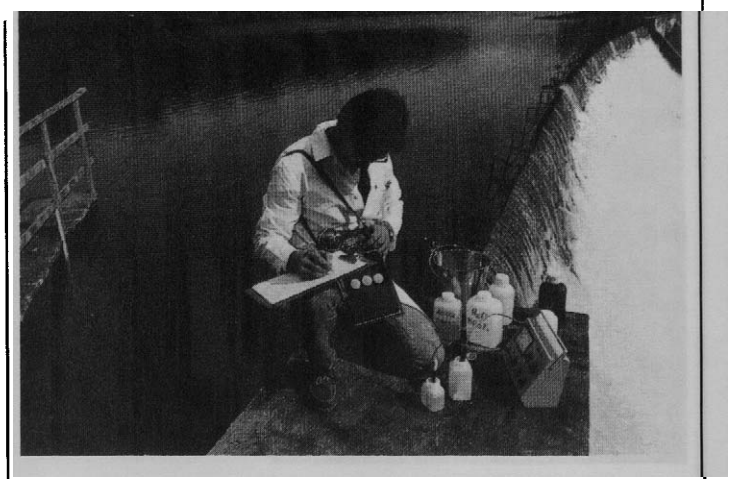

Figure 4. Studies of water pollution.

SERVICES USING RADIOACTIVE TECHNIQUES

CETESB has highly sensitive equipment and specialized technicians for measuring low concentrations of radioisotopes in the environment. These techniques are used in measuring such variables as: the flow in rivers, streams, canals, sewers and industrial effluents; the scattering time in rivers; how long the isotopes remain in chemical reactors, lakes, and tanks for the treatment of domestic and industrial effluents; and the flow of sedimentary solids in rivers. They are also applied in surveying clandestine sewer connections and the investigation of hydraulic sources, ends, and interconnections. In São Paulo City and Santos, for example, the interconnections of sanitary sewer networks and pluvial water paths were detected through the use of radioactive tracers.

SOLID WASTES

In Project ELBA, concerned with gaining energy from garbage dumps in the lowlands of Santos, CETESB has been involved in studies of how to create sanitary dirt fills with urban and industrial biodegradable garbage. It carries out analysis of domestic garbage and solid industrial wastes, and has been involved in establishing a public clean up policy in the interior of the state of São Paulo and a national action policy, created by government agencies, concerning problems such as the collection, transportation and final destination of the garbage produced by the population.

INDUSTRIAL DEVELOPMENT

CETESB provides assistance to industries through studies of industrial processes and waste treatment, the analysis of treating station projects, and studies about recycling wastes and quantifying loss. Technical assistance was provided for establishing a programme of industrial pollution control in the state of Santa Catarina and to PRONACOP the National Program For Industrial Pollution Control. Various studies have been carried out to identify alternative locations for establishing industrial centres.

STUDIES OF TOXICITY

Research in this area has included: evaluation of the toxicity of industrial liquid effluents, using water organisms, aiming at establishing emitting limits compatible to the maintenance of the water organisms of the receiving body; toxic evaluation of industrial effluents and surface waters in Greater São Paulo and the Cubatão, Piracicaba, and Paraíba do Sul river basins; evaluation of the level of exposure of the population to chemical agents in Greater São Paulo, Cubatão and Vale do Paraíba; bio-accumulation of toxic substances in aquatic organisms in the Mogi-Guaçu and Pardo rivers, Santos Bay and estuary, the Cubatão River, and the Barra Bonita and Billings Reservoirs; programmes of human toxicology to evaluate the risks stemming from the interaction of the population with basic agents, including determining some biological indicators of exposure (IBEp) and a survey of the frequency and distribution of health hazards to the population; microbic biotests for genotoxicity and genetic mutability in environmental samples (water, air, solid wastes, etc.); biotests for acute toxicity with bacteria and fish, microcrustaceans and weeds applied in monitoring and evaluating water toxicity (industrial effluents, sewers, surface and underground water, etc.) and litter (sediment, soil, solid wastes. etc.).

INFORMATION TRANSFER

One of the main activities of CETESB is information transfer, to promote a continuous exchange of technical and scientific knowledge in the fields related to environmental quality improvement. These actions are based on a set of training systems, such as: courses, specialized practical training, distance learning (courses by mail), seminars, technical meetings, and so on. Many courses and other kinds of training dealing with environmental sanitation are carried out either at CETESB itself or in governmental agencies and private companies.

Courses

A typical CETESB course is an organized course with technical and practical content. Its objective is to train, provide qualifications and develop the individual knowledge and ability required for good professional performance in environmental management.

Specialized Practical Training (STP) aims to train professionals for the performance or improvement of a given function. STPs are characterized by the development of an individualized apprenticeship system, under the direct supervision of expert technicians in a real work situation (in CETESB laboratories or technical areas). Directed by technicians or officers of both public and private bodies, these trainings are conducted at CETESB facilities.

The subjects developed in the courses and STPs are grouped in various sectors, as follows:

- **Water Sector**
  Development of programmes designed to handle various aspects related to water supply and wastewater.
- **Soil and Solid Waste Sector**
  Development of programmes that cover criteria for the implementation, operation and treatment of solid wastes, both domestic and industrial, and methodologies for soil utilization.
- **Air and Noise Sector**
  Development of programmes designed to monitor, control and assess stationary and mobile sources as well as noise sources.

A group of programmes in what is known as the Special Sector cover environmental management and development actions such as:

- environmental accidents: prevention and control
- environmental control of mining
- microorganism bioassay applied to the control of environmental toxic contaminants
- environmental education
- environmental microbiology
- urban process and environment
- environmental radioactivity: cause and effects
- environmental sanitation and applied ecology
- hazard analysis techniques.

CETESB offers a number of courses by mail. They cover various themes related to the environment and are presented in hand-outs, with a methodology suitable for distance learning. Currently, courses on the following subjects can be requested:

- settlement installation
- sanitary sewers collection and transportation system
- water quality recovery
- ecology and environmental impact
- collection of groundwater
- urban solid waste and public cleansing
- works cost estimation – application to sanitation works
- swimming pool treatment, operation and maintenance.

Events

CETESB organizes many different kinds of events, designed to transfer environmental technology and with a specific methodology applied to each programme in accordance with previously established objectives. They include: seminars, symposia, round tables, forums, workshops, technical meetings, and panels.

A Service for the Community

All courses and events are offered to the community, in the public and private sectors, universities and international institutions, in line with CETESB's aim to make a contribution to the construction of a better world, and certainly a healthier one.

Consulting

Technicians from CETESB are frequently invited by the Pan American Health Organization (PAHO), the World Bank and other international institutions to give professional consultancy support to institutions in developing countries.

Library Services

The CETESB library is known as the 'Professor Dr. Lucas Nogueira Garcez Library', after one of the most important Brazilian engineers who dedicated his work to environmental sanitation. It is one of the most specialized and complete libraries on environmental pollution control in Latin America.

Due to the specific nature of its collection, the CETESB Library was chosen to be a reference library in the national document delivery system. Internationally it manages the Pan-American Information Network on Environmental Health (Red Panamericana de

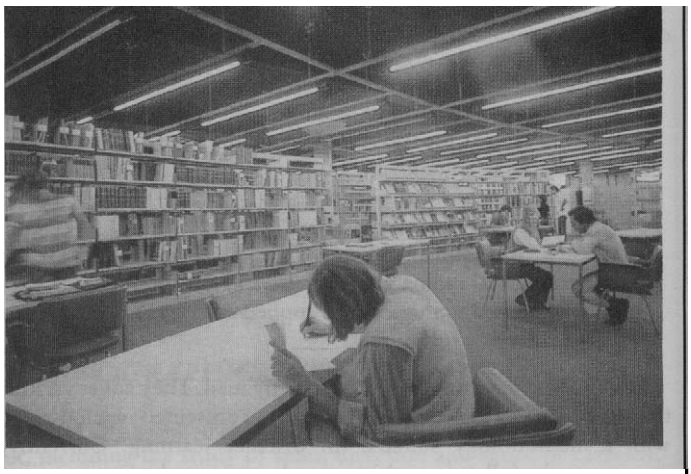

Figure 5 The CETESB Library.

Información en Salud Ambiental: REPIDISCA) in São Paulo and the Southern area of Brazil. Since August 1988, REPIDISCA data has been stored on CD-ROM, which also includes the CETESB library collection. The collection comprises:

- 27,000 volumes of books, technical reports, theses, proceedings, serial publications, and papers presented at technical meetings and other events
- 14,000 titles of technical reports from the Environmental Protection Agency (EPA) of the United States, on microfiche
- 492 journal titles (mostly international)
- 534 CETESB technical standards on pollution control, water analysis, materials, equipment, etc.
- a special collection of more than 5,000 CETESB technical reports, known as the Technical File, which is designed to preserve the company's technical memory.

The CETESB Library offers the following services:

- utilization of the collections by CETESB employees and the general public
- inter-library loan
- national and international document delivery
- photocopies of documents
- online searches in the CETESB database and other databases.

In addition, the library disseminates information on the latest journal contents and new acquisitions through its quarterly bulletin *Bibliographic Alert*, helping users to keep up to date with the literature in the field of environmental pollution control. This bulletin is distributed free of charge to many institutions in Brazil, Latin America (mainly REPIDISCA cooperating centres) and other countries in the world. Another way of disseminating information about new additions to the library's collections, besides the bulletin, is through supplying data about new acquisitions to REPIDISCA.

Another important activity of the library is the training of internal users in how to use the collection, the databases, and the computer, how to access information using CD-ROM and international databases like Dialog and Questel, and much it costs. The librarians also train users in how to make bibliographical references according to international and national standards.

As a REPIDISCA coordinating centre, the library also has a responsibility to train librarians from other REPIDISCA member libraries in how to use the network's methodology, for example in cataloguing, classification and abstracting documents to be included in the REPIDISCA database, as well as how to do searches in the CD-ROM databases.

CETESB AND PORTUGUESE-SPEAKING AFRICA

No one questions the need to improve information management in the water and sanitation sectors in the Portuguese-speaking African countries.

In recent years, CETESB has offered support from time to time to capacity building for the sector in these countries. Visits by CETESB staff and the provision of books and training materials (in particular, to Mozambique) have been part of this collaboration. CETESB has been an active contributor to the Lusophone Initiative[1] which aims to improve sector output and performance in the Portuguese-speaking African countries through capacity building in training and information management.

A specialized bibliographical collection and a variety of well-prepared training modules and courses is available. CETESB, as a specialized Brazilian agency in the field of water supply and environmental sanitation, can offer a lot of support through the provision of Portuguese information materials and courses.

MORE ON ENVIRONMENTAL DATABASES IN BRAZIL

Planejamento e desenvolvimento da base de dados Legi usando o MicroISIS. [Design and development of the Legi database using MicroISIS].

M. Martins and N.F.B.G. de Santos. *Ciência da Informação*, 21 (2) May/Aug. 92, p. 142–5. tables. refs.

Describes the use of MicroISIS in the automation of Legi, an environmental legislation database, at the Secretaria do Meio Ambiente, Departamento Estadual de Proteção de Recursos Naturais (Secretary of State for the Environment, State Department for the Protection of Natural Resources) in São Paulo. Discusses the development of the system, entry of the data and the production of the Cadastro de legislação do meio ambiente (List of environmental legislation).

(From: *Library and Information Science Abstracts*)

Note

1. For more information on the Lusophone Initiative, see the article, 'Information management for water and sanitation in Angola', by Maria Odete Pedro Trigo, elsewhere in this issue. [*Ed.*]

Abstract

Contribution to a special issue on information in the water and sanitation sector. Describes the activities of the Environmental Sanitation Technology Company (Companhia de Tecnologia de Saneamento Ambiental: CETESB), the environmental pollu-

tion control agency of the State of São Paulo, in Brazil. CETESB provides research and technical assistance services to public and private agencies in many parts of Brazil, and has legal responsibilities and powers in respect of monitoring and preventing environmental pollution in the State of São Paulo. Describes CETESB's work in collecting, processing and disseminating scientific data, including its training programmes, organization of events, library services and databanks.

Arleti Maria Bottesini Jorge is Library Manager of CETESB, where she has worked for the past twelve years.

Further information on CETESB is available from: Companhia de Tecnologia de Saneamento Ambiental (CETESB), 345 Prof. Frederico Hermann Jr. Avenue, São Paulo, SP, CEP 05489–900, Brazil. Tel. +55 (11) 210–1100. Fax: +55 (11) 813–0227.

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