

AND  
MANUSCRIPT

1976

BARABAS

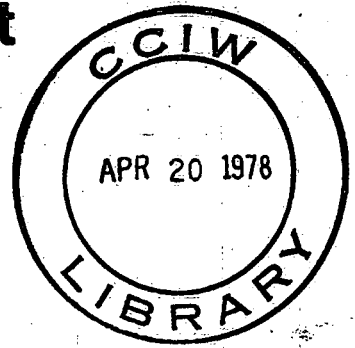


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ATTENDANCE AT AIDIS CONGRESS  
IN BUENOS AIRES, ARGENTINA  
AND VISITS TO  
CETESB, RIO DE JANEIRO, BRAZIL  
INSFOPAL AND CAR, BOGOTA, COLOMBIA  
AND, CVC, CALI, COLOMBIA

June 16 - July 2, 1976

by Silvio Barabas

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INSFOPAL AND CAR, BOGOTA, COLOMBIA  
AND, CVC, CALI, COLOMBIA

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During the period June 16 - July 2, 1976, the writer paid visits to some of the Latin American countries for the multiple purpose of:

- (1) Attending at the invitation of the WHO/PAHO Office, the Fifteenth Latin-American Congress on Sanitary Engineering in Buenos Aires;
- (2) Participating at the deliberations of a Symposium on Treatment and Disposal of Wastewaters, organized by WHO/PAHO to take place in conjunction with the Congress;
- (3) Reviewing with the PAHO and CEPIS officials participating at the Congress future WHO/CC activities in Latin America;
- (4) Paying a visit to FEEMA (Guanabara State Agency for Environmental Control) in Rio de Janeiro on his way to Buenos Aires, and;
- (5) Paying a number of brief visits to State Agencies in Colombia concerned with environmental control in Colombia on return trip to Toronto.

(1) FIFTEENTH INTERAMERICAN CONGRESS OF SANITARY ENGINEERING

InterAmerican Congresses on Sanitary Engineering are organized on a regular biennial basis by the InterAmerican Association of Sanitary Engineering, known as AIDIS (Asociacion Interamericana de Ingenieria Sanitaria). The previous AIDIS Congress was held in 1974 in Mexico City; the next AIDIS Congress will be held in 1978 in San Domingo.

The total registration at the Buenos Aires Congress was estimated at approximately 1000 people of which about 700 professionals and the rest distributed among the exhibitors, press and the accompanying spouses. The total registration, although somewhat below earlier expectations, was considered nonetheless, most satisfactory by the Congress officials in view of the fact that Argentina's largest and most prosper-

ous neighbour, Brazil, had only months earlier enacted legislation which makes travel abroad difficult and very costly.

The Congress was held in modern and comfortable quarters of the "Cultural Centre - General San Martin" in downtown Buenos Aires. It was opened by the Congress Chairman, Ing. Miguel Lasala of Argentina, followed by opening and congratulatory remarks by the AIDIS president Dr. Roberto do Rego Monteiro of Brazil, Dr. Daniel Lopez of PAHO, and several government officials of Argentina and of other Latin American countries. Simultaneous translation in Spanish, Portuguese and English was provided.

The Congress was organized in nine simultaneous sessions devoted to (1) Potable Water (supply of potable water to urban, suburban and rural areas); (2) Liquid Waste (disposal of urban and rural liquid wastes); (3) Contamination (pollution of soil, water and air; radioactive contamination; light and noise pollution); (4) Physical Planning (role of environmental sanitation in rural habitat); (5) Solid Waste (disposal of solid waste from urban and rural areas); (6) Public Hygiene (sanitation pertaining to industrial environment, public beaches, pools, etc.); (7) Planning (administrative and policy planning on a comprehensive national and interamerican basis); (8) Education and Research; (9) Disasters (planning for emergencies).

Unable to resolve the ubiquity requirements of attending simultaneous sessions and in the absence of any time-table of papers being presented at different sessions, the writer settled to attending the Session on Contamination (session no. 3). A comprehensive listing

of papers presented at the AIDIS Congress is given in Appendix I. The writer's comments on some significant papers given in session no. 3 are presented in Appendix II. Among them are: a paper by Monti and Mauro of Argentina describing a technology developed for removal of arsenic from arsenic-rich waters destined for human consumption; a paper by G.F. Oliveira of Argentina on mathematical modelling applied to diffusion of pollutants in semi-enclosed water bodies; a paper by H. Kawai et al of Brazil on balances of organic matter and dissolved oxygen in the Billings Reservoir; and a paper by Dos Santos et al., of Brazil describing a radioisotope technique for measuring dispersive capacity of water bodies.

(2) SYMPOSIUM ON TREATMENT AND DISPOSAL OF WASTEWATERS

The symposium was held the week preceding the AIDIS Congress. It was organized by PAHO for the purpose of providing an opportunity to some of the participants at the Congress to acquaint themselves with new low-cost technologies in wastewater treatment. Specialists from Argentina, Brazil, El Salvador, England, Mexico, Peru, United States and Venezuela gave lectures over the five-day period, on different aspects of wastewater treatment. Technical and organizational responsibility for the Symposium was assigned to CEPIS of Lima, Peru (a research and training arm of PAHO for Latin America). The writer did not take part at the Symposium itself but was present at an evening session during the AIDIS Congress when the conclusions reached at the Symposium were discussed and reviewed. The complete Symposium program is shown in Appendix III and a writer's summary of the conclusions of the Symposium is given in Appendix IV. In all, 192 people coming from a large number of Latin American countries attended the Symposium at which 20 speakers from 8 countries lectured. CEPIS will publish the proceedings of the Symposium.

(3) MEETINGS IN BUENOS AIRES

The AIDIS Congress has provided the writer with the opportunity of holding two formal meetings and a number of informal meetings with scientists and engineers attending the Congress at which WHO/CC past and proposed future activities on behalf of the Latin American countries have been reviewed.

At one of the "formal" meetings with Ing. Roberto Casanas, Director of the Institute for Water Use Technology (a branch of the Argentinian National Water Research Establishment known as INCYTH = Instituto Nacional de Ciencia y Tecnica Hidricas) and Ing. Dante Munoz of the WHO Buenos Aires office, the designation of INCYTH as the WHO National Collaborating Centre for Surface and Ground Water Quality was reviewed. Briefly, INCYTH has the competence and is desirous of becoming the national WHO/CC. The national WHO office fully supports such designation. It was left to the writer to initiate, on his return to Canada, formal steps leading to the designation of INCYTH as WHO/CC. Also a visiting 2-week fellowship by Argentina WHO allowing Ing. Casanas to visit CCIW was discussed. A tentative date for such a visit has been set for October 18-29, 1976.

At the other "formal" meeting with Ing. Odyer Sperandio, Director of CEPIS and Ing. Dante Munoz, past activities and future cooperation with our WHO/CC were reviewed. Among the topics discussed were: the designation of CEPIS as Regional WHO/CC (agreed); distribution of the Water Quality Bulletin to Latin American scientists and engineers

(no need for Spanish edition; CEPIS will supplement our current mailing list); CCIW assistance in providing lecturers for some of the training courses organized by CEPIS (CEPIS would pay travel and per diem expenses); WHO/CC participation at the World Water Conference in Mar del Plata, March 1977 (possible).

4. VISIT TO FEEMA, RIO DE JANEIRO

During the one-day visit to FEEMA (Fundacao Estadual de Engenharia de Meio Ambiente - State Corporation for Environmental Engineering) the writer met with Eng. Victor Coelho, Chief, Department of Pollution Control, Paulo Sergio da Cunha Leite, Head, Special Activities Service, Ana Maria Garrido, Head, Analytical Quality Control, Victoria Valli Braille, Chief, Air Pollution Control Division and several other FEEMA staff members.

Of particular interest to FEEMA was the adoption of Canada's NAQUADAT system. FEEMA staff were very pleased the way NAQUADAT has been working for CETESB in Sao Paulo.

Future intensification of contacts between FEEMA and WHO/CC has been agreed upon.

(5) VISIT TO COLOMBIAN WATER INSTITUTES

Since this was the writer's first visit to Colombia, the permanent WHO office in Bogota had arranged well in advance a most intensive program of visits to various Colombian water research and operational institutions in Bogota and Cali during the writer's 3-day

stay in Colombia.

On the first day in Bogota, brief discussions were held with WHO staff engineers Henryk Weitzenfeld and Guido Acurio. Ing. Weitzenfeld subsequently accompanied the writer to all institutes visited in Bogota and Cali.

5.1. Ministry of Health, Directorate General for Sanitation, Bogota

Discussions were held with the Director, Ing. Hector Collazos. He outlined the severe pollution problems resulting from rapid (and unplanned) urbanization of Colombia since the second World War. Some 85 cities in Colombia have more than 25,000 inhabitants, 3 cities (Bogota, Cali and Medellin) have passed 1 million population while a fourth city (Baraquilla) is approaching 1 million inhabitants. Among the current pressing problems is mercury contamination. The writer has been asked to send information on sampling, preservation and analytical methodology for mercury. Ing. Collazos accepted to write an article for the Water Quality Bulletin.

5.2. INSFOPAL, Bogota

Instituto Nacional de Fomento Municipal (INSFOPAL) is the National Institute for Urban Development responding to the Ministry of Health. The writer held discussions with Dr. Hector Gamarra, INSFOPAL Director, Dr. Hector Ospina, Chief Hydrogeology Research Division, Dr. Pedro Penuela, Chief, Planning Division and Ing. Gerardo Geath, expert in mathematical modelling (applied to problems of water supply, treatment and distribution).



It was impressed on the writer, the heavy dependence on ground water use in Colombia. The writer outlined the respective responsibilities and activities of Canada's DOE, IWD and CCIW. Agreement was reached on future exchange of information.

### 5.3. CVC, Cali

It might be indicative of the tight schedule of visits in Colombia the fact that the writer was required to leave the hotel at 05:00 am for a 06:45 am flight to Cali in order to attend a meeting at the head office of the Corporacion Autonoma Regional del Cauca (CVC) at 08:00 am. There a meeting was held with Ing. Alberto Patino, Chief, CVC Water Division, his assistant Ing. Guillermo Regalado and Ing. Raul Arias responsible for water pollution control.

CVC was established in 1953 to assume comprehensive responsibility over the regional development of the Cauca River Basin (very much along the lines of the Tennessee Valley Authority). The CVC budget comes from federal government contributions and 3 per 1000 tax contribution from the Cauca River valley property owners.

Based on data gathered over the past 35 years, the flow of the Cauca River extending some 210 km over the CVC region, has been calculated at 48 m<sup>3</sup>/sec (minimum), 1200 m<sup>3</sup>/sec (maximum) and 250 m<sup>3</sup>/sec (mean flow). Some 14 tributaries (averaging a flow of 104 m<sup>3</sup>/sec) enter Cauca through its right bank and 13 tributaries (averaging a flow of 69 m<sup>3</sup>/sec) enter through its left bank. Extensive use is made of ground water (about 17-23% of the total water supply). About 1300 people work for CVC of which 160 in water management.

Ing. Arias accompanied the writer to CVC laboratories as well as to the Cali industrial zone where untreated industrial sewage is discharged into the Cauca River. There are some 20 sugar plants, 2 pulp and paper plants, cement plants, tannery plants, asbestos plants, organic and inorganic chemical plants discharging into the Cauca River. Over extensive stretches of the Cauca River, DO is zero, its average value reaching 0.5 ppm. Coal mines discharging into the upper Cauca are another cause of oxygen deficiency.

Close cooperation between CVC and WHO/CC has been agreed upon.

#### 5.4. CAR, Bogota

On the final day of his stay in Colombia, the writer paid a visit to Corporacion Autonoma Regional de la Sabana de Bogota, etc (or briefly CAR). He was received by Ing. Hector Parra, CAR's Executive Director, and his assistant Ing. Angel Rodriguez.

The CAR responsibilities are similar to those of CVC except that they relate to the regional development of the Bogota Valley. They comprise among other things: rural electrification, reforestation, erosion control, recreational parks, aqueducts, ground waters, reservoirs, irrigation, etc.

The writer was accompanied by Ing. Rodriguez to various sites on the Bogota River. The degree of deterioration of the Bogota River was appalling. Over extensive stretches the River volume was extremely low, black in appearance and emitting obnoxious odours.

Understanding was reached to establish close relationship  
between CAR and WHO/CC. Ing. Parra has agreed to contribute an article  
to the Water Quality Bulletin.

- T E M A 1

<u>TRABAJOS</u>	<u>AUTORES</u>	<u>PAIS</u>
Fallas Estructurales en tanques para almacenamiento de Agua Potable.	Ing. P. Price "A. P. Montaña	COLOMBIA
Abastecimiento futuro de Agua Potable para LIMA metropolitana.	Ing. F. Chozo Nosiglia,	PERU
Diámetro más económico de una línea de impulsión con gasto variable,	Ing. C. Fuiz Altuna	PERU
Métodos de limpieza en filtros lentos.	Ing. E. Campuzano	ECUADOR
Sedimentación acelerada usando tubos y placas.	Ing. A. Torres	ECUADOR
Estudios de los residuales en el Sistema de Distribución de la Ciudad de San Carlos.	Ing. M. D. Barreto y otro .	BRASIL
Simplificación de los métodos de cálculo de redes de mallas	Ing. Moran y otro	BRASIL
Contribución al estudio de cortinas de distribución de agua de decantadores.	Ing. Di Bernardo y otro.	BRASIL
Posicionamiento de W. T. A. en sistema de abastecimiento de agua de pequeñas comunidades.	Ing. Fadel	BRASIL
Programa piloto para la implantación del sistema de abastecimiento de agua en pequeñas comunidades	Ing. E. E. Pesquis	BRASIL
Norma sobre agua para consumo humano de sistemas públicos de abastecimiento.	Ing. Parlatore y otro	BRASIL
El mejoramiento planificado de los sistemas de Agua Potable y alcantarillado.	Ing. G. Zouza	MEXICO
El polietileno y la termofusión. Nuevos aliados para resolver problemas en REDES de DISTRIBUCION y DRENAJE.	Ing. Franco.	MEXICO
Estudios hidrométricos en sistemas de abastecimiento para agua potable.	Ing. E. Perez Arrollo.	MEXICO

Control y Evaluación Periódica del Funcionamiento de los Sistemas de Agua Potable.	Ing. A. Eueno Carrera.	MEXICO
Preceptos jurídicos de la Operación y Administración de los servicios de Agua Potable en la República Mexicana.	Lic. Carlos Gra vioto Cortes.	MEXICO
Pepercusión que causa en la Economía de la familia sujeta a salario mínimo los pagos por el servicio de Agua Potable.	Ing. Mario López Mora	MEXICO
Una metodología de protección anticorrosiva a aplicar en el proyecto e instalación de las conducciones de agua.	Lic. A. Muratorio y otros	ARGENTINA
Femosión de arsénico de aguas destinadas al consumo humano.	Ing. F. Monti y otr.	ARGENTINA
Optimizac ión en el diseño de redes de distribución de agua potable.	Ing. I. P. Lasanta y otros.	ARGENTINA
Variaciones plantónicas del embalse San Foque (Córdoba República Argentina), y su relación con los procesos de potabilización.	Sr. J. C. Cachi	ARGENTINA
Resistencia de la Klebsiella a la cloración, su importancia como parámetro de desinfección.	Dr. H. Vazquez y otra.	ARGENTINA
Comportamiento de la pseudomonas aeruginosa en distintos tipos de agua	E. E. Calderón Médica Debenedetti.	ARGENTINA
Arsénico, fluor y vanadio en aguas de bebida, técnicas para corregir su exceso.	Dr. P. Callegaro y otros.	ARGENTINA

Tratamientos de residuos de usinas de productos lácteos. Obtención de parámetros de proyectos en escala de laboratorio mediante el uso de reactores biológicos aerobios.	Roberto E. B. Centurión y otros.	BRASIL
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Comentarios de normas para proyectos de redes de cloacas.	Ing. Amarilis Pereira de Souza.	BRASIL
Proyecto estructural de conductos de plástico enterrados para desagües.	Ing. Nelson Passetto.	BRASIL
Costos de los grandes canales de desagües sanitarios.	Ing. Augusto S. Pito Guimaraes y otro.	BRASIL
Proyecto San Juan 400. Experiencias en el PERU, en la utilización de desagües tratados y terrenos rellenados con basura.	Ing. Luis Malnati Fano.	PERU
Eficiencias en estanques de sedimentación.	Javier Garcia Flores C. y otros.	VENEZUELA
Reactores biológicos anaerobios en base a características ambientales. Digestión de una etapa para lodos de origen doméstico.	Sanir Masurka E. Melania de Valery.	VENEZUELA
Tratamiento de los líquidos residuales de curtiembre. Uso de los líquidos de ribera y curtido.	Ing. Mauricio Navón y otros.	ARGENTINA
Análisis de la correlación existente entre la D. P. C. y el O. C. en líquidos residuales de mataderos. Frigoríficos.	Ing. Ricardo L. Fach.	ARGENTINA
Combinación de procesos físicos, químicos y biológicos para la depuración de efluentes domésticos.	Ing. Pene F. Montes y otro.	ARGENTINA
El drenaje profundo de la ciudad de México.	Faúl Ochoa Elizondo.	MEXICO
Determinación práctica de la eficiencia de tratamiento que se logra en las lagunas de estabilización bajo diferentes condiciones.	Rodrigo E. Solis Alba.	MEXICO
Métodos preventivos de corrosión en sistemas de acantarillado.	Quim. Lucina Negrete Flores.	MEXICO

TRABAJOS

AUTORES

PAIS

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Diseño de serie de zanja de oxidación para poblaciones de 250 a 7.000 habitantes.

Ing. Fernando Delgado Vazquez ots.

MEXICO

Futuro del tratamiento de las aguas residuales municipales de México

Ing. Everardo Flores-

MEXICO

TEMA 3  
CONTAMINACION

Hoja 5

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Criterio para la clasificación legal y control de calidad de las aguas.	GEOPLANARCH Public. N° 46	VENEZUELA
Planta de agua pesada: Análisis de su emplazamiento y evaluación de los efectos potenciales sobre el medio ambiente.	Nicolas MAZZEO y ot.	ARGENTINA
Estudio de la contaminación atmosférica producida por automotores en el radio céntrico de la ciudad de San Miguel de Tucumán.	Mario Juarez y ot.	ARGENTINA
Modelos matemáticos para el estudio de la difusión de contaminantes en cuerpos de agua semi-cerrados aplicación al Golfo Nuevo.	Guillermo FERNANDES D'OLI - VEIRA	ARGENTINA
Estado de polución de las playas de Santos y el plan de saneamiento del estuario Santista.	Antonio GARCIA OCCHIPINTO	BRASIL
Modelos bidimensionales de calidad de agua y económicos para la Bahía de Guanabara -R. de Janeiro.	Ing. Victor MONTERO y ot.	BRASIL



T R A B A J O SA U T O R E SP A I S

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Estudios para mejorar los rendimientos sanitarios de reservatorio Dillings	Ing. Nelson Nucci y otros	BRASIL
Campaña para la conservación y mejor uso del Agua Potable	Ing. Sergio Martines Taboada	MEXICO
Revisión y análisis de los patrones del uso del agua en las ciudades	Ing. Eloy Uroz Jimenez y ots	MEXICO
La calidad del agua en el Lago de Chapala y su impacto en el ambiente	Biol. Juan C.O. San Miguel	MEXICO
Principales características sociales en la Operación del Sistema del Alto Lerma	Ing. Humberto Carrión Arias y otros	MEXICO
Estudio Integral de Aguas del Departamento Del Quindio	Ing. Germán Ramirez	COLOMBIA
Protección de manantiales de la región metropolitana de San Pablo	Empresa Metropolitana	BRASIL
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RESIDUOS SOLIDOS

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Los procesos intermedios en la manipulación de residuos sólidos.	Félix Miguel Sanchez	VENEZUELA
Literatura relacionada con los desechos sólidos producidos en los Institutos Hospitalarios y su evolución en el tiempo.	Eduardo Genatros	VENEZUELA
Trends in solid waste management	Greenleast Telasca Inc.	E.E.U.U.
Proteína a partir de desperdicios.	Urivald Pawlowsky	BRASIL
Proyecto San Juan 400.	Luis M. Fave	PERU
Sistema de control de Operación Coleta.	Ricardo Araujo Ferreira	BRASIL
Sistema de control de Operación Coleta - Anexo -	Idem	IDEM.
La importancia de la comunicación social para la limpieza urbana	Gastao Sengis	BRASIL
Usina de recuperación y trituración de basura de LAUJA.	Idem	IDEM
Relleno experimental de basura.	Fernando Augusto	BRASIL

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Evaluación Sanitaria de la Reutilización de agua a la Agricultura	Dr. Jorge AGUIRRE MARTINEZ y otro	MEXICO
Estudio de los Plaguicidas en la Cadena - agua-Forraje-Leche.	Ing. Ruben MARTELL y otro	MEXICO
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Tarifa de desagües y una proposición

Miguel Imbiriba FRASIL

Costas de las grandes canalizaciones de desagües sanitarios.

A. S. Pinto Guimaraes . Fundación Estado FRASIL  
Engenharia de Meio ambiente.

Viabilidad de sistemas de abastecimiento de agua y de sistemas de desagües.

S. Z. A. Chna Elíasz FRASIL  
Cynamon

Plan Nacional Hidráulico

Gonzalez Villarreal ARGENTINA

Criterios de calidad del agua en relación con el uso final del cuerpo receptor y su capacidad de asimilación.

Aniceto H. Torrea ARGENTINA  
y otros.

Políticas Tarifarias en los Servicios de Agua Potable en la República Mexicana.

S. Seedorf Castillo MEXICO

Desarrollo y Medio ambiente.

E. Díez y Canedo  
Ruiz

Intervención de la Secretaría del Patrimonio Nacional en el Control de OBRAS DE INGENIERIA SANITARIA EN MEXICO.

M. Montes de Oca MEXICO  
y otros.

Lineamientos para establecer una política eficiente de SERVICIOS DE AGUA POTABLE Y ALCANTARILLADO EN MEXICO.

A. Ereña Garduña MEXICO

Estructura de Tarifas para los Servicios de Acueducto y Alcantarillado y su Esquema de Aplicación Gradual en 24 meses.

J. A. Infante F. COLOMBIA

<u>TRABAJOS</u>	<u>AUTORES</u>	<u>PAIS</u>
Enseñanza e investigación.-Sociedad Mexicana de Ingeniería Sanitaria S.C. MEXICO:		
- El adiestramiento en el Sector Agua Potable y alcantarillado en México.	Ing.M.A.ARCINIEGA TER-VEEN	MEXICO
- Impacto de los detergentes en el Recurso Hidráulico.	Ing.F.ROMERO LUNA	MEXICO
- Efecto del Vórtice en los Tanques de Aereación de las Plantas de Tratamiento.	Ing. Jaime DE LA CRUZ NOGUEDA	MEXICO
- Recuperación de Sulfato de Aluminio en Plantas de Clarificación de Aguas	Ing.Luis FER NANDEZ VELASCO	MEXICO
- El entrenamiento de personal, Base Fundamental en los Programas de Control de Contaminación.	Q.F.B.Luz María CROPEZA MENDOZA	MEXICO
- Un método de Solución de la Ecuación de GUMBEL para el cálculo de Valores Extremos	Ing. Raúl E. OCHOA E.y ot.	MEXICO
- Procedimientos para elaborar el Plan de Adiestramiento del Sector Agua Potable y alcantarillado de México.	Ing.Hernando CORREAL CORREAL	MEXICO
- Operacionalización del Programa de Entrenamiento para el Sector de Saneamiento Básico en Brasil.	Ing.Airson MEDEIROS DA SILVA	BRASIL
- Dinámica de una Asociación de Clase	Ing. Airson MEDEIROS DA SILVA	BRASIL
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Saneamiento para emergencias y ca- tástrofes públicas.	Ing. LIQITA	BRASIL
Un estudio para el control de la --- erosión en áreas Urbanas de la Re- gión Noroeste del Estado de Paraná.-	Ing. A. B. PONTES	BRASIL

REMOVAL OF ARSENIC FROM WATERS DESTINED FOR HUMAN CONSUMPTION  
by Hector Julio Monti and Francisco Osvelo Mauro (in Spanish)

In the three Argentinian provinces of La Pampa, Santiago del Estero and Cordoba, the only source of water supply is groundwater high in arsenic. Arsenic in concentrations of 70.2 mg/l is known to cause chronic intoxication, localized tumors and dilatation of cutaneous capillaries. Arsenic is known to be carcinogenic as well as to affect the nervous system. Based on the authors' research, a pilot plant was built capable of treating 500-700 l/h of arsenical waters in Ponte Quemada (province of Santiago del Estero). Water containing 0.95-1.00 mg/l of arsenic is reduced to 0.25-0.30 mg/l after treatment.

Water is brought up from the well by means of a piston pump at the rate of 7 m<sup>3</sup>/h. to 2 iron tanks (25 m<sup>3</sup> each) in which are injected reagents 40 mg/l of ferric sulfate and 350 mg/l of calcium oxide. Tanks are filled in 3 hrs 30 minutes. Subsequently 2 hrs 30 minutes are allowed for the coagulate to deposit. The clear supernatant liquid is decanted into 2 cistern tanks where a second sedimentation of 2 hrs 30 minutes is allowed. The resulting liquid is filtered through a filter press at 10 m<sup>3</sup>/hr, pumped into an elevated tank (20-m high) of 30 m<sup>3</sup> capacity and from there distributed to 14 public outlets in the village.

## MATHEMATICAL MODELLING OF DIFFUSION OF POLLUTANTS IN SEMI-ENCLOSED WATER BODIES

by Guillermo Fernandez d'Oliveira (INCYTH)

The model has been applied to industrial discharges from Puerto Madrin into Golfo Nuevo in Argentinian Atlantic waters. Three bidimensional models were developed each as a function of time. In the first model are calculated the tides which in Golfo Nuevo have an amplitude of 2 m. In the second model are calculated the residual currents due to winds and their interaction with tides with the resulting total field of velocities.

The third model considers diffusion as the sum total of the advection due to regime of circulation calculated from models 1 and 2 and the diffusion proper, and the resulting drop in contaminant concentration.

### CONCLUSIONS REACHED:

- (1) Tide currents play a principal role in the dispersion and elimination of contaminants from the Golfo Nuevo.
- (2) Residual currents alone are not very effective in reducing contaminants given their small magnitude (2-3 cm/sec); however in combination with tides, they increase the effectiveness of the latter very substantially.
- (3) The maximum concentration in an area where contaminants are discharged increases very slowly as the system approaches equilibrium. Its magnitude, for a coefficient of turbulent diffusion of  $100 \text{ m}^2/\text{sec}$  is less than 1 ppm for a load of 1 kg/sec (for a homogeneous mixture in an area of 2.8 km x 4.1 m x 2.8 km). Authors claim that the models developed are easily applicable to other semienclosed bodies of water.



CHARACTERIZATION OF SANITARY CONDITIONS IN BILLINGS RESERVOIR FROM THE  
POINT OF VIEW OF BALANCES OF ORGANIC MATTER AND DISSOLVED OXYGEN

by Hideo Kawai, Tsutomu Yano, Sergio Jose Chinez (CETESB)

Billings Reservoir is situated in the south-eastern area of Sao Paulo. At present, it is highly polluted as a result of considerable discharge of domestic sewage and industrial wastes from the Greater Sao Paulo. In view of the plans to use this water not only for boating and swimming but also for water supply, studies were initiated to relate water quality to the varying hydraulic operations and pollution loads of the reservoir.

DETERMINATION OF DISPERSIVE CAPACITY OF WATER BODIES BY MEANS OF RADIO-ISOTOPIC TECHNIQUES

by Jose Leomax dos Santos, Edmundo Garcia Agudo, Augusto Merighi Junior and Wladimir Sanches (CETESB)

"Bromo-8 Z" used as radioactive tracer (obtained by neutron irradiation of either KBr or  $\text{NH}_4\text{Br}$ . Factors affecting physical dilution (effluent dispersion) based on special distribution of the tracer have been calculated using a mathematical model developed by Danish Isotope Centre.

APPENDIX III

PROGRAM

Tuesday, 15 June

Registration and distribution of technical documents

Opening Ceremony

Recess

Introduction

Objectives and Procedures of the Symposium  
O. Sperandio

Introductory Topics

Topic I A Status of Wastewater Treatment Systems in Latin America  
F. Yáñez

Topic I B The Role of Wastewater Treatment and Disposal in Water Pollution Control  
W. Castagnino

Topic I C Overview of Existing Technology  
E. Gloyna

Topic I D Management of Wastewater Disposal Systems in the United Kingdom  
A. Drake

Recess

Topic I E The Role of IBRD in the Development of Wastewater Treatment and Disposal Projects  
A. Zavala

PROGRAM (Cont.)

Wednesday, 16 June

Topic I F Considerations in the Selection and Application of Treatment Technology  
F. Yáñez

Topic I G The Activities of OSN Regarding Wastewater Treatment  
H. Armándola

Recess

Discussion of Introductory Topics

Topics on Treatment and Disposal

Topic II Ocean Disposal of Wastewaters  
R. Ludwig

Case study II a Experiences in the United States with Ocean Disposal  
R. Ludwig

Case study II b The Ipanema Submarine Outfall  
E. de Brito

Topic III Low Cost Sewerage Systems  
J.M. de Azevedo Netto

Discussions of Topics II and III

Recess

Topic IV Radioactive Waste Disposal  
C. Arias

PROGRAM (Cont.)

Thursday, 17 June

- Topic V**      Developments in Stabilization  
Pond Treatment  
F. Yáñez
- Case study**  
**V a**      Experiences in Cuba with  
Stabilization Lagoons  
C. Martínez
- Recess**
- Case study**  
**V b**      Experiences in Peru with  
Stabilization Lagoons  
Speaker to be determined
- Discussion of Topic V**
- Topic VI**      Land Application of Wastewaters  
B.L. Seabrook
- Case study**  
**VI a**      Experiences in Australia with  
Land Application of Waste-  
water  
B.L. Seabrook
- Case study**  
**VI b**      Experiences in Mexico with  
Land Disposal of Waste-  
water  
A. Paz Sánchez
- Discussion of Topic VI**
- Topic VII**      Biological Waste Treatment  
E. Gloyna
- Recess**
- Case study**  
**VII a**      Experiences in the U.S.A.  
with Biological Waste  
Treatment
- Case study**  
**VII b**      The Use of Extended Aeration  
in Curitiba, Brazil  
P.N. Costa Franco
- Discussion of Topic VII**

PROGRAM (Cont.)

Friday, 18 June

- Topic VIII**      Control and Treatment of  
Industrial Wastes  
C. Carrique
- Case study**  
**VIII a**      Experiences in Argentina  
with Textile Industry  
Wastewater Treatment  
C. Carrique
- Recess**
- Case study**  
**VIII b**      Experiences in Brazil with  
Sugar Industry Waste Disposal  
I. Hespanhol
- Case study**  
**VIII c**      Treatment and Disposal of  
Tannery Wastes  
M.L. Hess
- Case study**  
**VIII d**      Experiences in El Salvador  
with Coffee Wastes Treat-  
ment and Disposal  
G. Amaya de León
- Case study**  
**VIII e**      Experiences in Venezuela with  
Petrochemical Waste Treat-  
ment  
A. Reverol
- Case study**  
**VIII f**      Experiences in Argentina with  
Reuse of Tanning Liquids  
M. Navón
- Discussion of Topic VIII**
- Closing Ceremony**

CONCLUSIONS OF THE SYMPOSIUM ON  
TREATMENT AND DISPOSAL OF WASTEWATERS

General Consideration

As a result of a combination of high population growth and rapid industrialization of many countries of Latin America and the Caribbean Areas, problems of water contamination have become serious. Considerable resources will have to be devoted to the control of water contamination. Hence, it is important to be acquainted with suitable technologies for wastewater treatment. Such technologies should be adaptable to local conditions. An outline of such technologies is the primary purpose of the Symposium.

Technical Aspects

Design and construction of waste treatment plants must be in response to specific needs. Engineers often have at their disposal a number of alternatives. The solution adopted should be based on careful economic analysis which takes into consideration the local ability to manufacture equipment.

It should be recognized that in future, the costs of treatment of industrial and urban waste will be higher than they are today in spite of any technological advances.

In coastal cities, underwater discharges should be considered. In industrial areas, large scale treatment plants should be considered to reduce the costs. Likewise, there should be regionalization in management and maintenance of wastewater treatment plants. Also treatment of combined waste from many industrial plants in an industrial park should be found economical.

There is a need to reduce the volume of contaminants resulting from an industrial process. To this end, pilot plant studies should be helpful.

#### Planned Activities

It is recommended that an active programme of training and continuing education in wastewater treatment be initiated.

Re-use of wastewater should be investigated. Any project should be preceded by careful cost analysis.

Pertinent experiences gained by various countries and institutes should be exchanged through CEPIS and local technological centres.

Effort should be made to locally manufacture wastewater treatment equipment.

Processes of treatment by the way of stabilization lagoon and extended aeration should be explored.

Financing

Equitable financial contribution for the construction of wastewater treatment plants should be secured from users of raw water.

Also incentives should be offered to this end.

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