ORNL/FTR--3793

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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-3793

DATE: October 12, 1990

SUBJECT: Report of Foreign Travel by Harry L. Boston, Research Staff Member, Environmental Sciences Division

TO: Alvin W. Trivelpiece

FROM: Harry L. Boston

PURPOSE: To (1) participate as an invited member of a discussion panel on energy and to make a presentation on "Resources for Environmental Technology in the Tennessee Valley" at a Conference on Environmental Technology organized by the American Embassy—Paris and (2) present a paper at the Fourth International Conference on Environmental Contamination in Barcelona.

SITES VISITED:

9/24-25/90	Conference on Environmental Technology	Paris, France	Mr. M. Michaud
10/1-4/90	Fourth International Conference on Environmental Contamination	Barcelona, Spain	Dr. J. Barcelo

ABSTRACT: The traveler participated in a conference on environmental technology in Paris, sponsored by the U.S. Embassy—Paris, U.S. Environmental Protection Agency (EPA), the French Environmental Ministry, and others. The traveler sat on a panel for environmental aspects of energy technology and made a presentation on the potential contributions of Oak Ridge National Laboratory (ORNL) to a planned French-American Environmental Technologies Institute in Chattanooga, Tennessee, and Evry, France. This institute would provide opportunities for international cooperation on environmental issues and technology transfer related to environmental protection, monitoring, and restoration at U.S. Department of Energy (DOE) facilities.

The traveler also attended the Fourth International Conference on Environmental Contamination in Barcelona. Conference topics included environmental chemistry, land disposal of wastes, treatment of toxic wastes, micropollutants, trace organics, artificial radionuclides in the environment, and the use biomonitoring and biosystems for environmental assessment. The traveler presented a paper on "The Fate of Radionuclides in Sewage Sludge Applied to Land." Those findings corresponded well with results from studies addressing the fate of fallout radionuclides from the Chernobyl nuclear accident. There was an exchange of new information on a number of topics of interest to DOE waste management and environmental restoration needs.

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SUMMARY OF ACTIVITIES:

The Conference on Environmental Technology (see Appendix B) was intended to (1) serve as a forum for discussions of the integration of new environmental technologies into comprehensive pollution prevention strategies and for discussions of how trends in government regulation and university research and training can increase the rate of development and application of these technologies and to (2) to establish a foundation for a French-American Environmental Technologies Institute in Chattanooga, Tennessee, and Evry, France. The participants included Dr. Dennis Miller [Science Advisor to Office of Technology Development, Division of Environmental Restoration and Waste Management, U.S. Department of Energy (DOE)], Mr. Gerald F. Kotas [Director, Pollution Prevention Division, U.S. Environmental Protection Agency (EPA)], J. Oppeneau (Director of Research and Development for the French Ministry for the Environment). and representatives of industry, environmental consulting firms, universities, and others.

The presentations from the French environmental perspective were focused primarily on global environmental problems (atmospheric CO_2, O_3 depletion, ocean pollution, etc). Presentations from the U.S. perspective addressed specific regulatory issues relating to waste disposal, remediation technology, and sustainable growth. It was clear that the U.S. market for environmental technology is more regulatory driven than is the European market. However, because environmental programs and regulations developed by EPA serve as a model for foreign governments, the need for environmental information and the market for environmental technology are rapidly expanding. The National Environmental Technology Applications Corporation (NETAC) has been established by EPA and the University of Pittsburgh to encourage the development and application of environmental technologies. NETAC will serve as a model and contributor to the French-American Environmental Technologies Institute. Samuel Schulhof, President of NETAC, presented information on the size of U.S. market (about $100 billion in 1989) and the global market for environmental technology. Marvyn Riddle, of the International Finance Corporation and the World Bank, discussed the technological and financial requirements for implementing pollution control on a global scale. Dennis Miller (DOE) discussed the complexity of environmental problems at federal facilities and the need to identify technical needs and develop advanced technologies. He highlighted some of the environmental restoration activities and technologies developed and implemented at DOE facilities (including those in Oak Ridge).

The traveler's presentation (see Appendix C) was unique in that, rather than simply identifying environmental problems and technological needs, he was able to offer examples of capabilities and technologies developed and/or demonstrated at Oak Ridge National Laboratory (ORNL) for environmental evaluation, pollution abatement, and other aspects of environmental restoration. The traveler noted advances in areas such as bioindicators, risk assessment, hydrological and geological assessment methods, waste minimization and effluent treatment, environmental monitoring, toxicity assessment, regulatory compliance, waste immobilization, and in situ bioremediation. The presentation generated a good deal of interest and further solidified ORNL's future role in the French-American Environmental Technologies Institute (see Appendix D).

Although there was information from a number of firms involved with environmental technology, there was little information that was not already well known to ORNL and DOE. However, Interactive Media Communications made a presentation of interactive videodisc programs for health, safety, and environmental training. These programs, tailored to Occupational Safety and

Health Administration (OSHA) and EPA requirements, are automated, documented, and in use by several major corporations. The traveler found the information to be almost identical to that presented by ORNL training personnel. It appears that the use of an automated, individual-access system could substantially reduce training costs for DOE and DOE contractors. This information has been passed on to ORNL training personnel.

The traveler is confident that his participation in this meeting will lead to a larger role for ORNL in the French-American Environmental Technologies Institute, offering opportunities for technology transfer and collaboration on developing innovative technologies to meet the environmental needs of DOE and others.

The Fourth International Conference on Environmental Contamination was an excellent forum for the exchange of new information (over 200 oral and poster presentations) on the fate and effects of contaminants in the environment (see Appendix E). A published proceedings containing papers from many of the presentations was made available to participants. C. Vandecasteele (State University, Belgium) made an important contribution to the plenary session with a presentation on advanced techniques for inductively coupled plasma–mass spectroscopy for environmental analyses. The published text of this presentation will be a useful guide in future environmental assessment and compliance activities. W. E. Sopper (Pennsylvania State University) presented results of the use of sewage sludge fly–ash mixtures to revegetate steep coal waste banks. This technique seems useful for stabilizing and revegetating areas on federal facilities and provides a useful method for disposal of sludge and fly ash. Equipment used for these sludge–fly ash applications could also be used to apply sewage sludge in mature forests or in recently cut areas where trees are to be harvested for biomass energy use, thus benefiting DOE's Biofuels Pogram.

M. L. Berrow (Macauly Land Use Research Institute, United Kingdom) discussed the degradation of polycyclic aromatic hydrocarbons (PAHs) in sludge-treated soils. From a human-health perspective, PAHs, including benzo[a]pyrene, may be among the most important components in land-applied sewage. Total PAH in sludge was 10 to 100 ppm and resulted in a 1- to 1000-ppb concentration in soil. The fate of PAHs added to soils with sewage sludge was determined over a 17-year period. Loss rates of PAHs from soils were up to 82 $\mu g \cdot Kg^{-1} year^{-1}$, or 80 to 95% loss in 17 years, with the low-weight, low-ring-number PAHs being lost first. The half-life for sludge-applied PAHs in soils ranged from <2 to about 17 years, which is much longer than the half-lives (weeks) measured for PAHs from spike additions to laboratory soils. Therefore, PAHs may have much longer half-lives under field conditions than indicated by laboratory studies. Although PAHs are not accumulated by vegetation, direct ingestion of soil and dust by animals and humans may be a significant exposure pathway.

K. Bunzl (GSF–Institut fur Strahlenschutz, Federal Republic of Germany) presented data for soil-to-plant transfer of plutonium, americium, strontium, and cesium, with soil-to-plant transfer ratios for cesium similar to those presented in the traveler's paper for sites treated with sewage sludges contaminated with cesium, cobalt, and uranium. M. Roca (Universitat de Barcelona) presented data for radiocesium activity in pine needles from 11 forests in Spain following the Chernobyl accident. These data showed translocation of radiocesium to young needles and the role of organic carbon and faunal activity in the distribution of radiocesium in forest soils. While most of the mass of fallout ^{137}Cs was in the mineral soil, the ^{137}Cs concentrations were severalfold greater in the litter layers. G. Kirchner (University of Bremen, Federal Republic of Germany) presented

data for the mean transport of radionuclides from Chernobyl fallout in three soils. The data showed that cesium and plutonium were largely retained in the upper 5 cm of soil and completely retained in the upper 15 cm. Kirchner also reported that strontium was relatively more mobile than cesium or plutionium, as would be expected and as has been observed in our studies.

M. K. Hamdy (University of Georgia) discussed microbial systems developed for degradation of polychlorinated biphenyls (PCBs) in bioreactors. Organisms isolated from the environment were developed to grow in as much as 2500 ppm PCB as the sole carbon source in liquid culture. PCB-^{14}C was isolated in the lipid fraction of the microbes. Evidence was presented for aerobic dechlorination in the microbial cell wall, followed by entry and further degradation of the less-chlorinated compounds within the cell in 130 days if nutrient were added. Hamdy reported complete degradation of PCBs in oily water waste with initial concentrations of 1000 ppm PCB. The removal of toxic oils (using mild surfactants) from PCB-containing waste was required prior to introduction of the waste into the reactors. He emphasized the need for controlled reactor conditions and the absence of alternative carbon sources.

While at the conference the traveler also had lengthy discussions with Harry Hofstede (Murdock University, Australia) concerning the mixing of sewage sludge with bauxite refining residue (red mud) following aluminum extraction as a means to stabilize metals in sewage sludge prior to disposal. The traveler had discussions with Ken Steele (University of Arkansas) on the movement of NO_3^- to the groundwater below sites where animal wastes are land applied. His findings of low groundwater NO_3^- concentrations despite high nitrogen application rates were similar to results found at ORNL following application of sewage sludge to land. The traveler spent a good deal of time with S. K. Gupta (Swiss Federal Research Station) discussing the mobility of metals in soils following sludge application. Land application of sewage sludge has long been practiced in Switzerland, and Swiss scientists have excellent data for long-term responses of soil properties. Dr. Gupta was impressed with the current EPA regulations for sludge application and shared several helpful insights on long-term environmental responses.

The traveler received several papers from W. F. Warwick on the use of benthic insects in biomonitoring. These papers describe methods that may be useful in the biological-monitoring components of the remedial action programs at DOE facilities.

While at the conference the traveler discussed the current regulatory climate and new requirements for quality assurance/quality control with J. Fisk (EPA—Cincinnati) and site characterization and remediation at DOE facilities with Bob Gray (Pacific Northwest Laboratory).

The traveler received information from Garrette Clark (EPA) concerning the United Nations-sponsored International Cleaner Production Information Clearinghouse (ICPIC), an information data base for pollution prevention information. Access to this information may be useful to DOE and will provide a broad distribution for technical information generated by DOE contractors.

SUMMARY EVALUATION AND RECOMMENDATIONS FOR FUTURE CONTACTS:

All of the contacts made at these conferences were useful for information exchange. Participation in the Conference on Environmental Technology helped to make the French Environmental Ministry better aware of the technological expertise at ORNL. The traveler believes that our involvement will help to establish the French-American Environmental Technologies Institute and that this institute will provide a source of environmental technology that may be useful in addressing the complex environmental issues at DOE facilities. ORNL's interaction with the Environmental Technologies Institute will also provide ORNL with a potentially valuable collaborator on environmental issues and an active avenue for technology transfer to the private sector. The traveler strongly urges ORNL and DOE to maintain contact with the directors of the French-American Environmental Technologies Institute and to encourage growth and interaction. The Conference on Environmental Contamination was a wonderful resource for information on the fate and effects of contaminants in the environment. The traveler made a number of contacts that will be extremely useful to research in progress. The information in the conference proceedings will be useful to DOE environmental assessment, monitoring, and restoration efforts. The contacts with other investigators working with the fate of materials in sewage sludge will benefit DOE waste management efforts and aspects of the DOE Biofuels Program. The information on radionuclides and organic contaminants in the environment also will benefit energy production and development activities. The traveler strongly recommends that ORNL be represented at future International Conferences on Environmental Contamination.

APPENDIX A

Trip Itinerary, Persons Contacted, and Publications Received

TRIP ITINERARY

9/23/90	Travel to Paris
9/24 - 25/90	Conference on Environmental Technology
9/26 - 28/90	Free Time
9/29/90	Weekend
9/30/90	Travel to Barcelona
10/1 - 4/90	Fourth International Conference on Environmental Contamination
10/4/90	Return to Knoxville, Tennessee

PERSONS CONTACTED TO A SIGNIFICANT EXTENT

Conference on Environmental Technology — Paris

Jean-Claude Oppeneau (Director, Information and R&D, French Ministry of Environment, Paris, France), Dennis Miller (Office of Technology Development, Division of Environmental Restoration and Waste Management, DOE), Mary M. Walker (GES, Inc., Chattanooga, Tennessee), Dr. Ralph Hise (Advanced Technologies Management, Inc., Cleveland, Ohio), Dr. Robert Martin (Lyonnaise des Eaux, Paris, France), Roger Puff (Cerchar, Verneuil en Halatte, France), James L. Mason (Interactive Media Communications, Waltham, Massachusetts) Gerard Meyer (Euromerica Business Network Institute, Paris, France).

Fourth International Conference on Environmental Contamination — Barcelona

M. L. Berrow (Macauly Land Use Research Institute, United Kingdom), Claude A. Degueldre (Paul Scherrer Institute, Switzerland), J. F. Fisk (EPA, Cincinnati, Ohio), Robert H. Gray (Battelle Pacific Northwest Laboratories, Richland, Washington), S. K. Gupta (Swiss Federal Research Station, Switzerland), Harry Hofstede (Murdoch University, Australia), K. F. Steele (University of Arkansas, Fayetteville, Arkansas),
L. H. Weinstein (Boyce Thompson Institute, Ithaca, New York), Robert L. Gould (Science Applications International Corporation, McLean, Virginia), Garrette Clark (EPA ICPIC Program, Paris, France), M. Cinta Roca (Universitat de Barcelona, Barcelona, Spain), J. Barcelo (Universidad de Barcelona, Barcelona, Spain), D. Baumgartner (University of Bremen, Germany)

PUBLICATIONS RECEIVED

Barcelo, J., ed. 1990. Proceedings, Fourth International Conference on Environmental Contamination, Barcelona, October 1990, CEP Consultants Edinburgh, United Kingdom, 640 pp.

Gupta, S. K., and H. Hani. 1989. Methodik zur bestimmung biologisch relvanter schwermetallkonzentrationen im boden und ueberprufung der auswirkungen auf testpflanzen sowie mikroorganismen in belasteten gebieten. Schriftenreihe der FAC Liebefeld, Nummer 2, Cost 681. 54 s.

Warwick, W. F. 1985. Morphological abnormalities in Chironomidae (Diptera) larvae as measures of toxic stress in freshwater ecosystems: Indexing antennal deformities in Chironomus Meigen. Canadian Journal of Fisheries and Aquatic Sciences 42:1881-1914.

Warwick, W. F., and N. A. Tisdale. 1988. Morphological deformities in Chironomus, Cryptochironomus, and Procladius larvae (Diptera: Chironomidae) from two differentially stressed sites in Tobin Lake, Saskatchewan. Canadian Journal of Fisheries and Aquatic Sciences 45:1123-1144.

APPENDIX B

Program for Conference on Environmental Technology

CONFERENCE PROGRAM

TUESDAY, SEPTEMBER 25, 1990

CONFERENCE

Hôtel George V
8:30 am - 6:30 pm

8:30 am	Registration	
8:50 am	Welcome by: Melvin W. Searls, Jr.	Minister-Counselor, Commercial Affairs, American Embassy, Paris
	Gérard Meyer	Euromerica Business Network Institute, Conference Moderator
9:00 am	**The Global Environment: Pollution Prevention - A Systems Approach** Jean-François Saglio -Former Director of Industry,French Ministry of Industry	
9:30 am	**Pollution Prevention: - An American Perspective** Gerald F. Kotas - Director, Pollution Prevention Division, U.S. Environmental Protection Agency	
10:00 am	**Pollution Prevention: - A European Perspective** Jean-Claude Oppeneau - Director, Information and R&D, French Ministry of Environment	
10:30 am	Coffee break	
11:00 am	**The Research University: A Major Force in Pollution Prevention** Wesley W. Posvar - President, University of Pittsburgh	
11:30 am	**The Global Market: New Opportunities for Industry** Samuel A. Schulhof - President, National Environmental Technology Applications Corporation	

12:00 noon - 2:00 pm
Luncheon Speaker: Martyn Riddle - Senior Environmental Advisor,
International Finance Corporation/World Bank
Subject: Financing Pollution Prevention

2:00 pm	**Panel Discussion: Pollution Prevention - Manufacturing** Moderator: John McGlennon - President, ERM, New England Panel: Catherine de Lacy - Occidental Petroleum Corporation Patrick Brassart - President, Cie. des Bases Lubrifiantes (Union Française des Pétroles) Jean Michel Yolin - Directeur Régional, Industrie et Recherche (Ile de France Region)	
3:30 pm	Coffee break	
4:00 pm	**Panel Discussion: Energy** Moderator: Dennis F. Miller - U.S. Department of Energy Panel: Ralph E. Hise - President, Advanced Technologies Management, Inc. Harry L. Boston - Research Staff Scientist, Oak Ridge National Laboratory Jacques Guyard - Member of Parliament, Mayor of Evry, France; Founder, Centre International de Synergie, d'Environment et d'Aménagement	

5:30pm - 6:30pm - Cocktails
Farewell reception in adjoining area

APPENDIX C

Abstract of Presentation at Conference on Environmental Technology

RESOURCES FOR ENVIRONMENTAL TECHNOLOGY IN THE TENNESSEE VALLEY

Harry L. Boston
Environmental Sciences Division
Oak Ridge National Laboratory

With over 200 staff scientists and over 100 visiting scientists the Environmental Sciences Division (ESD) at Oak Ridge National Laboratory is the largest environmental research group in the U.S. Our primary mission is to conduct basic and applied research addressing the environmental aspects of existing and emerging technologies for energy use and development, and includes: environmental assessment, environmental engineering, environmental monitoring, innovative waste treatment technologies, and waste disposal and remediation technologies.

ESD offers an interdisciplinary resource of staff and facilities, that is addressing complex environmental issues of national concern: (1) acidic deposition; (2) effects of increasing concentrations of atmospheric CO_2 on climate and natural resources, and (3) hazardous chemical and radioactive waste disposal and remediation; in addition to a diversity of basic environmental studies.

ESD works collaboratively with the Chemical Technology, Engineering, and other divisions at ORNL, a number of federal agencies, universities, and the private sector to (1) identify and evaluate environmental problems (developing and employing bioindicators and biomarkers of toxicity; using simulation models and risk assessment; conducting hydrological and geochemical investigations), (2) develop and test innovative technologies for waste minimization and effluent treatment (using bioreactors and natural systems for waste treatment, in conjunction with laboratory and field toxicity testing), (3) develop environmental monitoring programs to demonstrate regulatory compliance, and (4) develop and demonstrate technologies for waste immobilization and in situ bioremediation.

We maintain close ties to the regional academic community, for example, in collaboration with the University of Tennessee-Knoxville's recently established Center for Biotechnology and Institute of Applied Microbiology, we are developing and implementing innovative technologies for dealing with industrial wastes in the environment. Local colleges and universities provide training in programs such as "Energy and the Environment", and "Waste Management Training".

The Tennessee Valley Authority (TVA) represents another significant resource with research groups addressing air quality and emission controls, aquatic resource inventories, assessments, and management, hydraulic modelling, energy production technologies, and waste management. TVA also has a history of interaction with other government agencies, universities, and the private sector. TVA and ORNL regularly interact, and in concert with regional academic institutions endow the Tennessee Valley with an outstanding resource of environmental talent and expertise ready to face the technological challenges of the future.

Prepared for the Conference on Environmental Technology, Paris, 25 Sept. 1990.

ORNL is operated by Martin Marietta Energy Systems Inc., under contract DE-AC05-84OR21400 with the U.S. Department of Energy.

APPENDIX D

Information on French-American Environmental Technologies Institute

FRENCH - AMERICAN ENVIRONMENTAL TECHNOLOGIES INSTITUTE

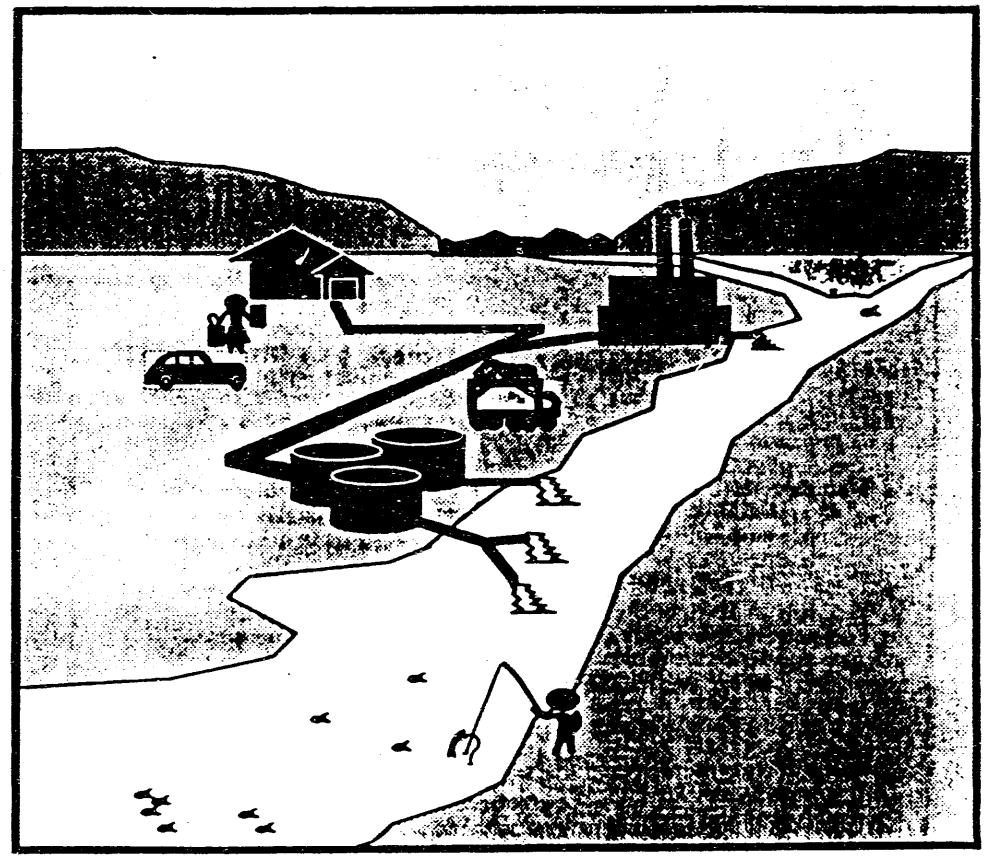
TO GATHER

TO INFORM

TO TRAIN

TO ORGANIZE

TO CONNECT



FOUNDING ORGANIZATIONS

IN THE USA

Oak Ridge National laboratories
The City and the Region of Chattanooga (Tennessee)
Tennessee Valley Authority
University of Tennessee
National Environmental Technology Applications
Corporation - Center for Hazardous Materials Research
(NETAC - CHMR) (University of Pittsburgh Applied Research Center,
with the help of Environmental Protection Agency

IN FRANCE

Ministry of Research and Industry
Ministry of Environment
The city of Evry / Paris sud
University of Evry - Val d'Essonne

The orientation committee of the twin centers will be equally composed of French and American officials.

THE ENVIRONMENTAL TECHNOLOGIES

In France, despite the value of governmental and private teams working in this field, there exists very few global opportunities for confrontation and coordination, very few organizations connecting businessmen, researchers, and governmental officials.

Taking advantage of the American experience, and basing themselves on the cooperation agreement set up between the governmental organizations of the two countries (US Environment Protection Agency and French Evironment Ministry), two twin centers working in complete coordination are created simultaneously on each side of the Atlantic by a single institute.

* EVRY Center (Essonne), acting as the French beach head

* CHATTANOOGA Center (Tennessee), acting as the American beach head

TRAINING, INFORMATION, RESEARCH, TRANSFER

Four main orientations in Ile de France

❒ Academic center, linked to the development of Evry - Val d'Essonne University

- Creation of a bilingual PHD program on environmental technologies conducting studies both in France (Evry) and the United States
- Establishing an internship program for training

❒ A Center for specialized research, coordinating the different projects conducted in France in the field of environmental technologies

❒ A Computerized information and documentation center accessible to industries and research organizations

❒ A Center specialized in the transfer of environmental technologies between the United States and Europe.

Within those different goals, priority will be given to technologies related to water

APPENDIX E

Contents of Proceedings of the Fourth International Conference on Environmental Contamination

CONTENTS

SESSION 3: Environmental Analytical Chemistry

SESSION 4: Micropollutants

SESSION 11: Contaminated Land

SESSION 12: Water System Transport

POSTER SESSION

END

DATE FILMED

11 / 21 / 90