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POST OFFICE BOX 2008, OAK RIDGE, TENNESSEE 37831-6285

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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-3383

DATE: September 27, 1989

SUBJECT: Report of Foreign Travel by C. R. Olsen, Research Staff Scientist, Geosciences Section, Environmental Sciences Division

TO: Alvin W. Trivelpiece

FROM: C. R. Olsen, Environmental Sciences Division

PURPOSE: The traveler was invited to (1) chair a session and present two papers (one invited and one contributed) at a symposium in the Federal Republic of Germany, (2) meet with scientists at the International Atomic Energy Agency (IAEA) International Laboratory of Marine Radioactivity (ILMR) in Monaco, (3) meet with scientists at the Institut F.-A. Forel in Switzerland, and (4) chair a session and present an invited paper at a conference in Switzerland.

SITES VISITED:

8/13-19/89	24th SIL Congress Munich, F.R.G.	Dr. J. Overbeck
9/4-5/89	IAEA Laboratory of Marine Radioactivity, Monaco	Dr. V. Noshkin
9/7-8/89	Institut F.-A. Forel Versoix/Geneva, Switzerland	Dr. J. Dominik
9/11-15/89	7th International Conference on Heavy Metals, Geneva, Switzerland	Dr. J.-P. Vernet

ABSTRACT: The 24th Congress of the International Association of Theoretical and Applied Limnology (SIL) was organized to provide an opportunity for about 2000 scientists representing more than 50 countries to present and discuss their research results on theoretical and applied limnology. The traveler was a co-organizer and co-chair of a special workshop/ symposium at this meeting entitled "Radiochemical Limnology." The traveler visited ILMR to learn about the research

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activities ongoing at this facility and to discuss his work supported by the U.S. Department of Energy's Office of Health and Environmental Research (DOE-OHER) on the fate of radionuclides and energy-related materials in the Savannah River estuary. The traveler also visited the Institut F.-A. Forel to discuss the use of radionuclides as tracers for watershed and snowmelt processes. The traveler gave a seminar at the Institut on his recent DOE-OHER supported work using radionuclide tracers for quantifying watershed processes on the North Slope of Alaska. Finally, the traveler chaired a session and presented an invited paper at the 7th International Conference on Heavy Metals in the Environment. The traveler received travel assistance (from the Technical Program Committee and U.S. Environmental Protection Agency) in the amount of $1000 for participation in this conference.

PURPOSE AND INTRODUCTION

The purpose of this trip was to (1) chair a session and present two papers (one invited and one contributed) at a symposium in the Federal Republic of Germany, (2) meet with scientists at the International Atomic Energy Agency (IAEA) International Laboratory of Marine Radioactivity (ILMR) in Monaco, (3) meet with scientists at the Institut F.-A. Forel in Switzerland, and (4) chair a session and present an invited paper at a conference in Switzerland.

About 2000 scientists representing more than 50 countries participated in the 24th Congress of the International Association of Theoretical and Applied Limnology (SIL) as authors or co-authors of scientific papers on a wide variety of aspects concerning theoretical and applied limnology. The traveler was a co-organizer and co-chair of a special workshop/ symposium at this meeting entitled "Radiochemical Limnology." In addition, the traveler presented two papers at the 24th SIL Congress, one entitled "Cosmogenic Beryllium-7: A Tracer for Biogeochemical Processes in Lakes and Reservoirs," and the other entitled "Transport and Accumulation of ^{137}Cs and Mercury in the Tennessee River and Reservoir System."

The traveler also met with scientists at the IAEA International Laboratory of Marine Radioactivity (ILMR) in Monaco. He provided a seminar on his work supported by the U.S. Department of Energy's Office of Health and Environmental Research (DOE-OHER) concerning the fate of radionuclides and energy-related materials in the Savannah River estuary and learned about several of the projects currently ongoing at ILMR. The traveler was most interested in a new long-term research program (EROS 2000) which is being initiated and sponsored by the European Commission to quantify and model biogeochemical processes in the European coastal environment.

In Geneva, Switzerland, the traveler met with scientists at the Institut F.-A. Forel and attended the 7th International Conference on Heavy Metals in the Environment. At the Institut, the traveler met with J.-P. Vernet (who also served as Chairman of the Conference Committee and the Scientific Program Committee for the conference) and gave a seminar on his recent DOE-OHER supported work using radionuclide tracers for quantifying snowmelt processes and hydrochemical fluxes in arctic and alpine watersheds. At the conference, the traveler chaired a session on Trace Metals in Freshwater Environments--Regional Studies and presented a paper entitled "Radionuclide Tracers for the Fate of Metals in the Savannah Estuary: River-Ocean Exchange Processes." The conference was attended by about 400 scientists representing 38 countries. Most of the papers presented at this conference were of high quality. The traveler learned much about the health effects and biological pathways of heavy metals as well as their dispersal and fate in the environment.

SUMMARY OF ACTIVITIES INCLUDING TRAVELER'S ROLE

24th Congress of the International Association of Theoretical and Applied Limnology (SIL)

About 2000 scientists representing more than 50 countries participated in the 24th SIL Congress as authors or co-authors of presented papers. The Congress is held once every three years and was organized into 82 half-day sessions or workshops (Appendix D). The traveler helped organize and co-chair the session on "Radiochemical Limnology."

The SIL Congress traditionally opens with the Baldi Lecture and a plenary session. The Baldi Lecture was presented by R. G. Wetzel (University of Michigan, U.S.A.) and was entitled "Land-Water Interface: Metabolic and Limnological Regulators." Dr. Wetzel stressed that (1) ecosystem analyses generally ignore or only give minor attention to interface processes, (2) growth and productivity (per unit area) at the land-water interface greatly exceed even the most intensive growth in terrestrial areas, and (3) nutrient loading and recycling within lake systems are strongly regulated by plants and animals at the land-water interface. Dr. Wetzel's lecture focussed on the third point. He discussed the metabolic pathways and coupling mechanisms by which macrophytes and microphytes adapt to the interface environment. He showed how macrophytes have developed elaborate gas-exchange and storage systems to cycle CO_2 from the root system to photosynthetic tissues and O_2 from photosynthetic zones to root systems in order to create oxic areas in anoxic sediments and to sustain rapid growth via the utilization of recycled nutrients from the sediments. Macrophytic growth also provides an immense surface area for microphytic (algal) growth which utilizes dissolved nutrients from the lake system. As a result, interface microphytes serve as a sink for lake nutrients,

whereas interface macrophytes serve as a source for lake particulate organic matter (POM).

Because of the traveler's DOE-OHER supported research activities at the land-ocean interface, he was quite interested in Wetzel's lecture. The traveler is currently reviewing a paper for *Environmental Science and Technology* in which it was suggested that the primary removal mechanism for Chernobyl radiocesium from Swiss and German lakes was sorption by macrophytes and sediments along the land-lake interface. Consequently, the traveler was a bit disappointed that physical and geochemical processes at the land-water interface were only surficially addressed in the Baldi lecture and that physical and geochemical processes have been largely ignored by the SIL Congress as a whole. This biological bias is recognized by the SIL Administrative Body and was addressed to some extent by the SIL Congress Chairman, Dr. J. Overbeck (Max-Plank-Institute für Limnology, FRG), who gave the first plenary presentation entitled "Initial, Present, and Future Aim of Limnology." Dr. Overbeck stated that SIL was founded by Einar Naümann and August Thienemann in 1922, and at the time research focussed on organisms, populations, and ecological communities. Future work, however, will span a wide variety of disciplines and will be directed more toward a molecular scale involving inorganic compounds, chemical pathways, and biogenetic responses to changing environmental conditions. The traveler had breakfast with Dr. Overbeck and discussed some of the recent work that DOE-OHER supported scientists have been conducting with regard to biomarkers for contaminant exposure.

The large number of sessions (Appendix D) required that as many as ten sessions be conducted simultaneously throughout the entire meeting. As the only SIL participant from Oak Ridge National Laboratory (ORNL), it was impossible for the traveler to cover many of the sessions and presentations that would be of interest to others at DOE-OHER or ORNL. Consequently, the traveler attended only the sessions within his areas of research or interest, including Atmospheric Deposition and Surface Water Interactions, Biogeochemical Cycles and Fluxes, Large Lakes and Global Climate Change, Radiochemical Limnology, and Sediment-Water Interactions. A few of the noteworthy papers presented in these sessions are briefly discussed here.

Long-term records of precipitation chemistry in New Hampshire were discussed by G. E. Likens (Institute of Ecosystem Studies, New York, U.S.A.). Dr. Likens showed that SO_4^{2-} concentrations in precipitation have decreased since 1964, reflecting the decrease in SO_4^{2-} emissions during the same period, but that NO_3^- concentrations in precipitation have remained constant. Both SO_4^{2-} and NO_3^-, however, showed a sharp short-term decrease in precipitation during the 1983-1984 water year. Likens suggested that this short-term decrease was not related to variations in emissions but rather to an increase in the number of coastal rainstorms relative to continental rainstorms in New Hampshire. S. J. Omerod (University of Wales, Cardiff, United Kingdom) presented an

interesting paper on the development of an aquatic biological model that permits the simulation of biological status under changing chemical conditions. Dr. Omerod showed that invertebrate densities and community structure changed drastically within two years after lake acidification. He also used his model to predict invertebrate responses to different management strategies. For example, he showed that lime treatments to an acidified lake will not restore the original invertebrate community structure but will change it to a hard-water benthic community.

On Wednesday (August 16), the traveler participated in a Mid-Congress Excursion to the River Lech, which has been impounded by about 20 hydro-electric power stations. As a consequence, the River Lech is neither a river nor a lake but has hybrid characteristics. The traveler discussed some of his work on the Tennessee River-Reservoir System with the German tour guide and learned about some of the German management techniques for maintaining floodplain ecosystems within channelized areas.

On Thursday (August 17), the traveler attended a special workshop, sponsored by the Great Lakes Environmental Research Laboratory (GLERL) of the National Oceanographic and Atmospheric Administration (NOAA), on "Large Lakes and Global Climate Change." J. Overpeck (Lamont-Doherty Geological Observatory, New York, U.S.A.) gave the workshop keynote address. Dr. Overpeck stressed that the doubling of atmospheric CO_2 and other trace gases will cause a mean global warming of 3.5 to 4.2°C. He suggested that the sedimentary record of lakes be used to understand the impact that large-scale climatic change has on terrestrial vegetation and biota and to evaluate or test the ability of climatic, vegetation, and hydrologic models to simulate responses to this change. T. L. Holcombe (U.S. National Geophysical Data Center, Colorado, U.S.A.) described how his organization is developing a global limnological data base by acquiring, managing, and interpreting paleoclimatic information from varved lake sediments, tree rings, ice cores, and marine sediments. F. H. Quinn (NOAA/GLERL, Michigan, U.S.A.) described the three general global climate/circulation models developed respectively at the Princeton Geophysical Fluid Dynamics Laboratory (GFDL), Goddard Institute of Space Studies (GISS), and Oregon State University (OSU). He also discussed how well each predicted present conditions for the Great Lakes. All three models were good at predicting air and water temperature, but only the OSU model came close to predicting precipitation data. R. A. Assel and T. E. Croley (NOAA/GLERL) and J. J. Magnuson (University of Wisconsin, U.S.A.) each used these global climate models to respectively predict the potential effects of doubling atmospheric CO_2 on the ice cover, watershed hydrology, and fisheries of the Laurentian Great Lakes. Dr. Assel indicated that both the period and extent of ice cover will be greatly reduced. Dr. Croley suggested that (1) the snowpack for Lake Superior will be reduced by 50% and will be absent for the other lakes, (2) soil moisture will be reduced by 50% around Lake Erie but will not be significantly impacted for the other lakes, (3) evaporation will increase between 25 to 50%, (4) runoff will decrease by 10 to 25%, and (5) lake levels will drop 0.5 to 2.5 meters.

Dr. Magnuson predicted that the Great Lakes' fisheries will be unaffected assuming that the fish will thermally reregulate and that the food supply will increase with increasing water temperature. The final paper in this workshop was presented by J. Robbins (NOAA/GLERL). Dr. Robbins discussed the history of biogenic silica accumulation in Lake Erie since 1800. He used ragweed pollen profiles in dated sediment cores to show that the doubling of silica accumulation in the early 1900s was kinetically linked to forest clearance activities and silica runoff.

On Friday (August 18), the traveler presented two papers (one invited and one contributed) and co-chaired the session on Radiochemical Limnology. The morning session was primarily devoted to the use of natural radionuclides as tracers for limnological processes, and the afternoon session was primarily devoted to anthropogenic radionuclides as tracers for limnological processes and the fate of Chernobyl radiocesium in freshwater systems. The traveler met and discussed his DOE-OHER supported research with all the scientists participating in this Radiochemical Limnology session. Many of these discussions took place during dinner meetings. The traveler was particularly impressed with the work being conducted in Lake Geneva, Lake Zurich, and Lake Constance by scientists at the Swiss Federal Institute for Water Resources and Water Pollution Control and at the Heidelberg Academy of Sciences. These investigators have found that as much as 30% of the Chernobyl radiocesium was dispersed and removed from these lakes by the horizontal advection of epilimnion water toward the lake margin and by the direct sorption of dissolved radiocesium on marginal macrophytes and sediments. This is apparently a relatively important process that has been unrecognized in the biogeochemical models that attempt to simulate the fate of energy-related and chemically reactive materials in limnological systems. During a discussion at dinner with J. Robbins (NOAA/GLERL) and D. Reed (NOAA/GLERL), the traveler learned that Dr. Robbins has recently taken a foreign off-site assignment to conduct research on the fate of Chernobyl radiocesium in Lake Constance.

On Saturday (August 19), the 24th SIL Congress ended by awarding their prestige Naümann-Thienemann medal to three scientists: J. F. Talling (Freshwater Biological Association, United Kingdom), R. Margalef (University of Barcelona, Spain), and D. W. Schindler (Freshwater Institute, Canada). The 25th SIL Congress will be held in 1992 in Barcelona, Spain.

International Laboratory of Marine Radioactivity

On Monday and Tuesday (September 4-5), the traveler met with the Director (Dr. A. Walton) and several scientific staff members at the IAEA International Laboratory of Marine Radioactivity (ILMR) in Monaco. Dr. Scott Fowler (head of the Radioecology Program) was away from ILMR during the traveler's visit, so Dr. Victor Noshkin (head of the Radiochemistry and Geochemistry Program) served as the traveler's host

and gave him a tour of the laboratory's facilities. Drs. Walton and Noshkin discussed ILMR's participation in several large oceanographic research programs, including a Vertical Transport and Exchange Program (VERTEX) sponsored by the U.S. National Science Foundation, a similar French program (ECOMARGE) that is carried out in the Mediterranean, another Mediterranean project (DYFAMED) on the fate of Sahara dusts and airborne particles in seawater, and a newly initiated long-term research program (EROS 2000) on biogeochemical processes in the European coastal environment. The EROS 2000 program is being sponsored by the European Commission, and the program objectives are to (1) specify the sources and pathways of natural and anthropogenic substances in the European coastal environment; (2) investigate the mechanisms and rates of processes controlling the fluxes, the internal biogeochemical cycles, and the exchange of these substances at the land-sea and air-sea interfaces; and (3) develop biogeochemical models to predict the long-term consequences of human-induced changes.

On Tuesday (September 5) the traveler gave a seminar at ILMR entitled "Radionuclide Tracers for Biogeochemical Processes at the Land-Ocean Interface." The seminar stimulated a lot of interest at ILMR and lasted for more than 1 1/2 hours. The traveler discussed his DOE-OHER supported research in the Savannah estuary and his interests in the EROS 2000 Program. In the afternoon, the traveler met with Drs. A. Sanchez and C. Nolan. Dr. Sanchez is developing the capability to radiochemically measure ^{99}Tc in coastal waters. Dr. Nolan has been conducting some very interesting research on the bioavailability of radionuclides and metals. He has shown that contaminants in the aqueous phase are orders of magnitude more bioavailable than those in sediments. Despite the fact that contaminants in sediments are practically unavailable to biota, Nolan has nevertheless shown that sediment is still the main source of contamination for benthic organisms.

Institut F.-A. Forel (University of Geneva)

On September 7-8, the traveler met with Drs. J.-P. Vernet, J. Dominik, R. L. Thomas, and P.-Y. Favarger at the Institut F.-A. Forel in Versoix/Geneva, Switzerland. The Institut was established in 1970 to help protect the water quality of Lake Geneva. In 1980 it became associated with the University of Geneva and its mission expanded to (1) develop and conduct undergraduate and graduate courses in the fields of limnology, oceanography, and environmental geology; (2) conduct basic and applied research in each of the above fields; (3) provide an information link between Swiss universities and the community; and (4) maintain collaboration with similar institutions in Switzerland and abroad. The F.-A. Forel Institut was founded by Jean-Pierre Vernet, and he still serves as its director. Dr. Vernet also served as the Chairman of the Conference Committee and the Scientific Program Committee for the 7th International Conference on Heavy Metals in the Environment, which the traveler attended on September 11-15, 1989.

The traveler spent most of Thursday (September 7) with Drs. Vernet and Dominik, discussing his research activities at ORNL and learning about the work conducted at the Institut. Dr. Vernet is a clay mineralogist who has been working with R. L. Thomas (Canada Centre for Inland Waters, Ontario, Canada) to examine the effects of metals released from suspended particles on plankton productivity. Dr. Thomas spends a few months each year at the F.-A. Forel Institut and is an associate professor at the University of Geneva. Drs. Dominik and Favarger are geochemists and have been conducting research using radioisotopes to estimate the dispersal and fate of contaminants in watersheds and freshwater aquatic systems. During the afternoon the traveler was given a tour of the Institut and its 15-ton limnological research vessel which is harbored in Lake Geneva adjacent to the Institut.

On Friday (September 8), the traveler presented a seminar at the F.-A. Forel Institut entitled "Cosmogenic Be-7: New Tracer Applications in Terrestrial and Aquatic Systems." On Saturday (September 9), the traveler met again with Drs. Vernet, Dominik, and Thomas, and along with Dr. J.-S. Chen (Vice-Director of the Center of Environmental Science, Peking University, Peoples Republic of China) was given a tour of the Lake Geneva area near the Institut. Dr. Chen later presented a paper on the clay mineralogy of the five major rivers in China in the session that the traveler chaired at the 7th International Conference on Heavy Metals in the Environment. Dr. Chen indicated that the People's Republic of China is concerned with the erosion of fertile farmlands and rice fields by these large river systems and the loss of soils, sediments, and nutrients to the China Sea.

7th International Conference on Heavy Metals in the Environment

On September 11-15, the traveler attended the 7th International Conference on Heavy Metals in the Environment. The purpose of this meeting was to bring together about 400 scientists from 38 countries to discuss recent research on (1) the transport, accumulation, and biogeochemical fate of heavy metals in the environment; (2) the metabolic and health effects of heavy metals; and (3) new analytical and industrial methods for heavy metal detection and wastewater treatment/management. The conference has been held once every two years since 1975 and was organized into 25 oral sessions (Appendix E) and 6 poster sessions. The traveler chaired the session on Regional Studies--Freshwater Environment and presented a paper entitled "Radionuclide Tracers for the Fate of Metals in the Savannah Estuary: River-Ocean Exchange Processes" in the session on Radionuclides as Chronometers and Tracers (Appendix E). Eight plenary lectures were presented, one at the beginning of each half-day session. These lectures were generally of high quality and together provided a broad interdisciplinary overview of the biogeochemical interactions and health effects associated with heavy metals in the environment.

The conference opened with a welcome from J.-P. Vernet and from the Lord Mayor of Geneva. These welcoming remarks were followed by two brief (ten-minute) presentations, one from the Vice-Director of the University of Geneva Medical School (A. Donath) and the other from the Vice-Director of the Swiss Office for Environmental Protection (M. Karlaganis). Donath's presentation was on radiation levels and human dosage. He showed a map of the natural radiation levels in Switzerland and provided information on radiation dosages associated with this background and with medical treatments. He then showed that the dosage contribution of the Chernobyl nuclear accident in 1986 comprised less than 4% of the total annual dosage to a Swiss individual and that the total input of Chernobyl ^{137}Cs to the Switzerland landscape comprised about one-third of the total ^{137}Cs fallout delivered in the mid 1960s. Although Donath's presentation was a bit unconventional for the opening of a conference, the traveler (and perhaps many of the participating scientists) found it quite interesting. Following Donath's remarks, M. Karlaganis presented a description of some of the geological, hydrological, and ecological characteristics of Switzerland.

A summary of each presentation and poster has been published as a concise three- to four-page paper in the Conference Proceedings (Appendix C). J. Wood (Gray Freshwater Biological Institute, U.S.A.) presented the first plenary paper on the transport, bioaccumulation, and toxicity of elements in microorganisms. He stressed that bacterial processes form the critical link between the fate of metals in the geosphere/geocycle and their fate in the biosphere/biocycle. He also warned that our computer and modelling capacities have greatly exceeded our capacity for understanding basic ecological processes and how they change with varying environmental conditions. The second plenary paper was presented by P. Baccini (Swiss Federal Institute for Water Resource and Water Pollution Control, Switzerland). He discussed the pathways by which metals are extracted from the geosphere, utilized by industrial societies, and then returned or disposed of in the environment. He stated that within the group of solid wastes, municipal solid waste is the most important carrier for trace metals.

On the second day of the conference, the traveler attended both sessions on "Radionuclides as Chronometers and Tracers" as well as an informal discussion session that was held during the evening. These sessions provided the traveler an opportunity to meet and discuss his current research activities with several scientists including J. N. Smith (Bedford Institute of Oceanography, Canada), H. Dahlgaard (RISO National Laboratory, Denmark), H. Dorr (University of Heidelberg, FRG), P. J. Kershaw (Ministry of Agriculture, Fisheries and Food, U.K.), and F. Oldfield (University of Liverpool, U.K.). Dr. Oldfield expressed an interest in working at ORNL, and the traveler suggested that he write to the Environmental Sciences Division Director.

Although the traveler was very impressed with the quality of all the papers presented in these two sessions, he was particularly interested in the papers presented by J. Robbins (Great Lakes Environmental Research Laboratory, U.S.A.) and J. Dominik (Institut F.-A. Forel, Switzerland). Dr. Robbins has a unique long-term data set that illustrates the response of Lake Erie to loadings of fallout radionuclides during the past 20 years. Although the deposition and removal of ^{137}Cs from the lake water column are largely complete within a few years after its introduction, he has used the distribution of ^{137}Cs in sediment traps and sediment cores to show that second-order processes of horizontal redistribution and focussing occur for many years. He stressed that many of the models used to predict contaminant fate neglect this long-term redistribution process. Dr. Dominik's paper was of interest to the traveler because it was an attempt to link geochemistry and sedimentology by correlating the vertical distribution of several radionuclides (^{7}Be, ^{210}Pb, and ^{137}Cs) in sediment cores with specific sedimentary processes, such as slumps, mixing, and erosional events.

On the final day of the conference, the traveler attended the session on "Regional Studies--Marine Environment" (Appendix E) and several poster sessions, including one on "Metals in Soils." One of the most interesting posters was on the elemental analysis of tree rings by N. I. Ward (University of Surrey, U.K.). Dr. Ward measured the concentration of Pb, Al, Ca, and 16 other elements in tree rings to evaluate sources of environmental pollution. He showed that Pb concentrations in tree rings began increasing in the mid 1920s with the introduction of leaded gasolines and that trees near the London Orbital motorway showed a dramatic increase in Pb since the opening of the motorway in 1985. In addition, Dr. Ward showed that the Al to Ca ratio in the rings of spruce trees from areas exhibiting forest decline (Black Forest, F.R.G. and Malmo, Sweden) has been increasing since 1960, whereas this ratio has remained relatively constant in the rings of spruce trees from a New Zealand "background" site. He suggested that the increase in the Al/Ca ratio reflects the loss of Ca from soils experiencing acidification and the mobilization and uptake of Al at lower soil pHs.

APPENDIX A

ITINERARY

8/12-13/89	Travel from Oak Ridge, Tennessee, to Munich, FRG
8/13-19/89	Attend 24th SIL Congress, Munich, FRG
8/20/89	Weekend
8/21-25/89	Vacation (Austria)
8/26-27/89	Weekend
8/28-9/1/89	Vacation (Bavarian Alps)
9/2/89	Weekend
9/3/89	Travel to Monaco
9/4-5/89	Meet with scientists at IAEA International Laboratory of Marine Radioactivity, Monaco
9/6/89	Travel to Geneva, Switzerland
9/7-8/89	Meet with scientists at Institut F.-A. Forel, Versoix/Geneva, Switzerland
9/9-10/89	Weekend
9/11-15/89	Attend 7th International Conference on Heavy Metals in the Environment, Geneva, Switzerland
9/16/89	Travel from Geneva, Switzerland, to Oak Ridge, Tennessee

APPENDIX B

PERSONS CONTACTED TO A SIGNIFICANT EXTENT

S. Ballestra
International Laboratory of Marine Radioactivity
2 Ave Prince Hereditaire Albert
MC9B000, MONACO

J. Beer
Swiss Federal Institute for Water Resources and Water Pollution Control
EAWAG
CH-8600 Dubendorf
SWITZERLAND

A. Beeton, Director
Great Lake Environmental Research Laboratory
NOAA
Ann Arbor, MI 48105

J. Bloesch
Swiss Federal Institute for Water Resources and Water Pollution Control
EAWAG
Ch-8600 Dubendorf
SWITZERLAND

J. E. Brittain
Freshwater Ecology and Inland Fisheries Laboratory
University of OSLO
0562 OSLO5, NORWAY

G. Brunskill
Canada Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N6
CANADA

J. S. Chen
Peking University
Department of Geography
BEIJING, CHINA

R. J. Cornett
Chalk River Nuclear Laboratories
Chalk River, Ontario
CANADA

H. Dahlgaard
RISO NAtional Laboratory
Health Physics Department
DK-400 ROSKILDE
DENMARK

J. Dominik
Institut F.-A. Forel
10, Route de Versoix
SWITZERLAND

H. Dorr
University of Heidelberg
Institut fur Umweltphysik
In Neuenheimer Feld 366
6900 Heidelberg
FRG

P.-Y. Favarger
Institut F.-A. Forel
10, Route de Suissee
CH-1290 Versoix
SWITZERLAND

L. Foulquier
CEA, ISPN, SERE
Centre D'Etudes Nucleaires De Cadarache
13108 St-Paul-lez-Durance
FRANCE

M. Heit
U.S. Dept. of Energy
Environmental Studies Division
Env. Measurements Lab
367 Hudson St.
New York, NY 10014

H. Kowa
Institut F.-A. Forel
10, Route de Suissee
CA-1290 Versoix
SWITZERLAND

B. J. Hurley
Thames Water Int.
Nugent House
Vastern Road
Reading RG1 8D8
UNITED KINGDOM

R. A. Jeffree
Environmental Science Program
ANSTO, PMB1, Menai 2234
AUSTRALIA

B. Kenney
National Hydrology Research
Institute
Saskatoon, S7N 3H5
CANADA

P. J. Kershaw
Ministry of Agriculture
Fisheries & Food
Pakefield Road
Lowestoft
Suffolk
UNITED KINGDOM

M. Makar
Institut F.-A. Forel
10, Route de Suissee
CH-1290 Versoix
SWITZERLAND

A. Mangini
Heidelberge Akademie der
Wissenschaften
Im Neuenheimer Feld 366
D-6900 Heidelberg, FRG

M. Meili
University of Uppsala
Institute of Limnology
S-75122 Uppsala
SWEDEN

I. Moreira
Catolica Universidade
Department of Chemistry
R Marques de S Vecente 225
Rio de Janeiro
DEP-22453, BRAZIL

K. Naes
Norwegian Institute for Water
Research
P B 333 Blindern
OSLO 3
NORWAY

C. Nolan
International Laboratory of
Marine Radioactivity
2 Ave Prince Hereditaire Albert
MC9B000, MONACO

V. Noshkin
International Laboratory of
Marine Radioactivity
2 Ave Prince Hereditaire Albert
MC9B000, MONACO

J. D. Nriagu
Environment Canada
National Water Research Institute
Box 5050
Burlington, Ontario
CANADA

F. Oldfield
University of Liverpool
Department of Geography
P O Box 147
Liverpool
UNITED KINGDOM

J. Overbeck
Max-Planck-Institute fur
Limnologie
Abteilung Mikrobenokologie
Postfach 165
D-2320 PLÖN
WEST GERMANY

U. Pollingher
Kinneret Laboratory
P O Box 345
Tiberias, 14102
ISRAEL

D. Reed
Great Lakes Environmental
Research Laboratory
NOAA
Ann Arbor, MI 48105

J. A. Robbins
Great Lake Environmental Research
Laboratory
NOAA
Ann Arbor, MI 48105

A. Sanchez
International Laboratory of
Marine Radioactivity
2 Ave Prince Hereditaire Albert
MC9B000, MONACO

P. H. Santschi
Texas A&M University
Department of Marine Science
P O Box 1675
Galveston, TX 77553-1675

J. Skei
Norwegian Institute for Water
Research
P B 33 Blindern
0313 OSLO 3
NORWAY

J. N. Smith
Bedford Institute of Oceanography
Dartmouth, NS
CANADA

R. L. Thomas
Environment Canada
Canada Centre for Inland Waters
867 Lakeshore Road, Box 50505
Burlington, Ontario
CANADA

J.-P. Vernet
Institut F.-A. Forel
10, Route de Suissee
CH-1290 Versoix
SWITZERLAND

Alain Vezina
UQAR
Rimouski, Quebec
CANADA

W. Victery
U.S. Environmental Protection
Agency
Research Triangle Park
N.C. 27711

A. Walton
International Laboratory of
Marine Radioactivity
2 Ave Prince Hereditaire Albert
MC9B000, MONACO

N. I. Ward
University of Surrey
Department of Chemistry
Guildford
UNITED KINGDOM

E. Wieland
Swiss Federal Institute for Water
Resources and Water Pollution
Control
EAWAG
CH-8600 Dubendorf
SWITZERLAND

APPENDIX C

PUBLICATIONS RECEIVED

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Foulquier, L., B. Descamps, A. Lambrechts, and M. Pally. In Press. Analyse et Evolution de L'Impact de L'Accident de Tehernobyl sur le Fleuve Rhone. 24th SIL Congress, Munich, F.R.G.

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Lampert, W., and K.-O. Rothhanpt. 1989. Limnology in the Federal Republic of Germany. International Association of Thoretical and Applied Limnology, Plön, West Germany, 170 pp.

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Santschi, P. H., and B. D. Honeyman. 1989. Radionuclides in Aquatic Environments. Radiation Physics and Chemistry - Part C. 34:213-240.

Scientific Program Committee. 1989. Proceedings International Conference on Heavy Metals in the Environment: Volumes 1 and 2. Vernet, J.-P. (editor), CEP Consultants Ltd, Edinburgh, U.K., 1153 pp.

Stiller, M., and A. Kaufman. 1984. Pb-210 during the destruction of stratification in the Dead Sea. Earth and Planetary Science Letters 71:390-404.

Walton, A. 1987. Scientific Publications of the International Laboratory of Marine Radioactivity (1976-1986). In: Radioactivity in the Sea. No. 77. International Atomic Energy Agency, Vienna, Austria, 23 pp.

APPENDIX D

Sessions and Workshops of the 24th SIL Congress
August 12-19, 1989 (Munich, F.R.G.)

Number of Sessions	Title of Session or Workshop
4	Applied Limnology
2	Atmospheric Deposition-Surface Water Interactions
3	Bacterial Processes, Microbial Loop
3	Benthos, Littoral
1	Biogeochemical Cycles and Fluxes
1	Case Studies and Monitoring
1	Climate and Interannual Variability
1	Detritus-Processing POC
1	Ecotoxicology
2	Eutrophication
4	Fish
3	Gases in the Hydrosphere
2	Groundwater Limnology
1	Humic DOC
2	Large Lakes and Global Climate Change
1	Large Rivers
2	Macro Invertebrates
1	Macrophytes
1	Mathematical Modelling
2	Metals
1	Molecular-Biochemical Environmental Approaches
3	Nutrient Dynamics
1	Paleolimnology
1	Periphyton
1	Physical Limnology
4	Phytoplankton
4	Phytoplankton-Zooplankton-Fish Interactions
2	Primary Production
2*	Radiochemical Limnology
7	Running Water
1	Secondary production
3	Sediment-Water Interactions
1	Special Session-Loosdrecht Lakes
1	Theoretical Problems
2	Trophic Dynamics
3	Tropical Limnology
1	Warm Lakes
1	Watershed Characteristics--Relation to Surface Water
5	Zooplankton

*The traveler helped organize these two sessions and served as a session Co-Chairman.

APPENDIX E

Sessions of the 7th International Conference on Heavy Metals in the Environment September 11-15, 1989 (Geneva, Switzerland)

Number of Sessions	Title of Sessions
1	Acid Deposition and Soil Acidification
1	Analytical Methods--Metal Speciation
1	Analytical Methods--Organometallics and General
1	Atmospheric Transport--Large Scale Models
1	Atmospheric Transport--Local and Urban
1	Bioaccumulation of Metals by Animals
1	Bioaccumulation of Metals by Plants
1	Effects of Metals on Plant Metabolism
1	Groundwater
2	Health Effects of Metals
1	Industrial Waste
1	Microbial Adaption and Interactions
1	Metabolic Effects of Metals on Animals
1	Modelling Experimental Ecosystems
1	Municipal Solid Waste
1	Neurotoxicity of Lead
1	Other Health Effects of Lead
1	Organo-Metallic Compounds
2	Radionuclides as Chronometers and Tracers
1	Regional Studies--Freshwater Environment
1	Regional Studies--Marine Environment
1	Soil Interactions
1	Wastewater Purification