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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-3571

DATE: April 4, 1990

SUBJECT: Report of Foreign Travel of Robert M. Reed, Group Leader, Environmental Sciences Division

TO: A. W. Trivelpiece

FROM: R. M. Reed

PURPOSE: To collect information at Palmer Station and on the Research Vessel (R/V) *Polar Duke* for preparation of a supplemental environmental impact statement on the U.S. Antarctic Program.

SITES VISITED:			
	03/17-22/90	R/V *Polar Duke*	Alexander Sutherland, Manager National Science Foundation (NSF) Ocean Programs
	03/21/90	Palmer Station	Peter Jorgenson, Station Manager

ABSTRACT: The traveler participated in a site visit to the U.S. Antarctic Program (USAP) facilities at Palmer Station and on the Research Vessel (R/V) *Polar Duke*. Interviews were conducted with NSF and ITT/Antarctic Services staff responsible for environmental management functions. The traveler participated in a tour of all facilities on the R/V *Polar Duke* and observed fishing and sediment sampling operations. At Palmer Station, he toured the facilities and participated in discussions with facility engineers. In addition, he visited the abandoned Old Palmer Station, the site of the *Bahía Paraíso* oil spill, and wildlife areas in the general vicinity of Palmer Station. The information collected during the site visit will be used in a draft supplemental environmental impact statement on the USAP to be published for public review in July 1990.

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INTRODUCTION

Under a Memorandum of Agreement between the National Science Foundation (NSF) and the Department of Energy, Oak Ridge National Laboratory (ORNL) is preparing a supplemental environmental impact statement (SEIS) on the U.S. Antarctic Program (USAP). As part of this task, Robert M. Reed, Task Group Leader for the SEIS, participated in a site visit to the USAP facilities at Palmer Station on the Antarctic Peninsula. The purpose of the trip was to collect information on USAP facilities and activities in the Antarctic Peninsula area. In addition to this visit by Reed, a site visit by Steven Railsback of ORNL's Environmental Sciences Division is being undertaken so that more time will be spent both on the Research Vessel (R/V) *Polar Duke* and at Palmer Station. The results of Railsback's trip will be summarized in a separate trip report when he returns in mid-April.

The site visit involved travel by commercial air to Punta Arenas, Chile, and a flight to Teniente Marsh Base on King George Island by a U.S. Air National Guard LC-130 Hercules cargo plane. The Air National Guard provides logistics support for Antarctic Peninsula research twice each austral summer season. This year LC-130 flights were made in December and March by an Air National Guard contingent from Schenectady, New York, to provide transport of cargo and passengers to the Chilean Teniente Marsh Base on King George Island located toward the northern end of the Peninsula. Passengers and cargo were then transferred to the R/V *Polar Duke* for transport to Palmer Station.

Weather conditions at King George Island delayed departure from Punta Arenas, Chile, for 1 day, so that only 5 days were spent in the Antarctic Peninsula area (March 17-22). At King George Island, the USAP-chartered ship R/V *Polar Duke* picked up the USAP group and transported them to Palmer Station. During the transit to Palmer Station, scientists on the *Polar Duke* conducted research activities involving fish collections, plankton tows, and retrieval of sediment samples.

The group of 28 people who traveled to Palmer Station on this trip included scientists conducting research projects on the *Polar Duke* or at Palmer Station; Dr. Robert Rutford, former Director of the NSF Division of Polar Programs and currently President of the University of Texas at Dallas; Carol Roberts, Deputy Director of the Division of Polar Programs; Alexander Sutherland, NSF Manager of Ocean Projects; two members of the State Department assigned to U.S. Embassies in Chile and Argentina; two members of the press; and the NSF/ORNL team. During the site visit, Reed worked closely with two NSF staff members—Gary Staffo, Head of the Safety, Environment and Health Office, and Sam Higuchi, Staff Member of the Safety, Environment and Health Implementation Team—in collecting information on USAP activities.

The site visit consisted of (1) general tours of facilities on the *Polar Duke* and at Palmer Station, (2) interviews with managers and engineers responsible for facility operations, (3) observations of ship operations

during the collection of scientific specimens and information, (4) a visit to the abandoned Old Palmer Station, and (5) a boat trip to areas of ecological interest in the vicinity of Palmer Station.

The information obtained during Reed's and Railsback's site visit will be used to prepare the SEIS, along with information obtained from a site visit to McMurdo Station and the Amundsen-Scott South Pole stations in November 1989, literature reviews, public scoping, and other sources.

MARCH 17-19

The flight to King George Island took approximately 2.5 h. Teniente Marsh Base consists of a small air strip with a hard surface runway, which is the only landing site on the Antarctic Peninsula large enough for LC-130 aircraft. Limited hanger and maintenance facilities are located next to the air strip. Because weather conditions at this location are often poor, flights are frequently delayed by poor visibility and severe storms. The Chileans have helicopters and twin-otter type aircraft operating at this facility. The rest of the base consists of prefabricated buildings that are used for housing, cooking, and recreation. Chile claims territorial rights for this part of Antarctica and has assigned staff and their families to this base to reaffirm these claims. We did not have a tour of the base, and I have no information on what type of laboratory or other scientific support facilities may be present. Next to the Chilean base is the Russian Bellingshausen base of nearly the same size. In addition, we saw bases belonging to Argentina and China along the shores of the harbor at King George Island.

Although there is a small pier at the Chilean base, there was not sufficient water depth to allow the *Polar Duke* to dock. Transport of cargo and passengers to the ship was accomplished with two Mark V Zodiac boats, capable of carrying about 14 passengers.

A general tour of the ship was conducted the first evening aboard. Laboratory space includes two laboratories in the cargo hold; one of these is used as an electrical shop and for storage, while the other is a general laboratory that can be used for a variety of purposes. These two labs have been developed as modular units so that they can be removed from the cargo hold if the need arises to replace them or if a larger cargo area is needed. Aft of the cargo hold and on the next deck above are a wet lab with 8 tanks for keeping fish alive and an associated space for handling sampling equipment. Immediately above these facilities is an electronics laboratory. The wet lab has ready access to the fantail area that is equipped with an A-frame structure and various winches that are used for deploying and towing sampling gear used during research operations. Above the main deck is the helicopter deck, which is currently used as a storage area; helicopter operations are not conducted from the ship, but the capability is there, if needed. A modular radioisotope laboratory is located beside the helicopter deck and is

designed to isolate any spills from the use of radioisotopes. This laboratory can be readily removed from the ship if it is not needed.

During the next 2 days, the NSF/ORNL team met with members of the ship's crew and had several discussions with ITT/Antarctic Services (ANS) and NSF staff responsible for ship operations. The following information was obtained during these discussions:

- The *Polar Duke* is owned by a Norwegian Company and is chartered by the USAP contractor, ANS, for research activities. It has a crew of 13, with the captain and the 2 mates being Norwegian. Normally, ANS has three people assigned to the ship, but five were on board during our trip. These people provide the interface between the crew and NSF-supported scientists.

- The ship is an ice-class vessel, which means that it has a reinforced hull similar to that of an icebreaker. The ship has less powerful engines than an icebreaker and is therefore limited to operating at the ice edge.

- The ship provides much of the resupply needs for Palmer Station, transporting passengers and cargo, and retrograding solid waste.

- The ship has two 4500-hp diesel engines and a single variable pitch propeller. Normal cruising speed is about 11 knots, and speeds up to 15 knots are possible although fuel consumption is much greater at the higher speeds. Generators can produce 2000 kW of power; normal use is about 1300 kW when scientists are conducting research. Diesel fuel is purchased in Punta Arenas and is slightly different from diesel fuel marine (DFM). Fresh water can be produced by using waste heat from the engines, oil-fired boilers, or open stack boilers. A fresh water supply of 140 tons can be stored in tanks; normal usage is about 6 tons per day. Gray water (i.e., wastewater from sinks, showers, and drains) is discharged continuously without any treatment. Sewage is treated with a standard marine vacuum system, in which wastewater is held in a tank and aerated. No chemical treatment or testing of either drinking water or wastewater is done.

- The ship has an incinerator for burning most of its wastes; cans and glass are removed before they are completely burned to protect the fire bricks. There is no control of emissions from the incinerator. Ash and residue are removed from the incinerator and stored in an open container on the deck for eventual disposal at Punta Arenas or McMurdo.

- The ship typically operates 10 to 11 months each year. This year it is scheduled to go into dry dock in Chile for about 37 days.

On the second day aboard (March 18), fishing operations were initiated to collect benthic fish, including icefish. Operations involved trawling along the bottom for approximately 15 min per tow; each operation took about 45 min for trailing the nets, making the tow, and retrieving the nets. The goal was to catch about 250 fish to be used for long-term physiological and molecular studies at Palmer on how fish adapt to cold temperatures. Fishing continued until 0600 the following morning, with approximately 150 fish caught and transferred to holding tanks in the wet lab. At one point the operation was delayed because a large rock was taken up in the net, causing considerable damage to the nets.

The ship then proceeded to a second site in the Northern Gerlache Strait to retrieve a sediment trap that had been deployed in early October. This study is part of the "research on antarctic coastal ecosystem rates" (RACER) program that is attempting to explain the zones of high marine productivity in parts of the antarctic coastal areas. The initial operation involved locating the trap with sonar detectors so that an acoustically triggered explosive device could release the sediment trap and associated apparatus from the bottom. After the trap was successfully located and released, several hours were required to retrieve it. A set of nutrient collection devices that were near the top of the sampling apparatus had failed, but the sediment trap was recovered intact. After this operation was completed, a series of plankton tows were made in this vicinity to evaluate levels of productivity at this time of year. The ship then proceeded to Palmer Station, arriving about 2150 that evening in a driving sleet storm.

MARCH 20

In the morning, the NSF/ORNL team participated with the general group of visitors (i.e., Rutford, the U.S. embassy staff, and the members of the press) in a tour of the Palmer Station Facilities led by the station manager, Peter Jorgenson. Palmer Station is a relatively small facility, consisting of two main buildings [the Biological Laboratory (BIOLAB) and the Garage/Warehouse/Recreation (GWR) Building]. We saw the following facilities during the tour:

- The Boathouse is a relatively small building located immediately above the pier. It provides work space for maintenance and repair of the Zodiacs that are used for transport to research sites around the Palmer vicinity. There are 12 Zodiacs, including Mark I (10 ft), II (13.5 ft), III (15.5 ft), and V (19 ft) models and a 22 ft Avon. Some of these boats are very old and need to be replaced. The boat coordinator is an ANS employee

who is responsible for maintaining the boats and ensuring that they are properly equipped. He is also responsible for upkeep and replacement of survival caches on the small islands around Palmer. The worst damage that occurs to the Zodiacs is from leopard seals which occasionally attack the boats. One of the biggest repair/maintenance problems results from operators damaging the propellers and motors by running them into the bottom or rocks.

- A trash compactor is in use in the BIOLAB to reduce the volume of solid waste. Compacted waste is placed in a MILVAN (i.e., a shipping container that can be loaded on a ship and then transferred to a truck for transport) for eventual shipment to Chile or McMurdo. Glass is not put through the trash compactor but is broken up separately. This year approximately 15 MILVANs were filled with solid waste (including hazardous waste). This was more than usual because of the need to dispose of the old siding from the BIOLAB. In a normal year approximately 10 MILVANs are filled; during the summer this is equivalent to about 1 MILVAN per month. This year much of this solid waste, including all the hazardous and radioactive waste, was retrograded (i.e., a term used by USAP to indicate the return of materials or wastes to their source or to an area outside the Antarctic) through McMurdo when the *Polar Duke* went there during its Ross Sea cruise.

- Two 100,000-gal bulk storage tanks for the station's fuel are located on the hill across from the GWR. When topped up, the tanks hold a 2-year supply of diesel fuel for the station. The fuel used is called diesel fuel-2 and is obtained from Punta Arenas. In the past, fuel has been transported to Palmer by research vessels and U.S. Coast Guard icebreakers. The *Polar Duke* may be the major means of transporting fuel in the future. There are no berms for containing a fuel spill from these tanks. Plans for next year include reconditioning all seals and piping associated with the fuel distribution system. In addition, plans are being made to build a concrete catchment around the fuel pumping area to contain any spillage that might occur. Fuel use at Palmer is about 60,000 to 70,000 gal/year.

- A small volatile storage building is located next to the loading dock of the BIOLAB. This building is equipped with flammable storage lockers and is readily accessed from the BIOLAB.

- A drum farm is located in the general area of the helicopter pad. Most of the drums contain gasoline for use in the Zodiacs, snowmobiles, and small portable equipment (e.g., chainsaws). Leaded gasoline is purchased from Punta Arenas. The boating coordinator told us that the outboard motors would not have lasted as long as they have if unleaded gasoline had been used.

- The Chilean dump is located in a small gully next to the helicopter pad. The name of this dump is based on the fact that in the past, Chilean naval vessels would visit Palmer periodically to salvage scrap metal and discarded equipment from the dump. The dump is no longer used; all solid wastes are retrograded to Chile or to the United States via McMurdo Station. The residue is unsightly, and it appears that drainage from the dump goes directly into Hero Inlet near the pier. There are no records of the types of amounts of materials placed in the dump. In the past, ash and residue from burning solid waste was pushed into the dump after each burn. The practice of burning solid waste has been discontinued.

- A small shed, designated the cylinder barn, has been constructed this year. This building provides storage for all compressed gas cylinders.

- A small building on the top of the hill (a T-5 building) provides space for the antenna satellite imaging system. Part of the equipment in this building is used to obtain data from National Oceanographic and Atmospheric Administration and Department of Defense satellites that provide coverage for all of western Antarctica. Similar equipment at McMurdo provides additional coverage of about half of eastern Antarctica. The weather data and images monitored here are archived at Scripps Institution of Oceanography. This building will also be used for a U.S. Department of Energy–supported project related to aerosol sampling; the principal investigator is from the University of Miami.

- Next to the T-5 building is the Clean Air Facility (CAF), a very small building used for UV monitoring and upper atmospheric studies.

- A small fresh water glacier melt pond is located in a depression below the T-5 and CAF buildings. This pond provides much of the station's drinking water during the austral summer. The medical staff person tests the water occasionally; there is no routine testing program, and no chlorination is done.

- The power plant, garage, approximately half of the dormitory space, and recreation facilities are located in the GWR building. The power plant consists of two 250-kW Caterpillar generators (model 3406) that were installed last year. Normally one generator is operated at a time; the average load is about 170–200 kW, and occasionally the demand may go up to 210 kW, depending on the kinds of scientific studies that are being done. There is an emergency 100-kW generator in the BIOLAB. Waste heat from the power plant is used for the desalinators and to heat the GWR building. In the past, waste oil has been burned in the diesel generators, but the new generators do not work well with this fuel. Waste oil and degreasing solvents are placed in a used oil barrel and retrograded.

- The BIOLAB houses a number of wet and dry laboratories, the galley and cafeteria, laboratory stores, dormitory space for about 20 people, an emergency generator, and the reverse osmosis water production facility. Ancillary facilities immediately adjacent to the BIOLAB include an aquarium, volatile storage building, and a sauna.

- Fresh water can be produced by a reverse osmosis system located in the BIOLAB and by desalinators using waste heat from the power plant. In addition, much of the water supply during the austral summer comes from the glacial melt pond. Water use is about 8000 gal/week during average periods of scientific activity (i.e., when station population is about 40). The reverse osmosis system can produce about 100 gal/h of fresh water, and each of the three desalinators can produce about 12 gal/h.

- The pump house is located below the BIOLAB and is used to pump saltwater for toilets, the aquaria, and the reverse osmosis and desalinator fresh water production systems. There are three pumps and three sand filters. Intakes include two short rigid pipes at a 12-ft depth below mean sea level (MSL) and one flexible pipe at a 40-ft below MSL, 180 ft from shore. This year they tried to improve the intakes, but ice destroyed everything they installed. The 40-ft intake is needed to provide water of appropriate temperature for the fish in the aquaria. Water is continually pumped through the aquaria and immediately discharged to the wastewater system.

- The wastewater discharge is immediately adjacent to the pier. A macerator has been installed this year to grind all solids passing through the wastewater discharge line. At the time we visited, the offshore discharge structure consisted of three 20-ft sections of flexible pipe that were weighted at the end so that discharge occurred about 2 ft below the surface. When the ice starts forming, this pipe will be taken in and surface discharge will be resumed. A major constraint for the discharge is keeping it from becoming blocked by ice and backing up the entire system. Without a major construction project such as building a jetty to protect the pipe, surface discharge during winter months appears to be the only feasible alternative. There are no studies of currents or water quality for the receiving system. Flow rates of wastewater discharge can be as high as 75 gal/min. These flows may be fairly steady when the aquaria are operating as they operate as flow-through systems.

- Construction activities this austral summer have involved (1) attempts to improve the seawater intakes, (2) replacement and repair of some of the antenna, (3) replacement of the siding of the BIOLAB, and (4) general maintenance and support.

- According to the station doctor, very little medical waste has been generated this season. It is not clear where the waste has been disposed. Careful consideration needs to be given to the handling, storage, and disposal of biohazardous wastes being generated by the medical department and in the biological laboratories.

- The station's inventory of motor vehicles includes two front-end loaders, two rough-terrain fork lifts, one wheeled mobile crane, four all-terrain vehicles, and two snowmobiles. The all-terrain vehicles and the snowmobiles are not used extensively.

- Oil containment booms, absorbent pads, and a small portable skimmer are stored in a MILVAN at Palmer. This equipment is left over from the cleanup operations after the *Bahía Paraíso* sank last year. There is no formal contingency plan for a spill at Palmer, but the engineers have discussed how they might deal with a spill. This year they have tried to control contaminated runoff from the heavy vehicle parking area by placing absorbent pads near the pier to stop drainage from going into the harbor.

- There have been no studies on use of alternate energy resources at Palmer. In the opinion of Palmer's engineering staff, the potential for solar energy use is limited because of the predominance of cloudiness associated with the maritime environment. There may be more potential for wind energy use; apparently there are records for wind data.

- Disposal of laboratory chemicals is a problem that needs careful consideration. In the past, many of the chemicals have been washed down the drain. This year a major effort has been undertaken to inventory all the chemicals, and handle, store, and dispose of them properly. Material safety data sheets have often been removed before the chemicals arrive at Palmer, but the laboratory manager has obtained a generic set of these sheets. The largest amount of chemical waste that has been accumulated are the E-6 photographic wastes. The lab manager has been collecting these in a 55-gal drum for disposal. Another problem area is the accumulation of excess amounts of some chemicals (e.g., they are greatly overstocked with scintillation fluids). Scientists have overestimated what they need and are not aware of what may be present in the stock room. A third problem is that containers of unknowns appear periodically, and the laboratory staff have no way of identifying what is in the containers.

In the afternoon, the visitors were given a boat tour to Old Palmer Station and various sites of ecological interest in the vicinity.

Old Palmer Station was built in 1965 near the site of the British Camp "N", which was used in 1957 during the International Geophysical Year. Old Palmer was used until 1968, when operations shifted to the current Palmer Station. During the last 2 months, USAP chartered a ship, the *Erebus*, to help in the cleanup of the Old Palmer site. A major activity was the transfer of diesel fuel from a fuel bladder at Old Palmer to the tanks at Palmer Station. This transfer was accomplished successfully. At the time we visited Old Palmer, the majority of equipment, scrap metal, connex boxes (small containers for ship transport), and other trash had been removed from the outside of the main building. The main building and a small connex container which had been used as an outhouse are all that remains of the original station. There is still a considerable amount of furniture, abandoned pieces of equipment, and trash present inside the building. In addition, the berm where the fuel bladder was, two areas where the connex boxes were located, and foundations of the British Camp "N" are conspicuous. USAP is developing plans for finishing the cleanup of this site.

After walking around Old Palmer Station, we boated out to the site where the *Bahía Paraíso* sank. All that can be seen of the ship is the bottom

of the hull. There was no evidence of an oily sheen on the water and no obvious signs of the oil spill or lingering effects. We then proceeded to Torgersen Island, which is the location of an Adelie penguin rookery. This island is a site where tourists go when they visit Palmer Station from cruise ships. We spent some time taking photographs and then moved on to Elephant Rocks, where we observed some elephant, crabeater, and fur seals. Litchfield Island, a Specially Protected Area (SPA) under the Antarctic Treaty, could be seen from a distance, but we did not visit it.

MARCH 21-22

The *Polar Duke* departed Palmer Station at 0705 and proceeded to the Northern Gerlache Strait site to replace the sediment sampler that was collected on the trip to Palmer. We traveled through the Neumeier Channel to reach this site and saw numerous icebergs and spectacular glaciers that were actively calving icebergs into the sea. After replacing the sediment sampler and conducting several plankton tows, the ship proceeded directly to King George Island, where we were picked up by the Air National Guard flight for our return journey.

CONCLUSIONS

This site visit and that of Steven Railsback completes ORNL's visits to all three active USAP stations in Antarctica. The observations made and the information obtained during these visits help establish the credibility of the ORNL team in preparing the SEIS, and they provide important insights on current and potential environmental impacts of USAP activities.

ITINERARY

03/13-14/90	Travel to Punta Arenas, Chile, by commercial airlines.
03/15-16/90	Issued cold weather clothing and awaited Air National Guard flight to King George Island.
03/17/90	Flight to King George Island and transfer to R/V *Polar Duke*.
03/18/90	R/V *Polar Duke* conducted fishing operations to collect specimens for research at Palmer Station; Reed and NSF staff toured ship and met with engineer to discuss ship's capabilities and discharges.
03/19/90	R/V *Polar Duke* retrieved sediment sampler and conducted plankton tows; Reed and NSF staff met with Al Sutherland, NSF Ocean Projects Director, and Peter Drury, ANS science project coordinator for the R/V *Polar Duke* to discuss current and planned operations on the *Polar Duke* and at Palmer Station; arrived at Palmer Station about 2130.
03/20/90	Toured Palmer Station with the ANS Station Manager, Peter Jorgenson, in the morning; met for an hour with the facility engineer and the construction engineer for Palmer Station; participated in a boat tour of Old Palmer Station, the site where the *Bahía Paraíso* sank, and various wildlife sites in the vicinity of Palmer.
03/21/90	Departed Palmer Station on the R/V *Polar Duke* at 0700; replaced the sediment sampler at Low Island in the afternoon and conducted several plankton tows.
03/22/90	Arrived at King George Island at 0900; flew to Punta Arenas on the Air National Guard flight, arriving about 1630; returned cold weather clothing.
03/23-24/90	Departed Punta Arenas at 1340 on commercial airline for return flight; arrived in Knoxville at 1145.

CONTACTS

National Science Foundation

Carol Roberts, Deputy Director, Division of Polar Programs
Gary Staffo, Head, Safety, Environment and Health Office
Sam Higuchi, Safety, Environment and Health Implementation Team
Alexander Sutherland, Ocean Projects Manager
Michael Kenifick, NSF Contracting Office

ITT/Antarctic Services

Peter Drury, Science Project Coordinator, R/V *Polar Duke*
Peter Jorgenson, Station Manager, Palmer Station

Scientists

H. William Dietrick III, Northeastern University
Bruce Sidell, University of Maine
David Kahl, University of Hawaii
Mark Huntley, Scripps Institution of Oceanography
Vernon Asper, University of Hawaii
William Burgess, Stanford University

Others

Robert Rutford, President, University of Texas at Dallas
James Walsh, U.S. Embassy, Argentina
James Smith, Los Angeles Times
Diego Goldberg, Freelance Photographer
Glen Rose, U.S. Embassy, Chile

MATERIALS OBTAINED

1. Site Plan Blueprints of Palmer Station
2. Eighteen rolls of color slides of the trip

DISTRIBUTION

1. John J. Easton, Jr., Assistant Secretary for International Affairs and Energy Emergencies (IE-1), Forrestal Building, U.S. Department of Energy, Washington, DC 20545
2. Sidney Draggan, National Science Foundation, Division of Polar Programs, Office of Safety, Environment and Health, 1800 G Street, NW, Washington, DC 20550
3. Elizabeth Q. Ten Eyck, Director, Division of Safeguards and Security (DP-34), U.S. Department of Energy/Germantown, Washington, D.C. 20545
4. A. Bryan Siebert, Director, Office of Classification and Technology Policy (DP-323.2), Forrestal Building, U.S. Department of Energy, Washington, D.C. 20585
5. J. A. Reafsnyder, Deputy Assistant Manager, Energy Research and Development, Department of Energy, Oak Ridge Operations, P.O. Box 2001, Oak Ridge, TN 37831-8600
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7. Dr. Rita R. Colwell, Director, Maryland Biotechnology Institute, University of Maryland, College Park, MD 20742
8. Dr. William E. Cooper, Professor of Zoology, College of Natural Sciences, Michigan State University, East Lansing, MI 48824
9. Dr. Jerry F. Franklin, Bloedel Professor of Ecosystem Analysis, College of Forest Resources, AR-10, University of Washington, Seattle, WA 98195
10. Dr. George M. Hornberger, Professor, Department of Environmental Sciences, Clark Hall, University of Virginia, Charlottesville, VA 22903
11. Dr. Gene E. Likens, Director, The New York Botanical Garden, Institute of Ecosystem Studies, The Mary Flagler Cary Arboretum, Box AB, Millbrook, NY 12545

12-13. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831

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