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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-3497

DATE: December 22, 1989

SUBJECT: Joint Report of Foreign Travel of Robert M. Reed, Group Leader, Steven F. Railsback, Research Associate (Environmental Sciences Division), and Richard B. McLean, Group Leader (Energy Division)

TO: Alvin W. Trivelpiece

FROM: R. M. Reed, S. F. Railsback, and R. B. McLean

PURPOSE: To collect information at the McMurdo and the South Pole stations for a supplemental environmental impact statement on the U.S. Antarctic Program

SITES VISITED:

11/8-21/89	McMurdo Station	Erick Chiang Senior U.S. Representative Antarctica
11/19/89	Scott Base	David Geddas Station Manager
11/20/89	South Pole	John Lynch Senior South Pole Station NSF Representative

Three staff members from Oak Ridge National Laboratory (ORNL) participated in a site visit to U.S. Antarctic Program (USAP) facilities at McMurdo Station, Amundsen-Scott South Pole Station, and remote field and support sites. Interviews were conducted with National Science Foundation, Navy, and ITT/Antarctic Services staff responsible for environmental management functions. The ORNL team visited all facilities at McMurdo Station, three remote field camps, a Navy refueling facility, South Pole Station, and Scott Base (a New Zealand installation). In general, the team found that environmental impacts of the USAP are minor for the Antarctic continent as a whole. Improvements for the handling and disposal of solid wastes and the discharge of wastewaters that have been initiated should help minimize environmental impacts of USAP activities. 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 June 1990.

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 (EIS) on the U.S. Antarctic Program (USAP). As part of this task, three environmental scientists from Oak Ridge National Laboratory (ORNL), Richard B. McLean, Steven F. Railsback, and Robert M. Reed, participated in a site visit to USAP facilities at McMurdo Station, Amundsen-Scott South Pole Station, and field research and support sites. The site visit involved travel by commercial air to Christchurch, New Zealand, where flights to the Antarctic are staged by the U.S. Military Airlift Command or the New Zealand Air Force. Poor weather conditions at McMurdo delayed departure from Christchurch for two days, so actual time in the Antarctic was from November 8 through 21. Visits were made to McMurdo Station, Williams Field, Amundsen-Scott South Pole Station, the Marble Point refueling station, several remote field camps, and Scott Base.

ORNL staff worked closely with two NSF staff throughout the site visit: Tom Forhan, Head of the Safety, Environment and Health Implementation Team (SEHIT), and Gary Staffo, Head of Safety, Environment and Health Office (SEHO). The ORNL/NSF team interviewed NSF staff as well as staff of the Naval Support Force Antarctica (NSFA), the Antarctica Development Squadron (VXE-6), ITT/Antarctic Services (ANS), and NSF-supported scientists. The information obtained during the site visit will be used along with information obtained from literature reviews, public scoping, and other sources to prepare a draft supplemental EIS.

The site visit consisted of (1) general tours of the facilities, (2) overview briefings by responsible managers, and (3) more detailed interviews with key staff, using checklists to assess the current status of environmental compliance at major facilities.

In general, the site visit indicated that the USAP has relatively minor impacts on the Antarctic environment as a whole. Several waste disposal practices and fuel spills have, however, created a perception of environmental insensitivity. It is clear that a major effort is under way to increase environmental awareness and improve environmental management practices at USAP facilities, but there are a number of areas where improvements are yet to be made. Planning processes to determine what improvements are most important and to conduct impact analyses and related studies to determine how best to make changes have been lacking. The creation of the SEHO and SEHIT and the preparation of a supplemental programmatic EIS are important steps towards improved planning, analysis, and implementation of an environmental program.

McMURDO STATION

The ORNL/NSF team arrived at McMurdo Station on Wednesday, November 8, and had an initial meeting with the Senior U.S. Representative, Erick Chiang, that evening to discuss plans for our visit. The following morning, the team gave an inbriefing to senior management from NSF, NSFA, and ANS to

discuss the objectives of the site visit. We emphasized that we were not at McMurdo to conduct an environmental audit but rather wanted to obtain an overall understanding of USAP activities that could affect the environment. After the meeting, Chiang gave us a "windshield" tour of the McMurdo facilities as an initial overview. In the afternoon, the Navy liaison officer assigned to NSF (LCDR B. Bohner) took us to the ice runway, which is used for landing wheeled aircraft (C-5s, C-141s, and C-130s) early in the season, and to Williams Field, which is the ski runway used by ski-equipped LC-130 Hercules aircraft later in the season when the ice runway can no longer be accessed.

On Friday, November 9, we had a morning meeting with the ANS contractor to obtain an overview of their operations and facilities. ANS is responsible for most of the construction and maintenance operations. They provide administrative support at the Chalet (the NSF administrative center), make all travel arrangements, and provide much of the logistical support needed by the scientists. ANS will be replaced by a new contractor during the next year. Although most of the current staff will probably be hired by the new contractor, senior management will change. This briefing was followed by a tour of ANS facilities that included: Eklund biology laboratory, aquarium, water intake quay and environs, sewage outfall, new macerator building, dive shack, power plant, desalinization plant, heavy vehicle maintenance garage, operations and maintenance shop, various dormitories and Jamesways (i.e., canvas-covered buildings), old water plant, and site of the old nuclear power plant. We also saw various construction areas, including the new dormitory, the new science building, and elevated utilidors that are replacing water, electrical, and sewage lines throughout McMurdo.

On Saturday through Tuesday (November 11-14), we had a series of meetings with Navy staff. An initial meeting was held with all the department heads. The Navy historically provided all the logistic support for the USAP, including construction, operation, maintenance, and transportation. Over the last few years, however, many of these functions have been turned over to ANS and the previous NSF contractor. Currently, the Navy (1) provides transportation and related services; (2) operates the galley and ship's store; (3) orders, transports, and stores all food and many other supplies (ANS orders and stores its own equipment and supplies but transportation is arranged through the Navy); (4) operates the morale, welfare, and recreation (MWR) program, including five clubs and various other recreational facilities; and (5) provides medical services. After the initial briefing from department heads, we met separately with each manager to discuss their activities and tour their facilities. These facilities included medical; supply (galley, offices, warehouses); operations (meteorological office and offices); fire department; safety; public works; terminal operations (offices and warehouses); communications; morale, welfare, and recreation; and fuel handling.

The terminal operations department is one of the most important Navy activities. This department, which is actually run by staff on assignment to NSFA from the Army, does all the contracting and scheduling of Military Airlift Command (MAC) and Military Sealift Command transportation of

personnel and materials into and out of McMurdo and the other USAP facilities. All supplies coming to McMurdo and all materials being retrograded to the United States or New Zealand are shipped either by surface vessel (one cargo ship and one fuel tanker each year) or by MAC aircraft. The terminal operations staff are responsible for transport of all hazardous materials and hazardous wastes and have a well-designed program in place that is generally in compliance with all requirements under U.S. law. McMurdo Station is successfully collecting, storing, and retrograding most hazardous wastes. This program has largely been developed through the efforts of the NSFA terminal operations department and the public works division. The support and scientific staff seem to be willing to take the necessary measures to handle hazardous wastes properly, when such measures have been made available.

Air transportation of personnel is the responsibility of the Navy. As noted above, transportation of supplies and equipment is a responsibility of the terminal operations department. They are also responsible for transporting personnel to McMurdo from Christchurch on MAC flights. Transportation of personnel and equipment to field sites and the South Pole is either by helicopter or LC-130s. Helicopter operations are run by VXE-6 and involve approximately six helicopters. The seven LC-130s are owned by NSF and are flown by Navy personnel. In addition, NSFA is responsible for all support activities for flight operations, including construction and maintenance of the ice runway and Williams field, all air traffic control and meteorological services, and all aircraft maintenance activities. The New Zealand Air Force also uses landing facilities at McMurdo, and under a cooperative agreement, the two countries provide transportation of personnel and supplies on each other's aircraft. New Zealand does not have an airfield for Scott Base (it does have a helicopter pad) and, therefore, relies on McMurdo facilities.

We spent Wednesday, November 15, on a helicopter trip to the Dry Valleys, Marble Point, and Cape Royds (see discussion below under remote field and support facilities). At the end of this trip, we toured the helicopter maintenance building.

On Thursday through Sunday (November 16-19), we conducted a series of meetings on specific environmental compliance areas including hazardous waste, hazardous materials, PCBs, air quality, and solid waste. In conducting these meetings we used an environmental compliance checklist to determine the degree of compliance with U.S. laws and regulations. The meetings were attended by managers responsible for specific areas from both ANS and the Navy. We prepared a draft report on the results of these meetings and left it with the senior managers of NSF, NSFA, and ANS for comment.

REMOTE FIELD AND SUPPORT FACILITIES

On Wednesday, November 15, we took a helicopter trip to three remote field camps in the Dry Valleys, a Navy refueling station at Marble Point, and Cape Royds. The first field site at Lake Fryxell is a relatively new camp consisting of a Jamesway and several module buildings that house chemical,

radioisotope, and electronic laboratory facilities. There will be eight scientists from the U.S. Geological Survey at this site during the austral summer who will be studying carbon cycling in this unique lake. This field site is well designed and well run. Staff are using a trash compactor and appear to be having no problems with segregating trash or containing their wastewater and sanitary wastes for retrograding to McMurdo.

The Lake Bonney field site, which has limited facilities, has been in place for several years. It consists of a Jamesway, an outhouse, and several tents where the scientists sleep. The scientists are studying the photobiology of algae at different depths in the lake. The camp appears to be complying with all requirements for handling, storing, and retrograding wastes.

We visited the New Harbor field site only three days after the current group of scientists arrived. The facility, which consists of a Jamesway and a diving hut, was originally established for drilling a geological core a number of years ago. The principal investigator at the camp is concerned about trash that has accumulated from temporary users over the past several years and feels that an effort is needed to retrograde all trash accumulated at the site.

In general, field scientists seem conscientious about protecting the environment and retrograding wastes. Concerns about the ultimate fate of wastes were raised, however, both from concern that retrograded wastes are recycled to the fullest extent and from concern that waste disposal procedures may be excessively conservative at the expense of science programs.

Marble Point is a refueling site for Navy helicopters operating in the Dry Valleys and across McMurdo Sound. The facility consists of several fuel bladders and a set of three buildings that accommodate the fuel handler and a meteorological observer. The ORNL/NSF team observed potential problem areas at the Marble Point site, including discharge of sewage and wastewater, collection and handling of drinking water, storage of waste oil drums, prevention of spills, and purging of nozzles during refueling. These observations were discussed with the responsible managers and are being corrected.

A brief stop was made at Cape Royds on the trip back to McMurdo. Cape Royds is the location of Shackleton's hut, which is a protected historic site, and the most southern penguin rookery in the Antarctic, which is a site of special scientific interest (a specially protected scientific area). We had the opportunity to go into Shackleton's hut, which was built in 1910 and is well preserved because of the cold climate. The boundaries of the specially protected area are marked with signs to prevent people from approaching the birds; any disturbance of protected species is a violation of the Antarctic Treaty and can result in a significant fine and imprisonment. The weather had changed dramatically since we departed McMurdo, and we landed in blowing snow with 30-knot winds (helicopters cannot fly in winds in excess of 45 knots).

SCOPING MEETING

On Friday evening, November 17, Erick Chiang scheduled an open forum at the Chalet to solicit comments from the McMurdo community on the scope of the supplemental EIS. Chiang introduced the forum with some comments on the past and present status of USAP activities. Tom Forhan briefly discussed his role as head of NSF's Safety, Environment and Health Implementation Team, and Gary Staffo briefly described the activities of his new Office of Safety, Environment and Health. Rich McLean then moderated the remainder of the session, during which members of the audience provided comments. Approximately 50 to 60 people were present in the audience, and comments ranged from concerns about energy and water conservation to the philosophy of who should be hired to work at USAP facilities. There was a general concensus among those attending the meeting that such a voicing of concerns was a very positive step and would facilitate future communication. ORNL staff prepared a report listing the various comments and concerns that were raised and provided it to Chiang as a record of the meeting.

SCOTT BASE

While we were waiting for an opportunity to fly to the South Pole Station on Sunday, November 19, we arranged to have a tour of New Zealand's Scott Base. Scott Base is located between McMurdo Station and Williams Field on a small promontory of Hut Point Peninsula. David Geddas, the station director, gave us a tour of the facility. The base can support a maximum of 80 people and is obviously a very different scale of operation than McMurdo. It has recently been rebuilt, and only two of the original structures remain (these will either be rebuilt or dismantled soon). Most of the buildings are interconnected to minimize the need for staff to don outdoor clothing and to reduce heat loss. They use a reverse osmosis process to desalinate water, and they are replacing the system this year. Their wastewater is macerated before it is discharged into McMurdo Sound; the discharge is very near the salt water intake, but this proximity is apparently of no concern because of the currents and the fact that the reverse osmosis process would remove any pathogens. Their vehicle fleet requires little maintenance because they recycle their entire fleet every three years. About 11 to 12 people winter over at Scott Base. Our overall impression was that this facility was very clean and very efficient. However, one must realize that Scott Base is very dependent on facilities at McMurdo, and, therefore, many of the operations associated with aircraft and logistics that contribute to the large size and industrial nature of McMurdo are not seen as also being part of Scott Base. We also got the clear impression that the working relationships between the New Zealanders and Americans were very good and the cooperative efforts were highly valued by both countries.

AMUNDSEN-SCOTT SOUTH POLE STATION

We visited the Amundsen-Scott South Pole Station on Sunday, November 20. We had tried to go earlier so that we could spend approximately 24 hours

there to tour the facilities and interview appropriate staff. Unfortunately, the weather at McMurdo had prohibited flights for much of our stay, and we ended up flying there and back on the same plane. We had only an hour and a half of ground time, therefore, to tour the facility. (Railsback was able to stay an additional two hours, but he was advised to come back on the next plane or risk being at the station for a considerably longer stay.) John Lynch, the senior NSF staff person at the South Pole, and two ANS staff (Mark Condon, the facility engineer, and Steve Marvin, the station manager) gave us a quick tour of the main part of the facility.

Research activities at the South Pole mainly involve studies of atmospheric physics, the ozone hole, and some geological investigations. The South Pole facility consists of a geodetic dome structure that covers the major living and support buildings, a cargo arch where supplies are stored, and a fuel storage arch where the major bladders of fuel are stored. There is also some temporary housing for construction personnel. The temperature in these structures was about -30°C. We first observed the power plant where an asbestos problem had recently been discovered during the process of replacing the main generators. Asbestos insulation has been identified in some of the piping, and an asbestos survey team from the Navy's PACDIV facility in Hawaii is in the process of developing a plan to remove and clean up the area. We then toured the galley, carpenter shop, equipment shop, communications facilities, science laboratories, weight room, and fuel storage arch. A recent fuel spill had occurred in the fuel arch due to faulty piping. Construction activity was under way to repair damage due to ice and snow pressure on the geodetic dome, and we inspected the damaged area.

The water supply is a snow mine located about one-half mile upwind of the station. The snow melter at the dome uses glycol heat from the power plant, and the melter at the summer camp uses diesel fuel. Wastewater is discharged into an ice pit; the pit has been moved three times since the current station was built. There are also three wastewater pits at the summer camp (i.e., two Jamesways used for housing additional construction and support personnel during the summer season). The small size of the South Pole station and the fact that there is literally no ecosystem at the site make this station's impacts appear to be minor.

MEETINGS IN CHRISTCHURCH, NEW ZEALAND

While in New Zealand, Steve Railsback met with Hugh Logan (Director) and Malcolm MacFarlane (Operations Manager) for New Zealand's Department of Scientific and Industrial Research's Antarctic Division. The purpose of the meeting was to request information from New Zealand's program that could be used in defining mitigation and alternatives that reduce the impacts of the USAP. The New Zealand staff were very helpful in providing data, studies, and their own concerns about USAP impacts.

In a visit unrelated to other purposes of the trip, Steve Railsback met with faculty of the Water Resources Center, Canterbury University in Christchurch, to discuss research interests and methods. The Water

Resources Center studies impacts of hydropower development that are highly related to studies conducted by ORNL for DOE and the Federal Energy Regulatory Commission.

CONCLUSIONS

The purpose of this site visit was to become sufficiently familiar with USAP facilities and operations so that ORNL could scope out the issues to be addressed in the supplemental EIS and assist NSF with future environmental assessment and compliance tasks. The results of our visit indicate that the principal issues to be addressed in the EIS are wastewater discharge, fuel handling and spills, open-air burning, energy conservation, and sensitizing scientific and support staff to environmental concerns of protecting the near-pristine environment. ORNL staff plan to participate in a site visit to Palmer Station in March 1990 to obtain similar insights on the only other permanent operating USAP research station. The information and experience gained during these two site visits will enable ORNL staff to assist NSF with a variety of tasks involving environmental assessment of newly proposed actions (e.g., new construction projects) and other ancillary tasks (e.g., advising NSF on the effectiveness of a new wastewater discharge or assessing the level of environmental compliance for particular activities).

ITINERARY

11/1-4/89	ORNL team traveled to Christchurch, New Zealand.
11/4-8/89	ORNL team was issued cold weather clothing and awaited transport to McMurdo Station.
11/8/89	ORNL team flew to McMurdo and had initial meeting with Erick Chiang, NSF staff member and Senior U.S. Representative in Antarctica.
11/9/89	ORNL team conducted inbriefing with NSF, Navy, and ITT/Antarctic Services (ANS) staff to explain objectives of site visit. NSF and Navy staff gave the team a "windshield" tour of McMurdo Station, Williams Field, and the ice runway.
11/10-14/89	ANS and Navy staff provided overview of their activities and a tour of their facilities at McMurdo.
11/15/89	ORNL team took helicopter trip to remote field stations, including Lake Fryxell, Lake Bonney, and New Harbor; also visited the Navy's Marble Point refueling station and Cape Royds where Shackleton's hut and a penguin rookery are located. Toured VXE-6 hanger.
11/16-19/89	ORNL team completed overview meetings with Navy staff and conducted meetings using environmental assessment checklist for hazardous waste, drinking water, wastewater, POL, air quality, and solid wastes.
11/19/89	ORNL team toured New Zealand's Scott Base.
11/20/89	ORNL team flew to South Pole Station and toured facility.
11/21/89	ORNL team toured new science buildings under construction; departed McMurdo Station for Christchurch.
11/22-23/89	McLean and Reed returned to Knoxville. Railsback stayed in Christchurch, met with faculty of Canterbury University and staff of New Zealand's Antarctic Program, took vacation, and returned on 12/1/89.

CONTACTS

National Science Foundation

Erick Chiang, Senior U.S. Representative
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Antarctic Division, New Zealand Department of Scientific and Industrial Research

David Geddas, Scott Base Manager
Hugh Logan, Director
Malcolm Macfarlane, Operations Manager

MATERIALS OBTAINED

1. Outline of Annual Science Meeting held by Steven Kottmeier, November 13, 1989.

2. Summary of average weather conditions at McMurdo.

3. COMNAVSUPPFORANTARCTICA Instruction 4600.1G, Annex A; Procedures for Processing and Shipment of Retrograde Material to Port Hueneme.

4. Memorandum from G. Fitzsimmons, Jr., to Safety, Environment and Health Office, Waste Water Outfall, November 3, 1989.

5. Memorandum from S. T. Kottmeier to R. R. LaCount, Disposal of Hazardous Materials from McMurdo Station Laboratory Facilities, February 3, 1989 (retrograded material from Eklund Biological Laboratory).

6. Current inventory (hazardous materials list--includes radionuclides) in the Eklund stockroom, August 12, 1989.

7. Memorandum from DPP.PCI to G. T. Staffo, Waste Water Outfall Task Force Report/Comments, dated November 7, 1989.

8. Memorandum from Captain K. Schwall to G. T. Staffo, Retrograde Inventory, November 14, 1989 (enclosure is the inventory; last page is hazardous waste).

9. Drawings of proposed discharge culvert and fill, two sheets, prepared by R. Olsen, October 20, 1989.

10. McMurdo hiking map.

11. Map of McMurdo handed out at Chalet.

12. ANS Key Personnel List dated October 26, 1989.

13. McMurdo Station Laboratory Facilities (four pages), ANS handout at overview meeting.

14. Memorandum from Commanding Officer Naval Petroleum Office, Cameron Station, Alexandria, Virginia, to Commander NSFA, Technical Assistance Visit to McMurdo Station, April 1985 (relative to evaluation team bulk fuel operations at McMurdo).

15. Fraylick, J. R. 1986. Avoiding low temperature brittle failures of flat bottom storage tanks. Pipeline Engineering Symposium. Amer. Soc. Mech. Engineers, New York, NY. pp. 125-131.

16. The Antarctic Network--McMurdo TV Schedule.

17. Unpublished current data from Jim Barry (two maps, two pages of graphs), November 12, 1989.

18. Medical In Brief, Tony Seggio (two pages), November 10, 1989.

19. Your Stay at McMurdo. USAP 1988, prepared by ITT/Antarctic Services, Inc.

20. McMurdo Station Site Plan, map dated February 6, 1988, prepared by ITT/Antarctic Services, Inc.

21. Request for Hazardous Waste Turn-In Form to NSFA Public Works Department (new one 1989-90).

22. Table of Contents for SOP for Radioactive Waste Handling (Sullivan, being revised).

23. McMurdo Station, The Antarctic Continent Telephone Company (Telephone Directory), ITT/Antarctic Services.

24. Facsimile from NSF Representative, Christchurch to NSF Representative, McMurdo, Preliminary Analysis of Fuel-Water Slush, (one page) dated November 15, 1989.

25. A. Daughtry. Report on Recycling. Draft report prepared by ANS for NSF. November 9, 1989.

26. McMurdo Station Area Drainage Plan. Prepared by ITT/Antarctic Services. August 2, 1986. Revised November 20, 1989.

27. Map of utilities distribution. Prepared by ANS.

28. Memorandum from S. Kottmeier to R. McLean, Outfall discharge characteristics. November 20, 1989.

29. Littlepage, J. L. 1965. Oceanographic investigations in McMurdo Sound, Antarctica. Ant. Res. Ser. 5:1-37 (one page only).

30. Kottmeier, S. T., and C. W. Sullivan. 1988. Sea Ice Microbial Communities (SIMCO). Polar Biol. 8:293-304.

DISTRIBUTION

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