ORNL/FTR--3596

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FOREIGN TRIP REPORT

ORNL/FTR-3596

DATE: April 27, 1990

SUBJECT: Report of Foreign Travel of S. F. Railsback, Research Associate, Environmental Sciences Division

TO: A. W. Trivelpiece

FROM: S. F. Railsback

PURPOSE: To collect information on operations and environmental effects of Palmer Station and the research vessel (R/V) *Polar Duke*, for preparation of an environmental impact statement on the U.S. Antarctic Program.

SITES VISITED:			
3/22-31/90	R/V *Polar Duke*	Weddell Sea, Antarctica	P. Druery
3/31-4/5/90	Palmer Station	Antarctica	P. Jorgensen

ABSTRACT: Oak Ridge National Laboratory is preparing an environmental impact statement for the U.S. Antarctic Program (USAP), which is operated for the National Science Foundation. This trip was a site visit to two USAP facilities: the R/V *Polar Duke* and Palmer Station. The *Polar Duke* is a 219-foot ice-strengthened vessel used as a research platform and for transportation. Palmer Station is a research base on Anvers Island near the Antarctic Peninsula. Environmental impacts include air emissions from diesel engines, discharges of untreated wastewater, the potential for spills of fuel and hazardous chemicals, and the attraction of tourists to the Palmer vicinity. Recommendations for minimizing impacts will be made in the environmental impact statement.

INTRODUCTION

The purpose of this trip was to visit Palmer Station, Antarctica, and the research vessel (R/V) *Polar Duke*. Palmer Station is one of three research bases operated by the National Science Foundation (NSF), which operates the U.S. Antarctic Program (USAP). The R/V *Polar Duke* is a research ship chartered for NSF for marine research and transportation in Antarctica. This site visit was needed to collect information for the programmatic environmental impact statement (EIS) that Oak Ridge National Laboratory (ORNL) is preparing for NSF. The EIS is to consider the environmental effects of the USAP and alternative mitigative measures to reduce the effects. Since Antarctic science and the environment are unique and because the USAP has come under intense public scrutiny, firsthand knowledge of the major research facilities is required for preparation of a defensible EIS.

The ORNL team preparing the EIS traveled to the other two U.S. bases in Antarctica (McMurdo and South Pole) in November 1989. R. M. Reed, project manager for ORNL, made a separate trip to Palmer Station on March 13-24, 1990, and submitted a Foreign Travel Report dated April 4.

Travel to Palmer Station is by commercial air to Punta Arenas, Chile (at the southern tip of South America), then by military supply aircraft operated either by the United States or Chile to the Chilean research base on King George Island, and then by the R/V *Polar Duke* to Palmer. I arrived in Punta Arenas on March 19, got outfitted with cold weather gear, and left for Antarctica on the next flight to King George Island, which was March 22. I boarded the *Polar Duke*, and it departed on March 22.

MARCH 22-31

The *Polar Duke* spent six days in the Weddell Sea (east of the Antarctic Peninsula and Palmer Station) conducting oceanographic studies and a day collecting fish samples near the Antarctic Peninsula between March 22 and its arrival at Palmer on March 31. My time aboard the *Polar Duke* was spent observing the ship operations and their environmental impacts, preparing for the visit to Palmer, assisting with the oceanographic studies, and observing wildlife.

The *Polar Duke* is a Norwegian ship chartered by NSF's support contractor to provide a research platform and transportation in Antarctic waters. It has science support facilities such as laboratory space, fish holding tanks, computers, and analytical instruments. Information about ship operations was obtained from P. Druery, Science Support Officer; T. Jakobsen, Captain; and I. Roberts, Chief Engineer. Operation of the ship appears to cause little environmental impact. Emissions of engine exhaust and wastewater are too small to cause significant impacts. Solid wastes are incinerated on board, and the residue is usually disposed of in Chile. Holding tanks for the laboratory drains can be used to prevent the discharge of chemicals. Engine oil is recycled on board. The impacts that do occur include the consumption of about 320 liters of fuel per

hour, the discharge of untreated wastewaters (however, oil is separated from bilge water when bilges are pumped), the opening of channels through the sea ice that allows marine birds and mammals (predators and prey) to enter areas they would otherwise be excluded from by the ice, the potential for anchoring to disturb benthic communities, the disturbance (but rarely injury) of marine birds and mammals when passing through habitats (such as ice packs) where these species are concentrated, the potential for minor oil spills during fueling operations, and the remote risk of a major oil spill should the vessel's hull be punctured.

MARCH 31-APRIL 5

The ship arrived at Palmer Station on the morning of Saturday, March 31. During the visit, information was obtained from P. Jorgensen, Station Manager; A. Deering, Facility Engineer; M. Mohyer, Laboratory Manager; other staff; and my own observations.

Palmer's air emission sources are the diesel power plant, vehicles, building heat, and fume hoods in laboratories. None of these sources appear to be of concern.

Drinking water is supplied by two desalination systems, augmented in summer with water from a pond that collects snowmelt. The water is filtered but not disinfected (such as by using chlorination). Wastewater includes sanitary wastes, ground food wastes, overflow from flow-through fish tanks, and brine from the desalinators. The wastewater runs through a macerator (a machine that chops up solid particles) and is discharged from submerged pipe. The wastewater varies in quantity and quality depending on whether fresh water is obtained from the pond or from desalination only, and on how many fish tanks are in use. Data on tides and flow at the discharge site are inadequate, so the dispersion of the effluent cannot be modeled accurately. I considered conducting a dye tracer study to measure the dispersion rate of the effluent after its discharge, but not all the necessary equipment was available.

Nonhazardous solid wastes are compacted and stored for shipment to Chile on the *Polar Duke*. In Chile they are transferred to a private company for disposal. This system appears to work well, as long as ships visit Palmer frequently enough to avoid storage problems. Hazardous wastes have most recently been disposed of by shipping them (via the *Polar Duke*) to McMurdo Station, another U.S. base in Antarctica; from McMurdo the hazardous waste was shipped to California for disposal through the military. An exception to this practice is shop wastes such as used oil, fuel, solvents, and batteries. These wastes, considered hazardous under U.S. laws, are also turned over to a private dealer in Chile. Palmer Station staff do not track the fate of these materials after they leave the *Polar Duke*. There is no evidence that PCBs were ever used at Palmer.

Fuel is supplied to Palmer by the *Polar Duke* or other visiting vessels. Bulk storage is in two tanks of 125,000 gallons each, and the two main

buildings are supplied via pipeline from the bulk tanks. None of the fuel facilities have secondary containment, such as dikes, to contain spills.

There is an abandoned waste dump at Palmer. I inspected the site; it contains residue from the past practice of open-burning the solid waste. There is evidence of petroleum leaching out of the dump towards the ocean. A sample of the contaminated soil was collected by the station manager, who will coordinate its analysis with NSF. The dump appears to cause little impact, except that it is visually unpleasant.

Tourism is a potential source of environmental impacts. During the summer many tourists, in group tour vessels or in private yachts, visit Palmer Station; it is clear that the presence of the station is an important reason for tourists to stop there. Therefore, any impacts caused by the tourists can be considered a secondary impact of Palmer Station. However, station management has been active in controlling tourist activities and is satisfied that impacts are minimal. Tourists are allowed to visit Torgeson Island and to make short visits to the station itself.

Prior to departing from Oak Ridge, we had requested that a visit be made to other countries' research stations near Palmer, if possible. On April 4 a visit was made to the nearest research station, the British Faraday Base. The trip, about 40 nautical miles each way, was made via the *Polar Duke*. We toured the base and I asked P. Stark, the station commander, questions about their waste disposal practices. The British base, which houses 10-15 people, uses waste disposal practices very similar to Palmer Station's. One exception is that the British open-burn their combustible material and then send the residue to the Faulkland Islands for landfilling. They dispose of sewage without treatment. There appeared to be no indoor storage or secondary containment for their hazardous wastes. Their bulk fuel tank has suffered numerous leaks in the past, as it was originally a water tank.

While at Palmer Station I discussed with Dr. M. C. Kennicutt the effects of the oil spill two miles from Palmer that resulted from the 1989 wreck of the Argentinean ship *Bahia Paraiso*. Dr. Kennicutt, of Texas A&M University, has been conducting chemical monitoring of the effects of the spill that occurred last year. His observations are that the spill caused high mortality among intertidal organisms such as limpets, but the fuel evaporated and was blown offshore quickly, and biological recovery was complete very quickly. Few traces of fuel can now be found in the Palmer vicinity.

Prior to departing Palmer Station, I submitted a draft report of my findings and presented it to the outgoing station manager and the overwinter station manager and his assistant. My report stated that Palmer appears to cause little environmental risk, but it mentioned the following concerns:

1. Solid and hazardous wastes are turned over to Chilean operators with no knowledge of their eventual fate. This practice presents a risk of public relations and legal problems should the station's wastes

be improperly disposed of or involved in an accident. I recommended that they develop a "cradle to grave" tracking system to ensure that their wastes are handled properly.

2. Some chemical wastes are disposed of to the wastewater system. For a few items such as diluted inorganic acids and bases, there may be no risk involved; however, since there is no wastewater treatment or monitoring, it would be prudent to prepare written guidance on the disposition of laboratory wastes and to generally avoid their disposal to the sewage system.

3. The laboratory manager, who handles chemical waste disposal, needs access to expertise on proper practices. Such access should be developed through the contractor that operates the station or through NSF. The military disposal office at Port Hueneme, California, which handles the station's wastes upon their arrival in the United States, should also be consulted about packaging and mixing of wastes.

4. The drinking water ought to be sampled more often and more thoroughly. Since some of the water comes from a pond where access is not restricted and since the water is not disinfected, it seems prudent to conduct routine bacterial sampling. Also, occasional complete organic and inorganic testing would be appropriate.

5. A spill prevention, contingency, and countermeasure plan, as required for bulk fuel storage in the United States, would be a useful way to determine the need for fuel spill prevention measures. Such a plan is being prepared for McMurdo Station. An emergency response plan for fuel spills should also be developed. A carefully designed response plan would be especially useful at Palmer because there is a high turnover in staff, because there is no secondary containment for fuel storage, and because the numerous tourist boats are another likely cause of fuel spills.

6. The abandoned dump warrants at least a chemical analysis to determine whether any toxic compounds may be leaching from it. It is expected that only trace amounts of fuel residual are leaching and that the decision of whether to remove the dump would largely be based on aesthetic considerations.

I departed Palmer Station via the *Polar Duke* on the evening of April 5, arriving in Punta Arenas, Chile, April 9. I departed for home on the morning of April 10.

ITINERARY

Date of Travel	Destination	Purpose
3/17-19/90	Punta Arenas, Chile	Issue of cold-weather clothing; await transport to Antarctica
3/22	Marsh Base, Antarctica	Board *Polar Duke*
3/22	Weddell Sea, Antarctica	Observe ship operations en route to Palmer Station
3/27-31	Palmer Station, Antarctica	Observe operations and environmental impacts of Palmer Station
4/5-9	Punta Arenas, Chile	Return travel
4/10-11	Knoxville, Tennessee	Return travel

LIST OF PERSONS CONTACTED

Name	Title	Organization
R/V *Polar Duke*		
P. Druery	Science Support Officer	ANS, Inc.
T. Jakobsen	Captain	Rieber Shipping, Inc.
I. Roberts	Chief Engineer	Rieber Shipping, Inc.
Palmer Station		
P. Jorgensen	Station Manager	ANS, Inc.
A. Deering	Facility Engineer	ANS, Inc.
M. Mohyer	Laboratory Manager	ANS, Inc.
Faraday Base		
P. Stark	Base Commander	British Antarctic Survey

LITERATURE ACQUIRED

The purpose of the trip was to collect information on operations and environmental impacts of the sites. This information was in the form of operating records, personal observations, unpublished reports, computer data bases, drawings, and photographs. Although much information was acquired on the visit, none was in the form of citable literature.

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