ANTARCTIC TREATY
XIXth CONSULTATIVE MEETING

TRAITÉ SUR L'ANTARCTIQUE
XIXème RÉUNION CONSULTATIVE

TRATADO ANTARTICO
XIX REUNION CONSULTIVA

ДОГОВОР ОБ АНТАРКТИКЕ
XIX КОНСУЛЬТАТИВНОЕ СОВЕЩАНИЕ

SEOUL
May 8-19, 1995

XIX ATCM/INF 108
May 16, 1995
Original: English

INITIAL ENVIRONMENTAL EVALUATION: ANTARCTIC AND SOUTHERN OCEAN SEABORNE TOURISM OF MARINE EXPEDITIONS INC.

Agenda *Item 7*

(Submitted by IAATO)

We enclose a copy of our IEE. We are sorry that, because of limited availability, we can only provide one copy for each delegation.

INITIAL ENVIRONMENTAL EVALUATION:

ANTARCTIC AND SOUTHERN OCEAN

SEABORNE TOURISM OF

MARINE EXPEDITIONS INC.

Prepared for:

Marine Expeditions Inc.
13 Hazelton Avenue, Toronto, Ontario M5R 2E1 Canada
Telephone: + 1 416 964 9069; + 1 800 263 9147; Fax: + 1 416 964 2366

Prepared by:

Poles Apart
P.O. Box 170, Sandy Bay, Tasmania 7005 Australia
Telephone: + 61 02 237779; Fax: + 61 02 241664
Email:L.K.Kriwoken@geog.utas.edu.au; and

Poles Apart
P.O. Box 89, Bourn, Cambridge CB3 7TF United Kingdom
Telephone/Fax: + 44 954 718044; Email:DMR13@cam.ac.uk

Comments and suggestions are encouraged on this Initial Environmental Evaluation. Please forward these to Poles Apart.

May 1995

Initial Environmental Evaluation: Antarctic and Southern Ocean Seaborne Tourism of Marine Expeditions Inc.

Table of Contents

List of Figures

List of Tables

Appendices

Acknowledgements

Poles Apart would like to thank all MEI staff (in Toronto and based out of Ushuaia) and the Captain and crew of the Ioffe, Vavilov and Livonia for their full cooperation and assistance.

1. Executive Summary

1.1 Conclusions and Recommendations

This Initial Environmental Evaluation (IEE) provides an assessment of the seaborne commercial activities of Marine Expeditions Inc. (MEI) in the South Atlantic sector of Antarctica and sub-Antarctic islands in that region. The IEE has been prepared in accordance with the requirements of the Protocol on Environmental Protection to the Antarctic Treaty 1991 (Madrid Protocol; SCAR 1992), particularly Annex I on Environmental Impact Assessment. The format of the IEE is based on the "Practical Guidelines for Environmental Impact Assessment" developed by the Committee of Managers of National Antarctic Programs (COMNAP guidelines; COMNAP 1992).

Whilst the COMNAP guidelines have been used as a basis, it is acknowledged here that environmental auditing provides an additional methodology that is useful in assessing MEI's environmental impact. Environmental auditing is used on existing commercial activities and focuses on compliance with legislative and regulatory requirements. Environmental auditing has been used in: a wide variety of commercial applications (Brown 1994); an assessment of the New Zealand Antarctic Program (NZAP 1994); and increasingly in the tourism industry (Goodall 1995). The IEE has been therefore modified to include environmental auditing procedures in the evaluation of MEI's seaborne operations.

The IEE concludes that the environmental impact of MEI's commercial activities are considered consistent with the Antarctic Treaty and its Recommendations, the Agreed Measures for the Conservation of Antarctic Fauna and Flora, the principles of the Madrid Protocol (Annex I - Environmental Impact Assessment and Annex III - Waste Disposal and Waste Management), and the environmental regulations outlined in the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).

In the 1994-95 season MEI completed 33 trips to Antarctica with a total of 2,020 passengers. MEI's seaborne commercial tourism operations are considered to have a minor or transitory environmental impact on the Antarctic environment and its dependent or associated ecosystems.

Conclusions are made with respect to MEI's (a) office procedures, (b) management of ships and (c) management of staff, passengers and crew. Recommendations are made in the following areas in order to reduce MEI's operational environmental impact:

- expansion of MEI's environmental management policy;
- preparation of an environmental handbook;
- preparation of a waste management plan;
- preparation of a fuel spill contingency plan;
- choice of landing sites;
- care over introduction of non-indigenous species;
- translation of relevant documents in to the four Antarctic Treaty languages;
- review of staff and crew training; and
- preparation of an industry-wide IAATO initiative on cumulative impact assessment.

1.2 Aim of the IEE

The aim of the IEE is to undertake an environmental impact assessment of MEI's operations in accordance with the requirements of the Madrid Protocol (Article 8), Annex I (Environmental Impact Assessment), Annex III (Waste Disposal and Waste Management), and the relevant regulations in MARPOL 73/78 (MARPOL 1992).

There is no requirement under current Antarctic international or national legislation for commercial operators to undertake an IEE. MEI commissioned the environmental assessment in full knowledge of the Madrid Protocol, accepting that it has not yet been ratified.

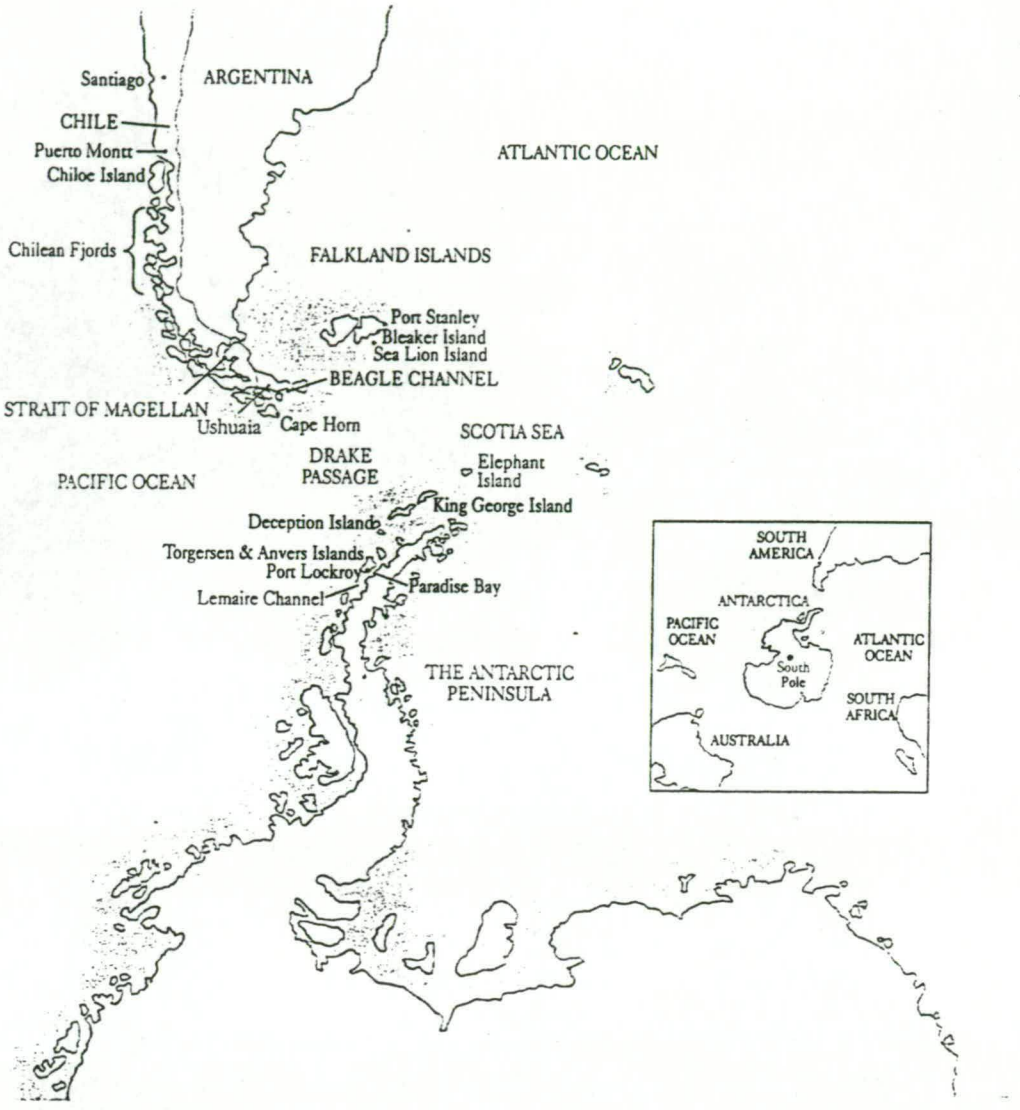
Relevant legislation considered in the preparation of this IEE includes:

- Antarctic Treaty and Recommendations;
- Agreed Measures for the Conservation of Antarctic Fauna and Flora (Agreed Measures);
- International Convention for the Prevention of Pollution from Ships (MARPOL 73/78);
- Protocol on Environmental Protection to the Antarctic Treaty 1991 (Madrid Protocol);
- United States (US) Antarctic Conservation Act 1978;
- US Marine Mammal Protection Act 1972;
- Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter 1972 (London Dumping Convention); and
- Falkland Islands Dependencies Conservation Ordinances 1975.

1.3 Existing Activity

MEI is a commercial tour operator based in Toronto, Ontario, Canada that offers shipborne cruising to Antarctica, the Southern Ocean and the Arctic. MEI runs trips to the Antarctic Peninsula and three marine and sub-Antarctic island groups (South Georgia, South Orkney Islands and Falkland Islands) (Figure 1). During the 1994-95 season, MEI operated three ships, all equipped with Zodiac (inflatable) landing craft.

Figure 1: Marine Expeditions Inc. - Operational Area in Antarctica and the Southern Ocean



An MEI representative attends the annual United States National Science Foundation (NSF) Tour Operators Meeting which runs concurrently with the International Association of Antarctica Tour Operators (IAATO) meeting in Washington, D.C. The NSF and tour company representatives meet to review visits to US Antarctic stations, discuss upcoming itineraries, United States Antarctic Program (USAP) publications, status of USAP science, observers reports and developments in environmental regulations.

Although the NSF cancelled its observer program for the 1994/95 season, the Polar Information Section provides publications for distribution to passengers including: information on the USAP, conservation of birds, a visitors guide, recent US environmental actions, news clips, videos and US environmental legislation.

MEI has formally commenced exchanging information on its operations with the Canadian office of the Scientific Committee for Antarctic Research (SCAR) at the University of British Columbia, Vancouver, British Columbia, Canada. MEI also formally exchanges information with Argentina, France, Sweden and the United Kingdom.

1.4 Environmental Issues

MEI is presently in the process of developing a formal environmental policy. The following provides, in outline, MEI's various existing environmental policies for expedition cruising which will form the basis of the formal environmental policy.

- Expedition cruising offers an unique opportunity to visit some of the world's rare and remote places in an intelligent, comfortable and safe way. These are trips designed for people who are truly interested in their destination; we have done away with black-tie dinners, focusing instead on an enriching program of talks, lectures and shore excursions. Our goal is to provide great value - without sacrificing quality.

- Expedition cruises are educational - although not tediously so. We uphold the belief that controlled tourism by well-informed, well-prepared travellers in small groups has an ultimately positive effect on the fragile ecosystems of this world; they know best what they stand to lose.

As a member of the IAATO since 1994, MEI abides by the Guidance for Visitors to the Antarctic (previously the Guidelines of Conduct for Antarctica Tour Operators) (Appendix I) and the Guidelines of Conduct for Antarctica Tour Operators. The Guidance for Visitors to the Antarctic mirror Antarctic Treaty Consultative Meeting (ATCM) Recommendation XVIII-1 on tourism and non-governmental activities which was approved at ATCM XVIII in Kyoto, Japan in April 1994. The tour operator guidelines list requirements for: legislation, visitor management, lecturers, staff, crew and passengers, communication, and waste management.

Article 8 of the Madrid Protocol refers to the requirement of environmental assessments "pursuant to scientific research programs, tourism and all other governmental and non-governmental activities in the Antarctic Treaty area ... " (SCAR 1992). The IAATO supports "environmentally sound tourism", believes that the Madrid Protocol is the most desirable policy framework for tourism and endorses the preparation of environmental impact assessments for its members (IAATO 1992).

MEI has not previously undertaken an environmental impact assessment of its Antarctic and Southern Ocean activities. This IEE represents the

third environmental assessment undertaken by an Antarctic tourism operator in the IAATO.

1.5 IEE Preparation and Distribution

Poles Apart, an independent, international environmental consulting company, was commissioned to prepare the IEE. Field work was conducted during January and February 1995 in the South Atlantic sector of Antarctica and sub-Antarctic South Georgia Island. Poles Apart accompanied each of the three ships used by MEI during this period. During September 1994 Poles Apart was given access to all relevant files and documents at the headquarters of Marine Expeditions Inc. in Toronto, Canada.

The IEE refers to a number of documents available in the Antarctic literature. A select number of these documents have been reproduced in the text or as appendices. Copies of other material not reproduced in the IEE could be obtained from MEI or the IAATO Secretariat. Other legislative and technical documents can be obtained directly from the relevant national or international organisations.

A draft version of the IEE will be submitted to the Antarctic Treaty Consultative Meeting (ATCM XIX) in Korea in May 1995 and the Scientific Committee on Antarctic Research (SCAR) through its Group of Specialists on Environmental Affairs and Conservation (GOSEAC). It will be circulated to relevant non-governmental organisations and other interested parties to obtain a range of feedback. Comments and suggestions should be sent to Poles Apart and will be included in the final version of the IEE.

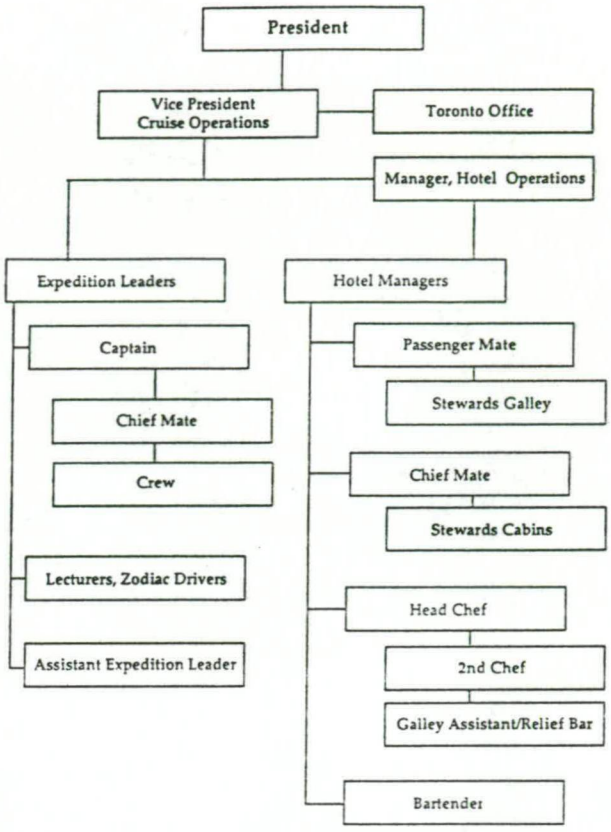
2.0 Description of Marine Expeditions Inc.

2.1 Type of Activity

MEI describes itself as an adventure travel and ecotourism company based in Toronto, Ontario, Canada selling and operating tours to both the south and north polar regions (Figure 2). They operate seasonal tourist cruises to Antarctica and Southern Ocean regions, including the Falkland Islands, South Georgia and South Orkney Islands. In the 1994/95 season MEI had approximately 20 percent of the Antarctic seaborne tourism market. MEI has plans to include two more ships in the 1995/96 season.

MEI is incorporated in Canada, employs a full time staff of fourteen, and began operating as a company in the 1994-95 season undertaking 33 trips to Antarctica with a total of 2,020 passengers (Table 1). In the 1993/94 season MEI was jointly involved with Polar Expeditions and operated 16 trips to Antarctica carrying 699 passengers. Ships are chartered by MEI for Antarctic and Southern Ocean cruises. During the 1994-95 season, three ships were

Figure 2: Marine Expeditions Inc. - Company Structure



chartered for various periods. MEI provides retail and wholesale ticketing. They also provide block bookings to travel agents for Antarctic cruises.

MEI holds a Protection and Indemnity (P & I) policy that includes public liability and sudden and accidental pollution subject to the "American Institute Pollution Exclusion Clause and Buy-Back Endorsement A (July 4, 1976)". The liability of this coverage is limited to US$50 million, all inclusive.

2.2 Description of MEI's Operations

The Antarctic season commences in November and ends in March. All ships depart from Ushuaia, Tierra del Fuego, Argentina and concentrate their activity in the Antarctic Peninsula and nearby islands (usually north of 65 degrees South latitude) and three marine and sub-Antarctic island groups (South Georgia, South Orkney Islands and Falkland Islands).

There are several stages in the process of organising and operating cruises. The initial stage is selling, booking and providing pre-departure documentation; the second stage is briefing and familiarisation of passengers, staff and crew; finally, there is the running of the cruise itself.

Table 1: Marine Expeditions Inc. - Passenger Summary 1994-95 Season		
	Number of Voyages	Total Passengers
Akademik Ioffe		
7 night trips	1	68
8 night trips	7	505
10 night trips	2	162
13 night trips	2	170
Total	12	905
Akademik Sergey Vavilov		
8 night trips	7	519
11 night trips	1	84
13 night trips	1	57
24 night trips	1	81
Total	10	741
Livonia		
8 night trips	7	271
10 night trips	2	68
13 night trips	2	35
Total	11	374
Combined Total	33	2,020

The term staff refers to direct employees of MEI (i.e. Expedition Leaders, Hotel Managers, lecturers, Zodiac drivers). The Vice President, Cruise Operations is responsible for MEI's environmental compliance in this process.

In brief, the first stage commences with ship charter arrangements, initial itinerary planning and advertising. Relevant permissions, requirements for notification and courtesy letters are dealt with. Staff are appointed. Passengers are sent a briefing pack on confirmation of booking.

At the start of the season and commencement of each cruise a series of briefings are given to staff, passengers and ship's crew. These include ship safety requirements, ship routines, landing procedures and activities ashore. Cruises are run along well established lines, and one that has a high degree of flexibility to allow for weather and ice conditions, other vessels and unforseen circumstances. Radio contact is made on a routine basis with ships in the area and stations to which visits are planned.

All the ships are equipped with Zodiac Mark IV (Heavy Duty) inflatable craft fitted with 40 horsepower Mercury outboard motors. These use a two-stroke oil/gasoline mix.

During a cruise the day is filled by landings, lectures, and presentations. Landings by Zodiac occur during the day and are typically 2-4 hours duration. Zodiac cruising involves taking passengers on wildlife and scenic viewing trips for up to two hours. MEI uses a personalised check off system to keep track of passengers ashore. The passenger list is the responsibility of a staff member whereby each passenger must be sighted before leaving or returning to the ship. A recap session is often held to reinforce the educational part of the cruise and to allow passengers to comment on activities.

MEI publishes details of pre-arranged tours to a variety of Antarctic and sub-Antarctic destinations. In addition, MEI has provided logistic support to scientific and private expeditions which is outlined in Section 2.5.

2.3 Expedition Leaders

The Expedition Leader is responsible for the safety of the passengers and staff and in charge of overseeing MEI's environmental responsibilities. The Expedition Leader works closely with the Hotel Manager whose responsibility it is to coordinate accommodation, food preparation and distribution. The Hotel Manager also has responsibility in overseeing MEI's waste management environmental responsibilities.

MEI provides an Expedition Leaders' Handbook on every ship. The Handbook is used extensively by every Expedition Leader. Relevant environmental points in the Handbook are listed below:

- briefing requirements for the Zodiac;
- protected areas and areas off limits;
- emergency procedures;
- Zodiac operations manual;
- expedition ship preparation in Ushuaia;
- IAATO's Guidelines of Conduct for Antarctic Tour Operators ;
- IAATO's Guidance for Visitors to the Antarctic;
- landing details and restrictions that apply;
- US Antarctic Conservation Act of 1978; and
- the United States Antarctic Program observers program.

The Expedition Leaders' Handbook also provides details on emergency contacts at sea and emergency procedures. MEI also publishes safety/emergency procedures for their staff. Expedition Leaders routinely brief staff, passengers and crew on safety procedures. The Expedition Leaders' end of cruise reports regularly contain comments on safety.

2.4 Permissions

The Vice-President, Cruise Operations is responsible for obtaining relevant permissions to visit Antarctic and sub-Antarctic sites. The process requires a long lead time because of the number of different countries, departments and formalities involved. Formal permissions are required for South Georgia and the Falkland Islands. There is currently no Canadian domestic legislation requiring permits for Antarctic tourism companies.

2.5 Scientific Cooperation and Environmental Projects

During the 1994/95 season MEI assisted in the following scientific and environmental projects.

- Scott Polar Research Institute, University of Cambridge, Cambridge, United Kingdom. MEI participated in the ongoing tourism impact study led by Dr Bernard Stonehouse at Cuverville Island. MEI ships provided logistical support to Project Antarctic Conservation (PAC) researchers throughout the season. The PAC has produced draft management recommendations for visitor sites in Antarctica for (a) Cuverville Island, Errera Channel, (b) Hannah Point, Livingston Island, and (c) Port Lockroy, Wiencke Island (PAC 1994 a, b, c).

- Oceanites Foundation, USA. Ron Naveen of Oceanites commenced a site monitoring project in conjunction with the United States Antarctic Program (Oceanites 1994). The project intends to catalogue the physical and biological characteristics of more than 60 locations in the Antarctic Peninsula. MEI assisted with logistic support by transporting researchers aboard three voyages and transporting the same group to various study sites throughout the season.

- Instituto Fueguino de Turismo (INFUETUR), Ushuaia, Argentina. The Antarctic Unit of INFUETUR, in conjunction with MEI, undertook a series of environmental tourism workshops this season. All passengers aboard Livonia were invited to participate in the program designed to assess tourist impressions and suggestions on the sustainable development of Antarctic tourism. The results of the workshop will be presented at the 1995 ATCM in Korea. Diana Galimberti, the Coordinator of INFUETUR, was an official observer on two MEI voyages (Vavilov and Livonia).

- Polish Academy of Sciences, Poland. MEI sponsored a clean up project of the Polish research base, Henryk Arctowski, at the end of March 1995. The project involved the volunteer international environmental non-profit organization, the View Foundation. Approximately 60 tonnes of abandoned equipment and hazardous oil products were removed from the base for recycling and disposal in Poland.

- Palmer Station, United States Antarctic Program, USA. During one voyage MEI participated in an ongoing tourism impact study at Torgersen Island. Preliminary findings of this study were disseminated at the IAATO/NSF meeting in July 1994.

- International Centre for Antarctic and Industrial Research (ICAIR), Christchurch, New Zealand. Every MEI voyage completed the International Database on Antarctic Tourism (IDAT) reporting forms. Coordinated through ICAIR, the information is intended to create an international baseline data on Antarctic tourism. This system will assist reporting under Antarctic Treaty Recommendation VIII-9, Annex C, which requires information on passenger nationality, visitor sites, landings on shore, and Zodiac cruising.

- Swedish Polar Research, Sweden. The Swedish Government has instigated a permitting system for Swedish nationals travelling to Antarctica. An official of the Swedish Polar Institute accompanied an MEI voyage to begin an assessment of the permitting process.

3. Description of Operational Area

MEI currently operates in the Atlantic sector of the Southern Ocean which includes the Antarctic Peninsula, islands of the Scotia Arc and the Falkland Islands. This is an important area in terms of breeding species, historical sites and current national operations. Three areas are defined for the purposes of this IEE:

- Oceanic (e.g. Southern Ocean);
- Sub-Antarctic Islands (e.g. South Georgia); and
- Maritime Antarctic (e.g. South Orkney Islands, Antarctic Peninsula).

3.1 Physical Characteristics

3.1.1 Oceanic

The Southern Ocean and related oceanic systems are important in terms of the world's climate. The Atlantic sector of the Southern Ocean is seasonally ice covered in winter to about 60 degrees South latitude. During summer the pack ice line typically withdraws south of the islands of the Scotia Arc into the Weddell Sea. On the Peninsula, pack ice may be met anywhere south of Anvers Island (64 degrees South latitude). Icebergs may be encountered well to the north of the Polar Front and present a significant shipping hazard around South Georgia and in the Falkland Current.

3.1.2 Sub-Antarctic Islands

South Georgia, Shag Rocks and offlying islands are within the Polar Front. They are mountainous, variously glaciated and often of volcanic origin. They lie within the predominantly westerly airstream that is common between 50 and 60 degrees South latitudes. The climate is cold, wet and windy.

3.1.3 Maritime Antarctic

The northern half of the Antarctic Peninsula and islands of the Scotia Arc, except South Georgia, are the main Maritime Antarctic areas, characterised by extensive exposures of rock during summer melt periods, high precipitation and seasonally open small lakes and ponds.

3.2 Biota

The three regions have a diverse biota that clearly demonstrates a classic biogeographical change from sub- to continental Antarctic over a comparatively short distance. The Atlantic sector of the Southern Ocean is a major breeding area for several species of penguin, petrels and seals, and is an important migratory destination for southern cetaceans. Crucially, it has experienced several phases of virtually uncontrolled exploitation of marine living resources. The krill and finfish take continues to be regulated by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).

3.2.1 Oceanic Biota

Antarctic food chains are typically short. During summer, the retreating ice front and near-24 hour daylight over much of the Southern Ocean drives phytoplankton blooms. Certain regions (e.g. Bransfield Strait) are important for primary productivity leading to massive zooplankton aggregations upon which many species of birds, seals, and whales feed. Inshore marine biota is surprisingly rich and provides a food source for

many species of breeding birds. Migrating species of birds and whales, notably Arctic tern (Sterna paradisea) and Humpback whales (Megaptera novaeangliae) tend to follow the retreating pack ice line during spring and summer.

3.2.2 Sub-Antarctic Islands

Typically these islands are treeless, windswept and tundra-like. There is a range of soils from weathered mineral deposits to peaty soils underlying grass and moss. Lakes and ponds are common, some of which have a well developed ecology.

Coastal and lower-lying areas have an extensive endemic vascular flora, which itself supports a rich invertebrate fauna, many of which are also endemic. Lichens, bryophytes and hepatics are also common, extending beyond the range of the vascular flora.

The islands support a wide range of penguin and bird species including certain land birds (e.g. South Georgia pipit, Anas georgicus) and seals. Large populations breed or moult on land and feed in coastal or oceanic waters. Various island systems have been affected by the recovery of the Antarctic fur seal population (Arctocephalus gazella) and disturbed by introduced land mammals such as cats, rats and reindeer. These have been responsible for reduction in burrowing petrels, overgrazing, trampling and flattening of tussock (Poa flabellata) grassland, changes that have allowed skua populations to increase.

The South Georgia population of wandering albatross (Diomedea exulans) has been declining in recent years. This has largely been due to by-catch from longliners.

3.2.3 Maritime Antarctic

The combination of ice-free habitat and relatively mild climate provide favourable conditions for vegetation. Most ice-free areas are typical Antarctic Fellfield but extensive areas may be covered by bryophytes and hepatics. Only two vascular plants are recorded. Enrichment of coastal cliffs by sea spray and nesting birds results in large colourful stands of lichen. Blooms of snow algae are typical on islands of the Scotia Arc and Peninsula during the summer. These result in red, green/yellow or grey coloration of the snow (Kerry 1993:56).

The terrestrial invertebrate community is relatively poor and consists mostly of decomposers with a few micro-predators. Two species of wingless midge are found on the Antarctic Peninsula. Freshwater lakes and ponds are common, ranging from oligotrophic to highly enriched, the latter dominated by phytoplankton.

Petrels are the most abundant of the 16 species of seabirds recorded in the Maritime Antarctic. Avifauna is dominated by penguins although all sea birds that breed in the region are common. The Atlantic sector is the centre for the chinstrap penguin (Pygoscelis antarctica) population but there are also large populations of Adelie and gentoo penguins (Pygoscelis adeliae, Pygoscelis papua).

The inshore coastal marine environment is subject to frequent and severe scouring by ice and there is sparse biota in the littoral zone. At protected sites and below the ice-scour level there are substantial algal growths and associated fauna. The rich marine fauna contrasts strongly with the relatively impoverished land biota.

All Antarctic seal species breed in the Maritime Antarctic, although fur seals are uncommon until adult males come ashore to moult. Considerable damage to the vegetation of low lying coastal areas has resulted from fur seals. Crabeater (Lobodon carcinophaga), Ross (Ommatophoca rossii) and leopard seals (Hydrurga leptonyx) breed circumpolarly in the pack-ice zone.

3.3 Protected Areas

Current Antarctic legislation under the Agreed Measures denotes protected areas as a Specially Protected Area (SPA), Sites of Special Scientific Interest (SSSI) or as Historic Sites and Monuments (HSM). Annex V of the Madrid Protocol redefines these areas as Antarctic Specially Protected Areas (ASPA) and Antarctic Specially Managed Areas (ASMA). ASMAs may include Historic Sites and Monuments. Although the Madrid Protocol has not come into force, some States are applying the more detailed ASPA and ASMA procedures.

The Antarctic Peninsula is particularly rich in historical monuments as well as having a large number of protected areas including some marine sites. Scientific and past exploration activity and the increase in tourism to the area has resulted in protected areas being concentrated in the Antarctic Peninsula and Ross Sea regions with a scattering of sites elsewhere in Antarctica.

3.4 Wilderness, Aesthetic and Recreational Values

All three areas have remarkable wilderness and aesthetic value. They constitute some of the most physically remote areas in the world and have seen remarkably little human activity. There has never been any continuous human occupation of the region. Aesthetically, the land areas are characterised by glaciated landscapes, isolated mountain peaks and extreme weather conditions. In concert, these characteristics represent exceptional Antarctic wilderness and aesthetic values.

Antarctica provides unique recreational and tourism opportunities. The Antarctic Peninsula in particular has opportunities for special interest groups, including photography, wildlife observation and mountaineering. Huts and remains from expeditions, especially from the 'Heroic Era' of exploration, are a further attraction as is visiting active scientific stations.

4.0 Ship Operation and Management

4.1 Jurisdiction

Antarctic Treaty Recommendations XV-3 and XV-4 give guidance for disposal of waste by ships. Recommendation XV-4 includes reference to the MARPOL. The MARPOL deals with all forms of ship-generated marine pollution, defines substances which are marine pollutants and determines where and how a substance can or cannot be discharged.

The Antarctic area, defined in the MARPOL Annex I, Regulation 10 as the sea south of 60 degrees South latitude, has been designated a Special Area. More stringent rules apply to marine shipping activities in Special Areas than elsewhere. The declaration of the Antarctic as a Special Areaxa totally prohibits the discharge of oil and oily mixtures from ships. The Marine Environmental Pollution Committee (MEPC) has made further resolutions to give guidance to ship operators and to provide specifications for ship-board equipment to match the MARPOL discharge requirements. A recent amendment to the MARPOL requires ships to have oil spill contingency plans.

There are five Annexes to the MARPOL. Annex I (oil and oily mixtures) and Annex II (noxious liquid substances in bulk) are mandatory upon ships registered with a signatory state. Annex III (harmful packaged substances), Annex IV (sewage, not yet in force) and Annex V (garbage) are optional.

Annex IV of the Madrid Protocol refers to the MARPOL (discharge of sewage). Many Antarctic Treaty States are signatories to the MARPOL, however, some key departure ports, such as Stanley, Falkland Islands are in countries which are not signatories. Recommendation XV-4(4) exhorts parties which have not acceded to the MARPOL (and other conventions) to do so. None-the-less, MEI applies the same procedures whatever the port's domestic legislative status.

4.2 Description of Ships and Inflatable Craft

MEI chartered three ice strengthened ships of Russian or Estonian registry for the 1994/95 season (Table 2) each staffed by Russian or Estonian officers and crew. The Captains of each of the ships were aware of the Special Area status of Antarctica under the MARPOL.

Table 2: Description of Ships used by Marine Expeditions Inc. in the 1994/95 Season

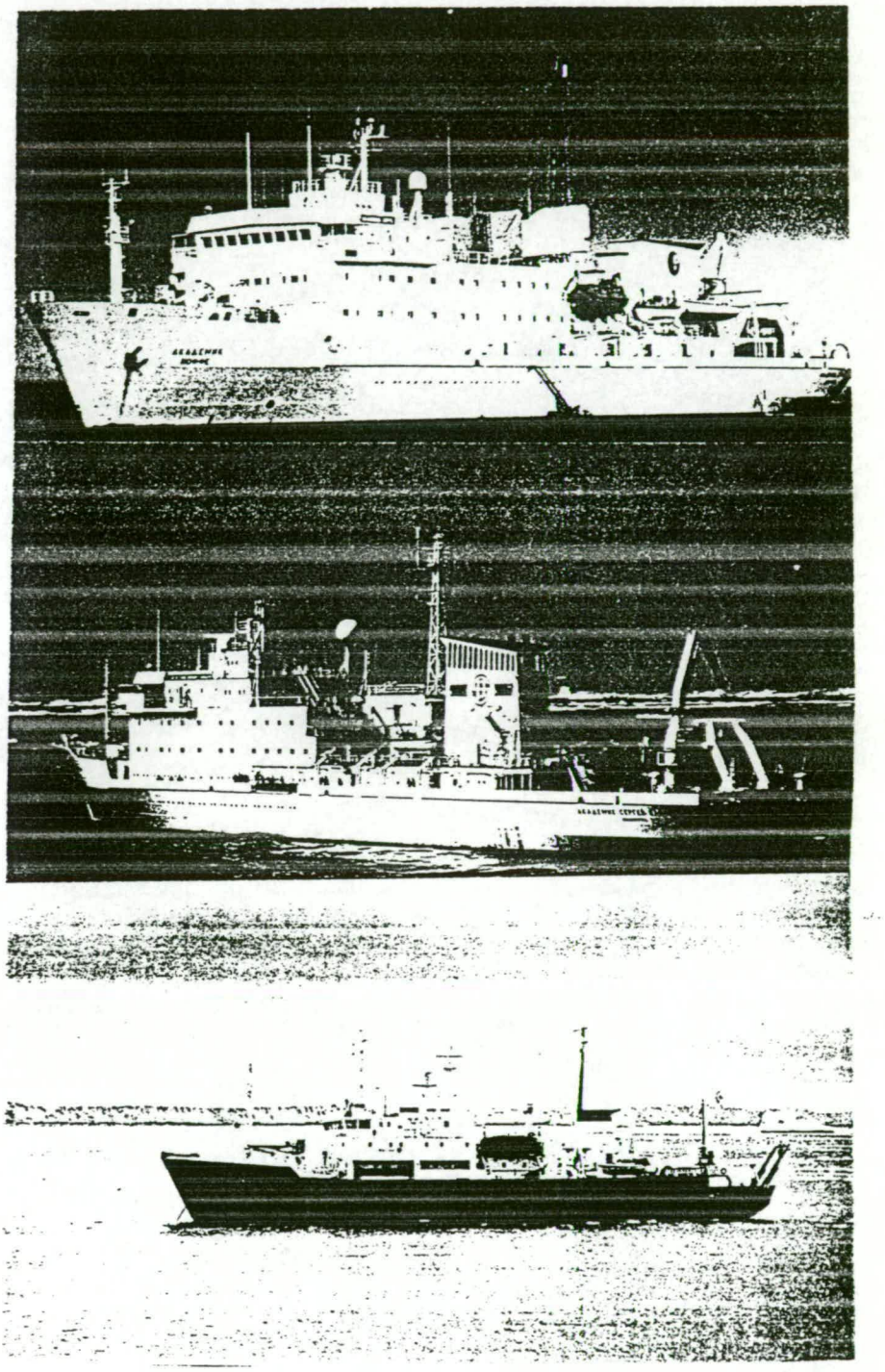
Akademik Ioffe
Finnish built, 1989, Holming Shipyard
Ice Class: KM*L1[1]A1, Canadian Type B
Power: 5,000 KW Diesel Twin engine, twin propeller 600 KW bow and stern thrusters
Length: 117 m
Breadth: 18.2 m
Draft: 5.9 m
Gross Registered Tonnage: 6,231
Number of Zodiacs: 5
Crew (including ship staff): 53
Passenger Capacity: 79

Akademik Sergey Vavilov
Finnish built, 1988, Holming Shipyard
Ice Class: KM*L1[1]A1, Canadian Type B
Power: 5,000 KW Diesel Twin engine, twin propeller 600 KW bow and stern thrusters
Length: 117 m
Breadth: 18.2 m
Draft: 5.9 m
Gross Registered Tonnage: 6,231
Number of Zodiacs: 6
Crew (including ship staff): 53
Passenger Capacity: 79

Livonia
Finnish built, 1984
Ice Class: KM*L1[1]A2
Power: 2 x 1,148 kW diesel
Length: 71.6 m
Breadth: 12.8 m
Draft: 4.5 m
Gross Registered Tonnage: 2,140
Number of Zodiacs: 3
Crew (including ship staff): 42
Passenger Capacity: 38

Akademik Ioffe (Figure 3 - top) and Akademik Sergey Vavilov (Figure 3 - middle) are sister ships built in 1989, while Livonia (Figure 3 - bottom) was built in 1984. All three ships were equipped with Zodiac craft, a library/card room, saloon bar, sauna and laundry. A Russian or Estonian medical Doctor accompanied each voyage.

Figure 3: Ships Chartered by Marine Expeditions Inc. in the 1994/95 Season - Akademik Ioffe (top), Akademik Sergey Vavilov (middle), Livonia (bottom)



These ships are designed for long endurance at sea. The amount of fuel consumed by each ship varied according to weather and ice conditions. Ioffe used in the order of 1,363 tonnes of marine diesel for the season whilst Vavilov used approximately 1,300 tonnes of marine diesel. Livonia used approximately 893 tonnes of marine diesel for the season. The main fuels used throughout the season were: light marine diesel, gasoline, two-stroke oil, and marine engine oils.

4.3 Waste Management

The five Annexes of the MARPOL provide for control of pollution at sea. By 1987, Russia had acceded to all Annexes and by 1992, Estonia had acceded to all Annexes. Many other States have taken reservations on some parts. Annexes I, IV, V require the issue and regular renewal of inspection certificates. These are:

- International Oil Pollution Prevention Certificate;
- International Sewage Pollution Prevention Certificate; and
- International Garbage Pollution Prevention Certificate.

4.3.1 Oil and Oily Mixtures - Annex I

Oil and oily water mixtures were collected and stored. Oily water mixtures were passed through a separator system which removed the oil and stored the separated water residue in tanks. The oil was burnt in the incinerator at 800 degrees C and the residue was released according to Annex I, Regulation 9 requirements. The discharge outlet was fitted with a switch that shut off if the oily mixture exceeded 15 ppm. Oily water residues were only discharged at sea when en route. The optical/electronic switches fitted to the ships were inspected. Outlet valves were sealed when the ships were within 12 nautical miles of land or ice shelf. The treatment of the oil and oily water mixtures met the MARPOL regulations and relevant inspection certificates were valid.

4.3.2 Sewage - Annex IV

Discharge of sewage at sea is prohibited unless it has been: (a) discharged through an approved system; (b) stored in holding tanks and discharged in an approved manner; or (c) processed in an approved treatment plant.

All the ships met the MARPOL requirements for sewage treatment. Ioffe and Vavilov were fitted with Salen and Wicander Neptumatic-Retro sewage and waste water treatment plants. All sewage, grey water and kitchen sink water was stored in a holding tank until it could be processed. The storage capacity for grey water on Ioffe and Vavilov was 14 cubic metres, for black water 14 cubic metres and for the galley 9 cubic metres. Total storage capacity was 39 cubic metres per ship. The treatment plant chlorinated and flocculated sewage, separating solids and liquids. Liquid

waste was held in tanks and disposed when beyond 12 nautical miles from land, ice shelves or north of 60 degrees South latitude. Sewage sludge was drawn from the treatment plant and incinerated. The galley holding tank was released every five days. The sewage discharge provisions of the ships were inspected and met relevant MARPOL requirements and relevant inspection certificates were valid. Discharge provisions also met the IAATO Tour Operator Guidelines. Sewage was flushed with seawater.

4.3.3 Garbage - Annex V

Annex V lays down conditions for the prevention of pollution by discharge of garbage from ships. Restrictions particularly apply to the discharge of garbage into coastal waters of designated Special Areas such as the Antarctic. The guidelines on the implementation of Annex V includes advice on minimising the amount of potential garbage, shipboard garbage handling and storage procedures, and shipboard equipment for processing garbage.

Solid waste generated onboard can be classified as wet or dry. Wet garbage is predominantly kitchen waste, generated largely from food preparation and disposal. Dry garbage includes kitchen waste and waste generated by passengers, staff and crew. Wet garbage may either be incinerated, macerated and released, or dumped directly over board (in certain areas).

The MARPOL restrictions prevent the dumping of macerated waste in the Antarctic Special Area when the ship is less than 12 nautical miles offshore. Macerated waste must pass through a 25 mm mesh. Onboard Vavilov and Ioffe wet garbage was macerated and stored in tanks until it could be released into the sea. North of 60 degrees South latitude wet garbage was not dumped over the ship's stern. Wet garbage was stored in the macerator room until such a time as it could be macerated and discharged. It was noted that, occasionally, small amounts of plastic from wrappings and containers were macerated or dumped with the wet garbage.

On every ship an attempt was made to separate avian products from other kitchen waste. Onboard Livonia avian products were stored separately and disposed of in Ushuaia. All uncooked poultry products were macerated with other kitchen waste and removed from the Antarctic Treaty area as required by Recommendation XV-3(14).

All putrescible wastes were sorted out into slop buckets during food preparation. Approximately 25 to 30 slop buckets (each approximately 3 kg) were generated per day. Onboard Vavilov and Ioffe the maceration system (affectionately known as the 'crocodile') produced approximately 3 cubic metres per 8 day voyage or approximately 80 cubic metres for the season. On Livonia the maceration system did not work. Putrescible wastes were stored in a series of bins for disposal in Ushuaia.

On Livonia plastic storage bins were located at the stern of the ship and garbage was sorted into each. These bins were then emptied into the garbage skips provided by the Ushuaia Port Authority. Although the garbage was sorted at the source there was no method of recycling the waste at the disposal site. Eight large black plastic bags of garbage were removed from the Scott Polar Research Institute's Project Antarctic Conservation field huts on Cuverville Island and disposed of in Ushuaia.

Onboard incineration of waste is an approved garbage treatment process under the MARPOL, and MEPC 59(33) incorporates specifications for shipboard incinerators. Revised guidelines for the implementation of Annex V (MEPC.59(33)) has standard specifications for incinerator plants with capacities up to 1,160 kW per unit. This resolution was adopted on 30 October 1992 but not yet entered into force (expected date is March 1996). The specifications set minimum temperatures of 850 degrees C and an Annex gives emission standards.

Dry garbage has the capability of being incinerated at between 400 to 600 degrees C at a rate of 30 kg per hour. However, dry garbage was not usually incinerated, rather it was stored for later disposal in Ushuaia. Medical wastes, including sharps, and all plastics were included in the dry garbage. The MARPOL totally prohibits the discharge of plastics at sea. Oil residues and sludges were incinerated on all ships. Incinerator ash was cleaned out weekly and stored in plastic bags for disposal in Ushuaia.

In most cases the IAATO Guideline 16 for operators, which states that all plastic should be retained for proper disposal on the mainland, was met.

Antarctic Treaty Recommendation XV-3(7) details items prohibited from Antarctica including polystyrene beads and chips. There was no evidence of these prohibited items. Recommendation XV- 3(11) lists items which must be removed from the Antarctic Treaty area and includes electrical batteries. Onboard Livonia an attempt was made to separate batteries from the regular garbage stream however it was not widely known by passengers. The batteries were disposed of in Ushuaia.

Madrid Protocol Annex III (1) encourages the consideration of recycling and source reduction of waste. MEI complies with the spirit of this legislation, and all bar and saloon waste was separated. Neither the MARPOL nor the IAATO Guidelines make recommendations about recycling.

Approximately 5 to 10 cubic metres of garbage was normally disposed of by each ship in Ushuaia at the termination of each 8 day voyage. The garbage consisted of cardboard, plastic, putrescible wastes, paper, glass, aluminium cans, wood, oily rags and ash from the incinerator. Over the total season MEI disposed of approximately 200 to 400 cubic metres of garbage in Ushuaia.

MEI provided staff, crew and passengers with biodegradable 'Green Pens' on every ship. There was no specific waste stream from the Doctor's surgery for items containing blood or used needles.

Cardboard boxes used for food storage were disposed of in Ushuaia. Approximately 1 cubic metre of waste cardboard was generated per 8 day voyage. All wooden crates used for fresh food storage were returned for reuse in Ushuaia to the food wholesalers. Approximately 15 to 20 wooden crates would be returned per 8 day voyage. Recyclable paper and used one-sided paper was used in the onboard MEI offices.

Most of the cleaners used onboard had instructions in German and these were not translated. Staff and crew who spoke English, Russian or Estonian often did not know how to correctly use each product. The provisioning of the ships specifies that low phosphate cleaners and toilet products should be used for all MEI ships. Drinking water was supplied in plastic containers which ended up in the waste stream.

The ships met relevant MARPOL and IAATO requirements for garbage disposal. Relevant inspection certificates were valid. The garbage refuse site in Ushuaia, Argentina was inspected. No recycling of any waste material occurs. The wooden food storage boxes were reused.

4.3.4 Ballast Water

Resolution MEPC.50(31) was adopted in 1991 and contains International Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharges. The Guidelines encourage appropriate ballast water management practices, aimed at preventing or minimising the uptake and discharge of contaminated water or sediment in ballasting and deballasting operations. In the absence of more scientifically based means of control, the exchange of ballast water in deep ocean areas or open seas is encouraged by the Guidelines as a means of limiting the effect of the transfer of contaminants in ballast water.

The ships chartered by MEI released only clean ballast from the Southern Ocean and met the MEPC Guidelines. No tank washing water or other oily residues and mixtures were released.

4.3.5 Anti-fouling Paints

Anti-fouling hull coatings, especially self polishing copolymers (SPCs) containing tributylin (TBT) are a marine pollutant. TBT has been found to produce deformities in various shellfish and marine life. MEPC Resolution 46(3), adopted 16 November 1990, considers measures to control potential adverse impacts associated with the use of TBT. Few countries formally prohibit the use of TBT anti-fouling paints by ocean

going ships. There is greater concern about repair and dry-docking of TBT coated ships and the potential for environmental impact by dock discharges. As major ship repairs are not normally scheduled during the Antarctic operations the problem of SPC/TBT is considered negligible. Routine maintenance, including painting above the waterline, continued in Antarctic waters. No anti-fouling coatings were applied within the Antarctic Treaty area.

4.4 Transport

4.4.1 Embarkation

Passengers, staff and crew disembarked the ships from the gangway when tied to a wharf or by Zodiac from the gangway. There are few permanent wharfs in Antarctica or the Southern Ocean region. Ships tied up to whaling station wharfs at Grytviken, South Georgia.

4.4.2 Zodiacs

Zodiac craft typically carry 10-12 passengers, are normally deployed by crane with a driver onboard and come alongside the gangway to load. Once in the water, the Zodiacs came alongside the ship's gangway and tie up whilst passengers were loaded into the craft. MEI Zodiac guidelines are outlined in Table 3.

Zodiacs use 40 horsepower outboard engines and have a maximum speed of approximately 15 knots. Gasoline was stored in 200 L drums on deck and transferred from the drums using semi-rotary or rotary pumps either to small fuel cans (Jerry cans) or directly into outboard fuel tanks. Two-stroke oil was added to give the correct running mixture. Scuppers were not plugged on any of the ships during refuelling of the Zodiacs. Only on Livonia were absorbent mats used when the Zodiacs were refuelled. The mats were incinerated at regular intervals.

MEI monitored Zodiac fuel consumption in a trip log for each outboard engine used on every ship. A total of 14 Zodiacs were used by MEI in the 1994-95 season. Lube oil which was often delivered in 200 L drums was secured on the stern next to the gasoline drums. Contaminated fuel was stored in empty 200 L drums and returned to Ushuaia. Oily rags used on the outboard engines were incinerated onboard.

Outboard engines are notorious for seeping fuel mix. There was nearly always an oil film left behind by idling or stationary engines. These losses were negligible, especially where the site was continually subjected to wave, wind or tidal action. Of greater importance was the control of refuelling onboard the ship to prevent accidental spillage, prevention of loss of gasoline and gasoline mixes through scuppers, and spillage due to

Table 3: Zodiac Safety Guidelines for Passengers

Much of the success that we enjoy on our expeditions is due to the proper use and handling of Zodiac landing craft. These craft are ideal for our operations, as they allow us access to otherwise inaccessible locations. They have shallow drafts, and contain six air-filled compartments which give them impressive flotation and weight carrying ability. The compartments are connected by valves which allow the internal air pressure to be regulated and they stay afloat even if one, or several, compartments become deflated. With these safe, durable and dependable boats we land at various sites such as: beaches, shallow river banks, rocky outcrops, ice floes, as well as more conventional locations such as docks, sea walls and jetties.

Passengers must be aware of, and adhere to, the following regulations regarding Zodiacs in order to assure landing operations.

- the Zodiac driver is in charge of the boat and its operations. Passengers must follow his/her instruction at all times;
- all passengers must wear Zodiac safety life vests, regardless of weather conditions. Drivers must also wear a life-vest or Mustang suit;
- no standing in the Zodiac, unless authorised by the driver;
- never smoke in or around the Zodiacs;
- when stepping into or out of the Zodiac, passengers should accept the helping hand of the Zodiac driver and or crew members. The "sailors grip" (gripping each other's wrists) is the preferred, much stronger grip;
- passengers should try and minimise the number of separate articles taken along in the Zodiacs. Backpacks are ideal for carrying cameras, binoculars, rain gear, extra shoes, etc. Carry-on items may be handed to the Zodiac driver or crew members while embarking and disembarking;
- always remain seated in the Zodiac and listen to the drivers' instructions before disembarking;
- during "wet" landings one may safely get in or out of the Zodiac by first sitting on the rubber pontoon and then swinging one's legs over the side. Always wait for instructions from the driver during landings;
- use a weatherproof bag (or bring along a small plastic bag) to protect non-waterproof items such as cameras and binoculars from sea spray or rain;
- never disembark over the wooden transom (stern); and
- Zodiac's carry safety kits, including space blankets, tool kit, first aid kit and food. Passengers should know where these are kept.

damage or overturning of craft. Storage and refuelling onboard should be reviewed so that accidental spillage or drum leakage does not occur.

Each Zodiac carried an emergency kit in complete order. Foot pumps were properly secured and available to all Zodiacs.

4.5 Port Facilities

MEI used shipping agents to deal with port arrangements for ships. Agents were responsible for a wide variety of activities including passenger transfers and assisting in ship resupply and refuelling. In the case of waste removal, dockside garbage containers were available in Ushuaia, Argentina. These containers were provided by the Ushuaia Port Authority as part of port charges. The garbage containers at Ushuaia met the provisions under the MARPOL and were emptied at a landfill site located approximately 10 km west of Ushuaia. The site was inspected and would meet the requirements of the Madrid Protocol (Annex IV, Article 8).

Approximately 200 tonnes of water from Ushuaia is taken onboard per 8 day voyage, or approximately 8,000 tonnes for all three ships for the season. The cost of garbage collection and water is paid by MEI.

At the completion of a cruise or at the end of the season, glass bottles and aluminium cans were disposed of in Ushuaia. This exceeded the MARPOL requirements which only require that waste is disposed of greater than 12 nautical miles offshore, once outside designated Special Areas.

Refuelling occurred at Ushuaia and was undertaken in accordance with the MARPOL, Annex I. Scuppers were stopped during the process and a crew member was present during the whole operation in case emergency shut-down was required.

4.6 Emergency Response, Accidents and Spills

The number of Zodiacs on each ship allowed a margin of safety for seaborne passenger operations. If one Zodiac was in trouble or had engine failure it was normal for another to be close enough to effect a rescue. Each Zodiac craft carried safety kits.

No fuel spills of any size were recorded over the season. The MARPOL Annex I, Regulation 26 provides for fuel spill contingency plans. The Madrid Protocol Annex IV, Article 12 adds further requirements for fuel spill and contingency planning. While the ships complied with the MARPOL requirements (the contingency plan was in Russian or Estonian), further contingency planing for gasoline should be addressed by MEI.

5. Management of Staff, Passengers and Crew

5.1 MEI Staff

The IAATO Tour Operator Guidelines set minimum standards for staff qualifications, numbers with previous Antarctic experience, and visitor to staff ratios. MEI policy is only to use staff with which they are familiar, a policy which it extends to sub-charters and block bookings.

The responsibility for passenger transfers from the ship's officers to the Expedition Leader once they have boarded the Zodiacs. It is the staff's responsibility to ensure guidelines are adhered to ashore.

MEI has produced an "Employee Policy Manual" which assists staff in "job performance by outlining their philosophies and goals and the methods and regulations to achieve them". Failure to comply with any environmental regulation could result in the dismissal of the employee. Environmental responsibilities are further mentioned in the manual under ecotourism where it is acknowledged that:

> Ecotourism is our business. This means that respect for the environment and proper knowledge of our impact on the sensitive regions we are visiting is of the utmost concern. Any form of pollution or unfavourable environmental impact cannot be tolerated. Be sure to set a good example, avoid excess waste, recycle and never pollute in any way.

Staff had access to all client information packages and received a briefing on joining the ship. The briefing included safety, communications, environmental requirements and staff/client relations. Some staff had relevant polar experience and mountaineering expertise, others were employed for their reputation as naturalists, geologists, historians or similar skills. The IAATO recommends that a minimum of 75% of staff have previous Antarctic experience. This was met or exceeded on all cruises. Competition for Zodiac driving jobs is high, none-the-less, few drivers had been trained professionally, such as that given by sea-survival courses run for the oil industry.

Expedition Leaders and lecturers often changed between cruises. A meeting was held soon after embarkation of each cruise to discuss the itinerary, plan lectures and outline general procedures onboard during transfers and ashore. Passengers are often split into groups for ease of management.

5.2 Passengers

The MEI policy for visitor management is to meet the IAATO Guidance for Visitors to the Antarctic and the Tour Operator Guidelines. Cruises had an educational as well as enjoyable component, and in some cases academic instruction and course-related field trips and excursions were provided. Lecturers employed for each cruise represented a range of disciplines and all were under the direction of the Expedition Leader.

Passengers received the following documents from MEI prior to departure:

- Antarctica: Pre-Departure Information (practical information, clothing list, notes on photography, reading list, traveller's code, cancellation insurance);
- Expedition Cruising: Tierra del Fuego, Antarctica, the Falkland Islands (136 page overview of the region that includes history, politics, geography and biology);
- Antarctic Travellers Code - "A Quick Checklist" (a summary for Antarctic visitors and tour companies);
- Guidelines of Conduct for Antarctic Visitors (includes a summary of the Agreed Measures and the US Marine Mammal Protection Act 1972);
- Zodiac Safety Guidelines for Passengers; and
- Important Information - Please Read Me (five page summary of housekeeping and ship information).

Passengers, staff and the ship's crew were briefed before and at various stages during cruises. Each passenger received the information listed above on confirmation of booking. Information available onboard complemented the pre-departure information.

After embarkation, passengers were given an introduction to, and compulsory safety briefings about, the ship. This was followed at a suitable time by a complete introduction and briefing on the running of landings and management of passengers ashore. Reference was made to the IAATO Guidance for Visitors to the Antarctic and only on Livonia were the Guidelines presented in a detailed fashion. A video tape supplied by the NSF about the US Antarctic Conservation Act was generally made available although not all passengers elected to watch it. Passengers were directed not to smoke ashore, and advised of smoking restrictions onboard. Restrictions applying to littering, eating on shore and toilets were discussed. The cleaning of boots was covered but only with respect to penguin guano, not for introduced species. No mention was made of removing batteries from the waste stream, although a dedicated box was available for disposal on Livonia.

Separate briefings were not always held for non-English passengers. Typically, the translator was the group leader, who may also act as a

lecturer/guide but may not be a MEI employee. Misunderstandings over procedures and guidelines were more likely with non-English speaking groups and they required disproportionately more time and attention.

5.3 Ships, Anchorages and Passenger Transfers

The ship provided more than just transport between landings. Many areas are inappropriate for landing passengers and routes were chosen for their scenic quality. Size and capability of the vessel was a factor as much as weather conditions in the choice of landing sites.

The Captain, in conjunction with the Expedition Leader, chose the anchorages. The Expedition Leader would often make suggestions in order to facilitate Zodiac journeys.

In crowded locations such as the Antarctic Peninsula, the Expedition Leader attempted to keep in reasonably close contact with other ships in the region to avoid unplanned meetings and overcrowding at anchorages. Stations required reconfirmation of arrival time of at least 24 hours but HF radio or satellite contact was not always established. Radio communications equipment onboard Russian vessels has restricted frequencies, which did not always match the working frequencies of stations or other ships. Contact was usually established by VHF radio once in range.

On arriving at a potential landing, a reconnoitre was made by a single Zodiac with MEI staff. A second craft was not always immediately ready if an accident should occur. If conditions were suitable then a landing would be initiated. The first craft ashore took most of the lecturers who reviewed the landing and made shore-side arrangements before the first passengers arrived 10-30 minutes later. Typically, a shuttle system was run so that passengers could choose the time they wished to spend ashore. The Expedition Leader, Zodiac drivers and some lecturers carried VHF radios to maintain contact between ship and shore.

5.4 Management of Passengers Ashore

Landings were made at any time, starting as early as 0530 and continuing until late at night if light allowed. Most Zodiac landings or tours were for 2-4 hours duration. Passengers were put into landing groups and taken ashore in groups of 10-12 in Zodiacs. At many sites the Zodiacs provided a useful filter to the speed of transfer of passengers, allowing groups of 15-20 to move off the landing before further came ashore. At all landings the number ashore was less than 100.

Activities ashore varied between cruises. The first Zodiac always took staff. At some sites the staff gave passengers a reminder of guidelines and indicated points of interest as they landed. On others, passengers were put

ashore and left to decide their own route. Passengers, in formal or informal groups, were either accompanied by a lecturer, or staff were sited at points of interest or where particular care was needed. In some cases no guides accompanied the first passengers (rather they assisted with unloading incoming passengers) and this resulted in some passengers getting too close to animals or visiting areas that might have resulted in unnecessary disturbance.

Many passengers preferred to roam at will around the site. Staff were responsible for ensuring guidelines and had to remind passengers from time to time to act correctly. Towards the end of the shore period staff guided passengers back to the landing spot for re-embarkation. When appropriate, ship's crew were offered tours ashore, although the opportunities were infrequent.

The potential for impact varied greatly between landing sites. At some locations on the Antarctic Peninsula and on many sub-Antarctic islands, there are extensive areas of moss and vegetation where uncontrolled passage of large numbers of passengers could cause considerable damage. A further consideration is the transfer of non-indigenous species. Footwear was washed at some locations, mainly for cleaning purposes. Passengers seemed unaware of the need to prevent transfer of non-indigenous species.

Generally the IAATO Guidance for Visitors to the Antarctic were adhered to. Tourists remained a minimum of 3-5 m from wildlife, and were careful when walking amongst colonies and along the beach where seals were lying. Passengers visiting the Antarctic for the first or only time wished to have photographs of themselves with penguins and seals. This sometimes led to posing closer to wildlife than is acceptable. The cost and time involved in Antarctic expedition cruising is such that many can afford only one trip to the continent. Those that have made repeated trips to the continent, and there are a surprisingly large percentage who have, tended not to have the same immediacy or desire to approach wildlife. In some cases however the ingress and egress points for penguins into water were blocked, mostly inadvertently, by passengers.

Noticeable also were two types of passenger that often approached too close to wildlife. They were professional photographers (of any nationality) and non-English speaking passengers. The professional photographers used the cruises to enlarge their portfolio and as a consequence had self-imposed pressure to recover the cost of the trip in picture sales later. Expedition Leaders and lecturers had to occasionally remind some photographers of the guidelines.

The second type suffered through a dilution of instructions via translation. Some clearly came from countries where environmental issues are not given the priority they are in Antarctica. They had to be reminded not to approach wildlife too closely.

Smoking restrictions resulted in a number of passengers and crew smoking on deck. As an inevitable result, ash and cigarette filters were sometimes seen on the decks. No provision was made for collection of these, and some must have been washed or blown over board.

There was no evidence of illegal souveniring of rocks, feathers or historical artifacts or the deliberate disposal of garbage ashore or at sea.

5.5 Visitor Numbers

The IAATO Tour Operator Guidelines recommend a limit of 100 passengers ashore on a landing at any one time. In all instances MEI meet these guidelines. More difficult to assess is when MEI should avoid overly frequented landings and how to recognise signs of degradation. Little research has been published on the requirements of cumulative impact assessment for repeated landings in Antarctica and even less on the requirements of strategic environmental assessment in the tourism industry. As seen in Section 2.5, MEI supports a number of scientific and environmental projects that are attempting to understand the magnitude and extent of impact related to visitor numbers in Antarctica.

5.6 Ship's Captain and Crew

Briefings were given to the ship's crew at the start of the first cruise of the season, using translators where necessary to explain guidelines and practices. Many in the crew came from a background with different standards of environmental awareness. The following impact from the ships' crew were reported: feeding skuas; smoking on Zodiacs; and disposing of cigarette filters overboard.

6. Description of Methods and Data Used to Forecast the Impacts of Existing Activity

6.1 Prediction, Data and Information

Environmental impact assessment (in this case an IEE) is equivalent to impact prediction (Beanland and Duinker 1983). Prediction refers to changes from baseline conditions as demonstrated by the results of monitoring. Baseline activities should be directed towards establishing quantitative descriptions of selected environmental attributes prior to project implementation.

Although MEI is an existing tourism company the predictive effort of this IEE will be made in Section 7 on the likely direct environmental impact of MEI's operations. Poles Apart has made audit arrangements with MEI to include post-implementation evaluation of the accuracy of the assessment and appropriate response to the results of monitoring activities.

Previous research on environmental impact and existing environmental impact assessments provide much useful data and information on assessment methods and direct, indirect and cumulative effects for the present IEE. Benninghoff and Bonner (1985:42-51) have assessed activities that might be expected to have a significant impact on the Antarctic environment. The Environmental Impact Statement for the United States Antarctic Program (NSF 1981), the EIA for the oil salvage operation on the Bahia Paraiso (Acero, et al. 1992), the Comprehensive Environmental Evaluation (CEE) for stratigraphic drilling east of Cape Roberts, Southwest Ross Sea (Keys 1992) and the New Zealand Antarctic Program Audit (NZAP 1994) all provide useful information on direct, indirect and cumulative effects specific to the Antarctic environment.

Three impact categories are specified in Article 3 of Annex I of the Madrid Protocol. The COMNAP (1992) definition of each category is adopted for this IEE. Direct effects are defined as any first order effect, impact or consequence that may be associated with an activity. For example, acute toxicity effects (mortality) in marine birds, or in intertidal limpets, or in pelagic krill caused by exposure to toxic constituents of petroleum products spilt at sea. Indirect and second order effects are defined as: [a]ny second order effect, impact or consequence that may be causally associated with an activity. For example, particulate emissions from combustion leading to melting of ice or snow that subsequently causes loss of ice or snow algae habitat. Cumulative impacts are: effects, impact, or consequences that may come from similar or varied sources, but that are additive, antagonistic or synergistic in their effect, impact or consequence. For example, disturbance to nesting skuas caused by existing scientific use and by a proposed use.

The limitations of the availability of baseline information limits the predictive capacity of the IEE to that of direct effects. Gaps or deficiencies in

the narrative methodology will be fully disclosed and suggestions will be made as to the direction that further research might be aimed in the following sections.

7. Likely Direct Environmental Impacts of the Existing Activity

The following environmental impacts associated with MEI's operations are compared against existing international standards. If the level of environmental impact meets or exceeds the international standard then MEI's compliance is met and the impact is of a minor or transitory level. The types of impacts included in the IEE are:

- air quality;
- marine pollution;
- noise;
- ground disturbance;
- flora/fauna disturbance.

7.1 Exhaust emissions from the three ships produce atmospheric pollution in the form of nitrogen oxides (NOx), sulphur dioxide (SO_2), carbon monoxide, hydrocarbons and particulates. Ship transport is relatively energy efficient compared with road or rail (energy consumed by road transport is 0.7 to 1.2 Megajoules/tonne-km compared with 0.3 Megajoules/tonne-km for a medium sized container ship) (International Chamber of Shipping 1993). Over the course of the season a total of 3,556 tonnes of fuel was consumed by the three ships used by MEI. The scale and distribution of the atmospheric pollution is considered to have a minor or transitory impact on the Antarctic environment.

7.2 The oily film produced by idling or stationary Zodiacs is an unavoidable impact. This was considered negligible as these minor spills were rapidly dispersed by wave, wind or tidal action. Although no spills were recorded during shipboard refuelling of Zodiac tanks there remains the potential for accidental spillage, loss of gasoline and gasoline mixes through scuppers and spillage due to damage or overturning of craft. Spills at sea are most likely to be less than 10 L which may cause a local impact. The volatility of gasoline indicates that this would have no more than a minor or transitory impact on the Antarctic environment. Spillage ashore could have a more serious impact but all refuelling was done onboard the ships.

7.3 Putrescible wastes were macerated daily on Vavilov and Ioffe and disposed in the Southern Ocean beyond 12 nautical miles from land or ice shelf and often in the Drake Passage. Approximately 80 cubic metres of macerated waste entered the Southern Ocean over the summer season. The disposal of putrescible waste met the Madrid Protocol and the MARPOL requirements. Macerated waste was disposed in the Southern Ocean and Drake Passage where the buffering capacity is considered high.

Putrescible wastes on Livonia were returned to Ushuaia for disposal. The amount of putrescible waste entering the sea is considered to have a minor or transitory impact on the Antarctic environment.

7.4 Sewage was chlorinated and flocculated in treatment plants, which separated solids and liquid factions. Liquid waste was held in tanks and discharged beyond 12 nautical miles from land, ice shelves or north of 60 degrees South latitude. Sewage sludge was drawn from the treatment plant and incinerated. The buffering capacity of the Southern Ocean (and regions greater than 12 nautical miles from land or ice shelf) is considered high and therefore the amount of treated sewage entering the sea is considered to have a minor or transitory impact on the Antarctic environment.

7.5 Oil and oily water mixtures were collected and stored. Oily water mixtures were passed through a separator system which removed the oil and stored the separated water residue in tanks. The oil was burnt in the incinerator at 800 degrees C and the residue was released according to Annex I, Regulation 9 requirements. The discharge outlet was fitted with a switch that shut off if the oily mixture exceeded 15 ppm. Oily water residues were only discharged at sea when en route. Outlet valves were sealed when the ships were within 12 nautical miles of land or ice shelf. The treatment of the oil and oily water mixtures met the MARPOL regulations and relevant inspection certificates were valid. The impact of the oil and oily water mixtures entering the sea is considered to have a minor or transitory impact on the Antarctic environment.

7.6 The use of incinerators was minimal as most dry and wet garbage that was not macerated was disposed of in Ushuaia. For this reason the atmospheric pollution from the incinerator is considered to have a minor or transitory impact on the Antarctic environment.

7.7 The measure of noise and associated impact with the ships, Zodiacs and humans is difficult to ascertain and it is an area that deserves more research. However, there was no evidence to suggest that the ships or the Zodiacs impacted the wildlife in more than a minor or transitory manner. Likewise with humans visiting rookeries, there was no evidence to suggest that human-generated noise adversely impacted the wildlife. For this reason noise was considered to be a minor or transitory impact on the Antarctic environment.

7.8 In Ushuaia a 5 to 10 cubic metre garbage container was filled per 8 day voyage. This garbage included wet and dry garbage and approximately 1 cubic metre of waste cardboard. Over the total season the three MEI ships would contribute approximately 80 cubic metres to the Ushuaia garbage disposal site. An MEI representative did not inspect the garbage disposal facility in Ushuaia. Greater effort should be directed to reducing the amount of garbage entering the Ushuaia disposal site and the possibility of

recycling should be investigated by the Argentine Government. The disposal of garbage in Ushuaia was considered to have a negligible impact on the Antarctic environment.

7.9 MEI carried a total of 2,020 passengers during the 1994/95 summer season. Landings were made at different sites on the Peninsula and in the South Orkney Islands and South Georgia. Passenger numbers ashore did not exceed the IAATO guidelines and the behaviour of passengers was consistent with the guidelines at all sites. The Guidance for Visitors to the Antarctic were abided. Landings are therefore considered to have a minor or transitory impact on the Antarctic environment.

The localised impact could increase in some instances with the arrival of more than one ship at a location. All attempts were made to avoid encountering other vessels during landings and MEI never landed at the same site as another vessel. The total impact by MEI operations on the aesthetic and wilderness values of these regions of the Antarctic is considered to be minor or transitory.

7.10 There is a cumulative impact on the Antarctic environment of the approximately 9,000 tourists visiting Antarctica in the 1994/95 season. As MEI passengers constitute approximately 20 percent of the total numbers they must contribute to the cumulative impact of the Antarctic environment. Research on the cumulative impact of tourists is in its infancy and monitoring is underway to make detailed assessments. Early indications are that human presence at penguin colonies, provided guidelines are followed, may have a minor or transitory impact (Nimon et al 1995). Section 2.5 outlined scientific and environmental projects supported by MEI. Some of these projects will assist in assessing cumulative impact whilst others will be actively removing garbage from Antarctica.

8. Alternatives

Reasonable alternatives to MEI's existing Antarctic and Southern Ocean operations are presented below in concert with an analysis of the environmental impacts associated with each alternative. This is done so that a comparison of environmental consequences can be made. Typically, investigation alternatives implies reviewing options including the following: locations or sites; different technologies or materials; use of pre-existing facilities; and timing and duration.

8.1 No Action

The first option is to discontinue MEI's existing Antarctic and Southern Ocean operations (i.e. the no action alternative). The advantage of this option is that there would be less tourism impact in Antarctica, South Georgia and South Orkney Islands. However, MEI have expertise in

providing an Antarctic tourism business over the last two years. The company brings a measure of control, accountability and monitoring to the commercial sector. MEI supports the environmental guidelines of the IAATO. In the absence of MEI, other Antarctic tourist operators would continue to visit Antarctica, and in some cases without any form of environmental assessment. For these reasons the option of discontinuing MEI's operations is rejected.

8.2 Concentration of Operations

The second option is to concentrate all operations and visitor activity on one ship capable of carrying from 100 to 250 passengers. The advantage of using a different size ship means that tourism impacts could be concentrated over time and space. For instance the amount of fuel consumed and the associated atmospheric pollution could be reduced by having one ship compared to operating three ships. The disadvantage is the concentration of visitors at each site and the environmental impact associated with disembarking 100 passengers over limited space and time. MEI considers that the smaller ships to be most environmentally appropriate. The concentration of greater than 100 passengers ashore is considered to be environmentally damaging and MEI has rejected this option.

8.3 Permanent Facility on the Continent

The third option is to provide a permanent tourism facility on the Antarctic continent. The advantages are that it would provide a formal educational and interpretation facility that could disseminate environmental guidelines to a wide variety of tourists. The disadvantages are that it would concentrate tourism activity in a selected area and most likely increase the environmental impact associated with trampling, souveniring and disturbance of wildlife. This option has been rejected by MEI because of the potential environmental damage to the Antarctic environment.

8.4 Fly Passengers to King George Island

The fourth option is to fly passengers to King George Island using the airstrip at the Chilean Marsh Station and then transferring passengers to the ships. The advantages would be less ship traffic across the Drake Passage and therefore less sewage disposal, incineration and the amount of fuel consumed. The disadvantages would be that waste discharges would then occur largely in the Bransfield Strait and those areas south to 64 degrees South latitude. The possible environmental impact associated with refuelling ships from King George Island is considered to have a potential impact. The unpredictability of the weather also increases the chance of accidents and associated environmental impact with greater aircraft traffic. The storage of wastes for each ship would be problematic

over the length of the summer season. Wastes could not be disposed of in Ushuaia on a regular basis over the operational season. The transfer of passengers by aircraft between Ushuaia to King George Island has been rejected because the problems of waste management, fuel spills and jettisoning, and the possibility of aircraft accidents.

8.5 Different Antarctic Location

The fifth option is for MEI to shift its operations to a different Antarctic location. The advantage of this would be that the environmental impacts associated with the ship and the passengers would likely be in areas not largely frequented, such as East Antarctica. The disadvantage with this option is that the present route south of Ushuaia is the shortest from any continent. Any alternative routing would require greater time at sea and therefore a proportionately higher use of fuel, disposal of wastes and incineration. In addition, the Peninsula is already an impacted region from tourism activities and national operations. This option is not considered environmentally acceptable.

8.6 Expansion of Operations

MEI intends to continue using its three ships in 1995/96 season. They are, however, considering the use of two more small ships for next season. This would bring the total number of MEI chartered ships to five. The extra two ships could add approximately 1,000 to 1,500 more passengers and 20 more voyages for the season and increase the total MEI passenger numbers to about 3,000. The ships being considered are small polar vessels capable of carrying 38 passengers. MEI believes that it can successfully increase its capacity whilst maintaining the present level of environmental impact on the Antarctic environment at a minor or transitory level. MEI also believes that the social benefits of responsible visits to Antarctica outweigh the impacts and that tourists can act as 'ambassadors' for the region promoting environmentally sustainable activities.

9. Mitigation Measures

MEI undertakes the following:

9.1 Prior to arrival in Antarctica, MEI passengers, staff and the ship's Captain and crew are briefed on the IAATO Guidance for Visitors to the Antarctica.

9.2 MEI abides by the IAATO Guidelines of Conduct for Antarctica Tour Operators, attends the NSF/IAATO annual meetings and obtains the appropriate licenses to visit Antarctic and sub-Antarctic locations.

9.3 MEI actively encourages Antarctic scientific cooperation and supports environmental projects that are studying the potential impact of tourism.

9.4 MEI carries industry standard Protection and Indemnity policies that includes public liability and sudden and accidental pollution to a limit of US$10-50 million.

9.5 Captains of all ships chartered by MEI recognise and abide by the MARPOL designation of the sea south of 60 degrees South latitude as a Special Area.

9.6 Educational and interpretation information supports the minimisation of environmental impact from passengers, staff and crew.

9.7 MEI Hotel Managers have introduced a system reducing the normal washing cycles of passenger towels thus reducing the amount of effluent discharged from the ship.

9.8 On every ship an attempt was made to separate avian products from other kitchen waste as required by Recommendation XV-3(14).

9.9 Low phosphate cleaners were specified in the provisioning process and used on all ships.

9.10 Every 8 day voyage returns 15 to 20 wooden crates for reuse to food wholesalers in Ushuaia.

9.11 MEI Hotel Managers have not allowed prohibited products onboard the ships.

9.12 MEI has commissioned this IEE in order to assess its environmental impact.

10. Monitoring

MEI undertakes some monitoring of their operations. Additional procedures that should be included to provide data and information to minimise environmental impacts are included in the Recommendations (Section 13).

10.1 MEI attends the annual NSF Tour Operators Meeting to review visits to US Antarctic stations, discuss upcoming itineraries, United States Antarctic Program publications, status of USAP science, observers reports and developments in environmental regulations.

10.2 Every MEI voyage completed the International Database on Antarctic Tourism reporting forms. This system will assist reporting under Antarctic Treaty Recommendation VIII-9, Annex C, which requires information on passenger nationality, visitor sites, landings on shore, and Zodiac cruising.

10.3 The Canadian office of SCAR opened at the University of British Columbia, Vancouver, Canada. MEI has formally commenced exchanging information on its operations with the Canadian SCAR office.

10.4 The amount of gasoline and oil used in Zodiacs is monitored ensuring that seepage does not increase with a malfunctioning engine.

10.5 Passengers are continually monitored by the Expedition Leader, staff and lecturers in order to ensure compliance with existing IAATO guidelines. Transgressions are noted in the Expedition Leaders' log book.

11. Audit Arrangements

Audit arrangements include post-implementation evaluation of the accuracy of the assessment and appropriate response to the results of the monitoring activities. MEI will be responsible for both the accuracy and the assessment of the monitoring activities.

12. Conclusions

The IEE concludes that the environmental impact of MEI's current commercial activities are considered consistent the Antarctic Treaty and its Recommendations, the Agreed Measures, the principles of the Madrid Protocol (Annex I - Environmental Impact Assessment and Annex III - Waste Disposal and Waste Management), and the environmental regulations outlined in the MARPOL. MEI's seaborne commercial tourism operations are considered to have a minor or transitory environmental impact on the Antarctic environment and its dependent or associated ecosystems.

12.1 Office Procedures

12.1.1 An approved company environmental policy is fundamental to effective planning and management. MEI is currently developing an environmental management policy based on its policy for expedition cruising (Section 1.4), the Expedition Leaders' Handbooks (Section 2.3), its Employee Policy Manual (Section 5.1) and the IAATO guidelines. Environmental considerations were taken into account by the owners, personnel and expedition staff in operational planning.

12.1.2 Information gathering on environmental issues and regulations within the office was spread throughout various files and often different individuals had relevant information and detail. There was little central organisation of environmental material.

12.1.3 MEI representatives attend the annual NSF Tour Operators Meetings which were considered helpful and useful for the dissemination of information on recent developments in environmental regulations and responsibilities.

12.1.4 Information received on protected areas needs to be formalised in a central file, updated yearly.

12.1.5 Information flow between management and employees, especially to Expedition Leaders and Antarctic staff, needs to be formalised, especially environmental requirements, contingency planning and waste management procedures.

12.1.6 MEI has a formalised safety/emergency policy. There was no formalised medical policy.

12.1.7 The process of obtaining access permissions was well managed by the Vice President, Cruise Opertions.

12.2 Management of Ships

12.2.1 Brief fuel contingency plans had been prepared and complied with minimum MARPOL requirements. However, they were published in Russian or Estonian and therefore were not readily accessible in English. They did not contain provisions for containment for Zodiac operations. Antarctic Treaty Recommendation XIV-4(6) provides for the establishment of contingency planning.

12.2.2 Waste management on the ships generally matched or exceeded the MARPOL regulations. However, waste management procedures should be prescribed in order that Captains, Expedition Leaders and staff are briefed on their requirements and informed of changes.

12.2.3 Separation of plastic from wet food waste was not always effective resulting in a very small amount of plastic entering the maceration system.

12.2.4 Sorting of garbage is only useful for incineration purposes. Sorting of garbage for recycling is not useful until Ushuaia provides suitable reception facilities.

12.2.5 Attempts were made to remove batteries from the Antarctic Treaty area. Prohibited products such as polystyrene beads were not seen. In some instances MEI discusses packaging with suppliers, however, packaging of stores could be further reduced.

12.2.6 The separation of uncooked poultry products and wrappings from other food waste always occurred. Separation and proper disposal of poultry products was a priority with all Hotel Managers.

12.2.7 Smoking was permitted on deck and it has been noted that a very small number of cigarette filters were sometimes disposed of in the ocean. There was no evidence of cigarette filters disposed on land.

12.2.8 Information on the Antarctic Treaty, the Recommendations and the Madrid Protocol was generally available onboard the ship in an accessible form to passengers.

12.3 Management of Staff, Passengers and Crew

12.3.1 Generally passengers were well managed ashore, however, additional care was needed when passengers were allowed to wander freely, especially in areas of extensive vegetation and at certain times during seabird breeding cycles. Passengers should be made aware of ingress and egress points for all wildlife.

12.3.2 In some cases the IAATO guidelines were not explained in sufficient detail to passengers.

12.3.3 Lecturers employed by MEI represented a range of environmental awareness and ability to manage passengers.

12.3.4 Prevention of transfer of non-indigenous organisms was not discussed by Expedition Leaders. This is particularly important to avoid accidental transfer between ice-free areas and sub-Antarctic islands.

12.3.5 In some very limited cases the ship's crew caused the greatest environmental impact at landings. Increased coordination between MEI staff, the Captain and crew will be required to enforce environmental guidelines.

12.3.6 Not all Antarctic Treaty documents were available in the languages of the passengers and crew.

12.3.7 There was no evidence that passengers, staff or crew entered into any protected area or historic site and monument.

13. Recommendations

The following recommendations will assist in the development of improved environmental procedures, and reduce the environmental impact of MEI's Antarctic and Southern Ocean operations.

13.1 MEI should utilise the conclusions and recommendations of this IEE along with its policy for expedition cruising, the Expedition Leaders' Handbooks, its Employee Policy Manual and the IAATO guidelines to assist in the development of a formal company environmental management policy. The policy should be stated on all its advertising material where appropriate.

13.2 MEI should compile an Environmental Handbook of information relevant to its operations drawing from this IEE and from its existing policies listed in Section 13.1. This should include legislation, permits and general information required for continuing the environmental verification process. Sections of the Handbook could be translated to relevant languages.

13.3 The Environmental Handbook should include procedures for emergency response and contingency plans for fuel spills.

13.4 MEI should prepare a waste management plan as outlined in the Madrid Protocol Annex III, Article 8. This plan should be incorporated into the Environmental Handbook. One section of the Handbook should specifically deal with hotel management and be used in the pre-season briefing given to Hotel Managers.

13.5 Instructions to Captains and Expedition Leaders should be formalised as Sailing Orders. Reference should be made in these orders to the Environmental Handbook. The staff and crew should continue to be briefed about the environmental responsibilities of MEI.

13.6 MEI, along with IAATO members, should consider adopting the Management Recommendations for Visitor Sites in Antarctica prepared by Project Antarctic Conservation, Scott Polar Research Institute, University of Cambridge, Cambridge, UK.

13.7 MEI should discuss with their suppliers and agents the reduction of packaging of ships' stores whilst ensuring the elimination of prohibited materials.

13.8 MEI and their agents should encourage that ports receiving waste from Antarctic and sub-Antarctic voyages install reception facilities for recycling. MEI should promote this through the IAATO.

13.9 Poultry products (including poultry preparation products and wrappings) should continue to be separated from other food wastes in the kitchen. Poultry products should be kept in a secure store prior to disposal. No poultry products should be taken ashore on landings.

13.10 Crew and kitchen staff should be encouraged to take greater care when separating plastics from wet garbage (e.g. food wastes).

13.11 Batteries should be kept separate from other waste and removed from the Antarctic Treaty area. Passengers, staff and crew should be officially informed of this procedure.

13.12 Hotel Managers should ensure that all staff know how to use the cleaners provided onboard. Instructions should be translated into Russian, Estonian and English.

13.13 MEI should design and install deck-mounted ashtrays for smokers.

13.14 Aluminium can crushers should be mounted in the bar and the kitchen. Staff, crew and passengers should be encouraged to crush all aluminium cans in order to reduce the volume of waste entering the Ushuaia garbage depot.

13.15 Consideration should be given to recycling all aluminium and glass from MEI's operations by transporting the material to a recycling depot in North America or Europe after the ship is repositioned.

13.16 The practice of serving drinking water in plastic containers should be reconsidered. Each ship could be provisioned with bulk drinking water and then served in reusable jugs or containers.

13.17 All foot wear should be clean before entering ice-free areas in order to reduce the likelihood of the introduction of non-indigenous organisms. Footwear should be washed after all ice-free landings to reduce the likelihood of transfer. Staff and passengers should be briefed of the need to avoid unintentional transfer.

13.18 Consideration of the choice of sites should include regard to the effective control of passengers ashore to prevent trampling of moss and vegetation. MEI, through the IAATO, should support the installation of duck-boarding where trampling is otherwise unavoidable.

13.19 MEI should review the training of Expedition Leaders, lecturers and Zodiac drivers to improve environmental awareness and knowledge of health and safety procedures. Training should include relevant information on the Antarctic Treaty, Recommendations, the Agreed Measures (protected areas) and the Madrid Protocol in an accessible form.

The IAATO guidelines should be explained in detail to all passengers at the initial briefing session.

13.20 MEI should review the briefing and training of ships' crew to encourage increased environmental awareness and compliance with Antarctic Treaty, its Recommendations and the Madrid Protocol.

13.21 The workshop on "Tourism and the Role of Environmental Education", jointly supported by MEI and INFUETUR, should be encouraged in the following seasons.

13.22 MEI should propose that the IAATO translate all relevant Antarctic Treaty material and the IAATO guidelines in the four Treaty languages: English, French, Spanish and Russian.

13.23 MEI should require each ship, as part of its charter, to detail all operational discharges into the atmosphere and ocean.

13.24 The pre-charter survey should ensure that relevant MARPOL criteria for discharges are met. MEI should ensure that the ships chartered for the 1995/96 season abide by the revised guidelines for the implementation of Annex V (MEPC.59(33)) on specifications for incinerator plants.

13.25 The requirements for oil spill contingency planning in Annex I, Regulation 26 of the MARPOL comes into force for all ships (previously only applied to new ships) on 4 April 1995. MEI should ensure that the regulation is abided by for the 1995/96 season.

13.26 MEI (in conjunction with other tourism operators) should examine the application of cumulative impact assessment for IAATO members and the Antarctic tourism industry.

14. References

Acero, J.M., Agraz, J.L., Aguirre, C. A., Marschoff, E.R. and Coosen, J. 1992. Environmental Impact Assessment associated with the salvage operation of the remaining oil of the Bahia Paraiso. Instituto Antartico Agentino, Argentina and Rijkswaterstaat - Tidal Waters Division, The Netherlands.

Beanlands, G.E. and Duinker, P.N. 1983. *An Ecological Framework for Environmental Impact Assessment in Canada.* Federal Environmental Assessment Review Office, Ottawa, Canada.

Benninghoff, W.S. and Bonner, W.N. 1985. *Man's Impact on the Antarctic Environment.* Scientific Committee on Antarctic Research and International Council of Scientific Unions, Cambridge, 56p.

Brown, 1994. *Environmental Audit Guidebook.* Centre for Professional Development, Melbourne, Australia.

Committee of Managers of National Antarctic Programmes and Scientific Committee on Antarctic Research (cited as COMNAP), 1992. The Antarctic Environmental Process: Practical Guidelines. SCAR, Cambridge, 14p.
Croxall, J.P. 1993. in litt. British Antarctic Survey, Cambridge,UK.

Doake, C.S.M., 1987. Keystone to Gondwana, Chapter 13, In: Walton, D.W.H. (ed), *Antarctic Science.* Cambridge University Press, Cambridge, UK.

Goodall, B. 1995. Environmental auditing: a tool for assessing the environmental performance of tourism firms. *The Geographical Journal,* Vol. 161, No. 1.. pp. 29-37.

International Association of Antarctica Tour Operators (cited as IAATO) 1992. Responsible Tourism in Antarctica. Antarctic Treaty Consultative Meeting information paper. XVII ATCM/INFO 76, 12 November.

International Chamber of Shipping 1993. *Shipping and the Environment: A Code of Practice.* London, UK.

International Union for Conservation of Nature and Natural Resources (IUCN) 1991. *A Strategy for Antarctic Conservation.* Gland, Switzerland.

Kerry, K. 1993. Antarctic fauna and flora: conservation issues; pp. 53-74, In: *Towards a Conservation Strategy for the Australian Antarctic Territory.* Handmer, J. and Wilder, M. (eds), Centre for Resource [a]nd Environmental Studies, Australian National University, Canberra, Australia.

Keys, J.R. 1992. Draft Comprehensive Environmental Evaluation. Antarctic Stratigraphic Drilling East of Cape Roberts in Southwest Ross Sea, Antarctica. Department of Conservation, Turangi, New Zealand, 93p.

MARPOL 1992. *MARPOL 73/78 Consolidated Edition, 1991. Articles, Protocols, Annexes, Unified Interpretations of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto.* International Maritime Organization, London, UK.

National Science Foundation (cited as NSF) 1981. US Antarctic Program, Final Environmental Impact Statement, Washington, D.C.

New Zealand Antarctic Program 1994. *New Zealand Antarctic Program Environmental Audit Under the 1991 Madrid Protocol.* Royds Garden, Christchurch, New Zealand.

Nimon, A.J., Stonehouse, B and Schroter, R.C. 1995. Heart Rate of Disturbed Penguins. *Nature*, Volume 374, 30 March, p.415.

Oceanites 1994. Antarctic Site Inventory: Scope of Work. Unpublished paper, Cooksville, USA.

Project Antarctic Conservation (cited as PAC) 1994 a, b, c. Draft management recommendations for visitor sites in Antarctica for (a) Cuverville Island, Errera Channel, (b) Hannah Point, Livingston Island, and (c) Port Lockroy, Wiencke Island. Scott Polar Research Institute, University of Cambridge, Cambridge, UK.

Scientific Committee on Antarctic Research (cited as SCAR) 1985. Conservation areas in the Antarctic, Cambridge, UK.

Scientific Committee on Antarctic Research (cited as SCAR) 1989. Waste Disposal in the Antarctic. Report of the SCAR Panel of Experts on Waste Disposal. Australian Antarctic Division, Kingston, Australia.

Scientific Committee on Antarctic Research (cited as SCAR) 1992. The Protocol on Environmental Protection to the Antarctic Treaty, with Annexes, done at Madrid 4 October 1991, and an additional Annex done at Bonn 17 October 1991, SCAR Secretariat.

Appendices

Appendix 1: Guidance for Visitors to the Antarctic

Activities in the Antarctic are governed by the Antarctic Treaty of 1959 and associated agreements, referred to collectively as the Antarctic Treaty System. The Treaty established Antarctica as a zone of peace and science.

In 1991, the Antarctic Treaty Consultative Parties adopted the Protocol on Environmental Protection to the Antarctic Treaty, which designates the Antarctic as a natural reserve. The Protocol sets out environmental principles, procedures and obligations for the comprehensive protection of the Antarctic environment, and its dependent and associated ecosystems. The Consultative Parties have agreed that, pending its entry into force, as far as possible and in accordance with their legal system, the provisions of the Protocol should be applied as appropriate.

The Environmental Protocol applies to tourism and non-governmental activities, as well as governmental activities in the Antarctic Treaty Area. It is intended to ensure that these activities do not have adverse impacts on the Antarctic environment or on its scientific and aesthetic values.

This Guidance for Visitors to the Antarctic is intended to ensure that all visitors are aware of, and are therefore able to comply with, the Treaty and the Protocol. Visitors are, of course, bound by national laws and regulations applicable to activities in the Antarctic.

1. Protect Antarctic Wildlife
Taking or harmful interference with Antarctic wildlife is prohibited except in accordance with a permit issued by a national authority.

- Do not use aircraft, vessels, small boats, or other means of transport in ways that disturb wildlife, either at sea or on land.
- Do not feed, touch, or handle birds or seals, or approach or photograph them in ways that cause them to alter their behaviour. Special care is needed when animals are breeding or moulting.
- Do not damage plants, for example by walking, driving, or landing on extensive moss beds or lichen-covered scree slopes.
- Do not use guns or explosives. Keep noise to the minimum to avoid frightening wildlife.
- Do not bring non-native plants or animals into the Antarctic such as live poultry, pet dogs and cats or house plants.

2. Respect Protected Areas
A variety of areas in the Antarctic have been afforded special protection because of their particular ecological, scientific, historic or other values. Entry into certain areas may be prohibited except in accordance with a permit issued by an appropriate national authority. Activities in and near designated Historic Sites and Monuments and certain other areas may be subject to special restrictions.

- Know the locations of areas that have been afforded special protection and any restrictions regarding entry and activities that can be carried out in and near them.
- Observe applicable restrictions.
- Do not damage, remove, or destroy Historic Sites or Monuments or any artifacts associated with them.

3. Respect Scientific Research
Do not interfere with scientific research, facilities or equipment.

- Obtain permission before visiting Antarctic science and support facilities, reconfirm arrangements 24-72 hours before arrival, and comply with the rules regarding such visits.
- Do not interfere with, or remove, scientific equipment or marker posts, and do not disturb experimental study sites, field camps or supplies.

4. Be Safe
Be prepared for severe and changeable weather and ensure that your equipment and clothing meet Antarctic standards. Remember that the Antarctic environment is inhospitable, unpredictable, and potentially dangerous.

- Know your capabilities, the dangers posed by the Antarctic environment, and act accordingly. Plan activities with safety in mind at all times.
- Keep a safe distance from all wildlife, both on land and at sea.
- Take note of, and act on, the advice and instructions from your leaders; do not stray from your group.
- Do not walk onto glaciers or large snow fields without the proper equipment and experience, there is a real danger of falling into hidden crevasses.
- Do not expect a rescue service. Self-sufficiency is increased and risks reduced by sound planning, quality equipment, and trained personnel.
- Do not enter emergency refuges (except in emergencies). If you use equipment or food from a refuge, inform the nearest research station or national authority once the emergency is over.
- Respect any smoking restrictions, particularly around buildings, and take care to safeguard against the danger of fire. This is a real hazard in the dry environment of Antarctica.

5. Keep Antarctica Pristine
Antarctica remains relatively pristine, the largest wilderness area on Earth. It has not yet been subjected to large scale human perturbations. Please keep it that way.

- Do not dispose of litter or garbage on land. Open burning is prohibited.
- Do not disturb or pollute lakes or streams. Any materials discarded at sea must be disposed of properly.
- Do not paint or engrave names or graffiti on rocks or buildings.
- Do not collect or take away biological or geological specimens or human-made artifacts as a souvenir, including rocks, bones, eggs, fossils, and parts or contents of buildings.
- Do not deface or vandalise buildings, whether occupied, abandoned, or unoccupied, or emergency refuges.