

# Review on the clean up of Cape Hallett Station

Graduate Certificate in Antarctic Studies - ANTA502



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## Abstract

Past human activity has littered Antarctica with abandoned rubbish, machinery and buildings creating an environmental concern. The Antarctic community has addressed the issue by the creation of the Environmental Protocol. The Protocol has put environmental restrictions on present and past activities and the methods of waste managements for these sites. The removal and clean up of these areas are costly to the nations in which the activities originated from as the Protocol places the responsibility onto them. But for environmental protection and the conservation of the “wildness” factor in Antarctica, these requirements and regulations have to be enforced and completed by all of the different Antarctic programs.

The New Zealand and United States of America programs, had a combined station at Cape Hallett in Northern Victoria Land, which was abandoned in 1973. The area has had various clean up attempts made spanning the last 34 years as environmental commitments and moral pressures were put on Antarctic programs to remove and remediate, present and past wastes from sites. This review will focus on the Cape Hallett Station and the history of the clean up activities of this site.

## Introduction

Cape Hallett Station ( $72^{\circ}19'S$   $170^{\circ}16'E$ ) was established in 1956/57 as a joint station of New Zealand and United States of America Antarctic programs. The station was initially built for the purpose of recording and forecasting weather information for American aircraft flying to Antarctica and into McMurdo Sound. Cape Hallett Station was situated about 600km north of McMurdo Sound, this location meant that the base was closer to New Zealand for radio contact with aircraft. The station was also used for a landing area for aircraft if McMurdo Sound was closed due to bad weather. When the station was being built an Adelie penguin colony had to be relocated outside the perimeter of the station. The station was also involved in research activities starting with the IGY (International Geophysical Year) in 1957/58 and then continued on after the IGY. The station was a large station containing around thirteen buildings and large fuel tanks, providing a base for scientific researchers and logistical staff. The base had a population of up to 50 people during the summer and decreased to around 20 over the winter.

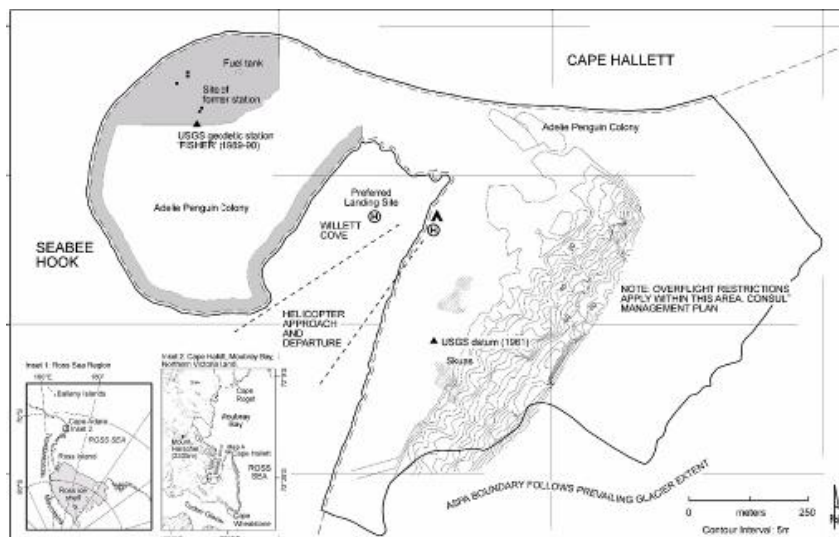


FIGURE 1: MAP OF CAPE HALLETT AND THE POSITION OF THE STATION INDICATED. COURTESY OF THE ANTARCTIC CONSULTATIVE MEETING REPORT 2006

The station was occupied year round as a joint base until fire destroyed the main scientific laboratory in 1964. In 1964 New Zealand withdrew from Cape Hallett and the station became an American only base. The base was used as a summer only base until 1973 when the base was left abandoned in the idea of returning in the future. The food, equipment and fuels were left in and around the buildings at Cape Hallett. The valuable scientific instruments and items of value were removed and taken back to McMurdo Station.

An area of Cape Hallett was designated in 1966 as an Antarctic Specially Protected Area No. 7(ASP) for vegetation that was an outstanding example of biological diversity. The boundary of the area was enlarged in 1985 to include further areas of vegetation to the north and south and labeled ASPA 106. Then in 2002 the area was again enlarged to include Seabee Hook, the site of Cape Hallett Station for the breeding area of the Adelie penguins.



FIGURE 2: CAPE HALLETT STATION 1973 THE YEAR THAT THE BASE WAS ABANDONED. COURTESY OF THE ANTARCTIC TREATY CONSULTATIVE MEETING REPORT 2006

### Initial Clean Up (Pre Environmental (Madrid) Protocol)

Cape Hallett Station was never reopened and some initial clean up work was undertaken by the both American and New Zealand teams between 1971 and 1996. These were focused on the removal of surface debris and the remaining fuels, some buildings were also removed.

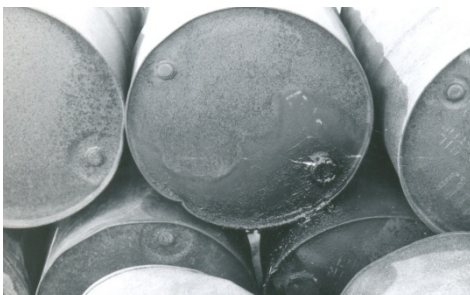
Pre-closing the station, clean up work was completed by the collection of 3000 used 55 gallon drums and 50 tons of scarp metal and other surface rubbish in 1971/72 this was completed by the American program and was helped by the American Navy to transport the material.



Condition reports were made of the station by both the American and New Zealand programs in the early 1980's to survey the environmental concerns and the site condition for any possibility of re-opening the station in future years. The U.S. Geological Survey Report completed in December 1981 concluded the station would be able to be reinstated if the need or desire came up in the future. However in the 1983 a New Zealand Inventory of Cape Hallett Station recorded a different appearance, suggesting that maybe only five buildings were salvageable and immediate repairs would be needed. The report also suggested the contents of the building were in poor condition and looked as if the station had been ransacked with open doors, cupboards and tools scattered across the floors. The condition of the contents of the buildings also proved to be unsalvageable with many rusting, damp and decomposing. The remaining food and clothing was indicated not to be usable as the method of storage of these items were not protecting and preserving them.



FIGURE 3,4,5,6 & 7: PHOTOS OF CAPE HALLETT STATION 1983 TAKEN BY THE NEW ZEALAND TEAM CONDUCTING AN INVENTORY OF THE ABANDONED STATION. ABOVE THE PENGUIN COLONY MOVING IN AROUND THE BUILDINGS. BELOW THE STATE OF THE STATION IN 1983. COURTESY OF THE INVENTORY OF CAPE HALLETT STATION 1983



After these reports, teams were sent to clean up the station; they deconstructed some of the buildings, collected rubbish from around the site and did repair work to those buildings that had been selected to be kept for future use. Many of the techniques used in these work parties would not be allowed under the Environmental Protocol. The dismantled buildings were burnt on site with all other combustible material. The non-combustible material was taken onto the sea ice and left. When the sea ice melted the material would sink into the sea, however no full fuel or oil drums were allowed to be disposed of in this manner. Also in 1988 the first attempt of the removal of fuel and oil products was undertaken by an American team of joint navy and civilian personnel. They removed 189,250 litres of fuel (off-specification diesel fuel-marine) from the largest of the tanks at Cape Hallett Station. Although this effort removed a large quantity of fuel, a lot of fuel and oil products were left behind in several different tanks and drums.

Several more proposals over the following years were suggested for the removal of the remaining fuels but these were unsuccessful and the tanks and drums were left disintegrating on site. In 1991 a site visit reported that although the tanks and drums were not leaking there was a high possibility of leakage and contamination within the next few years if no remediation was completed.

This started efforts to remove the remaining fuel from the site and proposals came in the winter of 1993. There were two methods available for the removal of the remaining fuel at this time; burning off the remaining fuel or the complete removal of the fuel from the site. The two options were considered but there were limitations on the option of burning the material because of the ASPA next to the site. The burning of materials could be done if the wind speed and direction of the ash and gases could be proved to not damage the area. The ASPA next to the site made this option impossible and also the American program was phasing out the disposal of waste in this way and would have needed to be completed before March 1 1994. In the 1993/94 season initial remediation measures were conducted to prevent any leakage occurring in situ. However after these measures were in place there was a spill of 500 gallons of oil in which the U.S. Coast Guard responded to and completed preliminary clean up measures.

From 1994 to 1996 the U.S. program managed to pump all the fuel tanks dry and removed the contents to McMurdo and later back to America. This was an approximately 20,000 gallons of fuel, oils and antifreeze. This operation was a large scale with the cooperation of planes, U.S. Coast Guard and a field team. The field team was transported in to the site with a supply of 450, 55 gallon drums in which the contents of the tanks were pumped into and then sealed. The field team also removed the contaminated soil from the previous year spill. The drums were then left for the collection by the U.S. Coast Guard Cutter when the sea ice permitted.

These clean up programs were intended to focus on foremost environmental concerns, of the penguin colony, soil and water. They usually focus on the fuels and oils left at the station which were an increasing problem as the tanks and drums began to rust and decay. If the fuels were left on site with no work to remove them then the environmental impact could have serious with ASPA and penguin colony within the area.

## Environmental Protocol

The Environmental (Madrid) Protocol was internationally enforced in 1998 and contains 6 Annexes to regulate the environmental aspects of activities in Antarctica. Under Annex III – Waste Management regulations are established on the management and disposal of the waste from activities. This includes past sites as Article 1, Paragraph 5 “Past and present waste disposal sites on land and abandoned work sites of Antarctic activities shall be cleaned up by the generator of such wastes and the user of such sites”. The clean up of sites does not include “sites designated as a historic site or monument” or where the removal of the waste “would result in greater adverse environmental impact than leaving the structure or waste in its existing location”.

New Zealand adopted the Environmental Protocol by the creation of the Antarctica (Environmental Protection) Act 1994. By the creation of this act New Zealand had ratified the Environmental Protocol and accepted the waste management regulations and the responsibility to clean up sites of past activities.

United States of America adopted the Environmental Protocol in 1997 by the creation of the Antarctic Science, Tourism, and Conservation Act of 1996 signed by President Clinton.

The signing and ratifying the Environmental Protocol the two states have agreed to the clean up of any past sites of activity. Each party of the Protocol have to prepare an annual review of the waste management issues and also include programs for cleaning up existing abandoned work sites. Cape Hallett was a joint base between these two countries and by the ratification of the Environmental Protocol meant they are both were responsible for the clean up of the buildings, machinery, materials and contamination of any surrounding environment around Cape Hallett affected by the station. Both programs had already had teams working and cleaning up at Cape Hallett since the closure of the base in 1973, removing fuels, rubbish and unusable buildings.

The Environmental Protocol specifies how wastes can be disposed of and methods of doing it. The methods used before the adoption of the Protocol would now not be acceptable. All fuels, fuel drums and solid non-combustibles must be removed from the Antarctic Treaty Area. Some incineration of materials could be conducted under the Environmental Protocol but because of the location and national program regulations this was not possible at Cape Hallett Station. Therefore the materials at Cape Hallett had to be removed from the site and transported out of the Antarctic Treaty Area to one of the countries of origin.

### Assessment 2000-03

A joint assessment of Cape Hallett Station was conducted by the New Zealand and United States programs in 2000/01 season. The environmental assessment and inventory of the remaining wastes, machinery and buildings was undertaken in a three week site visit in January 2001. This was to indicate how much work was needed for the completion of the clean up activities and the preservation of the area back to a penguin colony and a pristine environment.



FIGURE 8: PHOTO OF THE BULK (100,000 GALLON) FUEL TANK AT CAPE HALLETT IN 2001. COURTESY OF THE ANTARCTIC TREATY CONSULTATIVE REPORT 2006

By the time of 2001 site assessment only four buildings, tanks and machinery remained after the clean up attempts in previous years. As part of the site assessment soil and water samples were taken from around the site and analysed for hydrocarbon contamination. During the assessment a few Adeli penguin chicks were found to be contaminated with small amounts of oil. The survey found debris left scattered around the original station site, throughout Adeli penguin colony and even up on the Cape Hallett cliffs. Many of these materials were decomposing, rusting, leaking and letting dissolved heavy metals contaminate the soils. Much of the re-establishing penguin colony had rusting waste throughout, which the penguins had built the nests amongst.

From these primary assessments, two of the melt water ponds were considered to contain diesel-range organic in low levels. This suggested that the melt water pond should be fenced off from the penguin colony until it was proven the amount was insignificant or cleaned up. The following season 2001/02, a joint team went to Cape Hallett to erected seven temporary fences to keep nesting penguins away from the contaminated melt water ponds.

Further 177 soils samples and 28 water samples were taken for analysis in the 2002/03 season. These samples provided a range of hydrocarbon concentration due to the areas of collection. The soils samples measured <20 to 30,100 ppm and water samples 0.2 to 320 ppm petroleum hydrocarbon. The range did suggest however that the hydrocarbon could be being transported in groundwater.



### Clean up of station (2003-05)

The clean up of Cape Hallett started in 2003/04 by a six person New Zealand team situated at the field camp supporting the LGP (Latitudinal Gradient Project) at Cape Hallett. This team decommissioned the remaining buildings and packed up the waste ready for collection. They also removed the fences that were placed around the suspected contaminated melt water ponds as the concentration of the pollutants had decreased. Visual assessments of the melt water ponds were conducted during the clean up and only one showed possible contamination. The clean up continued in the 2004/05 season focusing on the surface debris around the site, the entire spit and up on the Cape Hallett cliffs. They finished the packing of the waste material ready for collection and removal by the Italian research and supply vessel *Italica*. Waste material weighing 28.5 metric tonnes was removed by the Italian vessel in this season. The vessel also brought in equipment for the removal of the bulk fuel tank which would be dismantled the following year. The waste was then shipped back to Canterbury, New Zealand. The equipment delivered to the site, was used in the 2004/05 season to transfer the contaminated water in the remaining tanks to drums ready for removal in the following season.



FIGURE 9: THE GEOMAGNETIC DOME BEING DISMANTLED ON SITE AT CAPE HALLETT. COURTESY OF ANTARCTICA NEW ZEALAND

### The removal of the bulk fuel tank and other smaller tanks (2005/06)

The removal of the bulk (100,000 gallon) fuel tank had a greater potential environmental impact and an IEE (Initial Environmental Evaluation) was undertaken by the American program, for the removal of the tank from Cape Hallett. The concern was the residue fuel, water/sludge and contaminated waste in the tank could contaminate the surrounding environment and impact on the penguin colony. This included groundwater and soil contamination that could affect the specially protected vegetation. The IEE



looked at the risks and concluded that with the correct removal methods and trained personnel, the risk of contamination was low. The bulk fuel tank was then removed in the 2005/06 season by a team of three New Zealanders and one American. The tank was vented and dismantled without any contamination of the environment over a 6 week operation. The smaller 10,800 gallon tanks were also removed in this season. Again the Italian vessel was used to remove the tank and materials weighing 71 tonnes leaving about 20 tonnes to be removed in 2006/07 season.



FIGURE 10: THE BULK FUEL TANK DURING THE 6 WEEK REMOVAL.  
COURTESY OF THE ANTARCTIC TREATY CONSULTATIVE REPORT 2006

## Disposal of Materials

The disposal of materials from Cape Hallett Station after the Environmental Protocol meant the transport of materials out of the Antarctic Treaty Area and back to the country of origin. The Cape Hallett Station was dismantled and packed up in Antarctica and transported back to Lyttelton, Canterbury, New Zealand by the Italian vessel *Italica*. In New Zealand, Canterbury Museum wanted to obtain the material brought back to add to their extensive Antarctic collection. The first materials that returned to New Zealand were the buildings and debris from the station. The Canterbury Museum put together a special exhibition about the aspects of working and living at Cape Hallett, Antarctica. This benefited the Antarctic programs as the cost of disposal of the material was reduced and instead was donated to the museum. This meant that the clean up operation was more cost effective and could also provide a great educational tool to promote both the environmental conservation and Antarctica.

## Conclusion

The human impact on Antarctica is always going to be evident as long as people travel and stay in Antarctica, however the affect on the continent can be reduced. Over the past years the same conservation and environmental concerns that we currently hold were not evident. This has allowed the disposal of waste to be conducted without major concern for the environment. However now the environmental impacts of these early activities have been addressed and measures have been taken to

remediate the effect. The creation of the Environmental Protocol has formed a set of regulations for the disposal of waste both for current and past activities.

Cape Hallett Station was a past site of activities that had been abandoned since 1973 and New Zealand and America were responsible for the clean up. Clean up activities had been constant since the closure of the station in 1973, but concentrated on the immediate environmental concerns of the contamination of soils, water and biological species by hydrocarbons left at the station. Early attempts of clean up of the station involved the removal, burning and dumping of materials. Although this removed the material from the site it is not an appropriate environmental solution.

After the creation of the Environmental Protocol the clean up of the station became an issue that had to be remediated as part of the Protocol. The Protocol also sets up regulations on how the material could be disposed of, which are more environmental friendly. The New Zealand and American programs then worked together to successfully remove the entire station and remediate the area so that the relocated penguin colony could return.

In conclusion the clean up of Cape Hallett Station was successful in that all material was moved off site and limited contamination of the site has occurred. The logistics and remote setting of Cape Hallett Station away from the New Zealand and American bases provided challenges to the teams but these were successful sorted. The environmental impact has proven to be low, as the displaced penguin colony has started moving back onto the site and hopefully will re-populate. Monitoring of the site to justify the success of the clean up will be an ongoing activity when logistics and weather permits. Photos from both cruise ships and aerial will be used for monitoring as well. This is a positive environmental effort by New Zealand and USA programs and should be used as an example for further clean ups and for other programs.

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- Antarctic Treaty System ([www.ats.aq](http://www.ats.aq))
- Committee for the Environmental Protection (CEP) ([www.cep.aq](http://www.cep.aq))
- Antarctic New Zealand ([www.antarcticanz.govt.nz](http://www.antarcticanz.govt.nz))

## Appendix 1

### **ANNEX III TO THE PROTOCOL ON ENVIRONMENTAL PROTECTION TO THE ANTARCTIC TREATY WASTE DISPOSAL AND WASTE MANAGEMENT**

#### **ARTICLE 1**

##### ***GENERAL OBLIGATIONS***

1. This Annex shall apply to activities undertaken in the Antarctic Treaty area pursuant to scientific research programmes, tourism and all other governmental and nongovernmental activities in the Antarctic Treaty area for which advance notice is required under Article VII (5) of the Antarctic Treaty, including associated logistic support activities.
2. The amount of wastes produced or disposed of in the Antarctic Treaty area shall be reduced as far as practicable so as to minimise impact on the Antarctic environment and to minimise interference with the natural values of Antarctica, with scientific research and with other uses of Antarctica which are consistent with the Antarctic Treaty.
3. Waste storage, disposal and removal from the Antarctic Treaty area, as well as recycling and source reduction, shall be essential considerations in the planning and conduct of activities in the Antarctic Treaty area.
4. Wastes removed from the Antarctic Treaty area shall, to the maximum extent practicable, be returned to the country from which the activities generating the waste were organized or to any other country in which arrangements have been made for the disposal of such wastes in accordance with relevant international agreements.
5. Past and present waste disposal sites on land and abandoned work sites of Antarctic activities shall be cleaned up by the generator of such wastes and the user of such sites. This obligation shall not be interpreted as requiring:
  - (a) the removal of any structure designated as a historic site or monument; or
  - (b) the removal of any structure or waste material in circumstances where the removal by any practical option would result in greater adverse environmental impact than leaving the structure or waste material in its existing location.

#### **ARTICLE 2**

##### ***WASTE DISPOSAL BY REMOVAL FROM THE ANTARCTIC TREATY AREA***

1. The following wastes, if generated after entry into force of this Annex, shall be removed from the Antarctic Treaty area by the generator of such wastes:
  - (a) radio-active materials;
  - (b) electrical batteries;
  - (c) fuel, both liquid and solid;
  - (d) wastes containing harmful levels of heavy metals or acutely toxic or harmful persistent compounds;
  - (e) poly-vinyl chloride (PVC), polyurethane foam, polystyrene foam, rubber and lubricating oils, treated timbers and other products which contain additives that could produce harmful emissions if incinerated;
  - (f) all other plastic wastes, except low density polyethylene containers (such as bags for storing wastes), provided that such containers shall be incinerated in accordance with Article 3 (1);
  - (g) fuel drums; and
  - (h) other solid, non-combustible wastes;provided that the obligation to remove drums and solid non-combustible wastes contained in subparagraphs (g) and (h) above shall not apply in circumstances where the



removal of such wastes by any practical option would result in greater adverse environmental impact than leaving them in their existing locations.

2. Liquid wastes which are not covered by paragraph 1 above and sewage and domestic liquid wastes, shall, to the maximum extent practicable, be removed from the Antarctic Treaty area by the generator of such wastes.

3. The following wastes shall be removed from the Antarctic Treaty area by the generator of such wastes, unless incinerated, autoclaved or otherwise treated to be made sterile:

- (a) residues of carcasses of imported animals;
- (b) laboratory culture of micro-organisms and plant pathogens; and
- (c) introduced avian products.

### **ARTICLE 3**

#### ***WASTE DISPOSAL BY INCINERATION***

1. Subject to paragraph 2 below, combustible wastes, other than those referred to in Article 2 (1), which are not removed from the Antarctic Treaty area shall be burnt in incinerators which to the maximum extent practicable reduce harmful emissions. Any emission standards and equipment guidelines which may be recommended by, inter alia, the Committee and the Scientific Committee on Antarctic Research shall be taken into account. The solid residue of such incineration shall be removed from the Antarctic Treaty area.

2. All open burning of wastes shall be phased out as soon as practicable, but no later than the end of the 1998/1999 season. Pending the completion of such phase-out, when it is necessary to dispose of wastes by open burning, allowance shall be made for the wind direction and speed and the type of wastes to be burnt to limit particulate deposition and to avoid such deposition over areas of special biological, scientific, historic, aesthetic or wilderness significance including, in particular, areas accorded protection under the Antarctic Treaty.

### **ARTICLE 4**

#### ***OTHER WASTE DISPOSAL ON LAND***

1. Wastes not removed or disposed of in accordance with Articles 2 and 3 shall not be disposed of onto ice-free areas or into fresh water systems.

2. Sewage, domestic liquid wastes and other liquid wastes not removed from the Antarctic Treaty area in accordance with Article 2, shall, to the maximum extent practicable, not be disposed of onto sea ice, ice shelves or the grounded ice-sheet, provided that such wastes which are generated by stations located inland on ice shelves or on the grounded ice-sheet may be disposed of in deep ice pits where such disposal is the only practicable option. Such pits shall not be located on known ice-flow lines which terminate at ice-free areas or in areas of high ablation.

3. Wastes generated at field camps shall, to the maximum extent practicable, be removed by the generator of such wastes to supporting stations or ships for disposal in accordance with this Annex.

### **ARTICLE 5**

#### ***DISPOSAL OF WASTE IN THE SEA***

1. Sewage and domestic liquid wastes may be discharged directly into the sea, taking into account the assimilative capacity of the receiving marine environment and provided that:

- (a) such discharge is located, wherever practicable, where conditions exist for initial dilution and rapid dispersal; and
- (b) large quantities of such wastes (generated in a station where the average weekly occupancy over the austral summer is approximately 30 individuals or more)

shall be treated at least by maceration.

2. The by-product of sewage treatment by the Rotary Biological Contacter process or similar processes may be disposed of into the sea provided that such disposal does not adversely affect the local environment, and provided also that any such disposal at sea shall be in accordance with Annex IV to the Protocol.

#### **ARTICLE 6**

##### ***STORAGE OF WASTE***

All wastes to be removed from the Antarctic Treaty area, or otherwise disposed of, shall be stored in such a way as to prevent their dispersal into the environment.

#### **ARTICLE 7**

##### ***PROHIBITED PRODUCTS***

No polychlorinated biphenyls (PCBs), non-sterile soil, polystyrene beads, chips or similar forms of packaging, or pesticides (other than those required for scientific, medical or hygiene purposes) shall be introduced onto land or ice shelves or into water in the Antarctic Treaty area.

#### **ARTICLE 8**

##### ***WASTE MANAGEMENT PLANNING***

1. Each Party which itself conducts activities in the Antarctic Treaty area shall, in respect of those activities, establish a waste disposal classification system as a basis for recording wastes and to facilitate studies aimed at evaluating the environmental impacts of scientific activity and associated logistic support. To that end, wastes produced shall be classified as:

- (a) sewage and domestic liquid wastes (Group 1);
- (b) other liquid wastes and chemicals, including fuels and lubricants (Group 2);
- (c) solids to be combusted (Group 3);
- (d) other solid wastes (Group 4); and
- (e) radioactive material (Group 5).

2. In order to reduce further the impact of waste on the Antarctic environment, each such Party shall prepare and annually review and update its waste management plans (including waste reduction, storage and disposal), specifying for each fixed site, for field camps generally, and for each ship (other than small boats that are part of the operations of fixed sites or of ships and taking into account existing management plans for ships):

- (a) programmes for cleaning up existing waste disposal sites and abandoned work sites;
- (b) current and planned waste management arrangements, including final disposal;
- (c) current and planned arrangements for analysing the environmental effects of waste and waste management; and
- (d) other efforts to minimise any environmental effects of wastes and waste management.

3. Each such Party shall, as far as is practicable, also prepare an inventory of locations of past activities (such as traverses, field depots, field bases, crashed aircraft) before the information is lost, so that such locations can be taken into account in planning future scientific programmes (such as snow chemistry, pollutants in lichens or ice core drilling).

#### **ARTICLE 9**

##### ***CIRCULATION AND REVIEW OF WASTE MANAGEMENT PLANS***

1. The waste management plans prepared in accordance with Article 8, reports on their implementation, and the inventories referred to in Article 8 (3), shall be included in the annual exchanges of information in accordance with Articles III and VII of the Antarctic Treaty and related Recommendations under Article IX of the Antarctic Treaty.

2. Each Party shall send copies of its waste management plans, and reports on their implementation and review, to the Committee.
3. The Committee may review waste management plans and reports thereon and may offer comments, including suggestions for minimising impacts and modifications and improvement to the plans, for the consideration of the Parties.
4. The Parties may exchange information and provide advice on, inter alia, available low waste technologies, reconversion of existing installations, special requirements for effluents, and appropriate disposal and discharge methods.

#### **ARTICLE 10**

##### ***MANAGEMENT PRACTICES***

Each Party shall:

- (a) designate a waste management official to develop and monitor waste management plans; in the field, this responsibility shall be delegated to an appropriate person at each site;
- (b) ensure that members of its expeditions receive training designed to limit the impact of its operations on the Antarctic environment and to inform them of requirements of this Annex; and
- (c) discourage the use of poly-vinyl chloride (PVC) products and ensure that its expeditions to the Antarctic Treaty are advised of any PVC products they may introduce into that area in order that these products may be removed subsequently in accordance with this Annex.

#### **ARTICLE 11**

##### ***REVIEW***

This Annex shall be subject to regular review in order to ensure that it is updated to reflect improvement in waste disposal technology and procedures and to ensure thereby maximum protection of the Antarctic environment.

#### **ARTICLE 12**

##### ***CASES OF EMERGENCY***

1. This Annex shall not apply in cases of emergency relating to the safety of human life or of ships, aircraft or equipment and facilities of high value or the protection of the environment.
2. Notice of activities undertaken in cases of emergency shall be circulated immediately to all Parties and to the Committee.

#### **ARTICLE 13**

##### ***AMENDMENT OR MODIFICATION***

1. This Annex may be amended or modified by a measure adopted in accordance with Article IX (1) of the Antarctic Treaty. Unless the measure specifies otherwise, the amendment or modification shall be deemed to have been approved, and shall become effective, one year after the close of the Antarctic Treaty Consultative Meeting at which it was adopted, unless one or more of the Antarctic Treaty Consultative Parties notifies the Depositary, within that time period, that it wishes an extension of that period or that it is unable to approve the amendment.
2. Any amendment or modification of this Annex which becomes effective in accordance with paragraph 1 above shall thereafter become effective as to any other Party when notice of approval by it has been received by the Depositary.