



## ANTARCTIC TREATY CONSULTATIVE MEETING 2006

IP 115

Agenda Item: CEP 12  
Presented by: New Zealand,  
United States  
Original: English

### **Clean up of abandoned Cape Hallett Station**

# Clean up of abandoned Cape Hallett Station.

## Information Paper submitted by New Zealand and the United States

### Introduction

Article 1 of Annex III to the Protocol, requires abandoned work sites to be cleaned up unless the site has been designated as an historic site or monument, or the removal of such structures or waste materials would cause greater environmental impact than leaving them in place.

This Information Paper summarises the successful programme undertaken by New Zealand and the United States to clean up an abandoned research station at Cape Hallett, northern Victoria Land.

### Cape Hallett Station

During the summer of 1956/57, New Zealand and the United States established a joint research station in Northern Victoria Land, in order to provide weather data for American aircraft flying between New Zealand and Antarctica, as well as to undertake an IGY research programme covering meteorology, geomagnetism, aurora, ionospheric, and seismology.

The site chosen for the new station was Cape Hallett on the northeast coast of Victoria Land. The base was constructed on what is now called Seabee Hook by the US Navy's Construction Battalion (men known as Seabees). Seabee Hook is a curved spit of coarse volcanic material, with a total area of approximately 0.25 km<sup>2</sup>. The Hook projects west from Cape Hallett (72°19'S 170°16'E) at the southern end of Moubray Bay, northern Victoria Land, in the western Ross Sea (Figure 1). Total elevation of the Hook is only about 5m above sea level. A small bay called Willett Cove is enclosed on the south side of Seabee Hook.

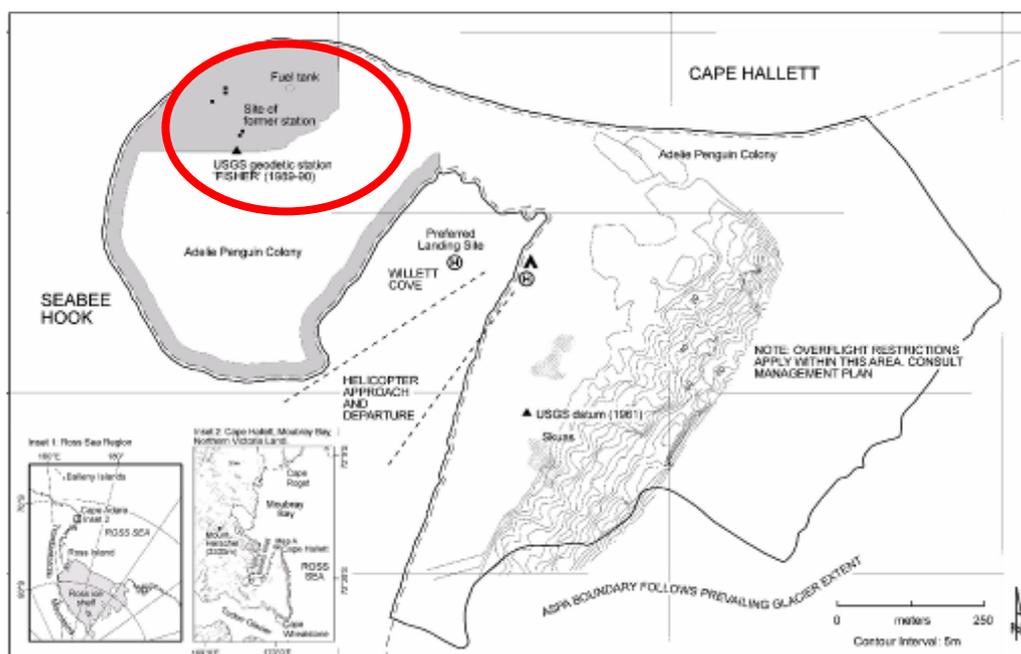


Figure 1. Seabee Hook, Cape Hallett, with the site of the joint New Zealand / US station circled in red.

Cape Hallett Station was occupied year round between 1957 and 1964 (figure 2). Following the completion of the IGY research programmes, the station continued to undertake meteorological measurements as well as biological research on the large Adelie penguin rookery on Seabee Spit.

In 1964 a fire destroyed the main scientific laboratory. From that point on the station was operated as a summer-only research station until 1973 when the station was abandoned. At the time it was left in place in anticipation of being reopened again in the future. However, no efforts to reopen the station have ever been made.



Figure 2. Cape Hallett station in 1973 prior to the initial clean up work.

## Area Protection

In 1966 Cape Hallett was designated as Specially Protected Area No 7 (Recommendation IV-7) after a proposal by the United States of America on the grounds that the Area provided an outstanding example of biological diversity, containing, “a small patch of particularly rich and diverse vegetation which supports a variety of terrestrial fauna”. The proposal gave special mention to the rich avifauna in the Area, which was noted as being of “outstanding scientific interest”. The boundaries of the Area were enlarged in 1985 (Recommendation XIII-13) to include extensive stands of vegetation to the south and north of the Area, increasing the Area to approximately 32 ha. Having been renumbered ASPA 106, the boundaries of the site were further extended in 2002 to include critical avifauna habitat at Seabee Hook, notably the breeding area of the substantial colony of Adelie penguins.

### *Clean up activities 1971 - 1996*

Clean up operations at Cape Hallett have been ongoing since the early 1970s. The following summarises the early clean up efforts between 1971 and 1996.

In 1971/72 3000 used 55 gallon drums and 50 tons of scrap metal and other rubbish were collected for removal.

In January 1984 a combined NZ/US expedition visited Hallett Station to assess the condition of the station and establish a clean up plan. At the same time, a four-person work party carried out limited clean up work at the station over an 18 day period. Over the next three and a half years, three other New Zealand work parties visited the station and undertook various clean up activities, including dismantling the bulk of the old station buildings, cleaning up site rubbish and establishing a few small buildings for future use.

Most of the clean up work carried out during this period would not meet present obligations under the Protocol. Demolished buildings were burnt on site along with other surplus materials. Non-burnable items such as scrap steel, old vehicles and other equipment was hauled out onto the sea ice and allowed to melt through to the sea floor. Some remedial landscaping work was undertaken using a Caterpillar D4 bulldozer, which had been left on site.

The United States Antarctic Program (USAP) conducted two visits to Hallett Station during the 1993/94 season to locate and assess the 55-gallon drums and storage tanks that remained on station. Thirty one 55-gallon drums were placed into overpacks, and an attempt was made to pump the contents of the smallest of 11 bulk fuel storage tanks into new drums for removal, though this was unsuccessful due to the viscosity of the oil.

In 1994/95 residual fuel from large tanks of suspect integrity were transferred to smaller, new, 55-gallon drums for removal. A total of 21,665 gallons of liquid was removed from the original tanks and drums on station and transferred to 453 new drums. These drums were removed during the 1995/96 season by US Coast Guard helicopters, and the US Coast Guard Cutter *Polar Sea*.

Between these seasons, approximately 230 gallons of lubrication oil had leaked from a 300-gallon tank on the southwest side of the large above ground storage tank. The US Coast Guard completed the initial clean up of oil and contaminated snow during February 1994. Some oil contaminated gravel was also removed during the second season of clean up operations.

### ***Clean up activities 2000 - 2006***

Following these earlier clean up efforts over several seasons, the two national Antarctic programmes agreed to undertake a more dedicated programme aimed at completing the work.

However, no comprehensive assessment had been undertaken at Cape Hallett since the substantial decommissioning work in the 1980s. Given this lack of information and the potential for serious ongoing environmental impacts at the site, as well as the potentially costly nature of any further remediation, a joint US / NZ site visit was undertaken in 2000 in order to:

- develop an inventory of the remaining structures;
- survey the nature and density of surface debris at the station site and in the area of the penguin colony;
- assess any visible areas of contamination;
- analyse immediate threats to the penguin population, and
- identify priorities for future work.

The team concluded that although the buildings would be relatively easy to dismantle, removal of the large 100,000 gallon bulk fuel tank would require serious consideration. In addition, a concerning amount of debris was found to be scattered through the penguin colony including rusting metal, spikes, wire and nails.

During the same visit a series of soil and surface water samples were taken from the numerous melt pools that occur throughout the site, to test for hydrocarbon contamination. The primary concern was to determine the risk of penguin chicks becoming contaminated from polluted ponds. The analyses showed that two

ponds contained diesel-range organics in low levels. No semi-volatiles were found other than phenolic compounds likely to be associated with guano.

#### **Joint US/NZ Site Visit (November 2001)**

A joint US/NZ team visited Cape Hallett in November 2001 with the primary aim to establish temporary fences around the contaminated meltwater ponds, as a precautionary measure. A total of seven fences were erected around nine pools. Members of the US Coast Guard subsequently repaired the fences in early February 2002.

#### **Site characterisation visit (January-February 2003)**

Four United States Antarctic Programme personnel conducted a further site characterisation visit in late January / early February 2003. Nineteen test pits were excavated to permafrost or ground water level and 177 soil samples and 28 water samples were collected and analysed for total petroleum hydrocarbon (TPH). Initial soil results ranged from <20 to 30,100 ppm and results from the 28 water samples taken ranged from <0.2 to 320 ppm. The most contaminated soils were associated with the subsurface of the former station area and particularly the bulk fuel storage tank.

High accuracy GPS measurements of the ground water level were also made and a groundwater contour map constructed. This suggested that most of the ponds observed represent groundwater expressions rather than surface water. There was therefore concern that contaminants in soils around the fuel storage areas might be being mobilized in the ground water and contaminating the ponds.

#### **Clean up visit (December 2003-January 2004)**

Between 2003/04 and 2005/06 a New Zealand managed field camp was located at Cape Hallett to support research projects that were part of the Latitudinal Gradient Project (LGP). Arrangements were put in place to make use of the camp (and camp staff) to support the final phase of clean-up of the abandoned station.

During the 2003/04 season a six person New Zealand team decommissioned the remaining buildings, removed fences from around suspected contaminated ponds and collected surface debris, staging all wastes for removal. During the season further visual assessments and sampling of the ponds was undertaken. However, only one pond was found to have a visible sign of possible contamination (a small sheen <1% of the pond's surface area). TPH analysis in sediment samples from that pond showed compounds consistent with faecal, rather than hydrocarbon, contamination. As a result, the conclusion was drawn that whilst areas of significant soil contamination were present (particularly around the old fuel tank) the ponds did not appear to contain significant amounts of hydrocarbons that were putting the Adelie penguins at risk.

#### **Bulk fuel tank assessment and clean up visit (November 2004-January 2005)**

In November 2004 the Manager of Waste Operations from McMurdo Station visited the site to assess the bulk fuel tank, and identify the requirements for its dismantling. From mid December to mid January in the same season three New Zealand personnel collected further surface debris. In late January 2005 the Italian research and supply vessel *Italica* was able to remove the assembled construction waste and debris (a total of 28.5 metric tonnes of material) as well as to put in equipment for the bulk fuel tank demolition. The LGP Camp Mechanic was able to make use of some of this equipment to transfer fuel contaminated water from the bulk fuel tank into 100 open top drums.

Ahead of the 2005/06 season an IEE was prepared for the removal of the bulk fuel tank. This included a risk assessment of the potential for the removal of the tank to release hydrocarbons into the surrounding area and the consequences for the Adelie penguins. The risk assessment concluded that the risk of releasing hydrocarbons and thus contaminating the birds was low.

#### **Bulk fuel tank removal (November 2005-January 2006)**

Following approval of the IEE under New Zealand law, a team of three New Zealanders and one US person again made use of the LGP camp to undertake the dismantling of the bulk fuel tank. The team was lead by the LGP Camp Mechanic, and included a fuel tank expert who was employed as part of the team to ensure all safety protocols were followed.

Over a period of six weeks, the 100,000 gallon bulk fuel tank and 10, 800 gallon day tanks we opened, vented and dismantled. No contaminants were released as a result of the tank dismantling. See figures 3,4 and 5.

The tank dismantling and on-site clean up of debris resulted in a further 91 tonnes of material staged for removal from the site (mostly steel plates and beams). Again generous support from the Italian Antarctic Programme in making their vessel *Italica* available allowed the vast majority of these materials to be removed. At the end of the 2005/06 season only 20 tonnes of materials (mostly steel plate from the fuel tanks) remains on-site. This will be removed at the earliest opportunity.



Figures 4,5 and 6. Fuel tank prior to dismantling; dismantling in progress; sections of fuel tank ready for helo lifting to the *Italica*.

### **Next steps**

The clean up has been a considerable success. But it was agreed early in joint discussions that monitoring would be needed at this site following the completion of the work, with the aim of assessing the effectiveness of the clean up.

It is assumed that the clean up has increased the area available for Adélie penguin nesting, removed hazards posed to the penguins and other wildlife and restored aesthetic values of the site. But in order to test these assumptions further monitoring at the site is planned. Particular concerns include ensuring that no adverse effects on hydrocarbon contamination of ground water have been caused by the disturbance, checking for residual debris or other items which may come to the surface over time, and determining (if possible) whether factors other than natural variation is impacting the penguin population.

The following monitoring programme was therefore outlined in the IEE:

### **Visible impacts**

Monitoring objective:

Assess changes in the visual appearance of the site over time to determine whether clean up has reduced the disturbed area.

Methods:

Assessment of randomly selected 5m<sup>2</sup> areas using terrestrial disturbance criteria, whenever logistical opportunities allow (e.g. observers on tour ships). Consistency of assessments to be verified with 35mm photography of selected plots.

### **Adélie penguins**

Monitoring objective:

Determine whether the clean up has any influence on the Cape Hallett Adélie penguin population.

Method:

Analysis of annual aerial photography census, undertaken by Landcare Research, supported by opportunistic ground counts by observers on tour ships, to identify re-colonisation of former station areas and any trends in total population (breeding pairs).

### **Ground water contamination**

Monitoring objective:

Assess whether hydrocarbon contamination in Cape Hallett ground water is reducing over time.

Method:

Analysis of ground water sampling from existing piezometers for TPH, BTEX and PAHs as appropriate, whenever logistical opportunities allow (e.g. observers on tour ships).

## **Conclusions**

Cape Hallett is remote from current areas of New Zealand and US activities and thus presented a logistical challenge to clean up the abandoned station. Nevertheless a dedicated programme of clean up over the last three years has resulted in the successful removal of all remaining buildings and contents and the dismantling and removal of the fuel tanks. This success has been made possible for three reasons: the ability to make opportunistic use of a managed field camp established at the site over three seasons (the LGP camp); the commitment of LGP camp staff to supporting the clean-up efforts, and the generous support of the Italian Antarctic Programme in making available the research and supply vessel *Italica* to remove waste and other materials from the site. Without that dedicated ship support, the removal of materials from the site would have been a much lengthier affair.

Ongoing monitoring will now be undertaken to assess the effectiveness of the clean up effort.

A further benefit of the clean up is that the Canterbury Museum in Christchurch, New Zealand has made use of the returned materials to put together a display of the history and occupation of Cape Hallett. Canterbury Museum has re-created aspects of Hallett Station's history from 1956 to 2005. The history of the station is both a human and an environmental account of an important era in Antarctic exploration and science. Selected buildings and the weather dome, a key feature of the base, have been re-assembled, and artefacts from the original base are displayed to illustrate life in an extreme environment. For further information see [www.canterburymuseum.com](http://www.canterburymuseum.com)