Federal Foreign Office

Federal Republic of Germany – Republic of South Africa Joint Inspection

German-South African Report of Inspections under Article VII of the Antarctic Treaty and Article 14 of the Protocol on Environmental Protection

January 08-29, 2013

Troll (Norway)
Halley VI (United Kingdom)
Princess Elisabeth (Belgium)
Maitri (India)

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INTRODUCTION

This is the report of a joint inspection in Antarctica carried out by representatives of the Republic of South Africa and the Federal Republic of Germany in January 2013, as observers under Article VII of the Antarctic Treaty and Article 14 of the Protocol on Environment Protection to the Antarctic Treaty (Madrid Protocol), which provide for inspections to promote the objectives of the Treaty and ensure the observance of its provisions.

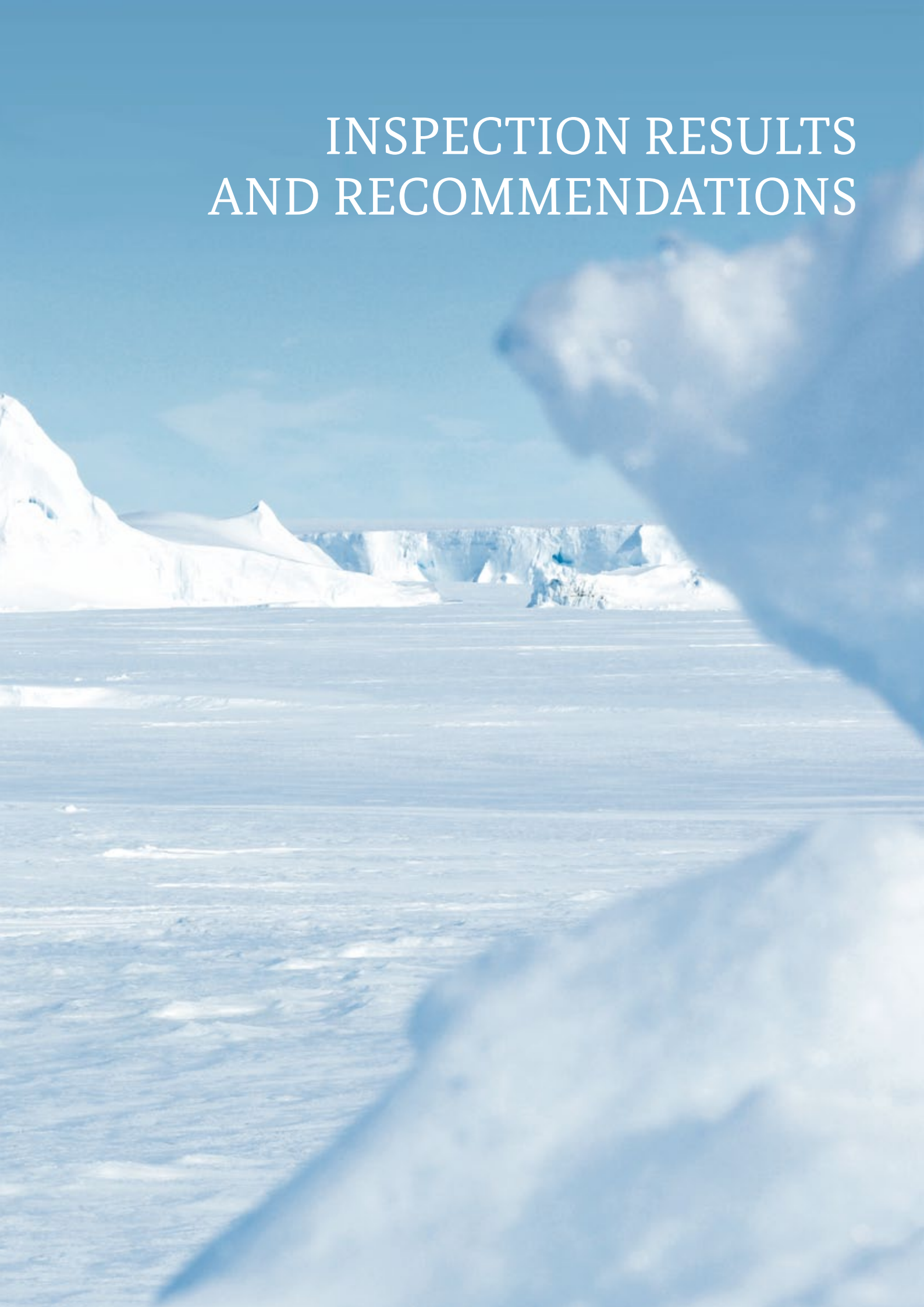
This was the first inspection conducted by South Africa while Germany has participated in joint inspections with France in 1989 and the United Kingdom in 1999.

The inspection team was gratified by the friendly welcome by personnel at all stations visited and inspected. The inspection team wishes to express its gratitude and appreciation for the cooperation and hospitality it received from the governments of Norway, the United Kingdom, Belgium and India, as well as from the polar stations Troll, Halley VI, Princess Elisabeth and Maitri. The team would also like to thank the stations SANAE IV and Neumayer III for the hospitality and support during its stay in Antarctica, as well as the air crews of the IL-76 TD aircraft, the BT-67 (Mia), the Twin Otter DHC-6 and the Bell 212 helicopters for their professional skills and valuable assistance.

The inspection team further wishes to thank the DROMLAN community, ALCI as the DROMLAN operator and the staff of the ALCI office in Cape Town, as well as the meteorologists of the German Weather Service (DWD) for the reliable flight weather forecasts provided from Neumayer III.

I.

INSPECTION RESULTS AND RECOMMENDATIONS



1. Overview

(1) Background of Antarctic Inspections

Article VII of the Antarctic Treaty provides that each Consultative Party has the right to designate observers to undertake inspections in Antarctica. Observers have complete freedom of access at any time to any and all areas in Antarctica. Parties are obliged to have all areas of Antarctica, including stations, installations and equipment, open at all times to inspection by designated observers. This also applies to all ships and aircraft at points of discharging or embarking cargoes or personnel in Antarctica. The provision for inspection is a key element of the Treaty and is designed to promote the objectives of the Treaty and ensure observance of its provisions.

Article 14 of the Madrid Protocol also provides for inspections to be conducted, consistent with Article VII of the Treaty, to promote protection of the Antarctic environment and ensure compliance with the Protocol. The Protocol requires that reports of inspections are sent to the Parties whose facilities are subject to inspection and that, after those Parties have been given the opportunity to comment, the report and any comments on it are circulated to the Committee on Environmental Protection, considered at the next Treaty meeting and then made publicly available.

(2) Overview of the Inspection

i. The Inspection Team

The inspection team consisted of five observers designated by the Federal Government of Germany and six observers designated by the Government of the Republic of South Africa.

Federal Republic of Germany

Ambassador Dr. Martin Ney, The Legal Advisor, Federal Foreign Office

Ms. Andrea Heyn, Unit System Earth, Federal Ministry of Educ. and Research

Mr. Fritz Hertel, Protection of the Antarctic, Federal Environment Agency

Dr. Uwe Nixdorf, Dir. Logistics and Science Platforms, Alfred Wegener Institute

Dr. Hartwig Gernandt, Senior Advisor, Logistics, Alfred Wegener Institute

Republic of South Africa

Mr. Henry Valentine, Dir. Southern Oceans and Antarctic Support/SANAP, Dept. of Environmental Affairs

Mr. André Stemmet, Senior State Law Advisor, Dept. of International Relations and Cooperation

Dr. Gilbert Siko, Dir. Science Platforms, Dept. of Science and Technology

Ms. Carol Jacobs, Integrated Environmental Authorisations, Dept. of Environmental Affairs

Mr. Potlako Khati, Integrated Coastal Management, Dept. of Environmental Affairs

Mr. Sabelo Malaza, Dir. Compliance, Monitoring, Dept. of Environmental Affairs

In accordance with Article VII of the Treaty, all Parties to the Antarctic Treaty were notified of the names of the members of the joint inspection team through diplomatic channels on 21 November and 21 December 2012.

ii. Preparation

In conducting the inspections the observer team was guided by the inspection checklists adopted by the Antarctic Treaty Consultative Meeting (ATCM) under Resolution 3 (2010). The observers received comprehensive documentation on the inspected stations during the visits to Halley VI, Troll and Princess Elisabeth Stations.

iii. Inspection Visit

The logistic arrangements for the travel into Antarctic and to the various stations being inspected were coordinated with the Dronning Maud Land Air Network (DROMLAN). During season 2012/13 the DROMLAN air operations comprised 12 intercontinental flights between Cape Town and the airfields Troll and Novo Airbase in Antarctica, as well as a great number of internal Antarctic flights between the various stations in Dronning Maud Land (DML). These flight opportunities to and within DML provided an efficient opportunity to perform the inspection visits to the dedicated station in the western and eastern part of DML.

The DROMLAN cooperation was set up in the spirit of the Antarctic Treaty, which calls on signatory states to encourage international collaboration for mutual usage of available national infrastructure in Antarctica. The DROMLAN founding members were the National Antarctic Programmes of Belgium, Finland, Germany, India, Japan, The Netherlands, Norway, Russia, South Africa, Sweden and the United Kingdom responsible for operating research stations in DML or having scientific research

activities in this region. The cooperation between the National Antarctic Programmes of these countries began with the signing of DROMLAN Terms of Reference in August 2003.

The regular elements of DROMLAN activities during an Antarctic season are:

(i) Performance of intercontinental flights from/to Cape Town as the Antarctic gateway. Since the beginning of the DROMLAN cooperation the long-range cargo aircraft IL-76TD performed more than 100 flights. The aircraft is chartered by ALCI (Cape Town).

(ii) Operation and maintenance of two blue ice runways at Novo Airbase (Russia) and Troll station (Norway). The Troll airfield has been inspected during this inspection. The blue ice runways are also used by other wheeled aircraft in the framework of national activities.

(iii) Performance of Antarctic flights with small ski-equipped aircraft according to the requirements for transport of personnel and cargo to the stations, performance of scientific flight missions and other national or governmental activities.

Two small BT-67 (DC3) aircraft are operated by ALCI to cover all requirements of DROMLAN members and other national or international activities. If needed, other aircraft can additionally be mobilized for Antarctic flights.

(iv) Flight weather forecast service for intercontinental and Antarctic flight operations distributed from Neumayer Station III (Germany).

By using these air links the inspection team learned that DROMLAN in its current stage of mutual understanding and assistance is an exemplary model of what can be achieved by international sharing of logistic infrastructure and in kind contributions of the members beyond national needs. A great part of national activities would not be possible without the regular intercontinental flights and the well-established air operations within the Antarctic.

The inspection team used the DROMLAN to conduct the inspection over a twenty day period, flying from Cape Town to Troll runway on 9 January 2013 aboard the IL76 TD aircraft on flight D8 of the DROMLAN air schedule and back to Cape Town on 29 January 2013 on flight D9. In Antarctica, it used a Twin Otter DHC-6 and a Basler BT-67 fixed wing aeroplane (both allocated by DROMLAN) for transportation, and on one occasion, while the inspection of Troll station was conducted from South Africa's SANAE IV base, two Bell 212 helicopters operated by that station were used. During the visit, the inspection team stayed at the SANAE IV and Neumayer III bases, and at the ALCI guesthouse at the Novolazarevskaya station when conducting the inspection of the Indian Maitri station which is situated close by. The Maitri station commander kindly offered and supplied transportation of the inspection team from and to Novolazarevskaya station. The team also paid courtesy visits to the Novolazarevskaya, Aboa and Wasa stations. At all these stations the inspection team was welcomed with the warm hospitality characteristic of the cooperative foundations of the Antarctic Treaty.

The inspection team visited:

Troll station on 14 January 2013
Halley VI station on 15 January 2013
Princess Elisabeth station on 18/19 January 2013
Maitri station on 20 January 2013

iv. Other Recent and Preceding Inspections

The joint inspection of Halley VI was the first one since the commissioning of this new British Antarctic station in 2012. The official opening of the station is planned for the beginning of February 2013.

Princess Elisabeth station began operations in the 2008 season, after a long interval without an own station following the decommissioning of the first Belgian station in 1967. Meanwhile, Belgian researchers were welcome to and relied on the hospitality of other stations. Princess Elisabeth was last inspected by Japan in 2010, according to the ATCM homepage.

Reportedly, the inspection of Troll was last conducted by teams in the 2013 summer season, to be reported at the ATCM XXXVI in May 2013, and by Japan in 2010, according to the ATCM homepage.

Maitri was last inspected by Japan in 2010 and before that by Norway in 2001.

v. Reporting

In accordance with Article 14(4) of the Protocol, copies of the report were provided to the United Kingdom, Norway, Belgium and India for comment. Comments were received from all the Parties. Insofar as these comments respond to content, they have been incorporated into this final version of the inspection report presented to ATCM XXXVI.

2. Summary of Inspection Results

(1) Overview

Although no direct violations of the Antarctic Treaty or the Environmental Protocol were observed, it was noted that the four inspected stations implemented the standards of the Treaty System with varying degrees.

(2) Logistics and Operations

The team found examples of highly sophisticated solutions for alternative energy use and environmentally sound operations. The inspection team considers that there is room for improvement in the upkeep and maintenance of older stations.

The inspection team observed that during summer seasons a large number of logistics personnel are present at the stations for construction, reconstruction and maintenance work. This means that more operational personnel than scientists are present at the stations during these seasons.

(3) Environmental Protection

The understanding of and importance attributed to environmental protection measures and the implementation thereof varied from station to station. Some improvements have been made subsequent to the 2010 Japanese inspection.

i. Waste Management and Disposal

All stations have waste management plans, with varying degrees of complexity. Maitri's and Troll's systems have room for improvement.

No incineration takes place at Princess Elisabeth and Troll. At Halley VI, the incinerator is of the second highest European quality standard (the UK is considering improving this system) and at Maitri, no improvements have been made to the fuel incinerator for food and medical waste since the last inspection.

ii. Treatment of Sewage and Domestic Liquid Wastes

The waste water treatment unit at Princess Elisabeth deserves special mention, due to the excellent quality waste water produced, which is recycled once prior to disposal into the environment. Halley VI and Troll's systems are more than adequate, although they do not recycle their water. The installation of a new rotational biological contactor at Maitri is commended, however its waste water disposal method is not adequate.

iii. Conservation of Fauna and Flora

No non-native species were observed at any of the stations inspected, although systems to prevent these introductions could be improved at all stations, except Halley VI where stringent biosecurity measures are implemented.

iv. Area Management

At Maitri and Troll stations, the relevant permits for the ongoing glaciological monitoring in ASPA No. 163 and the bird project in ASPA No. 142 respectively were not available.

(4) Scientific Investigation and International Cooperation

The inspection team observed that all stations increasingly make available their data to global data bases. Moreover, by sharing scientific infrastructure (e.g. scientific equipped aircraft), as well as scientific data and research results, greater synergy between the Treaty Parties in scientific investigations is possible. Furthermore, the inspection team observed that due to an increase in international collaboration, including the exchange of scientists in the field, there is an increasing ability of the international science community as a whole to tackle larger projects on key scientific questions.

The inspectors observed that remote data access and data transfer contribute substantially to lowering the carbon footprint of scientific research in Antarctica. It is established best practice to install scientific monitoring equipment during the summer season in Antarctica and to download the data via satellite at the home bases of the sending countries during the winter season. Due to improved technical capabilities, it is possible to repair and adjust installed monitoring equipment by remote control even during the winter season, thus ensuring continuous scientific data collection.

Monitoring in the different scientific disciplines by different nations for reference is regarded as useful.

(5) Use of Antarctica for Peaceful Purposes

All stations inspected appeared to be in compliance with the Treaty obligation that Antarctica shall be used exclusively for peaceful purposes. No weapons or arms or any activities in contravention of the obligations were observed. None of the stations employed military personnel. Some stations have in the past used their armed forces for logistical support, which is not in contravention of the Treaty. One station had a small amount of explosives used for rock-blasting in ongoing construction activities, which was stored safely.

(6) Training and Awareness

At all the stations, it was observed that all managers were aware of the Antarctic Treaty and the Madrid Protocol and were making efforts to promote these objectives and comply with them. Furthermore, it was also noted that predeployment courses and briefing sessions were held at the respective countries before all personnel were taken to Antarctica. However, despite these considerable efforts on training and awareness provided at all the stations inspected, there is still some room for improvement.

(7) Reporting

It has been noted that the level of compliance with reporting obligations contained in the Treaty differed substantially from station to station. Those stations that have taken advantage of modern technology are better able to comply, whilst those that have not embraced the use of such technologies are still lagging behind. The level of information entered by stations into the EIES varied considerably – while most stations provided comprehensive information, one station was noted to provide insufficient information.

(8) Tourism

The philosophy on accepting tourism differed from station to station. This raised the question of how to ensure that tourism remains small-scale, sensible and controlled in order to ensure that the Antarctic Treaty principles are upheld. The question of how to maintain a balance between respect for the Antarctic environment, on the one hand, and wider support of the Antarctic Treaty principles in the future, on the other hand, seems to be a long term policy question for the ATCM to consider.

3. Recommendations on Inspection Results

(1) General Recommendations

The inspection team identified the need for all nations operating in Antarctica to ensure the availability of ice-breakers and appropriate flight operations as a principal issue for efficient supply of stations and deployment of scientific expeditions.

It was noted that the logistical and construction personnel may exceed the scientific personnel in the summer season. National programmes should take into account the need of stations to accommodate large numbers of logistical and construction personnel for on-site construction and maintenance during the summer seasons.

With respect to reporting on activities within the Antarctic Treaty System on the EIES, one Party should consider improvements and stations are encouraged to employ modern technology in order to facilitate compliance with the Treaty requirements. This will allow them to have up to date records of information to be reported and will also assist in meeting country reporting obligations.

As this inspection team built on previous inspection results, it recommends to future inspection teams to make use of prior inspection reports as reference points when checking on treaty compliance. It also invites Member States operating stations in the Antarctic to embrace inspection results as a chance to learn from other stations and to improve their facilities and operating methods.

Available technologies and best practices should be used more efficiently to ensure environmental compliance.

As DROMLAN is exemplary in the sharing of logistical support for scientific research in the Dronning Maud Land area, it should be continued and reinforced. It is also worth considering whether an equivalent logistical support network could be introduced in other parts of Antarctica.

(2) Environmental Recommendations

- Waste Management and Disposal

In some instances, environmental impacts are of concern, especially where aging incinerators are equipped with inadequate emission control mechanisms, and where old and non-functional items and equipment are randomly stored and have not yet been removed from Antarctica. Much improvement in the prevention of and response to existing oils spills (as mentioned in the 2010 Japanese report), in line with the COMNAP Fuel Manual, could also be achieved and should be given priority.

- Treatment of sewage and domestic liquid wastes

Although an additional waste water treatment unit was recently installed at one of the stations inspected (as recommended in the previous inspection report) and incinerator toilets are used for sewage waste, the quality of the treated water should be monitored, and the disposal thereof into the environment requires consideration. The remaining stations were found to be monitoring the quality of the treated waste water (which was recycled in one case) and adequate to high quality waste water was disposed of into the environment.

This inspection team is in agreement with the 2010 Japanese recommendation for COMNAP to consider adopting practical guidelines on waste water quality as necessary, in accordance with the standards “to the maximum extent practicable” (Article 2 (2) of Annex III to the Protocol) and “the only practicable option” (Article 4 (2) of Annex III to the Protocol).

- Conservation of fauna and flora

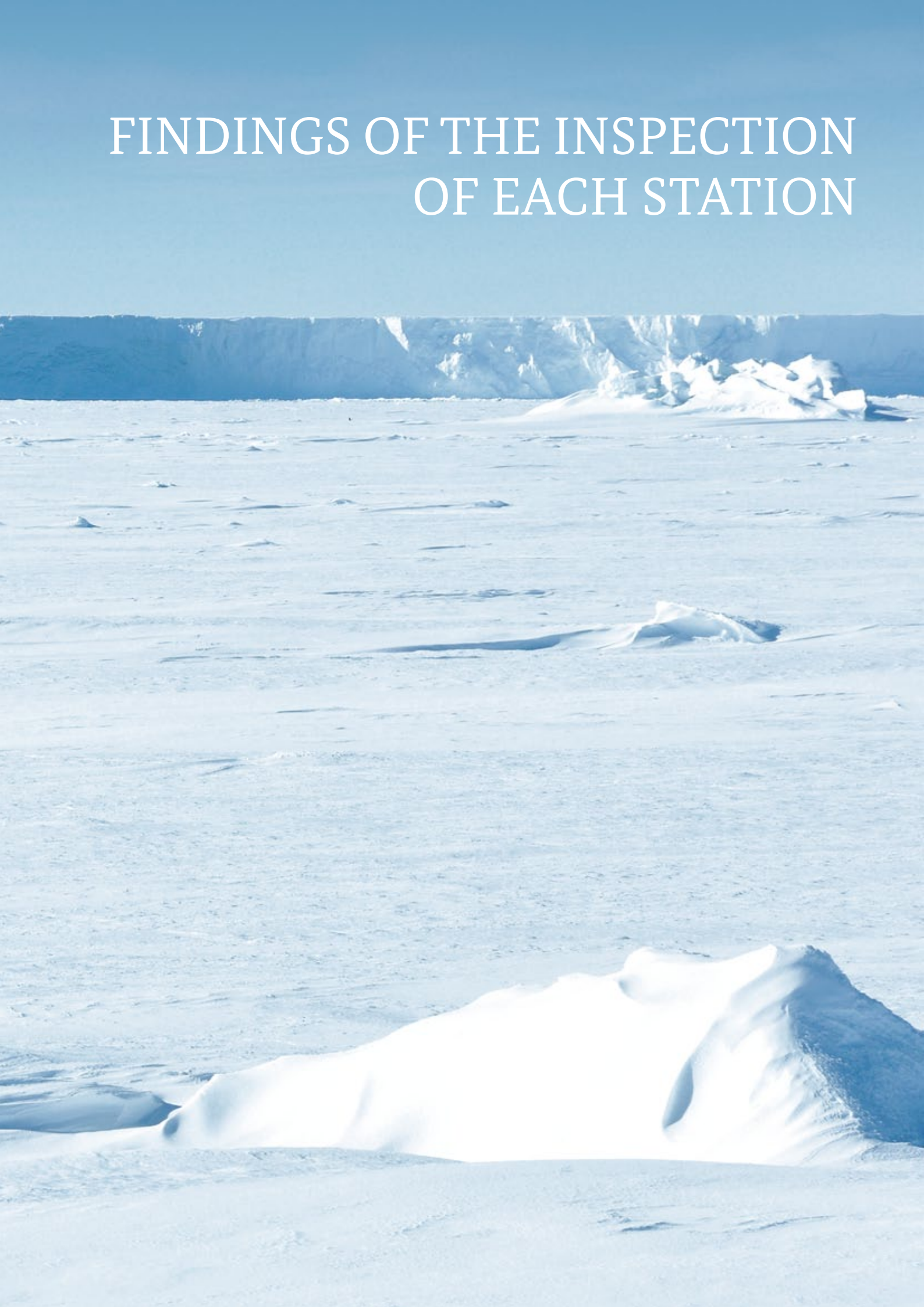
One of the stations inspected has commendably implemented stringent measures to prevent the introduction of non-native species, and the remaining stations are strongly encouraged to adopt these practices, especially as this is easily facilitated by COMNAP’s Non-native Species Manual and its user-friendly checklist.

- Area Management

Those stations undertaking research or monitoring within ASPAs should ensure that the necessary permits are obtained.

II.

FINDINGS OF THE INSPECTION OF EACH STATION



1. Princess Elisabeth Station (Belgium)

(1) Overview

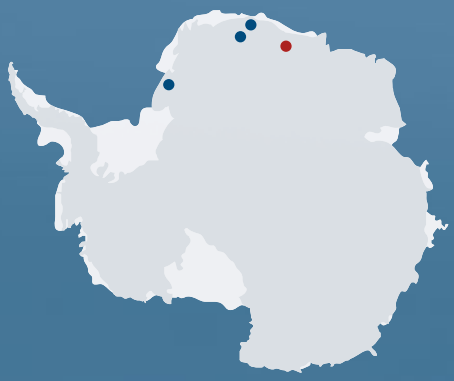
The Princess Elisabeth Antarctica research station (PEA) is a summer only facility. It is occupied from November until February each Antarctic summer season. The main purpose is to be used as a base for extended field activities in the region extended up to the inland ice plateau.

The station is located on the Utsteinen Ridge, north of the Utsteinen Nunatak, Dronning Maud Land, East Antarctica.

Coordinates:	**71°57' 01"S; 23°20'48"E**
Elevation:	**1397 m a.s.l.**
Distance to the coast:	**220 km**
Research areas:	**Sør Rondane Mountains, glaciers, coast and the Antarctic Plateau**

The station is owned by the Belgian state and operated by the Belgian Polar Secretariat.

The inspection team arrived at PEA on 18 January 2013, 17:00 UTC. The inspection was performed on 19 January 2013, 09:00 until 16:00 UTC.



The inspection team was welcomed by station manager Alain Hubert.

Various documentation, according to selected parts of the checklist, and other material were handed over to the inspection team. Interviews were conducted with the station manager and selected members of staff during the visit.

Station manager Alain Hubert emphasised the fact that PEA is there to support scientists in the field, going back to the original aims of the Antarctic Treaty. Thus, the PEA is widely relied upon by other Antarctic Treaty Parties for scientific expeditions and field work. Extensive outside science facilities ensure long-term monitoring in east Antarctica. The high performance broadband satellite link (sponsored by SES ASTRA) at PEA allows remote control of the station during unmanned winter times, as well as the transfer of valuable scientific data year round.

The Belgian Antarctic programme is entirely funded by the Belgian State (Belgian Science Policy).

23°20'48"E

(2) Logistics and Operations

Commander for season 2012/13: Alain Hubert
Language at the station: Dutch, French and English were spoken at the station, English being used as a technical working language.

i. Station Facilities and Description

Personnel at the station on the day of inspection:
15 at station, 11 in the field

The station was commissioned in February 2009. The special design concept of using alternative energy sources requires a sophisticated energy management system. An important component of this system is the remote control of the station during winter – an important segment of the design in order to keep the main building at the necessary temperature level and to make the base operational for the subsequent summer season.

It consists of several buildings and facilities. There is a main building with an attached wooden construction on the lower entrance side. On the roof of the wooden construction a battery of solar panels is mounted. Likewise solar panels are fixed at the outside walls of the main building.

The wooden construction accommodates workshops, the power plant, the snow smelter, and storage for field equipment, food and supplies, as well as an additional accommodation block.

This construction was undertaken in phases. In 2009/10, an additional accommodation block was added consisting of 8 rooms for beds each. In 2011/12, the technical block was rebuilt and extended by 360 m^2.

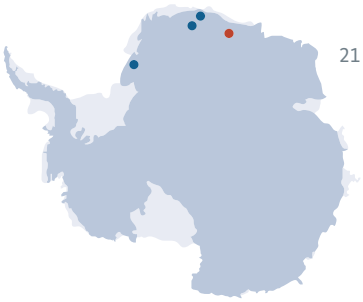
During the current season, the construction activities included consolidation of the foundation of the wooden construction onto the rocks, the reconstruction of the entrance and the extension (108 m^2) of the technical block.

Other buildings and infrastructure not attached to the main building are:

- Snow runway
- Winter storage assembled with containers
- Emergency accommodation
- Fuel storage on a steel platform located at the ridge
- Two modules for air chemistry and magnetic observations on the ridge
- Satellite dish on the ridge
- Wind generator park – 9 windmills, plus 1 more added at the other side this season

In front of the main building an extended parking area on ice is used for mobile accommodations for field camps, transport sledges, tracked vehicles, skidoos, cranes etc.

Planned construction:
A hangar at the skiway for maintenance work of vehicles and an automatic weather station. A substantial extension of the station is considered for the coming years. A separate new station building linked to the existing mains building will be constructed on the southern end of the Utsteinen ridge.



The total area of the station (footprint of activity) is estimated to 2,5 by 3 km. All the buildings of the station cover a protected area of 2000 m². The main building is 500 m².

The oldest building is the main building (2009). Extensions are younger and in good condition.

Temporary field camps for scientific activities are established each season according to the scientific projects and extend up to the inland ice plateau. The entire camp infrastructure (cabooses, tents, depots etc.) is returned to the main station at the end of each season.

The ship unloading operations usually take place in the Crown Bay (70°05'S; 23°00'E) or in the neighbouring Breid Bay depending on sea ice conditions. At the unloading sites there are no permanent facilities. The sites are completely empty and cleaned up after each ship call and finalization of over land transport.

The route from the unloading site to the station is 220 km long. The traverse route is marked and crevasse free. Every year the traverse route is inspected for safety purposes.

During the inspection the following facilities were visited:

Main building:
All rooms, workspaces and technical installations have been visited inside the building:
- Control and ventilation unit
- Central computer control room
- Battery room (192 batteries weighing 72 kg each)
- Energy management system
- Water treatment plant
- Medical facility

The steel foundation construction anchoring the main building to the underlying rock was also inspected.

Technical block/Waste processing facility:
- Diesel generator shed
- Workshops
- Storage for base supplies (freezer and fridge food storage)
- Comprehensive storage for field equipment and supply
- Additional accommodation (8 rooms)
- Snow smelter container
- Battery installation of solar panels

Other installation on the ridge:
- Wind generators (not operational at the time of inspection because of maintenance)
- Fuel platform
- Satellite dish and antennas
- Air chemistry laboratory

Mobile facilities in the parking area:
- Mobile accommodations on sledges
- Transport sledges
- Cranes and other lifting equipment
- Containers

ii. Station Operations

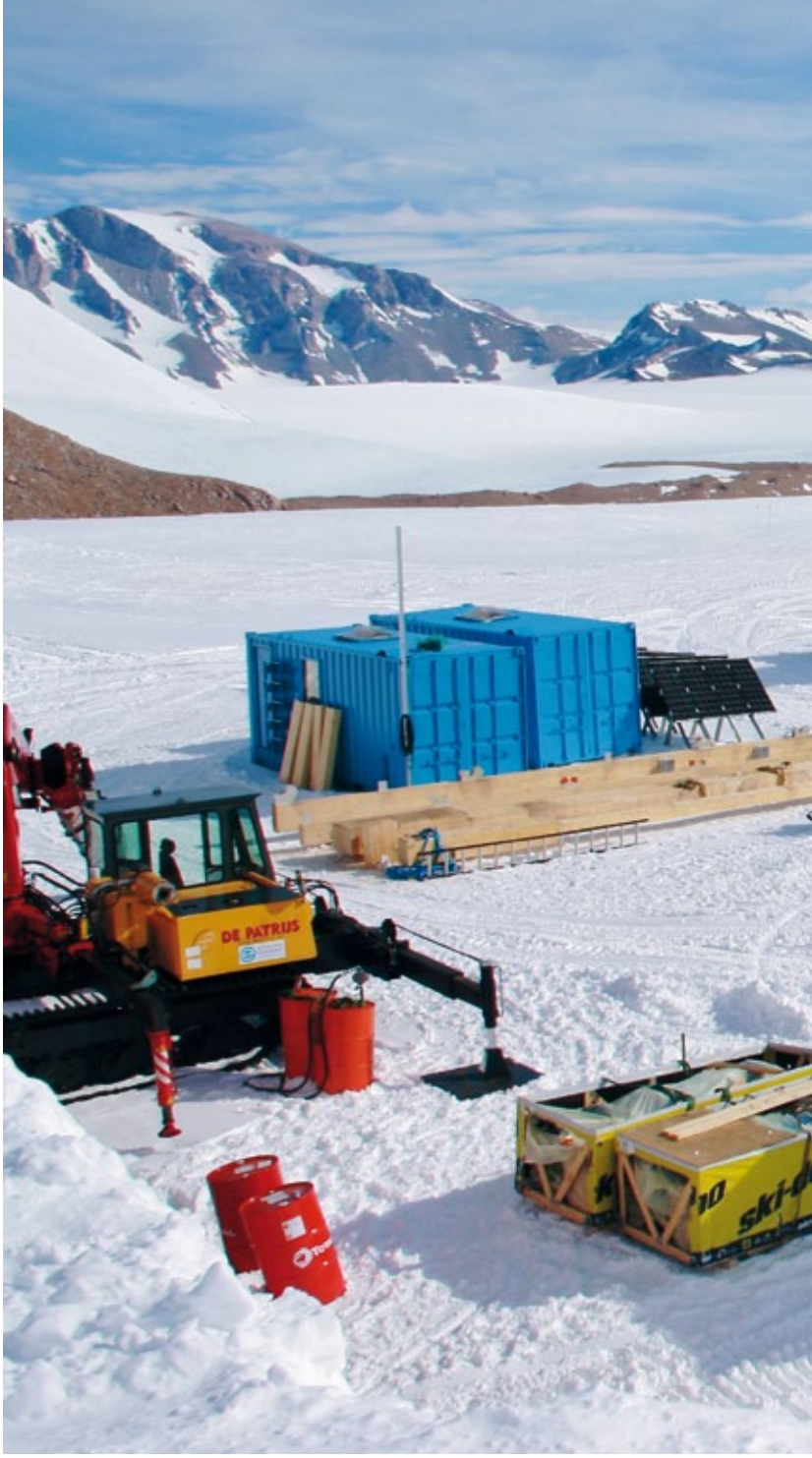
The following information was collected by onsite interviews and documents handed over to the inspection team.

Communication
The station has a permanent satellite link 1 (download) + 1.5 (upload) Mb/s (SES Astra), Iridium, HF, VHF also VHF repeaters for field parties. Inmarsat is used as backup, and for voice telephony.

Fuel storage and usage
Polar diesel is used for the diesel generators which function as a backup to the station energy supply. Petrol unleaded 95 octane is used for skidoos and portable generators. Jet-A1 fuel for aircraft (fixed wing aircraft and helicopters) is stored in drums on sledges. Aircraft crews refuel the aircraft with onboard pumps. White gaz is kept in small amounts for various applications.

Fuel drums for generators and vehicles are stored outdoors on a platform on the north side of the station on the Utsteinen ridge, and vehicles are fuelled in this area. Because the drums are rarely moved, it seems unlikely that they will break or spill fuel. Jet fuel was kept outdoors near the airfield on sledges.

The inspection team found that the station personnel were well aware of the risks associated with fuelling operations. For this reason, measures against fuel and oil spill such as the use of secondary containment (e.g. drip tray) and absorbent material were taken. No major fuel or oil spill incidents have occurred so far.



Fuel Contingency and Fuel Management Plans are in place. According to the interview with the station manager, there was one oil spill in the past three years (since commissioning) i.e. 40 l of hydraulic oil. The contaminated snow was collected and cleaned up. The incident was reported to COMNAP.

Power generation and management
The inspection team received a conducted tour of the power generation and management system. The primary energy supply is wind and solar energy. The permanent back-up consists of two diesel generators of 100 kW each.

The core of the energy supply is a battery pack consisting of 192 batteries. In case of low wind or solar energy, the backup diesel generators will automatically start to keep the batteries charged. It requires 100 to 120 hours a month to charge the batteries which last 6 to 8 hours at a time.

On the day of inspection, both the solar panels and the wind generators were not in operation due to maintenance and recabling. The 9 wind generators provide 6 kW each. The collection of solar panels generates 55 kW. The average daily consumption of the station is 600 kWh provided in combination of the three power sources i.e. wind, solar and diesel.

The base is constructed of wood which proved to be a good thermal insulator. The walls consist of two layers of wood with synthetic insulation in between. No additional heating of the internal of the building is therefore required during the summer months. Sophisticated ventilation and air circulation systems are an integral part of temperature management. During winter the inside temperature is controlled remotely to above zero degrees C.

Although designed as an emission free station, diesel generation is required to supplement the alternative energy supply. The backup generators therefore are operational almost throughout the year. From the interview information on the energy production from April to December 2012, only during the months of September till November no diesel energy was needed.

The energy supply of the station is managed by a smart grid system, which is based on a dynamic prioritization principle. This implies channelling a variable supply of energy on a priority basis, e.g. scientific demand will be given a higher priority than for example general activities.

Water systems (supply, storage, treatment)
The main water supply is melting of snow, which does not require electricity. A solar thermal system on the roof of the main building generates sufficient energy to warm up the collection tank into which snow is thrown to melt. On average 800 l per day of water are produced.

The water treatment plant is a nanomembrane filtration biological system. Black and grey water enters an anoxic zone followed by an aerobic zone where oxidation and pH is controlled. The next step is a filtration system/active carbon/UV system and chlorine is added. The sludge filter collects 160 kg of sludge per season. The treated water is reused once for everything except drinking and cooking. Water conservation is managed through a very stringent water usage system e.g. showers are controlled in 30 second squirts. The water supply and treatment system is shut down at the end of summer activities and set up again at the beginning of next summer season.

Medical capabilities
A small hospital room is accommodated in the main building equipped with the necessary medical facilities as well as telemedicine connection with a hospital in Switzerland. Field teams are led by certified mountain guides who are all paramedics.

iii. Emergency Response Capability

A sophisticated fire alarm system is in place, which also monitors the station during winter. A fire emergency plan is available. A sprinkler system is installed in the main building. 25 fire extinguishers are distributed throughout all station housings. One fire fighting and evacuation exercise is conducted when the summer season activities begin.

iv. Stations Logistics and Supply

Ground transport:
A list of vehicles on site was not supplied during the interview. Transport of fuel and supply from the unloading site to the station is performed by track vehicles and sledges. Track vehicles, sledges and skidoos are used to deploy field parties.

Ship supply:
One ship call per season for fuel and bulk supply. Three to four cargo traverses are required to transport the arriving cargo from the coast to the station. One traverse is required to transport waste to the ship for evacuation.

Air operations:
Aircraft movements are performed in the framework of DROMLAN to transport personnel and dedicated scientific equipment, e.g. 11 movements during season 2012/13. The station is also used as a base for scientific survey flights from other countries. Scientific requirements determine the number of aircraft operations. Helicopters are chartered for dedicated scientific field activities and/or to deploy field parties to remote areas.

v. International Logistic Cooperation

Belgium is a member of DROMLAN. The Belgian Polar Secretariat contributes to DROMLAN beyond national needs by providing fuel and ground service for Antarctic flights performed within the DROMLAN cooperation, as well as regular weather reports to the flight weather forecast centre at Neumayer III.

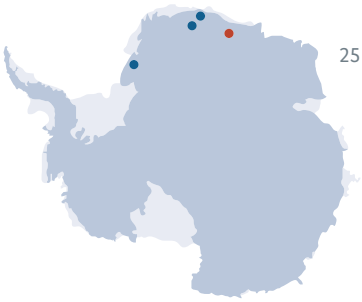
DROMLAN became an important element for the station's logistic operation and the scientific activities. The Belgian Polar Secretariat intends to actively take part in the future DROMLAN cooperation.

(3) Environmental Protection Measures

Emanating from the previous Japanese inspection report, the translation of the updated field manual for environmental conservation into English, to familiarize all personnel with conservation measures, was not yet available, due to the decision to insert relevant pictures.

i. Waste Management and Disposal

- Waste management
A comprehensive waste management plan for the reduction, reuse, recycling, collection (separation), storage, and disposal of waste is readily available at the station and all personnel are trained accordingly. The inspection team was advised that waste was being sorted into wood, chemical/medical liquid, organic, paper, metal, glass and general waste. Sorted waste is stored in 20-foot containers (to prevent dispersal or access by scavengers), which are taken to Cape Town for disposal. There is no incinerator at this station.



The very little hazardous waste generated by PEA is stored separately for removal from Antarctica – batteries in a container and chemical waste in barrels.

Environmental monitoring is conducted at the station via a comprehensive weekly checklist. This practice is highly commended.

- Waste disposal
The comprehensive waste management plan provides for the recycling of wood (that is not reused), paper and fuel drums. According to the management plan an environmental impact report is prepared annually for the Ministry of the Environment in Belgium.

- Handling of fuel
There is a comprehensive Oil Spill Prevention and Response Strategy available at the station. Only fuel drums – no fuel tanks – are used at this station to minimise spills (should they occur) to 205-litres only. All fuel drums are stored on a steel platform. Empty drums are used for storage of organic waste and fuel spills and, as well as any empty drums are stored in containers prior to removal from Antarctica.

ii. Treatment of Sewage and Domestic Liquid Wastes

A fully functional membrane bioreactor water treatment unit (WTU) has been installed for the treatment of all sewage and domestic liquid (bathroom and kitchen) waste. The water is recycled once, after which it is disposed of in a deep crack between the rocks and ice (Bergschrund). A strict water usage policy is implemented to ensure the proper functioning and maintenance of the WTU. The quality of the water is monitored on a regular basis.

The sludge filtration unit generates about 160 kg of solid waste per season from about 700 litres of sludge, which is disposed of in Cape Town.

iii. Conservation of Fauna and Flora

Mandatory preseason training (4 days) is undertaken by all station personnel and scientists, including an environmental code of conduct and rules against interference with flora and fauna.

Research on macro bacteria is carried out on a regular basis on the ridge near the station since the 2006 – 2007 season and this area is “off-limits” to everyone, except those undertaking the studies, in order to preserve the habitat.

Although there are brief notes pertaining to interference with fauna and flora, the field manual, which is still under development (see above), may contain more detailed information in this regard. The station manager advised that no permits have been granted for scientific research which causes harmful interference with flora and fauna. In general, field expeditions from the station only take place under the leadership of field guides who are all certified mountain guides.

(4) Scientific Investigation and International Cooperation

Since PEA opened, several different multidisciplinary research projects have been supported. Over the last four seasons, a number of international collaborative projects are running at the station. Some projects run for several years, while others are more limited in scope.

Projects hosted by PEA include:
BIOLOGY: The BELDIVA microbiology project studies the microorganism biodiversity of habitats around PEA, and uses this information to assess the station’s impact on the surrounding microbiological ecosystems. The DELAQUA project links microbial community composition at different sites with environmental conditions and the glaciation history of the Sør Rondane Mountains.

GLACIOLOGY: The BELISSIMA project investigates the characteristics of ice streams near the Sør Rondane Mountains, grounding zones, ice shelves and coastal ice rises in Dronning Maud Land.

GEOLOGY AND GEOPHYSICS: In the GEAII study, geologists and geophysicists have been collecting rock samples, conducting structural readings and taking magnetic susceptibility measurements on outcrop rocks to learn more about the rocks in the region and how they have been formed and deformed over time by orogenies (deformations of the lithosphere) that led to the formation of the Sør Rondane Mountains, for example.

The Lithospheric and Intraplate Structure and Seismicity in Antarctica (LISSA) research project investigates the intraplate seismic activity and the lithosphere around the PEA station. They have installed and used a broadband seismograph, which adds to the global network of seismic stations. It also makes it possible to monitor possible ice quakes. The GIANT (Geodesy for Ice in Antarctica) study evaluates ice mass changes and their relation to the deformation of the Earth's crust. It includes taking annual absolute gravity measurements as well as permanent GPS measurements.

The Japanese Antarctic Research Expedition (JARE) spans a number of decades, and considers the geology and geomorphology of the DML. In recent expeditions, the Japanese researchers classified sediments according to their (relative) age and weathering characteristics, and preliminary results revealed that the Antarctic Ice Sheet thinned about 700 m during the Pleistocene Epoch. A team of 4 Japanese scientists was in the field in January taking measurements.

METEORITES: Meteorites provide valuable information about the formation of the solar system and the planets. Antarctica is an excellent place to collect meteorites because they are preserved by the ice and are highly visible. Team members of the SAMBA and MICROMETA projects have gone to different ice fields to collect new meteorites in the hope to learn more about the formation and evolution of the early solar system and planetary bodies.

ATMOSPHERIC SCIENCE: The goal of the BELATMOS project is to contribute to the long-term monitoring of the chemical and particle composition of the atmosphere in Antarctica, as well as monitor the amount of UV radiation reaching the Earth's surface. Preliminary results showed very few aerosols and very low concentrations of lightabsorbing particles at PEA. The GLACIOCLIM-SAMBA project considers the relationship between glaciers and climate in Antarctica. Using a network of stakes affixed to the ice sheet, researchers are trying to better define the surface mass balance of the Antarctic Ice Sheet by measuring snow density and accumulation rates as well as glacier movement. The HYDRANT project is investigating the atmospheric part of the hydrological cycle in Antarctica. They are focusing on weather systems and cloud formation, and their influence on the ice mass balance in the area.

Science facilities are available in mobile container units, on the station roof, along the ridge, and free standing in the vicinity of the station. Apart from the integrated meteorological observation facilities and Automatic Weather Station, the station also has two platforms for instrumentation for atmospheric chemistry (BELATMOS) and geophysics (seismometer, absolute gravimeter) and a unique platform for a magnetometer installed by the NIPR.

Next to the Belgian researchers, scientists from the following countries participated in the expedition: Japan (4), Germany (5), one each of Norway, UK, Switzerland and Luxembourg.

(5) Use of Antarctica for Peaceful Purposes

During the construction period, the station received logistic support from the Belgian armed forces. For the running operation of the station, military support is limited to assistance with the downloading in Belgium of data sent from the station by satellite.

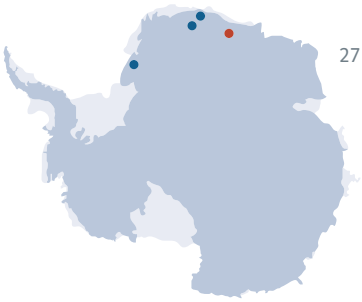
No military personnel are present at the station. As limited construction work is still ongoing, a small amount of explosives is still present at the station and is stored safely.

(6) Training and Awareness

Training:
In Belgium, a selection/recruitment panel decides on the roles to be undertaken, as few applications are received. Currently, the personnel selected for technical and engineering work have prior experience and understand the conditions in Antarctica.

The station only operates in summer and personnel are provided with a briefing in Brussels and 4 days training in Chamonix, held annually from September – October, as well as at the station, on campaign planning aspects and environmental matters, as follows:

a) **General training to all personnel –**
- Briefing session on the Antarctica environment and conditions
- Environmental matters, including the Madrid Protocol
- First aid training, field survival and environmental training
- Emergency evacuation procedures



- GPS use for geo-referencing and locations
- Crevasse training
- Skidoo operation and use
- Major incident response training
- Fire safety and fire evacuation training
- IT equipment (internet, telecommunication, computers and other communication)
- Search and Rescue (SAR)
- Health and Safety

b) **Specialised training to specific personnel** –

- Heavy vehicle training (vehicle safety) to personnel with qualifications to drive/operate heavy vehicles/ machinery (minor training at the station)
- Electronic training is provided to electronics personnel
- Waste management training
- Fuel/Oil management and spill response training

Awareness:
The personnel are briefed weekly by the team leader or station manager on activities to be undertaken. The Madrid Protocol, as well as the fuel spill action card, environmental code of conduct, etc., are placed on the notice board and in strategic areas for personnel awareness.

(7) Reporting

As regards personal injuries resulting from accidents, injuries or near misses, the station has no formal reporting system in place, and is dependent on patient records that are kept at the doctor's office, as a system to capture these types of occurrences. The station has had no accident or incident in the last twelve months that has resulted in human death or significant injuries, major damage to the station facilities or to the environment. A Fuel Spill Response Strategy exists and fuel spills are reported to COMNAP.

There is no up to date information about the former or future Belgian activities in the Antarctic in the EIES of the Antarctic Secretariat available (EIES completed until 2011).

(8) Tourism

During the International Polar Year (2008/2009) the station received a number of royal and VIP-visits, as well as from several art photographers and documentary television teams.

Recognizing that the UK-Government has issued a permit for the adventure expedition "The Coldest Journey", the station decided to provide logistic support to the expedition on condition that the permit`s environmental and search and rescue requirements are fully implemented. No requests for tourist visits were received.

(9) Summary and Findings

Latest technologies are applied to run the main building with a combination of wind, solar and diesel energy, significantly reducing emissions (although not to a zero level) and the station is in many aspects exemplary.

The inspection team recommends sharing technical information and operational experience in order to assist other nations to develop advanced replacements if intended. Especially the energy management (smart grid) and the measures to reduce water consumption are noteworthy. Other stations are encouraged to consider adopting these technologies.

The station at this location is an example on the advantages of the DROMLAN cooperation. Without the access via DROMLAN the station would not be operational in an efficient manner. Likewise, the construction would not have been completed in the short time. The future operation depends on the logistic cooperation in air operations among the stations in DML.

The establishment of a more formal classification and reporting system for accidents and incidents should be considered.

The comprehensive waste management plan and the oil spill prevention and response strategy that exist for the station are commendable, especially the exemplary waste water treatment and recycling process.

Belgium should consider implementing measures to minimize the danger of introducing non-native species to Antarctica and should also ensure that the preseason and annual report information on the Belgian activities in Antarctica are available annually on the EIES.

The inspection team noted that excellent science is undertaken by the joint Belgian-international staffed expeditions that do field work around PEA.

2. Troll Station (Norway)

(1) Overview

Troll is a year round station which was opened in February 2005 after extensive construction work. The station is built on rock. Troll was initially commissioned as a summer station in 1990.

Coordinates:	**72°01'S; 02°32'E**
Elevation:	**1275 m a.s.l.**
Distance to the ice shelf margin:	**263 km**

A number of research areas have been established in the vicinity of the station. Scientific activities comprise field parties and work at the Tor field station.

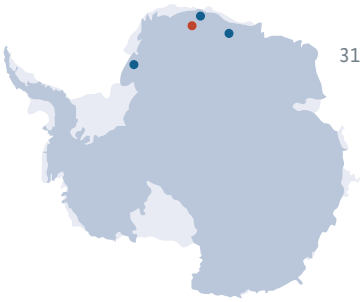
The station is owned and operated by the Norwegian Polar Institute (NPI). The national research programmes are funded by the Research Council of Norway and the NPI.

Station commander for season 2012/13: Ken Pedersen
Language at the station: Norwegian, almost all staff speaks English. The inspection team was welcomed by station commander Ken Pedersen.

The inspection was performed on 14 January 2013 from 10:00 hrs until 16:00 UTC.

Comprehensive documentation according to the checklist and other material was handed over to the inspection team, and a number of interviews were performed with the responsible members of staff during the visit.

At the time of inspection, 45 persons were present at Troll station.



(2) Logistics and Operations

i. Station Facilities and Description

The station covers an area of approx. 50 000 m². Additionally the area of the station includes the airfield and outlying cargo lines on the glacier.

The inspection team estimates the footprint of the activities to be about 100 000 m².

The buildings and containers are on steel platforms, their dedications and year of construction/age are:

- Main station 1990 / 2005 / 2009 / 2011
- Main power station 2007
- 2 emergency power stations 2000 / 2005
- Emergency station: 2005
- Summer accommodation: 2013
- Igloo: 1990
- Garage/workshop 2005
- Hobby workshop: 1990 / 2005
- Container workshop
- Container platform/storage: 2009
- Food containers/reefers 2005
- Fuel transfer pump container
- Storage containers
- NILU scientific station (air pollution): 2007
- Communication antenna 1 and 2: 2005 and 2007
- Vehicle/machines winter storage garage: 2012
- Satellite tracking and command antenna 1 and 2: 2006 and 2011

Winter staff comprises 6 persons.

Troll airfield construction work started in October 2004, about 7 km north of Troll station, and the airfield was established in February 2005, with the first inaugural flight being undertaken as a national flight by the Norwegian Air Force with a C130. Norway's investment was coordinated within the DROMLAN agreement.

Coordinates:	**71°57'S; 02°28'E**
Elevation:	**1,298 m a.s.l.**
Length:	**3,000 m**
Width:	**60 m**
Condition:	**blue ice**

According to the interview, the runway is subject to sand and gravel blown from nearby mountains scattering on the ice surface, which are melted by solar heat creating numerous holes. Routine repair work is carried out to drill holes in the ice, remove the gravel and fill the holes with water so that it will freeze over. This repair work is considered part of the maintenance of the runway. Because of being located at a relatively high latitude, Troll runway, unlike Novolazarevskaya runway, is free from melting during summer.

The unloading site (70°07'S; 05°18'E) at the Fimbulisen ice shelf margin is used for unloading/loading during ship calls. No permanent facilities are at the unloading site and the area is empty when transport to the station has been completed.

The Tor field station (71°55'S; 05°10'E; approx. 1500 m a.s.l.) is an outsite facility of Troll station, with one container used for accommodation. It is located 110 km East of Troll in the Svarthamaren mountain, and provides a logistic base for scientific activities in the ASPA No. 142. Access is with skidoos via a marked route.

During the inspection the following facilities were visited:

Main building

- Living quarters
- Communication room
- Hospital – telemedicine, operating theatre in one room, medical store second room
- Ventilation, heating, heat exchanger
- Organic waste treatment (waste from kitchen)

On the platform of the main building, a separate block with grey and black water treatment is installed. According to the station master, treated water is not used, because sufficient water is available year round.

The workshop and garage (heated) for maintenance of vehicles, the fuel pump station, snow smelter and power plants (main and emergency) are housed in separate units away from the main building.

The power plant unit also accommodates a UPS battery backup for 1 hour, as well as a fire fighting control centre.

The power plant unit of the former summer station is now used as a further emergency generator and the liquid hydrogen generator for the clean air laboratory is accommodated here as well.

ii. Station Operations

All detailed information was handed to the inspection team according to the checklist and is outlined below.

Communication
National phone system through satellite link, Iridium phone, Inmarsat, fax, HF, VHF. Bandwidth for Internet connection is 250 Mb/s.

Fuel storage and usage
The following fuel types are stored:

- Arctic diesel: 500 m^3 – for generators and vehicles
- Jet A-1 fuel: 210 000 l – for aviation ops
- Petrol 95 octane: 6000 l – for skidoos and small generators
- Propane: 1500 Kg – for cooking

Types and capacity storage containers:
Arctic diesel is stored in 11 m^3 glass fibre tanks mounted inside 20 ft steel containers, as well as 24 m^3 double-walled fuel tanks.

Jet A-1 fuel: 200-l drums
Petrol: 200-l drums
Propane: 14 Kg and 48 Kg propane bottles
Total storage capacity at Troll station: 555 000 m^3.

Monitoring of fuel pumping systems and storage tanks (method):
Arctic diesel: manually operated fuel transfer pump, comprising an insulated steel pipeline (partly above the ground) from the fuel pump to the storage tank inside the power plant. Jet A-1 and petrol: manually operated.

As an easy, quick, safe and environmentally-friendly method of emptying fuel lines, a fixed fuel line with closing valves is used, comprising a suction hose connected with a dry-break coupling for connecting/disconnecting This system dissipates trapped fluid pressure into the hose coupler without any spillage.

Field fuel depots:
6 fuel depots are used for traverses between the offloading site at the shelf and Troll station.

Protection against leaks and spills:
Double-walled transport and storage fuel containers are mounted inside 20 ft steel containers. All fuel connections are inside the container. Fuel drums are stored on fuel store mats to prevent any spill in case of damage to the drums. Fuel absorbing materials are used to protect against spills and leaks during maintenance.

Power generation and management
Basic power supply is by diesel generators (electric energy and thermal energy), with a separate emergency plant. There are no alternative energy sources, however Norway is looking at introducing alternative energy production at Troll (solar energy). Studies for the possible use of wind energy have been completed, however there is not sufficient wind potential.

Number, type and capacity of generators:
Main power station:
2 diesel generators, each 300 kVA (240 kW).
Emergency power station no. 1:
3 diesel generators, 80 kVA (64 kW).
Emergency power station no. 2:
1 diesel generator, 60 kVA (48 kW).

Annual fuel consumption for power generation is about 250 000 litres per year with the current activity. No filtering and monitoring of emissions is taking place.

Water systems (supply, storage, treatment)
An ice/snow melting system, using exhaust heat from generators, is used for water supply. Water is treated using filters and ultraviolet (UV) purification, then stored in a 3 600 l tank. Snow for this process is readily available from the glacier nearby the station. Regular analysis of water samples indicates that good quality water is produced. The consumption of water is 80 – 100 l per person per day.

Management of dangerous elements
To prevent leaks, spills and for safety reasons, chemicals and dangerous goods are stored in their original containers in workshops, the power station, the main station building (technical room and sewage treatment plant) and the Norwegian Air Research Institute (NILU) station.

Medical capabilities
A medical doctor is available at the station throughout the year. The medical centre houses basic medical equipment (X-ray, ultra sound, telemedicine equipment, 1 patient bed, etc.) and various medicines. The medical doctor is, to some extent, also trained in dental issues and has basic equipment for emergency dental treatment.

As regards the state-of-the-art telemedicine facilities at this station, the doctor has the option of requesting and receiving year round qualified medical support and second opinions in all specialities on a 24-hour basis from the University Hospital of Northern Norway (UNN) in Tromsø.

Primary contact is by direct telephone, video or email contact and X-ray-records may be transmitted by email. The doctor initiates the system by calling Emergency Admission at the UNN, who then makes direct contact with the telemedicine unit in the hospital having live voice and image transmission capacity. Pictures of patients in standing, sitting and or lying position can be transferred.

iii. Emergency Response Capability

The wintering team is trained on SAR operations during their field course in Norway and also during extra training on this issue when arriving at Troll Station. A SAR exercise is conducted at the end of the summer season for the wintering team. Other resources for SAR are vehicles. No incidents were reported in the last year.

In general, incidents are reported to Norwegian authorities according to the NPI reporting routines. Reports are also made available through the COMNAP network.

In addition to the availability of ground transport facilities, there is the possibility for evacuation by aircraft to Cape Town within the DROMLAN framework and also by national arrangements. This will be coordinated through NPI by the Expedition Leader during the summer season and by the Antarctic Operations Manager in Tromsø during the wintering period.

All new personnel are briefed on the fire emergency plan (which is also available in the living room) and the use of fire-fighting equipment upon arrival at the station. At Troll station, there is also an emergency station, which can house up to 8 people.

A fire alarm system with smoke detectors is installed. Sprinklers and fire extinguishers are spread through-out the buildings. Fire drills (evacuation) are undertaken once during the summer season and once during the wintering period.

iv. Stations Logistics and Supply

Ground transport:
The following vehicles are available:

- 6 x Prinoth Everest tracked vehicle for transport of equipment between shelf and Troll
- 1 x Prinoth T4S tracked vehicle for airfield maintenance
- 4 x TL-6 tracked vehicle for scientific projects
- 4 x BV 206 tracked vehicle for station duties (waste handling etc)
- 1 x tractor with back mounted crane
- 1 x wheel loader, 18 t
- 3 x excavator, 4.7 t, 7.5 t and 26 t
- 11 x skidoos
- 4 x Articulated Track vehicle (ATV)
- 1 x Toyota pick up

All vehicles are in good order and well maintained.

Ship supply is coordinated with Belgium and other DROMLAN parties, as and when required. According to the programme's needs, one or two ship calls are scheduled.

The coordination of ship operations to supply several stations was very successful and cost efficient.

Every year, a total 1,400 tons of fuel and equipment are moved from the unloading site to Troll along the 260 km long marked route. At the beginning of the season, prior to the commencement of transportation, investigation of crevasses is undertaken by ground penetrating radar.

The inspection team observed that vehicles with no loads are put on empty sledges and towed to the off-loading site to reduce the carbon footprint and fuel consumption for surface transport.

Air operations:
Personnel and limited cargo are transported via DROMLAN flights. There were about 25 landing/take offs during 2012–2013, including 2 intercontinental DROMLAN flights and DROMLAN Antarctic flights for logistics and science. Aside from the DROMLAN flight activities, the airfield is also used by national charter aircraft (Orion 2B, Gulfstream III, Boeing 737 BBJ) for medevacs, visits of Norwegian officials and for test flights. One medevac was conducted just prior to the inspection on December 31, 2012.

A first midwinter flight was performed (medevac) on June 22, 2011, which was a challenging air operation and demonstrated the feasibility of flights even in midwinter.

v. International Logistic Cooperation

The station is a member of DROMLAN. It contributes to DROMLAN beyond national needs by running the airfield, providing fuel and ground service for the intercontinental flights, as well as for Antarctic flights to the various destinations within DML and providing regular weather reports for the flight weather forecast and accommodation of passengers in transit. NPI logistics will further use the DROMLAN cooperation as one segment for efficient logistic activities at the station.

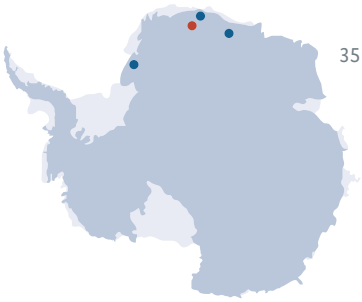
(3) Environmental Protection Measures

At the time of inspection, the environmental management handbook, jointly prepared by Finland, Sweden and Norway in 1999, was available for reference at the station. A handbook to address the needs of the new station should be developed.

The inspection team noted that activities to extend the station were ongoing. The Norwegian 2011 – 2020 IEE states that the Norwegian Polar Institute will ensure that further development of the station will be in line with the land use strategy outlined in the Troll land use plan. In particular, this plan comprises a zoning scheme, the objective of which is to ensure that environmental and scientific values of the area have the highest priority in the further development of the area. Ongoing upgrading activities are taking place in this operational zone. However, it remained unclear for the inspection team whether the observed construction activities have been assessed in terms of their potential environmental impacts.

i. Waste Management and Disposal

- Waste management
The inspection team observed that a very concise 2009 waste control separation plan exists. However, the development of a more comprehensive waste management plan (system), including aspects such as waste reduction, storage and disposal, as outlined in Annex III of the Madrid Protocol, should be duly considered. A waste production report is compiled annually, however, it is in Norwegian and not published. According to the station, the food waste compost plant reduces the volume of food waste by at least 90 %. The compost is placed in buckets and transported out of Antarctica to South Africa. The water generated in the process is treated together with the sewage and other liquid wastes. New equipment to compress plastic, cans, cardboard and other waste had been installed during



the 2009/10 summer season. No incineration takes place at the station. Recyclable waste is disposed of in South Africa.

- Handling of fuel
Currently, the 1999 oil spill response plan is not in use and there is no special training for dealing with spills. As a result, no spill response exercises are conducted. As the station is growing continuously, the updating of the 1999 plan or the development of a new comprehensive oil spill response plan, as well as regular spill response training and exercises, are highly recommended. Some empty fuel drums are used for waste disposal. Most of the drums are compressed and shipped to South Africa for disposal by approved waste disposal contractors.

ii. Treatment of Sewage and Domestic Liquid Wastes

A sewage treatment plant is installed at Troll Station. Solids come out as compost, which is stored in buckets and transported out of Antarctica. The near clean filtrate is discharged into the area east of the station for which a permit has been approved by the national environmental authorities. Sampling and testing of this filtrate is done monthly. Although grey water was used in the past in the toilet system, this practice has been discontinued due to discolouration of the toilet bowls and the availability of snow to produce water.

iii. Conservation of Fauna and Flora

During their predeployment field course, the wintering team is briefed about flora and fauna issues at Troll, however, a presentation "Troll in brief" provided to visitors to the station did not sufficiently cover fauna and flora matters. This aspect should be added to the presentation. Awareness was demonstrated, while at the station, when the helicopter crew were informed that an altitude of 1,000 m was to be maintained when taking aerial photos of the station for the inspection, due to the snow petrels breeding in the area.

There are modestly sized snow petrel colonies in the peaks surrounding the station, which are monitored (marking and GPS location) three times each summer season. No special actions are taken to prevent the introduction of non-native species to the station, however, no permits were issued by the authorities to introduce such species and none were found at the base.

iv. Area Management

No permit could be located in the EIES pre-season report for the capture and handling (blood samples) for the 3-year bird project currently being undertaken near the station and in ASPA No. 142 Svarthamaren.

(4) Scientific Investigation and International Cooperation

Norway maintains its long-term commitment of scientific research in Antarctica. The Norwegian Polar Institute (NPI), as the national coordinator, enables Norway to maintain this role for its research and long-term monitoring and survey activities. In addition to NPI, the NILU undertakes long-term survey and remote sensing activities in Antarctica. NPI provides the main infrastructure for polar research, maintains the permanent Norwegian presence in Antarctica, and supports international objectives through collaborative scientific and logistic links with many other national programmes. As an important contribution for long-term scientific activities, Norway runs the permanently occupied research station Troll.

Major scientific programmes supported by the station:

Norwegian Air Research Institute (NILU)
The main goal of the Troll atmospheric monitoring and research programme is to characterize the atmospheric composition and its seasonal and interannual variability at this site with its unique placement on the slope running from the Antarctic Plateau down to the coast. The programme focuses on trace species which are expected to have a noticeable spatial and temporal variability, such as aerosols, ozone and UV radiation, inorganic and organic pollutants (as for instance mercury, surface ozone and CO), organic pollutants such as non-methane hydrocarbons (NMHC), established POPs (e.g., PCBs, pesticides), and finally newly emerging POPs. These substances are, at least partially, also monitored at coastal and more continental stations. Furthermore, an archive of air samples in pressure flasks is accruing.

Norwegian Seismic Array (NORSAR) received funding to install a permanent broadband seismic station at Troll within the Norwegian Antarctic Research Programme in 2011. A bedrock installation has the advantage that seismic signals are not disturbed by multiples due to the thick Antarctic ice sheet.

The "ICE RISES" programme was started in June 2011 to investigate grounded ice masses (ice rises), such as isles and promontories. The key findings so far include upward arches (Raymond Bumps) underneath the ice-rise summits, and evidence of the stability of these ice rises over millennia.

The NPI maintains a bird monitoring programme named "Antarctic Seabirds (2011–2014)" in two snow petrel colonies in ASPA No. 142 Svarthamaren. The objective is to understand the interactions between changes in oceanographic conditions and Antarctic seabird foraging as well as seabird population dynamics. The annual monitoring programme in the two small snow petrel colonies close to Troll station has a different objective, namely to monitor whether there seems to be any effect on the colonies due to the permanent presence of and activity at the Troll station.

The company Kongsberg Satellite Services (KSAT) has established TrollSat at Troll station as the most southern ground station of their network. This station collects data from polar orbiting environmental and meteorological satellites, data from global oil-spill and ship/ice detection services etc. The company is 50% owned by the governmental Norwegian Space Centre, an entity under the Norwegian Ministry of Trade and Industry, and 50% owned by the Kongsberg Group, which again is half owned by the Norwegian Ministry of Trade and Industry.

Among the international programmes run at the station are the European Space Agency's ground reference point for GALILEO, the Finish Geodetic Institutes' (FDI) absolute-gravity measurement in cooperation with NPI and the Swedish Institute for Space Physics (IRF) experiment Movable Atmospheric Radar for Antarctica (MARA).

The "ICEGRAV" project was started in 2010–11 as an Argentine-UK-Norwegian-US-Danish logistic and scientific cooperation and will continue in 2012–13.

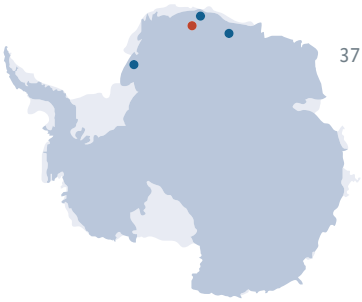
The policy for Norwegian polar research for 2010 – 2013 was drawn up by the Norwegian National Committee on Polar Research. The Research Council has included key challenges for Norwegian polar research and new trends in the polar regions.

(5) Use of Antarctica for Peaceful Purposes

There are no military personnel present at the station nor is there any other military support rendered to the station. No explosives or weapons are kept at the station.

(6) Training and Awareness

Training:
Most summer personnel (technicians, drivers) recruited have prior experience and understand the conditions in Antarctica. Interviews are conducted annually in March – April and the selection/recruitment panel considers team effort, cultural aspects, age differences, mental fitness, correct placement and gender issues in appointing the team.



The winter and summer teams receive intensive training in Norway two months prior to departure, as well as upon arrival at the station, as follows:

a) **General training to all personnel –**
- Environmental matters, including the Madrid Protocol
- Administrative preparations and team building
- An 8 – 10 days field training course in Tromsø and Spitzbergen on traversing glaciers
- Field training at the station
- Fire-fighting and safety training
- First aid training

b) **Specialised training to specific personnel –**
- Heavy vehicle training to 3 – 5 personnel at Troll station
- Water purification plant training to 3 personnel from the wintering team

Awareness:
All personnel arriving at the station are given the mandatory "Troll in brief", which provides information regarding administration routines, waste handling/sorting procedures, pollution awareness, safety precautions, danger areas around the station (crevasse areas, etc.), rules for field trips and ongoing activities. Briefings every morning focus on for daily activities to be undertaken. A list of training courses undertaken by each personnel member is placed on the notice board.

(7) Reporting

Troll station has a detailed reporting system in place, which is in line with the Norwegian reporting regulatory requirements and it follows the NPI routines. The station has a guideline or procedure in place to manage, deal with and classify incidents for reporting purposes. There were no significant incidents at this station in the last twelve months that resulted in serious harm to human health, the environment and or the station itself.

The EIES reporting is comprehensive and up to date. However, no permits could be located at the station for the capture and handling (blood samples) for the 3-year bird project in ASPA No. 142 Svarthamaren and for the annual monitoring programme for the two snow petrel colonies near Troll station.

(8) Tourism

The Norwegian government's policy on tourism is restrictive and explicit – requests by tourism companies and individuals to visit the station or to make use of the landing strip for tourist flights are denied.

A private Swiss company performed a test flight with a Boeing 737BJ from Cape Town to Troll and back on 28 November 2012 without refuelling at Troll. The flight demonstrated both the potential of a reduced environmental footprint and of the use of such flights for larger-scale tourism. Norway attaches importance to the fact that the objective of this flight was in no way to explore the potential for its use for large scale tourism.

(9) Summary and Findings

The well run station's efforts to keep the Troll runway open, not only as the regional main hub during the summer season, but also as an emergency medevac exit point during winter, is commendable. The inspection team observed that all technical infrastructure is in good working order and well maintained. All documentation, guidelines and management plans regarding fire-fighting, oil spills, medical and other emergency are in place.

The inspection team observed that vehicles with no loads are put on empty sledges and towed to the off-loading site to reduce fuel consumption for surface transport. International cooperation DROMLAN and ship supply was considered important by the inspection team for efficient use of infrastructure for scientific activities.

The advanced waste treatment systems, largely reducing the volumes of food and sewage waste, as well as the treatment of liquid waste, are noteworthy. Staff briefing and documentation on pertinent issues, e.g. waste management, oil spill response, awareness of fauna and flora, introduction of non-native species, etc., could be more comprehensive.

A possible synergy effect was identified by the inspection team – if the KSAT-system and DLR-system at O`Higgins were made compatible, failure risks could be substantially reduced and large satellite missions could be tackled that cannot be realized under present conditions.

3. Maitri Station (India)

(1) Overview

The inspection team was confronted with two inherent difficulties. First, it was received by the station commander and staff who had just started their seasonal/yearly term and therefore had only limited experience with running the station. Second, the organization of the internal reporting and information system was such that the team present at the station had no access to the concluding reports of previous teams. Given these limitations, the station commander and staff made every effort to answer questions.

Maitri station is a yearround station opened in 1989 in the Schirmacher Oasis in Dronning Maud Land, Antarctica. The station is located on the southern shore of the Lake Zub (name according to the map issued by the Russian Antarctic Expedition).

Previously, India operated the station Dakshin Gangotri in this region. The former Dakshin Gangotri Station was constructed on the ice shelf and was operated from 1983 until 1989 and abandoned after being buried in ice. The remains of the station are currently about 20 meters below the surface of the ice shelf.

Coordinates:	**70°46'S°S; 11°44'E**
Elevation:	**approx 110 m a.s.l.**
Distance to the coast:	**approx 120 km**
Research areas:	**scientific activities are performed at the station site and in the ASPA No.163 (Dakshin Gangotri glacier)**

70°46'S; 11°44'E

The National Centre for Antarctic and Ocean Research (NCAOR) manages the Indian Antarctic programme.

Station commander for season 2012/13: P.S. Negi
Language at the station: mainly Hindi, partly English

The inspection was performed on 20 January 2013 from 11.00 till 16.00 hrs UTC.

Personnel at the station on the day of inspection: 30 persons
Winter staff: 25 persons
Additional personnel during summer season: 30 persons

Limited documentation, answers to the checklist, maps and station layouts were available on the day of the inspection.

(2) Logistics and Operations

i. Station Facilities and Description

The inspection team estimated the footprint of the activities of the station to be about 4 km².

The station consists of an 850 m² main building that includes the communication room, sleeping quarters, kitchen, mess, lounge, bathrooms, boiler room, hospital, laundry and other living facilities. Total capacity for accommodation is 65 beds in the main building. Additionally the station has summer accommodation facilities (10 container units, sleeping 3 persons each).

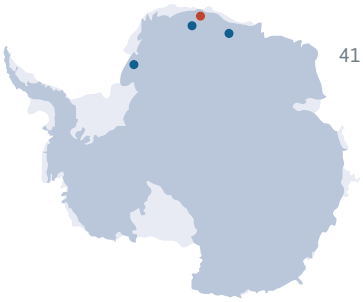
There are several containerized modules housing science and technical installations such as diesel generators, incinerators, water treatment plants, etc. A hangarsized construction accommodates workshops and facilities for vehicle maintenance.

The new station commander and his staff could not inform the inspection team on the age of the different buildings, which has been constructed after the commissioning of the main building in 1989.

There are areas for parking vehicles and trailers, tank storage and the deposit of metal waste and decommissioned equipment.

The unloading site for ship calls is at the margin of the Lazarev ice shelf in the socalled Indian Bay (70° 19'S; 12°19'E). At the unloading site no permanent facilities are installed. A mobile accommodation unit with 12 beds is left at the site between ship calls.

The route from Indian Bay to Maitri station is 136 km long crossing the grounding line eastward of the Schirmacher Oasis and approaching the station over the inland ice from the south.



During the inspection the following facilities were visited:

Main building inside units:
- Communication room
- Living quarters
- Sanitary unit
- Boiler room for hot water production
- Medical room
- Cold and warm food store facilities

Visited outside facilities:
- Pump station on a platform in the lake
- Water treatment facility and adjacent pond for treated water
- Power plants
- Workshop for vehicle maintenance
- Helipad with a landing mat in front of the main building
- Vehicles, sledges, trailers in the parking area
- Waste processing facility (incinerator)
- 3 sheds with diesel generators installed

Scientific laboratories and outside installations were also visited.

ii. Station Operations

The following information was collected by onsite interviews and documents handed over to the inspection team.

Communication
The station communication infrastructure meets the basic requirements for a safe and efficient operation:
- Permanent satellite link (Inmarsat)
- HF and VHF radio
- Iridium phone

Three personal computers permanently connected to the internet had been installed in the living room area for use by the station staff.

Fuel storage and usage
The station has new double walled fuel tanks of various capacities.
- 16 tanks (20 000 l)
- 8 tanks (10 000 l)
- 2 tanks (5 000 l)

There are 9 single-walled tanks (24 000 l) not in use, but also not discarded yet. Also, a great number of empty fuel drums are deposited in the station area. According to the interview with the station commander, these drums will be removed in phases. The future policy is to reduce the usage of drums and transport fuel in bulk and store it in double-walled tanks in the fuel farm at the station.

Power generation and management
All energy requirements are provided by diesel generators. The diesel engines are air cooled. The thermal energy (exhaust heat and radiator) is not utilized, only the electrical energy is used. Electrically heated boilers provide hot water and heat to the main building of the base.

The following diesel generators are available:
- 2 generators 135 kW each
- 4 generators 75 kW each
- 4 generators 62 kW each

The generators are accommodated in three separated sheds. The average energy demand is approximately 120 kVA. Thus two generators are running full time, one of them for scientific needs and one for the base requirement. No evidence was found for monitoring and filtering of emissions.

According to the interview the annual fuel consumption is between 300 000 and 400 000 l. The technical staff has not reported on measures to reduce the energy / fuel consumption. The inspection team observed no utilization of thermal (waste) energy and usage of alternative energy sources. According to the interview with the station commander some studies regarding alternative energy are under way.

Water systems (supply, storage, treatment)
The station is using water pumped from the nearby lake. The pump station is mounted on a platform. The catwalk to this pump station was of concern to the inspection team with regard to safety. The water is pumped through a heated pipeline into the boiler room in the main building. The station is equipped with two water tanks with a capacity of 5 000 l each.

According to the interview, water usage is estimated at 40 l per person per day. Water is not used for flushing the toilets (incineration).

Grey water is treated via both the old and the newly installed Rotating Biological Contactor (RBC) system (see Japanese inspection report and ATCM 35 Background Paper 22 by India). The system involves filtration and oxidation. The treatment system is accommodated in container modules next to the main building. The treated water is discharged into the adjacent collection pond. The pond was supposed to be sealed to prevent leakage into the ground and into the lake, as described in ATCM 35 BP 22 by India, however, the inspection team could not verify these measures.

Incinerator toilets in the main building are used for the treatment of sewage. Food waste is incinerated in a separate module outside the main building. This incinerator needs urgent upgrading or replacement. The ash of all incinerators is collected and removed from Antarctica.

Medical capabilities
Standard medical equipment is available in the medical room. Telephone and internet link is established to receive medical advice from India, when required.

iii. Emergency Response Capability

The fire fighting equipment essentially consists of fire extinguishers. Training of personnel on fire fighting is provided and evacuation drills are performed every 15 days.

iv. Station Logistics and Supply

Ground transport:
According to the interview the station has

- 16 track vehicles (Pisten Bully) of which two will be sent back
- 1 Polar Baar (not serviceable)
- 2 Snow Cats
- 1 Toyota Hilux
- 2 snow scooters (not serviceable)

The station has 2 sledges and 14 tracked trailers for transport purposes in the station area and outside operations. There are 10 discarded vehicles and a large quantity of metal waste, which is supposed to be back-loaded in phases.

Ship supply
The station is supplied by one ship call per year. The ship is chartered on annual contracts by the Indian authorities. All cargo is transported by sledge trains along a marked route from the unloading site to the station.

Air operations:
The supply ship carries helicopters on board. Helicopter flights are performed between the supply ship and the station during the unloading operation. No other flight activities were reported.

v. International Logistic Cooperation

The station closely cooperates with the adjacent Russian station Novolazarevskaya, located approximately 4 km eastward in the Schirmacher Oasis. Both stations support each other in various logistic matters, e.g. unloading and ground transport during ship calls.

Maitri station, as a member of the DROMLAN cooperation, provides vehicles for maintenance work at the runway at Novo Airbase and also assists with transportation to and from the Airbase to the stations in the Schirmacher Oasis. The bulk of the logistic and scientific requirements is transported by ship. However, a limited number of personnel and cargo are transported by DROMLAN flights. According to the interview, the commitments to the DROMLAN cooperation will remain in place.

(3) Environmental Protection Measures

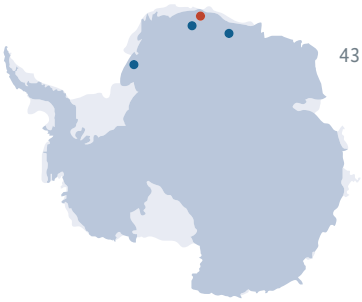
At the time of the inspection, it was noted that there was insufficient documentation relating to environmental protection measures available at the station and there appeared to be a lack of awareness in this respect.

i. Waste Management and Disposal

- **Waste management**

The written waste management strategy provides for the minimization, re-use, recycling, separation, disposal and storage of waste at the station, although it is unclear to what level this is being implemented. In terms of awareness, personnel are briefed in Goa (India) before departing to Antarctica.

The classification system broadly divides waste into biodegradable, non-hazardous and hazardous waste, with subcategories under each of these. The inspection team found that kitchen waste was sorted into (1) plastic and paper, (2) glass and metal and (3) food waste. The colour-coding system mentioned in the Background Paper 22 from India at the ATCM XXXV did not appear to be in place.



The litter and redundant items in the vicinity of the station need to be cleaned up.

- **Waste disposal**

Monthly waste production reports are sent back to India with the outgoing team, who had already left the station at the time of the inspection and were thus not available for interviews. These reports appear to be unavailable to the incoming team, thus compromising continuity.

Food and medical waste are burnt separately in an old fuel incinerator and the ash generated is also stored separately in old fuel drums and returned to India for disposal. The cyclonic particulate arrester mentioned in Background Paper 22 from India at the ATCM XXXV was not observed, nor was the mentioned new incinerator with proper fuel gas arrestor installed during the 2012/13 season.

- **Handling of fuel**

No fuel spill contingency plan was available at the station.

New double-walled as well as old single-walled fuel tanks are present at the station, with some of the new ones being placed on a concrete platform, covered with a protective reinforced polypropylene sheet. Although a spill would indeed be observed, there is no means of containing it, e.g. a retainer wall. It is envisaged that the fuel farm will be extended and a new fuel pipeline to the generator will be built as soon as all the tanks are placed on the new platform.

The old fuel tanks have produced contamination patches below each opening and other small spills were observed in the area as well. It is unclear whether the old single-walled tanks will be removed or used for back-up fuel storage.

Fuel pipelines run above and below ground (under the road) which makes the detection of leaks very difficult. It is recommended that the new fuel pipeline runs above the ground to facilitate monitoring for leaks.

Various large and unsecured (against high winds) fuel drum depots exist in the vicinity of the station, containing both full and empty drums, as well as open drums. It was mentioned that some empty drums are used for the storage of waste.

ii. Treatment of Sewage and Domestic Liquid Wastes

Grey water is processed via an old treatment plant (where sludge is scooped off the top of the tank for incineration) prior to passing through the newly installed Rotational Biological Contactor (RBC), after which it is disposed of into the treated waste water collection pond (temporary reservoir) which is pumped out into an area near the fuel tanks. The walls of the collection pond were raised to prevent leakage over the sides, however, the precast concrete slab liner and UV protective polypropylene sheet (mentioned in ATCM 35 Background Paper 22 by India), to avoid any permeation into the ground or to the lake, was not installed during the 2012/13 season. The small pond alongside the collection pond has been mostly filled with sand, as mentioned in the Background Paper.

There are 4 fuel toilet incinerators and 11 electric toilet incinerators to burn solid human waste. The ash is collected in old fuel drums for transport back to India for disposal.

There is no recycling of water or other liquids.

iii. Conservation of Fauna and Flora

In terms of awareness relating to the conservation of Antarctic flora and fauna, personnel are briefed in Goa prior to leaving for Antarctica. According to the station leader there are no wildlife or plant sites near the station, apart from some penguins at the ice shelf. However, the inspection team observed some skuas and small patches of moss in the vicinity of the station. The inspection team was advised that personnel are briefed about preventing the introduction of non-native species prior to departure, but no operational measures in terms of cleaning or disinfecting gear, cargo or clothing appear to exist. No non-native species were observed at the station. Personnel are also briefed about local guidelines controlling human activities close to concentrations of wildlife.

iv. Area Management

The station leader mentioned that a signboard for ASPA No. 163 had been installed near the site; however, this could not be verified due to lack of time. The management plan for this ASPA was not available at the station.

It was mentioned that the only study in the area was the ongoing glaciological monitoring; however, no permit could be provided for this at the station or on the EIES preseason information for the Indian 2012/13 summer season, in accordance with Annex III of the Protocol.

The old team had already left the station at the time of the inspection and it was mentioned that only the glaciological team would be entering the ASPA during the coming year.

(4) Scientific Investigation and International Cooperation

The Indian Antarctic Programme is a multi-disciplinary, multi-institutional programme managed by the NCAOR, a research and development body under control of the Ministry of Earth Sciences of the Government of India. The programme was initiated in 1981 with the first Indian expedition to Antarctica. The programme gained global acceptance with India's signing of the Antarctic Treaty and subsequent construction of the Dakshin Gangotri Antarctic Research base in 1983, superseded by the operation of Maitri base from 1990. Under the programme, atmospheric, biological, earth, chemical and medical sciences are studied by India, which is carrying out its 32nd scientific expedition as of October 2012. India is currently building an additional station in the region named Bharathi (beside Larsman Hill at 69'S, 76'E). Hence, the Government of India is all set to join the elite group of nine countries which run multiple bases in Antarctica.

India has recognised that the Antarctica is important to the understanding of global and environmental concerns. The continent has, for the last 35 years provided Indian scientists with opportunities to investigate the origin of the continents, the pollution of the globe, and changes in world climate. The Indian Department of Ocean Development has, inter alia, been launching scientific research expeditions on an annual basis to Antarctica from 1981. The Government of India recognised the advantages of joining the Antarctic Treaty system.

Scientific activities of India in Antarctica started at a modest scale, and have now increased and been turned into continuous programmes. In 1983 India established their first station at Dakshin Gangotri (70 05' S, 12 00' E) to support their scientific programmes. Maitri is India's second permanent station and was finished in 1989 before the first station was abandoned between 1990 and 1991. The station has facilities for most scientific observations done in Antarctica, including earth sciences, glaciology, meteorology and space science. The station accommodates up to 15 scientists. The station conducts scientific research programmes involving 12 organizations including Geographical Survey of India (GSI). The station had been engaged in several programmes during the International Polar Year 2007 – 2008.

Research supported by the Maitri station comprises the following:

Earth Sciences and Glaciology – India established their first ever reference gravity station at Maitri, and completed the precise absolute gravity measurements for deformation studies. Ice core studies are being conducted to trace back paleoclimatic and environmental conditions. Cores of 65 m, 75 m and 55 m have been retrieved from the continental ice and ice shelf respectively. Amongst other studies there is also monitoring of Dakshin Gangotri ice front to gain an understanding of ice dynamics and temperature variations therein.

Meteorology – For meteorological studies, a database of the meteorological parameters at Antarctica with the aim to relate the monsoonal pattern over India has been developed. As part of the global weather studies, Maitri station also transmits weather data and provides forecasts to support expeditions.

Atmospheric sciences – at Maitri, India has deployed a heterodyne laser instrument to measure vertical ozone profiles all the year round.

Environmental Physiology and Human Psychology – Experiments on human psychology are conducted with the aim of generating data on the effects of extreme climate conditions on human health and physiology. There are also studies conducted on the correlation of extra-terrestrial cosmic rays and magnetic storms on personnel to assist in enhancing their capabilities to survive in harsh conditions.

The data gathered at Maitri station is, according to the interview, sent to the Bangalore information hub, as well as being fed into international data bases at regular intervals. In 2012/13, Japanese and British scientists conducted field work from Maitri station, not on the basis of exchange of scientists.

(5) Use of Antarctica for Peaceful Purposes

According to the interview, Maitri station does not have military personnel, nor does it depend on military support. No explosives or weapons are kept on the base.

(6) Training and Awareness

Training:
A recruitment panel (interviews are conducted in India) selects candidates based on research proposals and the availability of space at the station. Most personnel are new, although some technical and engineering personnel have prior experience and understand the conditions in Antarctica. Team work efforts and mental and physical fitness of the personnel are taken into consideration in the recruitment process.

About a 2-week training programme is undertaken (including 3 days at NCAOR in Goa), as well as on-site training at the station is provided to all personnel on the Antarctica environment and conditions, which includes:

a) **General training for all personnel –**
- Environmental matters, including the Madrid Protocol
- Crevasse, ice movement and glacier training
- Use of electronic devices and communication
- A fire drill (evacuation) every 15 days at the station

b) **Specialised training for specific personnel –**
- Search and rescue (SAR) and field survival training to personnel conducting field work
- Health and Safety and first aid training to selected personnel, apart from the Doctor
- Heavy vehicle training (vehicle safety) to personnel with existing qualifications to drive/operate heavy vehicles/machinery
- Waste management training to specific personnel regarding the collection, separation and burning of waste
- Fuel and oil spill response training to specific personnel (drivers and mechanics)
- Fire fighting and safety training to selected personnel

Awareness:
A notice board is used for promoting awareness amongst personnel on environmental protection issues, e.g. littering.

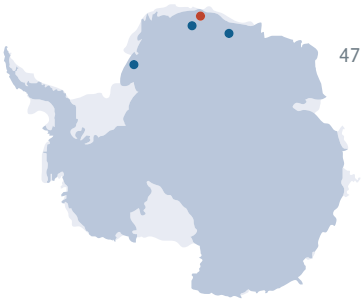
(7) Reporting

In as far as reporting of accidents, incidents and near misses are concerned, the station has no formal reporting and classification system in place. Patients' records kept at the doctors' office are used as a means to capture these types of incidents. The station has had no accident or incident in the last twelve months that has resulted in human death or significant injuries, major damage to the station facilities or the environment.

The EIES reporting system is almost comprehensive and up to date. Although there appears to be ongoing glaciological monitoring in ASPA No. 163, no permit for these activities could be provided at the station or on the EIES pre-season information for the Indian 2012/13 summer season, in accordance with Annex III of the Protocol.

(8) Tourism

The Indian government`s policy is not to allow tourism in Antarctica. Maitri station has not received requests for tourist visits.



(9) Summary and Findings

The inspection team gained the impression that the station has to cope with aging equipment and facilities. Further upgrading and improvement of the facilities and operation of the station, including the removal of redundant equipment and materials, is highly recommended.

Despite these disadvantages, the staff are highly motivated to fulfill all requirements for a safe and successful wintering period.

A formal classification and reporting system should be considered to properly capture and deal with accidents and incidents.

Waste management and disposal at the station should be far more stringently implemented, especially the storage and disposal of old fuel drums. The replacement of the old fuel incinerator, with the appropriate emission controls (as mentioned in ATCM 35 Background Paper 22 by India), is recommended.

A comprehensive fuel spill response plan should be drawn up and a more effective method of retaining any spill, should it occur, should be implemented at the fuel farm. It is recommended that the precast concrete slab liner and UV protective polypropylene sheet (mentioned in the Background Paper) should be installed at the treated waste water collection pond in order to avoid any permeation into the ground or surrounding area.

Although there appears to be ongoing glaciological monitoring in ASPA No. 163, no permit for these activities could be provided at the station or on the EIES preseason information for the Indian 2012/13 summer season, in accordance with Annex III of the Madrid Protocol.

70°46'S; 11°44'E

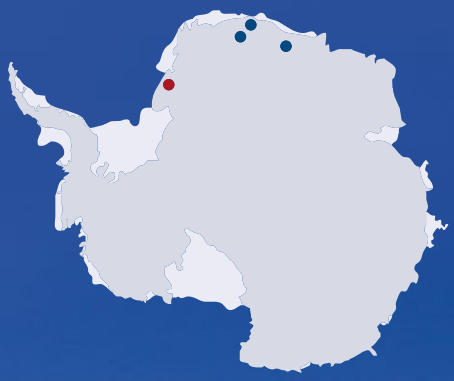
4. Halley VI Station (United Kingdom)

(1) Overview

Halley VI is a year round station located at the Brunt Ice Shelf since February 2012.

The Halley station was transferred from its former position to the new one because of the instability of the Brunt ice shelf.

Coordinates: **75°37'S; 26°14'W**
Elevation: **approx. 25 m**
Distance to the shelf ice margin: 20 to 46 km depending on the ice shelf condition.

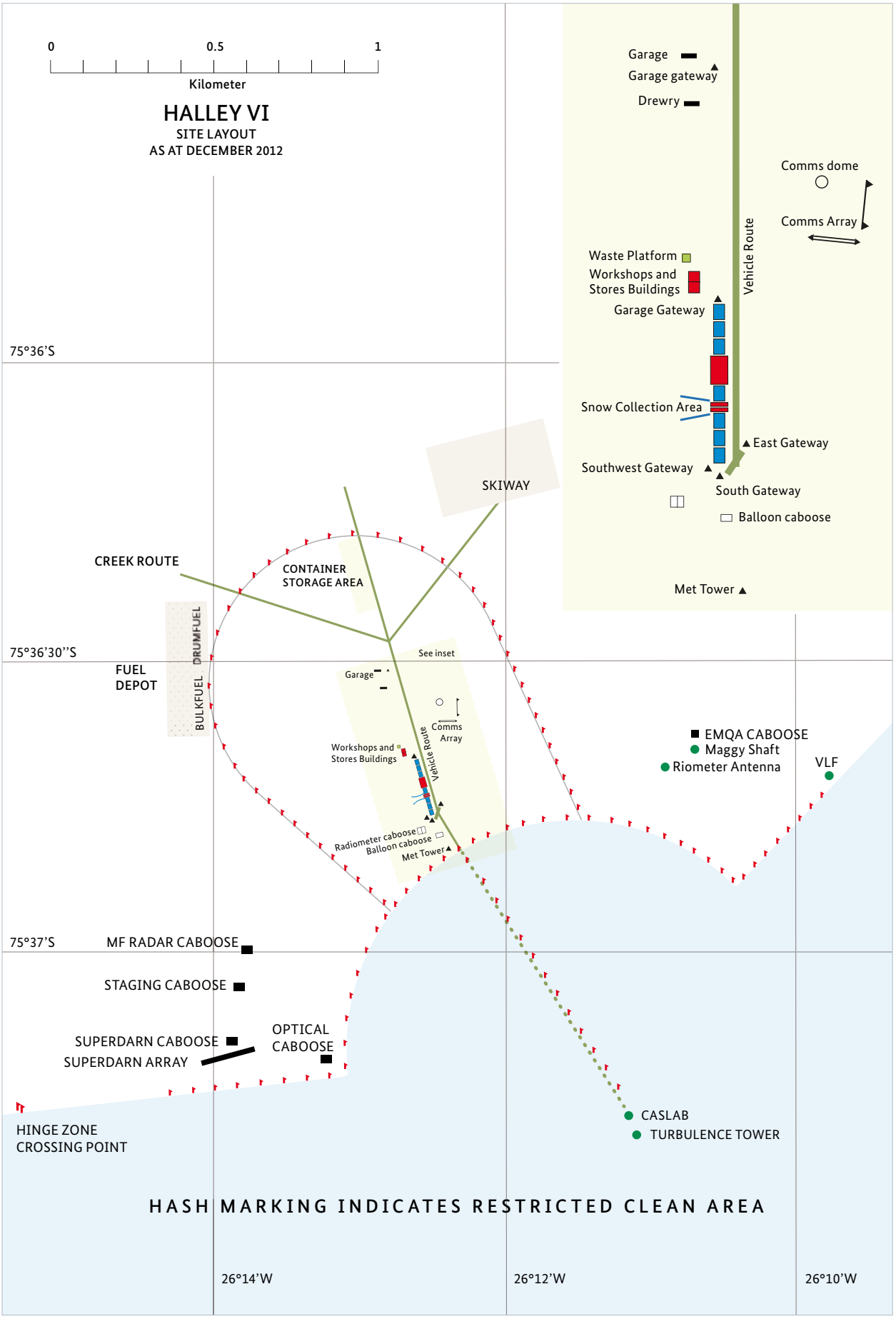


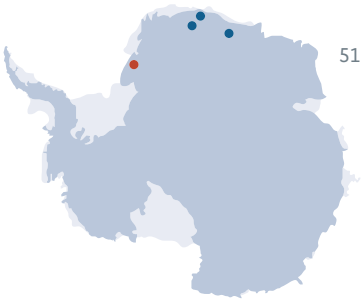
The station is operated by the British Antarctic Survey (BAS). The inspection was performed on 15 January 2013. The inspection team visited the station from 11.30 to 17.30 hrs UTC.

On the day of inspection, 86 persons were present at the station. Comprehensive documentation according to the checklist was provided to the inspection team.

Base commander for season 2012/13: Agnieszka Fryckowska. Temporary Base Commander at the time of the Inspection Visit: Caroline Lewis
Language at the station: English

This was the first visit of an inspection team after the construction of a new main building and the relocation of the entire Halley station. The manufacturing and onsite constructions works for the new building started in 2007/08 and the station and relocation was completed in 2012/13.


0
0.5
1
Kilometer
HALLEY VI
SITE LAYOUT
AS AT DECEMBER 2012
Garage
Garage gateway
Drewry
Comms dome
Comms Array
Vehicle Route
Waste Platform
Workshops and
Stores Buildings
Garage Gateway
Snow Collection Area
East Gateway
Southwest Gateway
South Gateway
Balloon caboose
Met Tower
75°36'S
SKIWAY
CREEK ROUTE
CONTAINER
STORAGE AREA
DRUMFUEL
BULKFUEL
FUEL
DEPOT
75°36'30''S
See inset
Garage
Comms
Array
Workshops and
Stores Buildings
Vehicle Route
Radiometer caboose
Balloon caboose
Met Tower
EMQA CABOOSE
Maggy Shaft
Riometer Antenna
VLF
75°37'S
MF RADAR CABOOSE
STAGING CABOOSE
OPTICAL
CABOOSE
SUPERDARN CABOOSE
SUPERDARN ARRAY
HINGE ZONE
CROSSING POINT
CASLAB
TURBULENCE TOWER
HASH MARKING INDICATES RESTRICTED CLEAN AREA
26°14'W
26°12'W
26°10'W



(2) Logistics and Operations

i. Station Facilities and Description

The perimeter of the station area is marked by empty fuel drums and flags and is approximately 5 km in circumference, excluding the outlying science areas and cargo lines. There is a Clean Air Sector to the south east of the main station and a skiway to the north east, both outside the perimeter drumline.

The main building is a new construction which was completed during the current season. The official inauguration of Halley VI will take place on 5 February 2013.

At Halley VI station all buildings are surface mounted. There is one below-surface facility. This is the Magnetometer shaft, located in the "electromagnetic quiet area" to the east of the Station.

The construction of the new main building was completed during season 2011/12 and was successfully tested over the winter period 2012. The main building consists of 8 interlinked modules:

- 2 x sleeping modules containing a total of 32 beds
- 2 x science modules
- 2 x energy modules, including sewage treatment plant
- 1 x command module containing Base Commander's office, Communications Room and Hospital
- 1 x double-height living module containing communal areas, including kitchen, dining facilities, gym, TV room and library.

The modules of the new building can be raised up by a hydraulic system in order to compensate the yearly snow accumulation. The modules are founded on skis and can be separately moved to another location, if needed. This new design enables a sustainable usage of the building on a flowing ice shelf in the long-term.

Further buildings in the station area are

- 16 Accommodation caboosees
- 1 Drewry summer accommodation building, currently being refurbished
- 1 Garage for maintenance of vehicles on site
- 1 Waste sledge, including incinerator for processing waste generated on site
- 1 Air Unit office at the ski-way
- 1 Air mechanic's container for aircraft equipment at the ski-way
- 1 Clean Air Sector laboratory (CASLab)
- 7 Science cabooses
- 74 Storage containers

The new science cabooses are installed on separate steel platforms and accommodate the scientific instrumentation. Most of the storage containers were in use by the contractor during the build of Halley VI and are due to be shipped out in January 2013. This will leave approximately 24 containers on site at the end of the season, 14 of which will be retained for long-term storage purposes. The rest will be removed in 2013/14.

According to the information in the checklist and interviews the buildings, containers and caboosees are used as follows:

The 16 temporary accommodation annex containers (cabooses) are currently on site to support the construction work and house summer staff in 2012/13. Some were also used to form the Halley V demolition camp but have since been returned to Halley VI. The annex is located between the modules and the Drewry building. A total of 60 beds (4 to each container) were available in early season during the Halley V demoli-tion. This has been reduced to 52 beds in the annex for the remainder of the season.

The summer accommodation building (Drewry) which is mounted on skis is not in use in 2012/13. It is being refurbished to provide 20 beds for summer visitors. Drewry is not intended for use in winter but has the facility to act as an emergency refuge for wintering staff, should the need arise.

The Clean Air Sector Laboratory (CASLab), built in 2003 and relocated from Halley V in 2010/11, is located 1 km away from the rest of the Station in order to minimise contamination. It has been fully operational in its new location since February 2012.

The Balloon And Radiosonde Terminal (BART), relocated from Halley V in 2011/12, is used for balloon launches.

The 6 remote containerized science cabooses, located on jackable legs to prevent being buried in snow, are new constructions and are being used for the various long-term scientific programs. An additional caboose for the microwave radiometer will be commissioned in 2012/13.

The garage is a selfcontained structure mounted on skis, relocated from Halley V in early 2011/12. A doublesledge towed building is being delivered and constructed in 2012/13 to provide Field Stores and general workshops.

Other facilities are

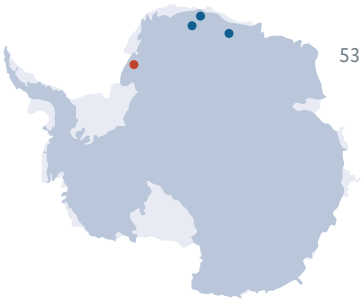
- 10 bulk fuel containers and a number of supply dumps of drummed fuel
- Designated waste sledge consisting of the incinerator, waste container, compactor and oil spill response equipment
- Science data collection towers and aerial systems for communication and scientific purposes
- Outgoing cargo line.

The subsidiary facilities include two mobile field huts for use in the area, Windy Caboose and Creeks Caboose. They are required as part of Halley's emergency evacuation procedure and for use during Relief. Both huts are in poor structural condition and due to be replaced as part of the Halley VI redevelopment. The Mechanic's caboose is deployed to the coast in support of relief operations.

There are no permanent roads. All routes are groomed and marked with empty drums or flags. The skiway is regularly groomed and operational between mid October and mid March.

Supply and resupply by ship is performed over sea-ice at the margin of the Bunt ice shelf. The ship will tie up alongside suitable sea-ice as close as possible to the station, which can vary from 20 km to 46 km depending on sea-ice conditions. In mid-December each year, Halley personnel start surveying the coast for a suitable landing site and prepare the area, establishing a small camp on the shelf ice near the coast and in advance of the arrival of the ship. The Base Commander is in frequent contact with the ship's Captain with regards to which area is suitable for landing.

In 2010/11 and 2011/12 this was unloading site "Creek 3", approximately 20km from Halley VI. In 2012/13, difficult sea-ice conditions at the Creeks resulted in use of an area of low shelf ice (point N9) located 46 km to the north-east.



During the inspection the following facilities were visited:

- Main building inside furnishings including meteorology/ozone observations laboratory
- Support construction of the main building
- Waste processing facility
- Mobile summer accommodation (Drewry) being refurbished

Beside the completion of the Halley VI in its new location, the demolition of the Halley V station and cleaning up the station area has been a major operation during season 2012/13. The construction of Halley V station was completed in 1992. These buildings have been decommissioned and removed down to the steel substructure below the surface in December 2012. Contents of the tunnels, except for the steel outer and the melt tank were removed and the whole site filled in and groomed. Flags mark the former location of the buildings.

The inspection team did not visit the Halley V site. By interview it was informed that all demolished material and waste were removed on board MS Mary Arctica (Royal Arctic Lines, Denmark) in January 2013.

ii. Station Operations

All detailed information was handed to the inspection team according to the checklist.

Communication
Types of Communication: HF, VHF, Iridium, Internet connection via VSat.
Methods of Communication: Voice, E-mail, internet.

Fuel storage and usage
Fuel management plans, oil spill contingency plans and oil spill action plan for Halley VI station are available.
Types, amount and use of fuel:

- approximately 200 000 l bulk aviation fuel
- approximately 2 000 x 205 l drums aviation fuel
- approximately 50 x 205 l drums petrol for small generators and use by field parties
- approximately 4 x 205 l drums kerosene for use by field parties
- up to 400 l oils and lubricants in various sized containers.

Types, number and capacity of station storage containers, including type of containment system(s) available:

- 10 x 22 000 l double-walled steel tanks
- approximately 2 000 x 205 l drums of fuel stored in crèches of 198
- 3 fuel tanks on modules (E1 and E2) 10 000 l each. Fully bunded and with overfill gauges.
- 4 fuel transit tanks of 5 000 l each.
- 1 double-walled fuel tank at Garage 3 800 l.
- 1 double-walled fuel tank at Drewry 1 200 l (not in use during refurbishment).
- mobile fuel bowser with twin tanks, each 400 l, one for petrol and one for “doo mix” (petrol/oil).
- mobile fuel bowser tank with 5 000 l, double-walled, with 800 l sump.
- waste management sledge with an incinerator installed which runs on waste oil.

Fuel pumping procedures are in place. BAS procedures require personnel to continuously monitor any fuel pumping operation from start to finish.

There are no fixed pipelines in use. There is an aviation grade hose connecting modules E1 and E2 across the bridge, this is to allow the building to flex without damaging the fuel line.

Mobile refuelling hoses are aviation grade double-band, double thickness low temperature hoses.

Transit tanks are filled with AVTUR during station relief from the ship at the ice-edge and towed up the ramp. The fuel is transferred into mobile bulk fuel containers at the head of the ramp and transferred directly to the station. Static fuel tanks at the station are normally filled directly from mobile bulk fuel containers, which are towed from the fuel depot as required.

Aircraft are fuelled with drummed fuel prepositioned at the ski-way.

Avery-Hardall dry-break valves are fitted to all refuelling hoses to eliminate any spillage.

The fuel depot is approximately 800 m to the west of the station, well away from snow used for fresh water supplies. There is no wildlife in the area.

Ten double-walled bulk fuel tanks of AVTUR are kept in the fuel depot. Drummed fuel and petrol is held in 205 l drums in the fuel depot and at the ski-way. Other oils and lubes are kept in 205 l, 100 l and 25 l drums in various locations on station, including: energy modules, garage, ski-way and other external cabooses.

While there have been no major spills in the last 5 years, there was one small spill involving up to 410 l in December 2009, which was reported under the BAS Accident, Incident, Near miss and Environmental (AINME) reporting system (ref. Z/11/I/1819). An Avery-Hardall coupling failed during refuelling of the flubbers in the Halley V tunnel. The fuel was contained within the bund around the flubbers. The spilt fuel was then cleaned up without contamination of the surrounding environment.

Power generation and management

- 4 6CT8.3 Cummins generators supply 24 hr power to the modules, garage, CASLab and outlying science cabooses. Two generators operate permanently with the other two acting as standby generators.
- Drewry summer accommodation and the new workshops will be powered from the central generators.
- 2 x 6 CT Cummins generator for station back-up generator.
- 2 x 6 BT Cummins generator sets in the Drewry building are being removed for disposal in 2013/14.

The fuel consumption for Halley V, when it was fully operational, was 240 m^3 per year. During the construction of Halley VI there was greater consumption because of the need to run two locations. Halley VI has been running since February 2012 and the average fuel consumption over that period has been 31 000 l per month. The following efforts are undertaken to reduce overall fuel usage:

- Finalise the Building Maintenance System (specialist engineer on site in December 2012).
- complete the lagging of the modules (January/February 2013)
- Potential future use of renewable energies.

Halley VI has improved energy conservation strategies in comparison to Halley V, by:

- vacuum drainage for toilets, showers, etc.
- increased insulation due for completion in 2012/13
- energy efficient lighting
- greater use of natural lighting
  Building Management System (BMS)

When using the incinerator, emissions are controlled by strictly limiting the type of wastes that can be incinerated on station to food waste, sewage sludge, waste oils and unpainted wood. Other waste types that would give rise to air pollution if incinerated are removed from the Antarctic. The BAS Waste Management Handbook provides information on how waste is to be handled.

Water systems (supply, storage, treatment)

Two snow melt-tanks, each 7 m^3 capacity provide the station's main fresh-water supply. Availability depends on manpower and demand – water conservation is in place. Vacuum drainage for toilets, showers, etc. significantly decrease water consumption and all personnel are reminded to keep water usage to a minimum, particularly in summer when there are more people on station. Melt tank fill is limited to once per day and there is a good quality water supply.

The average water consumption ranges from 12 m^3 (winter) to 23 m^3 (summer) per month

Management of dangerous elements:

Records are available on site. These are compiled using the Base Commander monthly reports and the electronic AMOS system. BAS operates a Chemical Approval Register (CAR). The Lab Managers and any scientist wanting to use hazardous chemicals or gases in any BAS lab must submit a register of the chemicals they intend to use.

Hazardous chemicals stores (Hazchem), designed to contain spills, are located at several locations:

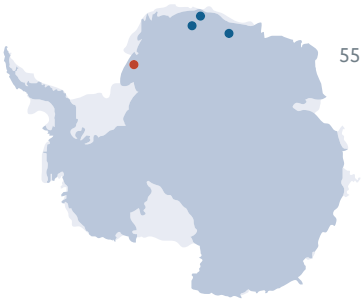
- 1 hazards container in waste room on the A module of the main building
- 1 battery container and 1 paint store located next to the garage
- Use of external containers for field stores.
- Use of external containers for construction/refurbishment materials, due to be used in 2012/13 and removed in 2013/14.

Medical capabilities:

Surgery, with X-ray, anaesthetic equipment and dental equipment is located in C Module of the main building. Emergency medical equipment is stored in H1 Module. 1 x medical bed is available in the surgery. Beds in B Modules (next to C Module) will be made available if the need arises.

The Drewry summer accommodation building will become the emergency medical room once refurbishment is completed.

There is one doctor, as well as three personnel trained in advanced first aid, available throughout the year.



iii. Emergency Response Capability

All wintering personnel and field scientists receive field training before leaving the UK. Field assistants are recruited from expedition leaders and have technical knowledge of rescue techniques.

Search and Rescue procedures are in place and the Search and Rescue (SAR) scenario takes place at least once a year, normally shortly before the beginning of winter.

A Major Incident Response plan is in place detailing roles and locations of resources.

There is an evacuation plan for medical emergencies which is coordinated by Cambridge Operations through the Major Incident Plan.

Fire-fighting
The Fire Emergency Plan is available on the Halley and BAS intranet systems. Hard copies of the Fire Emergency Plan are displayed in the base commander's office in C Module, at the main muster point in the C Module and in the garage. On completion of the refurbishment, a copy will also be kept in the Drewry building. Fire-fighting instructions are exhibited in the modules, the temporary accommodation annex and the garage. Station induction includes a familiarisation of these instructions for all personnel.

Fire-fighting equipment:
- Detectors and alarm points are located in all the modules and the garage, which are linked electronically.
- The Drewry will also be linked to the central detection and alarm system once refurbishment is completed.
- The temporary accommodation annex has a separate alarm system and a klaxon fitted to the roof.
- Modules are divided into sections with separating walls designed to provide 60 minutes of fire protection.
- Minor fires may be dealt with using fire extinguishers, located in each module and building.
- Fire-fighting equipment is inspected on an annual basis.
- The temporary accommodation annex is divided into sections with separating walls.

The wintering electrician undergoes fire training in the UK before leaving to go south. Those personnel wintering on station all receive training in rescue procedures once on station. BAS policy is not to fight fires but to vacate the buildings and muster as quickly as possible. Regular fire drills are carried out in winter and at least once during summer.

Pollution (oil and chemical spills) and response capabilities:
An oil spill contingency plan (Halley VI, 1st Edition Revision 1) is in place and details risks, hazards and procedures for dealing with spills. This is available in hard copy in the Base Commander's office and on the waste sledge, as well as electronically on the local intranet. All minor and major oil spills are reported and recorded through the AINME system.

Spill exercises are carried out twice a year (once in summer, and once in winter).

Most wintering personnel attending the BAS Introductory Conference take part in a one day oil spill response course. Selected personnel attend a longer course. On station, personnel receive a brief prior to exercises to highlight locations of equipment and procedures.

Oil spill response kits are held at:
- 2 fuel tank rooms on the modules
- garage
- mechanic's caboose
- waste sledge
- with the portable generator
- BAS aircraft carry their own spill response kit.

iv. Stations Logistics and Supply

Ground transport:
6 Snowcats, reducing to 4 in 2012/13
2 Challenger tractors, reducing to 0 in 2012/13
2 John Deere 7820 tractors with loaders for use as Relief vehicles
1 Piston Bully (arrived in 2012/13)
1 access platform crane (Genie)
1 JCB tracked tele-handler (built for BAS and unique to Halley)
2 Nodwell tracked cranes,
1 Mantis crane
1 Fassie sledge train
3 Snow management D5 NLPG
38 sledges, reducing to 37 in 2012/13
30 skidoos, 11 of which are for field use.

At the end of season 2012/13 altogether 9 towing vehicles will be available at the station. The number of skidoos will be reduced to a total of 24.

Ship supply and transportation to the station:
The Station is resupplied twice annually by BAS vessels, one in December and the other in February/March. The main resupply is on RRS Ernest Shackleton in December each year. The end of season call is normally restricted to small amounts due to the unpredictability of the sea-ice in February/March. In 2012/13, a charter ship (MV Mary Arctica) delivered the containerized workshop system and removed Halley V demolition waste.

Air operations:
1 BAS Twin Otter aircraft is based at Halley for part of each Antarctic season to carry out field science in the Halley vicinity. Aircraft is on secondment from Rothera. Transiting aircraft from BAS and Other Nations as required during the season. The following aircraft movements were serviced at Halley VI during season 2012/13:

- Field flights by BAS aircraft
- 5 x Twin Otter rotations between Rothera and Halley (including transfer of field science personnel)
- 1 x Twin Otter rotation between Halley and Novolazarevskaya, via Neumayer and SANAE IV
- 3 x positioning rotations by other international operators (DROMLAN, AWI)
- 3 x rotations by ALCI as DROMLAN operator moving BAS personnel between Halley and Novo Air-base

v. International Logistic Cooperation

The research stations Halley VI and Rothera are actively involved in the DROMLAN cooperation. Ground service and fuel is provided at these stations for mobilization and demobilization of small ski-equipped aircraft scheduled for DROMLAN and scientific missions in the Dronning Maud Land region.

The major part of the BAS construction team was transported via the DROMLAN airlink from Cape Town via Novo Airbase to Halley. Except for season 2008/09 the DROMLAN air transportation was used from season 2007/08 until 2012/13.

According to the interview BAS will continue in the DROMLAN cooperation and provide support as in the previous years. Personnel will be transported with DROMLAN flights in order to get efficient use of the available capacity of Halley VI station.

Other collaboration:
Occasional re-supply from Punta Arenas and Cape Town on aircraft belonging to other operators such as DROMLAN, AWI and others.

(3) Environmental Protection Measures

The Comprehensive Environmental Evaluation (CEE) was approved and recommended by the CEP at ATCM XXVIII in 2005, as it fully conforms with the requirements of Article 3, Annex 1 to the Madrid Protocol.

i. Waste Management and Disposal

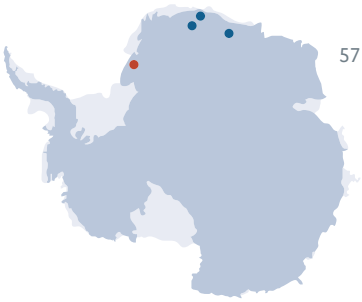
- Waste management
An excellent comprehensive BAS Waste Management Handbook dated November 2012 exists, with responsibilities, classification, storage and disposal of all waste being clearly outlined. All personnel are briefed prior to departure and at the station, and two general assistants are employed during the summer seasons for waste collection and processing.

Most waste is temporarily stored in large waste bags outside the station, which are secured with carabiners to prevent dispersal, prior to incineration or storage in containers for removal. 85% of waste is recycled/re-used, 15% is landfill and a small percentage is incinerated.

Hazardous waste is separated, clearly marked and stored in shipping containers until removal from the station.

- Waste disposal
There are two compactors present at the station for the reduction of selected waste, which is either incinerated (240 KW main incinerator located in separate waste container away from the station), e.g. wood, food waste, waste oil, paper, etc., and ash is stored in 205 l drums for later disposal in the United Kingdom. Emissions are not monitored (second highest grade according to European standards), but the installation of a replacement incinerator, which is less labourintensive with lower emissions, will be investigated.

The inspection team was advised that the old Halley V station has been fully decommissioned in accordance with the 2006 CEE for the Proposed Construction and Operation of Halley VI Research Station, and Demolition and Removal of Halley V. Only the metal foundation consisting of piles and base plates remained, as these were impossible to remove tenably and safely.



- Handling of fuel
A detailed 2012 oil spill contingency plan for Halley VI and oil spill response kits are readily available at the station, and all major and minor spills are cleaned up and reported on via the AINME electronic reporting system available on the intranet at the station. This information is received by the relevant manager at BAS for action.

All participants attend applicable Oil Spill Response courses and spill exercises are conducted biannually.

Over 2000 clearly marked fuel drums are stored at Halley VI. Empty fuel drums are also clearly marked, but they are stacked quite high. Even though the Halley VI staff asserted that they would ice in quickly, and therefore would not become dislodged or dispersed, it is recommended to consider additional measures to secure them against strong winds.

ii. Treatment of Sewage and Domestic Liquid Wastes

Grey and black water (no food waste, as it interferes with the bacterial processing system) are treated in the sewage treatment plant. The regularly tested outfall is disposed of into the environment, and the sludge (30-40 kg generated per day) is incinerated in a fully operational second incinerator located in the plant room. The ash is returned to the United Kingdom for disposal.

Re-use of the grey and black water outfall in the toilet system was not considered, as snow is readily available for easy and free water production, in that thermal energy generated from the power plant is used to run the snow smelter.

iii. Conservation of Fauna and Flora

The Brunt Ice Shelf contains no flora and there are no bird or seal colonies near Halley. A breeding colony of Emperor Penguins can be found close to the coast. Personnel are made aware of conservation of fauna and flora issues via the 2012 BAS Participants' Handbook and the 2012/13 Halley Arrival Information Booklet.

BAS has implemented stringent biosecurity measures such as those documented in the Non-Native Species Manual, the SCAR/COMNAP Checklists for supply chain managers of National Antarctic Programmes for the reduction in risk of transfer of non-native species and the CEP biosecurity handbook. Personnel are informed of these measures through the EIA process and during predeployment briefings and environmental inductions.

(4) Scientific Investigation and International Cooperation

In 1985 British scientists first measured the ozone depletion of the Antarctic stratosphere at Halley IV. Their discovery that this critical protection from ultra violet radiation had been decreasing from 1975 to 1985 made headlines around the world and led to the international agreement on banning chloro-fluoro-carbons (CFCs). Measurements are taken of Antarctic ice, the air in the troposphere above, the ozone in the stratosphere, and the plasma of the geospace beyond them all. The major scientific programmes on Halley VI cover upper and lower atmospheric sciences, glaciology and climatology. Studies at Halley VI are crucial for a global perspective on ozone reduction, atmospheric pollution, sea level rise and climate change.

Following completion of the construction work on the new station, most scientific facilities have been reinstated at Halley VI in February 2012:

- The CASLab: clean air sector laboratory, located to the south east of the modules.
- H1 Module – science office space, visiting science preparation room, kitchenette, small laboratory.
- H2 Module – electronic workshop, observation room, meteorological equipment, file storage and science preparation area.
- Several large aerial and radar arrays for atmospheric research
- 7 science cabooses.
- The magnetometer in sub-surface shaft.

International collaboration:
All of the science programmes at Halley have an element of international collaboration, particularly Superdarn, OH Imager, Bomem Spectrometer, Search Coil Magnetometer and VLF experiments. At the Station at the time of the

Inspection, there was one Danish scientist working at Halley with BAS Scientists on ICEGRAV from December 2012 to January 2013. Three US scientists were at Halley at the time of the Inspection, working on BARREL balloon launches.

(5) Use of Antarctica for Peaceful Purposes

No military personnel or support staff is present at the station. Explosives and firearms are not kept on the station.

(6) Training and Awareness

Training:
Winter and summer personnel are appointed and the selection/recruitment panel consider applicants from the Antarctica Employment Pool for British Antarctic Survey (BAS). Specialised personnel (technicians, drivers) are selected from the personnel with prior experience and understanding of the conditions in Antarctica. Interviews are conducted in the United Kingdom and cultural aspects, age differences and gender are considered in the appointment of personnel.

The summer season in Antarctica is considered as the probation period for the wintering team, where adaptability and ability to conduct the required work is evaluated. All personnel undergo a 1-week training course in Cambridge (United Kingdom) and at the station, which includes the following:

a) **General training of all personnel –**
- all personnel are issued with the BAS Participants' Handbook, Halley Welcome Booklet and Science on the Brunt Ice Shelf
- environmental matters, including the Madrid Protocol
- first aid and field survival training
- emergency evacuation procedures
- fuel and waste management training
- sea survival (for emergencies onboard), relief and mast rescue training
- major incident response training, including fire evacuation
- use of IT equipment (internet, telecommunication and intranet)
- guided walk for orientation and awareness
- search and rescue (SAR)
- health and safety

b) **Specialised training of selected personnel –**
- heavy vehicle training (vehicle safety) to specific personnel with existing qualifications to drive/operate heavy vehicles/machinery
- skidoo use and operation to overwintering and selected personnel
- oil spill response training to specific personnel
- aircraft safety training to selective personnel (overwintering team, field workers)
- emergency flare training to the overwintering team
- fire safety training to the electrician

Awareness:
The Antarctic Treaty, Madrid Protocol and UK Antarctic Act of 1994, as well as other relevant documents, are readily available on the BAS website and intranet. The programme is well-managed using the BAS intranet to link information between the station and the United Kingdom. All records of training conducted at Halley are stored on the training database at the station.

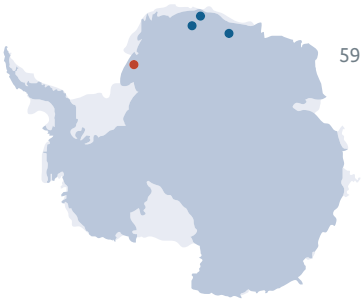
(7) Reporting

Halley VI station has a robust internal and external reporting system in place, which serves to record, manage and report incidents. AINME is also used to store all procedures and guidelines for the following: major incidents, fire and oil spills. The station did not have any accidents or incidents in the last year resulting in human death, significant injuries, or any significant damage to station facilities or to the environment.

At the time of the inspection, the operational information reflected in the EIES 2012/13 preseason information and 2011/12 annual information included both governmental and non-governmental expeditions under the same heading (non-governmental expeditions) while the chapter on governmental expeditions was missing completely. This was a result of the UK data not being properly authorized for publication to the public EIES website. This has been corrected and the website now provides the full information required.

(8) Tourism

Requests by tourists to visit the station are considered on a case-by-case basis. The last request in this regard was from a tourist ship in 2000, which was granted. The prevalent criterion is whether such visits will interfere with ongoing station operations or not.



(9) Summary and Findings

In general, the inspection team was impressed by the modern design and the functional and most comfortable central area of the new station. Both in design and in its scientific endeavours, the station convincingly combines tradition with modern requirements.

Although not inspected, the inspection team was advised that the old Halley V station has been fully decommissioned in accordance with the 2006 CEE for the Proposed Construction and Operation of Halley VI Research Station, and Demolition and Removal of Halley V.

The transportation of the remains of Halley V was a coordinated effort by Norway, Belgium and the United Kingdom using Dronning Maud Land Shipments (DROMSHIP) and was noted by the inspection team as a model for future sharing of infrastructure.

The various documentation and response systems at Halley VI are commendable, especially the AINME electronic reporting system (which can be completed anonymously) for the reporting of accidents, incidents, near misses and environmental incidents to the relevant managers at BAS for action, which is exemplary.

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