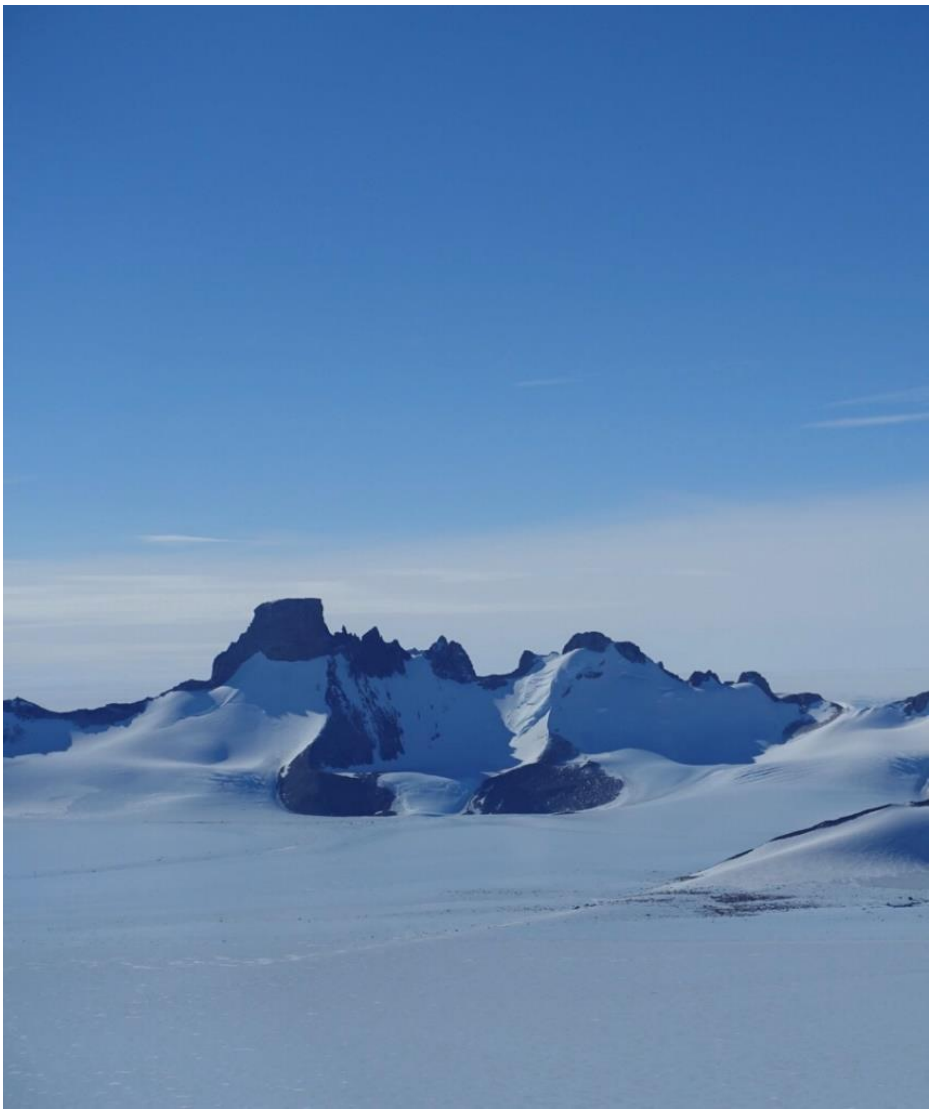

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REPORT OF THE NORWEGIAN ANTARCTIC INSPECTION UNDER ARTICLE VII OF THE ANTARCTIC TREATY AND ARTICLE 14 OF THE ENVIRONMENTAL PROTOCOL

FEBRUARY 2018

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PART I: Introduction

1 Introduction

1.1 Article VII of the Antarctic Treaty

Article VII of the Antarctic Treaty entitles each Consultative Party to designate observers who shall have the right to carry out unannounced on-spot inspections. The purpose of these inspections is to promote the objectives of and ensure compliance with the provisions of the Antarctic Treaty and the measures adopted under it. The observers shall be accorded complete freedom of access at any time to all areas of Antarctica, including all stations within those areas, as well as vessels and aircrafts at points of embarkation and disembarkation. Article VII also allows for aerial observations to be carried out at any time, over any or all areas of Antarctica.

1.2 Article 14 of the Environmental Protocol

Article 14 of the Protocol on Environmental Protection to the Antarctic Treaty commit the Consultative Parties to undertake inspections under Article VII of the Antarctic Treaty in order to promote the protection of the Antarctic environment and dependent and associated ecosystems, and to ensure compliance with the Environmental Protocol.

1.3 Past inspections under the Antarctic Treaty

Inspections have been carried out on a regular basis in Antarctica since the inception of the Treaty.

Inspections have been undertaken by Norway in January 1990, December 1996, January 2001 and February 2009. The fifth inspection was carried out during the period 9-17 February 2018 and is covered in this report. An overview of the Norwegian inspections is given in Table 1.

1.4 The 2018 Norwegian Inspection

1.4.1 Inspection Team

The 2018 Norwegian inspection team consisted of the following seven Norwegian nationals designated by the Norwegian Government in accordance with Article VII of the Treaty:

- Ambassador Anniken Ramberg Krutnes, Special Adviser for Polar Affairs, Ministry of Foreign Affairs
- Ms. Mette Strengehagen, Senior Adviser, Ministry of Foreign Affairs
- Mr. Øystein Mortensen, Director General, Ministry of Justice
- Ms. Aud Ingvild Slettemoen, Director, Ministry of Climate and Environment
- Dr. Nalân Koç, Research Director, Norwegian Polar Institute
- Mr. John Guldahl, Director, Norwegian Polar Institute
- Ms. Birgit Njåstad, Senior Environmental Policy Advisor, Norwegian Polar Institute

The names of the Norwegian observers were communicated to all Contracting Parties to the Treaty by diplomatic note of 30 January 2018 (Appendix #1). The inspection team was led by Ambassador Krutnes.

Ms. Slettemoen, Dr. Koç, Mr. Guldahl and Ms. Njåstad conducted the inspection at SANAE IV. During this inspection the team was led by Ms. Slettemoen.

Table 1: Overview of Norwegian inspections in Antarctica

Station	1990	1996	2001	2009	2018
Epica Drill site/Kohnen Station (Germany)			X		
Georg Forster (Germany)			X		
Georg von Neumayer I (Germany)	X				
Halley IV (UK)	X				
Halley V (UK)				X	
Halley VI (UK)					X
Maitri (India)		X	X		
Neumayer II (Germany)		X			
Neumayer III (Germany)					X
Novo Airbase and Airfield (ALCI/Russia)				X	X
Novolazarevskaya (Russia)		X	X		
Perseus Runway (ALCI Nord)					X
Princess Elisabeth Antarctica (Belgium)				X	X
SANAE III (South Africa)	X	X	X		
SANAE IV (South Africa)		X	X		X
SANAP Summer station (South Africa)					X

Picture 1: The 2018 Norwegian Inspection Team

@Øystein Mortensen

1.4.2 Logistical framework

Logistical support for the inspections were arranged within the framework of the Norwegian national Antarctic program, by the Norwegian Polar Institute. The inspection team travelled by air from Cape Town to Troll Airfield, within the DROMLAN flight framework. A Basler DC-3T (operated by Ken Borek Air of Canada) was used to reach the 7 stations and installations where inspections were carried out.

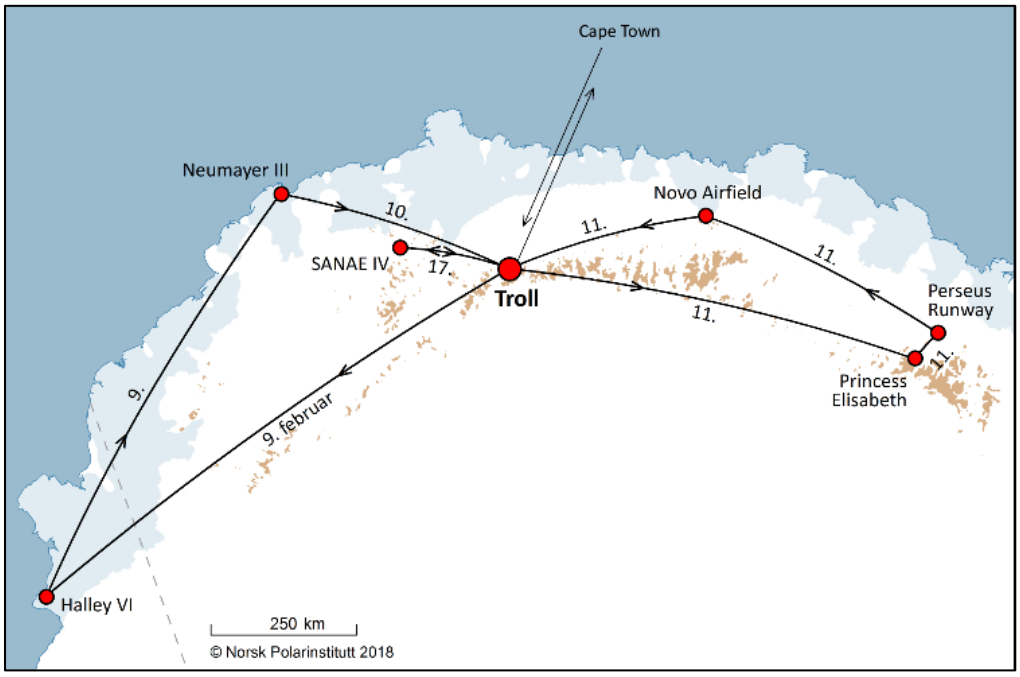
1.4.3 Stations and installations inspected

The 2018 Norwegian inspection covered 6 stations and installations in Dronning Maud Land and 1 station in Coats Land:

- Princess Elisabeth Antarctic Research Station[1] (Belgium)
- Halley VI (United Kingdom)
- Neumayer III (Germany)
- Perseus Blue Ice Runway (ALCI Nord)
- Novo Airbase and Airfield (ALCI[2] and Russia[3])
- SANAE IV (South Africa)
- SANAP Summer Station (South Africa)

Map 1 shows the locations of the stations/installations inspected.

Map 1: Stations and installations inspected



[1] Hereafter referred to as Princess Elisabeth Antarctica or PEA
[2] Operation of camp associated with airbase, and administrative operation of flights
[3] Technical operation of runway and flights

Four of the installations inspected were scientific research stations (Halley VI, Neumayer III, SANAE IV, and Princess Elisabeth Antarctica), one was a field station/logistical support base/e-base (SANAP summer station), while two installation provides support functions to *inter alia* national Antarctic programs (Novo Airbase and Airfield and Perseus Runway). Perseus Runway and SANAP summer station had not been inspected previously. Halley VI was last inspected in 2012/13 (Germany/South Africa), Neumayer III in 2010 (Japan), SANAE IV in 2010 (Japan), Princess Elisabeth in 2013 (both by Germany/South Africa and Russia/US), and Novo Airbase and Airfield in 2008/09 (Norway).

Stations and installations to be inspected were given notice in advance of the inspection team's departure from Cape Town, as well as through communication along the way. The inspection team notes, however, that the decision to inspect SANAP summer station was taken while the inspection team was inspecting Neumayer III, at which time the team was informed of the existence of this station, and its function as an evacuation site for Neumayer III. No advance notification was therefore given with regard to this inspection. The inspection team did not have contact details for the operation at Perseus for advance communication (ref. chapter 9)

English was used as means of communication during the inspections. No significant problems of interpretation occurred at the visited stations.

1.4.4 Limitations

There is always a risk in planning an activity in Antarctica during the period of the year in which the inspection took place. The Antarctic autumn and winter was just around the corner, and the weather and light conditions were increasingly unstable. The 2018 Norwegian inspection maintained flexibility with regard to adjustments of plans on this basis.

The inspection team notes that a majority of the stations inspected are relatively newly built, with high level of innovative engineering and planning involved in their establishment. This has provided the inspection team with good insight into new and modern station operations in Antarctica, but might not have given the team a balanced picture of the continental-wide status of station operations.

1.4.5 Inspection approach

The inspection team desired, through the inspections of a select number of stations and installations, to get an impression of general development trends in this part of Antarctica. The inspection team therefore maintained focus on an overarching, rather than on a detailed level, during the inspection. This has *inter alia* resulted in a separate "reflection chapter" in this inspection report. This also entailed that although the inspection team used the Inspection Checklist A[4] as guidance in preparing for the inspection and for general approach during the inspection, it did not aim to go through the checklist systematically as not to lose sight of the overarching picture.

[4] As adopted through Resolution 3 (2010): http://ats.aq/documents/recatt/Att462_e.pdf.

1.4.6 Acknowledgements

The Norwegian team would like to extend its warm appreciation to all personnel at each station and installation visited, for their hospitality and co-operation.

The team would also like to thank the pilots of the Basler for their professional skills and valuable assistance. Approximately 4140 km of air travel was covered in Antarctica for the purpose of the inspection.

1.4.7 Reporting

The following report seeks to summarise and emphasize the findings of the inspection team. The report particularly focuses on the reflections, with regard to the wider picture in this part of Antarctica, that the inspection team gained by visiting a few select installations.

The Parties whose installations/stations have been inspected have been provided the opportunity to comment a draft version of the report in order to avoid any factual mistakes. Comments received from the UK Foreign and Commonwealth Office, the South African Department of Environmental Affairs, the German Federal Foreign Office, the Belgian Ministry of Foreign Affairs, Foreign Trade and Development Cooperation and the Russian Ministry of Foreign Affairs have been incorporated into the text as appropriate. The inspection team is grateful for these comments which have ensured that mistakes and misunderstandings have been corrected. Both views are expressed where there are substantial discrepancies between the inspection team's observations/impressions and the Party's view of the situation (as reflected in their comments to the draft report).

It is, however, inevitable that errors and misunderstandings nevertheless may have occurred. The observers regret any such errors.

PART II: THE INSPECTION

2 Summary of findings

1. The inspection was carried out from 9-17 February 2018. Seven installations were inspected. Four of the installations were scientific research stations (Halley VI, Neumayer III, SANAE IV, and Princess Elisabeth Antarctica), one was a field station/logistical support base/e-base (SANAP summer station), whilst two installation provides support functions to *inter alia* national Antarctic programs (Novo Airbase & Airfield and Perseus Runway).

2. The inspection team was given complete freedom of access to all areas of the stations and installations visited. No weapons, military activity nor nuclear material or disposals were observed during the inspection at any of the installations.

3. As far as the inspection team could discern, permits and authorisation were in place for and at all installations.

4. As a general observation, the inspection team concluded that safety and emergency procedures and facilities at most installations seemed to be of satisfactory standard, although at two of the installations, improvements could be made (a lack of emergency shelter at one, and a shelter in bad condition at the other).

5. Generally speaking, education, training, and operational procedures and formal documentation were in place for all station programs. This indicated familiarity with the provisions of the Antarctic Treaty, Environmental Protocol and related agreements by station personnel at inspected stations.

6. There was a variety of organisational structures associated with the research stations, varying from the traditional clear governmental structure (Halley VI, Neumayer III and SANAE IV) to more mixed governmental/private structures (PEA). Mixed interests and ownerships also characterised the two support facilities inspected, ie. Novo Airbase and Airfield and Perseus Runway.

7. All the inspected research stations have substantial research activities. They all have a mix of long-term observations series and short-term projects. The stations with a clear link to a national research program seem to have a larger focus on the long-term series than the station with no formal national program. All the stations provide vital data for a global understanding. The degree to which these observation programs are internationally coordinated and fed into global observing systems varies.

8. Three of the research stations (Halley VI, Neumayer III and PEA) are fairly new stations, and standard setting in their own ways, with regard to efficient and environmentally friendly operations. This is clearly coloured by the framework provided by inter alia the Environmental Protocol, which now has been in force for 20 years. SANAE IV, the only pre-Protocol station inspected, has invested substantially over the last few years to move toward that same kind of post-Protocol standard. As such, the inspection team notes that the framework, provisions and principles of the Environmental Protocol and the Treaty system

seems to have had an overall positive impact on the conduct of national Antarctic operations.

9. The inspection team noted that there is an ongoing shift towards more complex technological systems that to a much larger degree than before can be operated remotely. There is also an increased automatization of observation and monitoring instruments, which could potentially reduce required on-site activity over time.

10. The inspection team observed a general and universal intent and desire by the inspected research stations to implement efficient and green technologies in their operations. There is, however, a marked difference between stations on how progressive they are with regard to energy production. All but one are still highly reliant on conventional energy sources.

11. The inspection team noted that in some cases there was a lack of information on relevant contact points. This makes information sharing difficult, and is also a serious concern in relation to emergency situations and SAR.

12. The inspection team noted that there is increased activity in the inspected region. This is shown, by amongst other things, the establishment of new runways, and an increasing number of flights.

3 Halley VI

3.1 About the inspection

The inspection team arrived at Halley VI on 9 February 2018 at 11:30 local time. On arriving the station, the inspection team was met by the station leader and the station operations manager. The station was informed about the inspection, and the planned date, by e-mail a few days ahead of the inspection (7 February). At arrival, the inspection team was provided with a package of written information containing information about the station, its operations and science activities, including a completed checklist for reference use.

The inspection lasted for 4,5 hours.

Halley VI was last inspected by the joint German/South African inspection team in January 2013. This is the only time the station has been inspected previously.

3.2 Operator

The Halley VI research station is operated within the framework of the national Antarctic program of United Kingdom. The responsible operating agency is the British Antarctic Survey (BAS), a component research station institute of the UK Natural Environment Research Council (NERC), operating under the Department of Business, Energy and Industrial Strategy. Halley VI is one of three stations operating within this framework and by this operator in Antarctica. The operation of these stations is financed through NERC's funding of BAS.

3.3 About the facility and operations

3.3.1 Location

Halley VI is located in Coats Land, and sits on the 130 meter-thick Brunt Ice Shelf on the Caird Coast (75°34'16"S, Long. 25°28'26"W). The ice shelf flows slowly out onto the Weddell Sea, where chunks of the ice 'calve' off as icebergs.

3.3.2 The structure

The Halley VI research station was opened as an year-round station in the summer season 2012-13, but has since the 2016-17 season been closed for winter operations due to unforeseen glaciological circumstances. The station is a re-locatable research facility. Halley VI is the newest of a number of Halley stations that have been located in the approximately same area since 1956.

The research station consists of eight interlinked ski mounted modules connected together, including two separate energy modules and sewage treatment plants. There is a bridge separating the two energy modules, i.e. parallel systems and serve as a backup for each other.

The modules of the building can be raised 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. This design enables a sustainable and long term use of a station structure located on a flowing ice shelf in the long term, such as Halley VI is. The station's modules were successfully moved

23 km upstream in February 2017, proving that the ski-based relocation system designed for the station works as intended.

In addition there are a number of external accommodation cabooses/buildings, garage and workshop cabooses/buildings, waste and storage containers and science laboratories/cabooses in the area surrounding the station.

3.3.3 Energy production

Halley VI operates on basis of conventional generator produced energy and has robust capacity and back-up capacity available. Four main diesel generators and a number of alternators of various capacities constitute the core of the system. The annual fuel consumptions for power generations is approx. 365,000 litres when in full winter use.

The inspection team was informed that when designing the station there were plans of including alternative energy sources to the diesel generators. In documentation provided by the personnel, it is noted that a project looking at micro turbine as a potential energy system addition was planned for the winter 2018. The inspection team learned that these plans would not be followed up due to the winter closure of the station.

3.3.4 Fuel storage

AVTUR (aircraft) and AVCAT (aircraft) fuel, petrol, paraffin is stored in steel tanks. Fuel is delivered to Halley VI by ship every year. Fuel is pumped from the ship into bulk tanks at the coast. Personnel continuously monitor all fuel pumping operations, and the transfer systems are designed to reduce risk of spillage, valve leakage, etc. to a minimum.

3.3.5 Water production

Heat recovery from generators is used to melt snow for water consumption. This provides access to good quality water at all times. According to information provided, average water consumption lies at approx. 80 litres per person per day.

3.3.6 Waste management

The winter station leader is normally responsible for waste handling, assisted by four general assistants responsible for inter alia day-to-day handling of waste management issues. All personnel are briefed in UK, and on their initial arrival at the station, in waste management issues. The waste management system at Halley VI can be summarized as follows, as laid out in the “BAS Waste Management Handbook”:

- Food waste and waste produced by field parties is incinerated at the station. Ash waste returned to UK for disposal.
- Grey water is normally discharged into a common drainage system, which is fed directly into the sewage treatment plant (STP), and thereafter clean outfall is discharged into a snow pit.
- All other waste is removed for further handling and disposal outside Antarctica (mainly in the UK).

The inspection team was informed that at the time of the inspection the STP was shut off due to the non-wintering of the station in 2018 and challenges in getting the STP operational after the 2017 winter closure. Grey water during this summer season had consequently been discharged directly

into the snow pit untreated. The UK's competent authority has been informed of this situation and have granted special dispensation under the terms of the British Antarctic Survey's permit.

3.3.7 The personnel

The main station building is built to accommodate 68 and additional staff in external modules. During the 2017-18 summer season, a total of 70 persons had been present at the station. On the day of the inspection, 63 persons were present, of which 12 were scientist.

3.3.8 Transportation

Halley VI is normally resupplied by vessel at the ice edge twice a season, approx. 34 kilometres from the station. Supplies are brought into station by ground transport.

A small skiway is maintained and operated throughout the summer season. Approximately 10 flights land per season to complete small volume passenger transfers, deploy scientific field parties and instruments.

3.3.9 Other observations

The station has high-technology solutions for monitoring the operation of the station. The operation can also be monitored from Cambridge, UK.

Monitoring revealed in 2015 that Halley VI was downstream of a widening crack in the ice shelf. As a result, the research station was relocated to a new, safer site in 2016. During the 2016-17 season the modules were successfully relocated 24 km. However, a second crack appeared unexpectedly in October 2016. BAS therefore decided, for safety reasons, to close its Halley VI Research Station during the 2017 Antarctic winter. The station will close down the year-round operation also in 2018 due to a complex and unpredictable glaciological situation.

3.4 Treaty obligations

The inspection team was given complete freedom of access to all areas of the Halley VI research station.

No weapons, military activity nor nuclear material or disposals were observed during the inspection at Halley VI station. The station leader also confirmed that they do not have such material, nor any weapons or explosives at the station.

The inspection team was informed that the an introduction to the provisions of the Antarctic Treaty, Environmental Protocol and related agreements is part of the pre-deployment training for all new personnel. The team noted that information about the Treaty and other relevant information was available in common areas in the station. The team got an overall impression that the station management had basic understanding of the ATS framework.

3.5 Permits and/or authorization

All activities undertaken by BAS in the Antarctic, including operation of and activities at Halley VI, have been and are to be subject to an environmental assessment procedure in accordance with the

Protocol on Environmental Protection and the UK Antarctic Act. The inspection team received copies of permits for activities taking place.

3.6 Scientific research

Science at Halley VI provides vital information for a global understanding of space weather, ozone depletion, polar atmospheric chemistry, sea-level rise and climate change. The station is situated in the auroral zone, which makes it ideally placed for geospace research and research into space weather. Ozone has been measured from Halley since 1956, by use of a Dobson photospectrometer. It was these long-term measurements that led to the discovery of the hole in the ozone layer in 1985.

Scientific activity at Halley VI comprise the following elements:

- Running of long-term time series, and maintenance of the instruments/observatories supporting these observation systems.
- Being a hub/staring point and providing support for remote field projects.

Normally there will be some projects not associated with the long-term observation series occurring at or out from Halley VI each season. However, the inspection team are of the impression that there was a hiatus in this regard in the 2017-18 season, potentially due to the uncertain glaciological and operational situation surrounding the station.

BAS research in Antarctica is guided by the policy paper *UK science in Antarctica: 2014 to 2020 - A framework for British research, outlining the UK's science strategy in Antarctica and the Southern Ocean from 2014 to 2020* and BAS' own science strategy[5].

It is the inspection team's understanding that on-going observation programs at Halley VI (ie. CASLab, WWLLN, AARDVARK) contributes to global observation networks, and that there is a high level of international collaboration, inter alia with NASA, ESA, AWI and NSF.

The ice situation at Halley VI, which has led to forced winter closure the last couple of years, is a strain on the ability to maintain operation of the long-term time series, which in the short term is a challenge for the scientific program. The situation is, however, forcing the science and science technology community to think and act innovatively to develop standalone technology that in the future will enable the continued winter observations without present personnel.

3.7 Environment

Some environmentally directed aspects of the operation at Halley VI that the inspection finds worth mentioning are:

- High focus on energy efficiency in the building, both with regard to the structure itself and the operational aspects of such things as energy production, waste heat use, LED lights, etc.
- Well organized litter and waste system, enabling easy separation (and thereby later handling) of station waste.
- Controlled environment for vehicle maintenance, containing any spill.

[5] https://www.bas.ac.uk/science/our-research/our-strategy/

- Good practice with regard to fuel handling limiting spill risk, while having clear routines for handling of any spills that take place through collection and melting of contaminated snow, and removal of remaining contaminated water. The inspection team were told that only one small spill of approx. 1 litre of hydraulic oil had occurred during the season.
- Clear guidance provided and adhered to when recreational trips to ice edge to visit penguin colony takes place.

3.8 Safety and emergencies

According to the information given to the inspection team, all personnel going to Halley VI station receive first aid training and survival and environmental training in United Kingdom during BAS pre-deployment training before leaving for Antarctica. Further induction training, local area familiarisation, IT and communication, vehicle and field training is held once personnel arrive at Halley VI. Further specialist training is conducted with specific staff regarding issues such as SAR and oil spill response. This training package amounts to around 20 days in total. Field assistants generally have more technical knowledge of rescue techniques.

The mirrored system provided by the moduled system which contains two separate areas (physically separated by an open-air bridge) of energy and water production, ensures a backup in case of fire in one section of the moduled building. A very technological advanced firefighting system has been installed at the station. This fire suppression system has been documented to be highly effective. The fire emergency plan is exposed in several locations around the station.

The summer accommodation module, external from the main station building, can also provide emergency shelter with all facilities available in case the full station should be damaged and/or become inaccessible for some reason.

There is one doctor stationed at Halley VI, which has a well-equipped surgery available. In addition, through recruitment and training an advanced first aid team is always present at the station. Medivac will normally be done by aircraft to Rothera and onward to Punta Arenas (Chile), or through the use of the DROMLAN network to Cape Town.

The considerations and actions that have been taken with regard to the development of the ice conditions in the area and the decisions to close the station for winter operations for the time being is in itself a clear demonstration of a high level of focus on health and safety matters in the UK National Antarctic Program.

As a general observation the inspection team concluded that safety and emergency procedures and facilities at Halley VI seemed to be of robust and comprehensive standard.

3.9 Non-governmental activities

Halley VI station is relatively inaccessibly located, which means that the stations does not meet many inquiries from tourists. No visits have taken place since the last inspection, which means that the last non-governmental visit at the station took place 18 years ago. BAS has a clear station visit policy. Only exceptionally will visits to Halley VI be allowed on request, and visitors will in these instances before touring the station be briefed either on-board ship or immediately on arrival at the station by the Base Commander.

Station personnel raised some concern and considerations regarding the seemingly increasing tourism activity in the area and potential burden this may place on national programs (including their own) in the area with regard to SAR expectations.

3.10 Concluding remarks

To sum up, the inspection team would like to highlight the following from the inspection of the Halley Vi research station:

- The Halley VI research station was opened as a year-round station in the summer season 2012-13. The modern award-winning and innovative research station, built on a floating ice shelf in the Weddell Sea, is the world's first re-locatable research facility. The BAS mission is to deliver a world class programme of scientific research and minimise negative environmental impacts and risks. The inspection team reflects upon the fact that Halley VI research station lack any renewable energy solution as a supplement to the diesel energy production.

- The Halley VI research station, following previous Halley stations, is an internationally important platform for global earth, atmospheric and space weather observation. This is underlined by long-term data made using the Dobson photospectrometer at Halley led to the discovery of the hole in the ozone layer back in 1985. Due to a complex and unpredictable glaciological situation the station will close down the year-round operation even in 2018. This will have negative consequences for some of the long-term observations.

- At the same time, the situation of shutting down the station during winter, will force the station to look for automatization, a situation that in the long run could facilitate the ability to operate critical operational and scientific equipment in periods of station closure, thus potentially reducing required on-site activity over time. The inspection team notes the potential for BAS to share knowledge and findings on this with the wider Antarctic community throughout this process.

- The station has high technology solutions for monitoring the operation of the station. The operation can also be monitored from Cambridge, UK. The level of technology may also lead to increase in vulnerability concerning transfer of knowledge between personnel.

4 Neumayer III

4.1 About the inspection

The inspection team arrived at Neumayer III on 9 February 2018 at 22:00 local time (UTC). The station was informed about the inspection, and the planned date, by e-mail a few days ahead of the inspection (7 February). The team was met by the field coordinator for the summer season and other personnel. Despite the late hour, the team was treated with a warm meal and was offered accommodation for the night, which was highly appreciated.

The inspection started at 09:00 on 10 February. The inspection team was provided with written information about all relevant aspects of the station, its operations and science activities, including a completed checklist for reference use.

The inspection lasted 7 hours[6].

Neumayer III was last inspected by the Japanese inspection in February 2010. This is the only time the station has been inspected previously.

4.2 Operator

The German Federal Ministry for Education and Research (BMBF) is responsible for the Neumayer III research station. The station is operated by Alfred Wegener Institute Helmholz Center for Polar and Marine Research (AWI). AWI is funded 90% by BMFB and the remaining 10% from federal counties. Neumayer III is the permanent German Antarctic station for scientific and logistics in Antarctica and thus constitutes the main platform for the German national Antarctic program.

4.3 About the facility and operations

4.3.1 Location

Neumayer III is located on the Ekström Ice Shelf near Atka Bay at 70°40'S S, 08°16'W, in Dronning Maud Land.

4.3.2 The structure

The Neumayer III station was constructed during the summer seasons 2007-2008 and 2008-2009, and was inaugurated for year-round operations on 20 February 2009.

The main building is an above ground building combined with sub-surface garage and storage structures. The building is a three-dimensional steel structure set up on 16 legs with bipod hydraulic cylinders for the compensation of equal and differential settlements and for raising the building to accommodate for the yearly snow accumulation.

[6] This also includes the inspection of SANAP summer station (cf. chapter 7).

In addition, there are summer accommodation modules, a clean air laboratory 1.5 km away from the main station complex, a magnetic observatory inside an insulated hut, a research "greenhouse" on a raised container unit, an automated penguin monitoring unit (container) 7 km from the station, and a small container library "on ice"[7].

4.3.3 Energy production

The station is powered mainly on conventional generator produced energy. There are 3 diesel generators (+1 emergency generator). All heating, air-conditioning and hot water production is powered by excess heat. The annual fuel consumptions for power generations is approx. 230,000 litres.

There is a small wind power plant of 30 kW supplying about 12 percent of the power demand with the given wind conditions at Neumayer III. An upgrading of wind power generation at Neumayer III has been planned over a number of years, but solutions that are robust enough have yet to be found.

4.3.4 Fuel storage

Polar diesel is stored in steel tanks inside the station and polar diesel, kerosene Jet A1 and petrol in tank containers on the ice. Most of the tank containers are double shelled. Fuel is transported to Neumayer III by ship every year. Fuel is delivered to shore through hose connection between ship and a tank container on the ice shelf, and to the station by pulling a tank container on a sledge to the station. Refuelling is conducted by connecting the tank container by a flexible hose to the manifold. Both visual and technical monitoring of the fuel pumping operations are in place, and the transfer systems are designed to reduce risk of spillage, valve leakage, etc. to a minimum.

4.3.5 Water production

Water for consumption is produced by melting snow in the 2 m^3 snow smelter utilising excess heat from the generator for the melting process. The water is tested regularly, and maintains high quality. There is no water shortage at Neumayer III, but water is nevertheless conserved through recycling of filtrate water from the sewage plant, reused for flushing toilets. According to information provided, average water consumption lies at approx. 160 litres per person per day.

4.3.6 Waste management

Waste is separated in groups according to the "Act implementing the protocol of Environmental protection to the Antarctic Treaty" and categorized according to MARPOL Annex V regulations. The inspection team was informed that waste is compacted or shredded and collected in shipping containers to be shipped out of the continent for handling and disposal in South Africa or Germany. Information received post-inspection indicates that no waste is taken back to Germany, and that most waste is shipped to Punta Arenas in Chile for proper disposal. There is no incineration at Neumayer III.

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[7] The «Library on Ice» is an art project by the artist Lutz Fritsch. He erected the library to create a space for interaction between science and culture in the far reaches of the Antarctica.

A fully biological wastewater treatment plant with ultra-filtration for sludge segregation and UV-disinfection has been installed for the treatment of sewage. The sewage plant is integrated in the station. All station waters are treated in this plant. Sludges are according to information received dried and removed to South Africa or Germany. The treated water is drained into an ice cavern 80 meters east of the station.

4.3.7 Personnel

The main station building is built to accommodate 48 persons and an additional 20 in the external summer camp. In the 2017-18 season, a total of 64 persons had been present at the station, of which 34 were scientists. The regular winter staff is 9 persons, while the 2018 winter season will have a team of 10 due to the addition of a researcher associated with the greenhouse research. Five of these overwintering personnel are scientists.

4.3.8 Transportation

Vessels delivering supplies dock at the ice edge in Atka Bay annually, and supplies are brought into the station by vehicles.

The Neumayer skiway is operational every season from mid-October to end of February. No lighting system is available, no navigational support is provided, and landing is only possible for ski-equipped aircrafts. There is a designated Helipad marked on request.

The station regularly uses four traverse routes, in addition to regular transport to the resupply point and penguin observatory in Atka Bay.

4.4 Treaty obligations

The inspection team was given complete freedom of access to all parts of Neumayer III research station.

No weapons, military activity nor nuclear material or disposals were observed during the inspection at Neumayer III. The personnel also confirmed that they do not have such material or any weapons at the station.

The team was informed that the station has a small amount of explosives for seismic projects. According to the information received by the inspection team, the explosives are stored in the winter storage area, 7 km from the main station, and only a few people are aware of its exact location.

The inspection team was informed that all personnel, including winter personnel, are required to go through a full-day seminar where there are special briefings focused on the requirements of the Antarctic Treaty and the Environmental Protocol. Conversations held during the inspection reflected this knowledge and awareness, and the he inspection team had interesting discussions with station personnel on various issues related to the Antarctic Treaty system.

4.5 Permits / authorizations

The operation of Neumayer III is authorised by the German Environment Agency in accordance with Environmental Protocol provisions and German legislation. The permit also covers the operation of

the scientific observatories associated with the station. The permit has to be renewed yearly. The inspection team received copies of the current authorization.

The inspection team was told that project based scientific activities have to have the necessary authorization from German Environment Agency (German projects) or their national authorities (international projects using Neumayer III as platform). The summer field coordinators familiarize themselves with these individual permits.

4.6 Scientific research

The main scientific task of Neumayer III is to run long-term observatories for meteorology, air chemistry, infrasound, magnetics, and seismic. The station has an infrasound array I27DE that is operated to monitor the compliance of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). In addition, there is a penguin monitoring observatory, the Single Penguin Observation and Tracking Observatory (SPOT), aiming to get a better understanding of emperor penguin behaviour using Atka Bay colony.

The station was used as the logistical hub for the EPICA[8] drilling operation taking place at the Kohnen station on the plateau until 2006. Neumayer III is still used as the logistical hub for further sub-glacial studies utilising the EPICA drill hole. No activity was taking place at Kohnen station the 2017-18 summer season.

Scientific activity at Neumayer III comprise the following elements:

- Running of long-term time series, and maintenance of the instruments/observatories supporting these observation systems.
- Providing a platform for specific research projects that can utilize the unique environment of the Neumayer III area.
- Being a hub/staring point and providing support for remote field projects.

Around 15 projects not associated with the long-term observation series has been or are taking place at or out from Neumayer III during the 2017-18 season.

There is a structured application and selection process for the purpose of identifying projects that will be allowed to take place at Neumayer III, including the involvement of an external advisory body providing quality assessment of projects. International projects are welcomed as part of this process.

There is international collaboration, in particular with the UK and Australia, with regard to the observation efforts. Data from the observation networks are fed into international global networks where relevant.

[8] The European Project for Ice Coring in Antarctica (EPICA) was a multinational European project for deep ice core drilling in Antarctica with the objective to obtain full documentation of the climatic and atmospheric record archived in Antarctic ice by drilling and analyzing two ice cores and comparing these with their Greenland counterparts (GRIP and GISP).

4.7 Environment

Some environmentally directed aspects of the operation at Neumayer III that the inspection finds worth mentioning are:

- High focus on energy efficiency in the building. Station design is based on the double shell principle. Inside the hull temperatures are kept at slightly above 5° C, normal room temperatures only in the inner building block. Energy efficiency with regard to also operational aspects such as alternative energy production and waste heat use. An energy management system controls all input and output of all types of energy production and consumption at the station.
- Well organised litter and waste system, enabling easy separation (and thereby later handling) of station waste.
- Clear routines for handling of any spills that take place through collection and removal of remaining contaminated snow. The inspection team were told that no spill of substance had occurred during the season.
- The German Environment Agency has issued guidelines on human activities close to concentration of wildlife. The station personnel is trained before leaving for Antarctica and pilots are briefed. Visits to the penguin colony at the sea ice of Atka Bay are controlled according to the guidelines.
- As part of the EDEN ISS project non-native species are present hermetically sealed in the Greenhouse container. Only seeds are imported into Antarctica, transported in closed cases. Specific permit in accordance with Environmental Protocol provisions has been granted for this import of non-native species.
- Monitoring of station activities in accordance with the description provided in the CEE for Neumayer III, with the aim to discover any environmental impacts of the operations.

4.8 Safety and emergency

According to the information given to the inspection team, all personnel going to Neumayer III station receive general training including safety issues such as firefighting, first aid, SAR training (mountain training), and medical evacuation procedures.

Fire is considered the biggest risk to the station and the winter personnel is given special training for firefighting over one week during their preparation. The winter staff is also set up as a firefighting brigade. There is fire detection system in every room and the station is well equipped with firefighting equipment.

In case of need of evacuation of the station, the facility of the SANAP summer station, located 7 km away from Neumayer III would be used. The inspection team noted that these facilities were not in good standard, and although they would function as an evacuation site for a short period during summer, they did not seem to be apt for long time winter emergency purposes. German authorities have later advised the inspection team that the summer station is checked regularly for operability and that in case of an emergency the station facilities can be complemented by equipment stored in the winter storage separate from the main station building. The inspection team also took note of the somewhat large distance to the emergency base, which could be an obstacle if a difficult situation occurs in concert with bad conditions and weather.

The station has adequate medical capabilities that consist of operating theatre, surgery and pharmacy/office. Extensive and cutting-edge telemedicine facilities are installed. There is one physician in winter-team and two during summer.

As a general observation the inspection team concluded that the safety and emergency procedures seemed sufficient.

4.9 Non-governmental activities

There is no non-governmental activity at Neumayer III. However, there is tourist activity in Atka Bay, close to the station. The Antarctic Company (TAC) has over a number of years conducted flights from Novo Airfield to Atka Bay for penguin viewing. This season the more recently established company, White Desert, announced 8 tourist flights to the Atka Bay penguin colony. The first reconnaissance flight flew over the colony at an altitude of 100 m and landed in front of the animals less than 100 meters. These operations caused disturbance in the penguin colony as well as impacting the running biological program. AWI raised the issue with the FCO of UK, the competent authority. No further problems occurred during the season.

Neumayer III has so far received few requests for use of skiway or visit to station. There is, however, a conceived feeling that this might increase in the future. The station does not allow tourist to visit except in case of emergency, and as a consequence no specific procedures to facilitate or control touristic activities are in place. The expedition leader will intervene if scientific works or projects are disturbed by visits or landings of aircrafts.

Station personnel raised some concern and considerations regarding the seemingly increasing tourism activity in the area and potential burden this may place on national programs (including their own) in the area with regard to SAR expectations.

4.10 Concluding remarks

To sum up, the inspection team would like to highlight the following from the inspection of the Neumayer III research station:

- The Neumayer III is operated in an impressive manner. The building works to its purpose and requires a relatively little staff for operational purposes while at the same time giving excellent facilities for the researchers and support to field operations.
- The inspection team noted a high level of commitment to the Antarctic Treaty and the Environmental Protocol provisions amongst station personnel, and it was clear to the team that these provided a formal framework for the operations at Neumayer III.
- The importance of the long-term observations and science from this geographically distinct area should be highlighted, and the operator should be commended for maintaining this focus.
- The inspection team notes that could be room for further expansion with regard to renewable energy systems, and encourage the operator to continue to look into potential solutions.

5 SANAP summer station

5.1 About the inspection

The inspection team arrived at Summer SANAP on 9 February 2018 at approx. 15:30 local time in conjunction with the inspection of the German station Neumayer III. The station was not manned, and the inspection was accomplished with guidance from personnel at Neumayer III.

The inspection lasted approximately 0,5 hours.

Summer SANAP has not been formally inspected as a separate entity before.

The inspection to this site was not pre-planned, as the team only became aware of the existence of this station, and the bilateral arrangements between Germany and South-Africa regarding the use of this station, during the course of the inspection of Neumayer III.

In conjunction with the inspection of SANAE IV on 17 February, SANAP personnel provided background information regarding this station. In short, when SANAP was forced to relocate the landing location at Penguin Bukta for their resupply vessel due to ice conditions, Atka Bay was chosen as the most appropriate location. The distance between this loading site and SANAE IV was substantial enough to make it desirable to establish a stopover facility for the supply chain personnel. With this as background, SANAP procured modules from Neumayer II at the time of demolishment of the old German research station. Today the landing site has been moved back to original position, and the summer station no longer is needed in the supply transport phase. The station is intermittently used by South African research teams working on projects focused on the coast. SANAP is aware of the less robust state of the station, indicating that it is no longer ideal neither as a summer base for their purposes or as an emergency base for the German program, and intend to initiate a dialogue with AWI to see what the future holds with regard to ownership and maintenance.

5.2 Operator

The station and its facilities (including an associated under-ground garage) is owned by and is the responsibility of the South African National Antarctic Program (SANAP). However, SANAP and AWI have a bilateral agreement enabling the German Antarctic Program to utilize this summer station as an emergency base should something happen at Neumayer III.

5.3 About the facility and operations

5.3.1 Structure

A number of container modules have been put together on a raised frame, containing sleeping modules (approx. 20 beds), sanitary modules, kitchen and mess module and generator module.

The underground garage which was built for Neumayer II was taken over as part of the agreement between SANAP and AWI. The inspection team was told by AWI personnel that a few smaller vehicles were kept there. The garage roof has, however, collapsed, and the garage no longer serves any purpose and is not a safe area.

5.3.2 Other observations

The structures are in poor condition and in dire need for repair, in particular the frame structure upon which the facilities rest. For the purpose of its role as an emergency base, it seems to the inspection team that it would be particularly important that the station is repaired and kept up to standard.

5.4 Concluding remarks

To sum up, the inspection team would like to highlight the following from the inspection of the SANAP summer station:

- Considering the change in use, the role of the station as an emergency station and its state, it seems imminent to the inspection team that SANAP and AWI come to an agreement with regard to requirements and responsibilities regarding maintenance etc. in light of its operational needs as an emergency base.
- Furthermore, SANAP might want to consider and decide on its future use and need for the summer station and act accordingly, *inter alia* by upgrading and maintaining as appropriate for desired use, formally adopt an agreement with AWI regarding maintenance and operation or remove the station in accordance with Environmental Protocol provisions.
- Risk and safety issues relating to the collapsed garage need to be considered and dealt with.

6 Princess Elisabeth Antarctica

6.1 About the inspection

The inspection team arrived at Princess Elisabeth Antarctica on 11 February 2018 at 15:00 local time (UTC). The station was informed about the inspection, and the planned date, by e-mail a few days ahead of the inspection (7 February). The team was met by deputy station leader, and several other members of the personnel and visitors at the station.

No documentation regarding station operations or authorisations were presented to the inspection team to support the inspection. In being informed about the inspection, Belgian authorities provided information about the IEE for the operations at the station to the inspection team[9], which the team found useful in this context.

The inspection lasted approx. 3 hours.

Princess Elisabeth Antarctica was last inspected by the Russian/US inspection in December 2012, as well as the German/South African inspection in January 2013.

6.2 Operator

The complexities of the station ownership and operation has been in focus over a number of years, particularly due to a number of legal cases regarding this situation in Belgium. The operational complexity has also been the cause for discussions in the ATCM, first brought up in the report of the 2009 Norwegian inspection. The inspection team therefore spent some time and effort in trying to understand and get clarity with regard to the current situation.

As the inspection team understands it, Princess Elisabeth Antarctica is today owned by the Belgium state, with the International Polar Foundation (IPF) keeping a symbolic ownership of 0,1 % . The Polar Secretariat, a governmental body with independent management under the Federal Science Policy Office, is responsible for the financial and material management of the station. The Polar Secretariat also provides the legal basis for the management of the station and the conduct of research, in partnership with the Belgian Science Policy Office. The strategic council of the Polar Secretariat is composed of 6 representatives of the federal state, 1 representative from IPF and 5 other private sector representatives. The Polar Secretariat is entrusted, by delegation of the Belgian state, to represent the Belgian state in COMNAP, Dromship and DROMLAN. IPF is the private operator of the station working under the supervision and guidance of the Polar Secretariat. According to the deputy expedition leader at the station it is now agreed that the IPF will continue to be the operator of the station for 10 years. The inspection team has post-inspection been advised by Belgian authorities the situation is a bit more complex than this, but that in short can be summarised that an agreement has been reached between the Belgian State and the IPF resulting in a 100% ownership of Princess Elisabeth Antarctica by the Belgian State; that an international non-profit organisation will take over

[9] Initial Environmental Evaluation for Antarctic activities carried out at the Princess Elisabeth Antarctic Research Station. BELARE 2017-2018.

the role of the Polar Secretariat in managing Princess Elisabeth Antarctica; and that the legal texts implementing the agreement will be submitted to Parliament soon.

6.3 Description of facility and operations

6.3.1 Location

Princess Elisabeth Antarctica is located 71°57'S, 23°20'E at the base of Utsteinen in Sør Rondane in Dronning Maud Land, about 190 km from Crown Bay at the coast.

6.3.2 Structure

Princess Elisabeth Antarctica was opened as a summer only station in 2009, and has since then been operated on a seasonal basis. The inspection team has noted that it has been built to enable year-round operations should this be desired at some stage in the future.

The station is constructed as a compact station, built above ground on metal pillars on a rock area. Adjacent to the building, there is a garage (wooden construction) and a tank for water heating.

At the time of the inspection, construction works were going on to upgrade the housing quarters. After reconstruction the station will be able to accommodate 48 people.

In addition, there are external garage and workshops, emergency accommodation modules, storage containers and scientific instruments and instrument modules.

6.3.3 Energy production

The station is operated with a zero-emission vision and uses a combination of sun and wind as its primary energy source. Much of the surface of the station and the roof is covered by photovoltaic solar panels, which feed the station with electricity whereas excess production is stored in batteries for use when the energy demand is higher than the current energy production. On one side of the roof there are thermal solar panels, which are used for water production (snow melting) and water heating. There are nine wind turbines at the station, which blades can be locked down in stormy weather, in order to prevent damage.

There are two back-up generators to ensure a constant energy supply at the station. The inspection team was informed that in the early years of the station, the green energy system did not run smoothly, and the diesel generators were in more frequent use. Specific focus on this issue by a dedicated consultant seems to have been successful and during the 2017-18 season the diesel generators had been in use only three times for short periods. Thus, it seems that the building has reached a point where the green energy system is working close to the zero-emission vision.

6.3.4 Fuel storage

Unleaded petrol for snowmobiles and Jet A1 for flight and vehicle operations as well as for use in the generators are the main types of fuel available at the station. All fuel is stored in 200-liter drums. A separate fuel platform has been constructed at the station for the purpose of storage. The inspection team notes that the IEE for the operations describe procedures for preventing and minimizing risk of spills. Fuel consumption at the station is estimated to be less than 2000 litres fuel per season.

6.3.5 Water production

Water for consumption is produced by melting snow, utilizing solar heat. At the time of the inspection a new snow smelter system for water production was being installed. After melting the snow, the water is directed to two separate locations. The cold water is stored in cold water tanks, and the warm water follows a circuit with thermal solar panels and is stored in the hot water tank after heating. According to information provided, average water consumption lies at approx. 40 litres per person per day.

6.3.6 Waste management

As far as the inspection team could discern, all waste is collected, separated, stored and transported out from Antarctica to Cape Town for further handling and disposal.

The station`s water treatment system allows for 100% treatment of its grey and black waters. About 60% of the water is re-used, while the rest is disposed of in a crevasse near the station. Before it is disposed of, the water is treated in order not to contaminate the environment. Sludge from the reactor is collected, stored and removed to Cape Town for handling and disposal. At the time of the inspection the waste water system was not functioning optimally due to capacity constraints. Consequently untreated water was discharged, noting, however, that alternative ways of handling sewage was in place to avoid the release of black water. The inspection team was informed that its function and capacity is under review, and that it will be replaced by a more reliable system.

6.3.7 Personnel

At the time of the inspection, there were a total of 27 people at the station. Out of these 27, three people were out on field work, including the expedition leader. A number of those present were science related, including participants in several international science projects (ia. a Turkish/Swiss project and a Canadian project). At the time of the inspection the co-chairs of the DROMLAN-network was also present at the station.

6.3.8 Transportation

The Belgian program loads and unloads from the supply ship at Crown Bay once every season, and supplies are brought into the station by overland transport.

A small skiway is operational every season. Landing is only possible for ski-equipped aircrafts. Princess Elisabeth Antarctica is located approximately 60 kilometres from the new Perseus airfield.

6.4 Treaty Obligations

The inspection team was given freedom of access to all parts of Princess Elisabeth Antarctica research station that the team wished to and had time to visit during the inspection.

The inspection team did not during the inspection receive any information as regard to training of personnel with regard to the Antarctic Treaty and the Environmental Protocol.

No weapons, military activity nor nuclear material or disposals were observed during the inspection at Princess Elisabeth Antarctica. The station leader also confirmed that they do not have such material or any weapons at the station.

6.5 Permits and authorizations

On the basis of the information obtained during the inspection, it seems that the permits and authorisations for the activities at the station, including the scientific activities (both nationally and internationally lead), are obtained by the IPF, within its mandate as Antarctic Operator. Post-inspection Belgium authorities advised the inspection team that also the Polar Secretariat has a role in obtaining the permits. The Ministry of Environment is the authorising agency. The station personnel did however indicate that the new Belgian act[10] had made it a bit unclear whether individual science projects would need to notify and be authorised separately by those responsible for the project, and that there was a bit of uncertainty around these aspects.

6.6 Scientific research

The station provides the platform for a wide spectre of instruments and facilities for long-term observations, a number of these also running automatically throughout the winter months when the station is unmanned. There is a geomagnetic observatory to conduct long-term observations of the earth's magnetic fields. There are also instruments for atmospheric measurements, such as a ceilometer, equipment for measurements and for the sun radiation.

At some distance from the station, by the foot of Utsteinen, there is a permanent scientific shelter with cooking facilities and other field necessities. There are also some mobile labs available for the researchers.

Scientific activity at Princess Elisabeth comprise the following elements:

- Running of long-term time series, and maintenance of the instruments/observatories supporting these observation systems.
- Being a hub/staring point and providing support for field projects.

Around 15 projects, including those associated with the long-term observation series, have been or are taking place at or out from PEA during the 2017-18 season.

The station personnel explained that some of the science projects are financed by the Belgian State comprising formally the Belgian Federal Science Policy (BELSPO). The IPF also provides support to the the Baillet Latour Antarctica Fellowship, which provides young scientists the opportunity to conduct research at the Princess Elisabeth Antarctica. Princess Elisabeth is also open and welcoming to international projects funded by their national programs (or other means).

The Polar Secretariat centralizes applications for scientific programs for the purpose of the activities at Princess Elisabeth Antarctica, and transmits the requests to the competent bodies. From

[10] Loi de 21 JUILLET 2017 Loi relative a la protection de l'environement et a la regulation des activites menees sous juridiction belge en Antarctique.

information provided by the station personnel, there does not seem to be a national strategic science plan available to guide and direct science efforts and priorities at the station. However, BELSPO proposals for scientific projects to be conducted at the Princess Elisabeth Antarctica are evaluated and approved by a peer review system, while the Belgian Polar Secretariat oversee applications from international research projects.

As far as the inspection team could discern, long-term observation data are fed into appropriate international networks where relevant.

The inspection team noted that the conflict between the Belgian state and the IPF may have had some negative effects on the science activities at the station in the period 2015-2017.

6.7 Environment

Some environmentally directed aspects of the operation at Princess Elisabeth Antarctica that the inspection finds worth mentioning are:

- There is a high level of use of solar and wind energy, with less and less dependence on the back-up generators. To the inspection team it seems like PEA is well on its way to accomplish a high degree of its zero-emission vision.
- High focus on energy efficiency and energy distribution in the building, both with regard to the structure itself and the operational aspects of such things as energy production, waste heat use, LED lights, etc. An energy management system controls all input and output of all types of energy production and consumption at the station.
- Active and continuous consideration of new, innovative technologies both with regard to potential green station improvements and green support activity (eg. vehicles, etc.).

6.8 Safety and emergency

In emergency situations and if it is necessary to evacuate the station, external modules are used as emergency shelter. There are external modules that have full cooking, sanitary, and other fundamental capabilities available. As the station is a summer only operation, it is considered sufficient, as in far as external rescue operations could and would be initiated as soon as weather would permit. There was, according to information received, one firefighter amongst the crew.

The station has one physician available during the entire operating season, and in addition, other personnel with paramedic competence were present. Medial facilities shave basic equipment, but no sophisticated capabilities.

As a general observation, the inspection team concluded that the safety and emergency procedures seemed sufficient, considering the station's status as a summer only operation.

6.9 Non-governmental activities

2009 Norwegian inspection report noted that the station at that time did not have a strategy or policy relating to potential tourism. From information obtained, there is still not a documented written strategy/policy in place, and the station personnel did not have a view on how one would respond to requests from tourists wishing to visit, as this was seen as an issue of little relevance in light of its remote position.

However, the inspection team notes that, in view of the outstanding beauty of the landscape surrounding the station, its innovative green image and the new airfield opening up in a relative short distance from the station (Perseus), as well as the general growth of interest in the Antarctic, some attention and interest may be expected in the years to come. It may therefore be of relevance to the station to develop a policy to meet such a development. The inspection team has been advised post-inspection that it is a clear Belgian policy that the station should be dedicated to science and not open to tourism.

6.10 Concluding remarks

- The inspection team finds the innovative and comprehensive approach to the zero-emission running of the station inspiring, and will encourage the Belgian state and IPF to distribute and share the technology and solutions, for other stations to be able to follow in their footsteps.
- The inspection team was informed that the building – as a zero-emission station – can be regarded as a project in itself, even if it the energy system of the building is not a science project in the formal sense. Both the building and the green energy technology seems to be highly innovative in the Antarctic context, and it involves not only the technical energy systems to create and store the energy from the sun and wind and energy preserving building structures, but also low energy consumption routines in the daily life and work at the station, for example special computer solutions for the scientists. The inspection team found the innovative solutions and the commitment to zero emissions at the station commendable. Furthermore, the inspection team noted that it also would be of interest to other national programs to learn more about how this may affect the work of the scientists at the station, where their work requires computer work and other energy consuming technological equipment, and how such conflicting interests may be dealt with.
- The inspection team notes that the partnership between private interests and the state in financing and operating the Princess Elisabeth Antarctica and the scientific activities there, has led to complex issues. The inspection team suggest that it will be important to ensure that necessary clarity and stability is safeguarded through appropriate arrangements when such partnerships are developed.
- The inspection team noted the unclarities that seemed to exist with regard to permitting and authorization procedures in light of the new Belgian Antarctic Act, and recommend that efforts are made to clarify these procedures as soon as possible.

7 Perseus runway

7.1 About the inspection

The inspection team experienced some difficulties in planning for an inspection of Perseus runway, as there are no points of contacts nor coordinates listed in the COMNAP Antarctic Flight Information Manual (AFIM). The inspections chose in the end to contact directly the director of ALCI in order to plan for a landing on Perseus.

At the point of departure for Perseus, the inspection team's pilot contacted the flight operator at Novo airbase radio in order to get a clearance for landing at Perseus. The flight operator stated that the inspection team's aircraft – a non-scheduled flight – should not land on Perseus due to an incoming Ilyushin. In consultation with the ALCI director, the team decided to wait until the Ilyushin had landed and to then look at the possibility to land if the pilots considered that that there was enough space, given that the there was an Ilyushin on the runway.

The inspection team's plane flew over Perseus at 18:30. The Ilyushin was parked in the middle of the runway, and the pilot decided to not land. The inspection was carried out as an overflight inspection (ref. Antarctic Treaty art. VII, which allows for aerial observations to be carried out at any time over any or all areas of Antarctica). The plane circled three times over the runway and then proceeded to Novo airbase. The team had a chance to ask questions related to the operations at Perseus while conducting inspection at Novo. The following information and analyses are thus based on overflight sightings and interviews with ALCI personnel at Novo, as well as on the document Perseus Blue Ice Runway Initial Evaluation report, which was provided to the inspection team by the ALCI director after the inspection [11]. This document is hereafter referred to as the initial Perseus document, as it is understood by the inspection team that the later document "Servicing the landing site in the vicinity of the Mount Romnæs"[12], constitutes the formal IEE for the establishment and operation of the runway.

7.2 Operator

According to information received by Russia post-inspection, the private Russian company ALCI Nord is and has been responsible for preparing the blue ice runway and establishing related infrastructure at the site. ALCI Nord has acquired the necessary authorization and permits from Russian authorities for these operations. The flight activities associated with Perseus Runway are permitted through the Russian Antarctic permitting system. The Novo Air Base crew provides flight support to the operations at Perseus. ALCI Nord prepared and submitted to Russian authorities the IEE entitled "Servicing the landing site in the vicinity of the Mount Romnæs" as documentation for these permits.

According to the descriptions provided in the initial Perseus document (cf. footnote 11), operations of the runway would be carried out by machinery and personnel of ALCI and IPF South Africa,

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[11] Perseus Blue Ice Runway – Initial Environmental Evaluation. Produced for *The Antarctic Logistics Centre International (ALCI)* by *The International Polar Foundation (IPF),* March 2016..

[12] Information available on EIES: https://ats.aq/devAS/ep_eia_listitem.aspx?lang=e. The IEE itself is available in Russian language only.

although it is unclear to the inspection team to which degree this initial Perseus document provides a fully updated and correct picture of the operational situation at the runway.

7.3 About the facility and operations

The runway (71° 25’ 15.20608”S 23° 31’ 06.604966” E, 850 metres in altitude) is positioned on a blue ice ablation zone, at approximately 14 km from the Romnæsfjellet.

According to the initial Perseus document, the prepared length of the runway would be 3000 m, with 500 m extra for manoeuvres. The width would be 60 m with additional 20 m on either side for security. The team was not able to verify if this corresponds to the actual established runway.

Based on sightings on the time of the overflight inspection, the team observed approximately 10 different objects on or in the vicinity of the runway: 1 Ilyushin on the runway; and what to the inspection team seemed to be 5 containers and a vehicle in some distance from the runway on one side, 2 piston bullies (one on the runway), 4 containers or cabooses, partly covered by snow on the other side of the runway. According to the description provided in the initial Perseus document, support facilities established at the site would be established for radio and communication services, weather observations, airstrip preparation, catering of transit passengers, accommodation for ground personnel (during operational phase), etc. From the observations made it was not possible to discern if any such facilities were already in place. The inspection team has post-inspection been informed that the facilities in place were loaned from the IPF (accommodation and workshop for the runway crew, and radio room). The two vehicles and other machinery and infrastructure on site belonged to ALCI, and so did the fuel and containers brought in by the *Akademik Fedorov.*

One refrigerated container contained frozen ice cores awaiting transport, belonging to the IPF.

ALCI informed that the Perseus runway had been established as a back-up to Novo, and that it was especially important for air operations in the far eastern part of Dronning Maud Land. According to ALCI’s overview of DROMLAN flight schedule there were three technical flights scheduled on 11 and 12 February, to run tests on the runway. Post-inspection, the team was informed that only two of these flights were completed. During conversations with ALCI at Novo Airbase in conjunction with inspection 11 February (see chapter 8), the inspection team was informed that the Ilyushin observed during the inspection had no passengers, but that it carried cargo. Furthermore, according to information received during conversations at Novo, personnel from Novo Airbase was on location at Perseus in connection with air operations, as well as in the period of opening and closing of the runway. The team got the impression that personnel could stay at Perseus for some time. In addition, the team was informed that the operation at Perseus did get some operational support from PEA, especially in connection with opening of the runway. This seemed to be in some contrast to information provided during inspection at PEA where the inspection team was told that PEA and the Belgian program had no connection to operations at Perseus. Post-inspection, the team has been advised that PEA/BELARE provide assistance to and benefit from Perseus under the DROMLAN umbrella.

According to the initial Perseus document, the operating period of the runway will be from late November to early February. It is expected that there will be two intercontinental flights and 6-10 intra-continental flights per season. The initial Perseus document notes that the establishment of this runway will support station activities (and research programs) in the eastern part of Dronning Maud Land. It also notes that the runway potentially also could support third-party operations in the area,

although inspection team recognizes that this might not be part of the purpose specified in the IEE submitted by ALCI Nord to Russian authorities (recalling that Russia made a statement at ATCM XL indicating that the runway's sole purpose is to serve as a back-up runway for DROMLAN).

7.4 Concluding remarks

The inspection team experienced some difficulties in establishing contact with the correct point of contact of Perseus, which again lead to unclear communication and possible misunderstandings in many respects and on more than one part. This did not only make it difficult to plan for and conduct an inspection, more importantly, it has a bearing on flight operation safety broadly speaking. The inspection team does, however, take note of post-inspection comments which indicate that the contact information had not yet been made available as the runway still is under testing, and not fully operational.

The inspection team encourage responsible parties and operators to work towards a more transparent and easily accessible operation framework of Perseus. Official contact points, both on management and operations level should be made known for all national programs in DROMLAN.

The inspection team's impression is that the Perseus runway is being established on the basis of a long-term strategy for developing and providing logistic services in the Eastern region of Dronning Maud Land. Although the runway itself only operates in summer season, a substantial part of the infrastructure/equipment will according to descriptions be permanently placed year-round on location as long as the runway is operational. The IEE concludes that since the infrastructure is fully capable of dismantling and being evacuated from the continent at some future date it is considered that the activity does not justify a full environmental evaluation (CEE). The inspection team notes that dismantling and evacuation of infrastructure after end of lifetime is currently generally a part of and planned for all new station infrastructure in Antarctica, while it is established that such infrastructure requires a full evaluation nevertheless. The inspection team therefore questions whether an IEE in fact is sufficient framework for these types of operations.

8 Novo Runway and ALCI Airbase

8.1 About the inspection

The inspection team arrived at Novo Airbase on 11 February 2018 at 20:15 local time. The team was met by the director of ALCI, the station leader and deputy station leader of Novolazarevskaya and the daily manager of the ACLI camp. The operator of the airfield was informed about the inspection, and planned date, by e-mail a few days ahead of the inspection (7 February).

The inspection lasted for approximately 2 hours.

Novo Airbase was last inspected by a Norwegian inspection team in 2009. This is the only time the airbase has been inspected previously.

8.2 Operator

Novo Runway, ie. the ice runway itself and the technical air field facilities (radio room and accommodation associated with these operations) are part of the Russian Novolazarevskaya research station and belong to the Russian Antarctic Expedition (RAE), which has the technology and specialists at its disposal for flight operations. Specialists at the Russian station are also responsible for the establishment and preparation of the runway at the beginning of each season. RAE also provides the fuel for the runway activity. These activities associated with Novo Runway are permitted through the Russian Antarctic permitting system in accordance with the provisions of the Environmental Protocol.

Antarctic Logistics Centre International (Pty) Ltd. (ALCI) is responsible for administrating the operation of the flights in and out at Novo Airbase. ALCI is registered in South Africa and has its main office in Cape Town (and a smaller office in St Petersburg, Russia). South Africa does not yet have legislation formally in place for the purpose of permitting/authorizing activities in Antarctica. ALCI has, however, worked closely with the South-African Department of Environmental Affairs, and the ALIC Airbase operations have received the necessary and appropriate authorisation despite this situation.

8.3 About the facility and operations

For providing the intercontinental flights from South Africa to Antarctica the ALCI Company charters airplanes (Ilyushin 76TD and Boeing 757) with qualified air crews. The internal flights in Antarctica are conducted by smaller aircraft (Twin Otter and Basler). Both aircraft and pilots/mechanics were at the time of the inspection chartered from Ken Borek Air (Canada). ALCI also provides personnel and equipment (skidoo's, sledges, containers, mess room, kitchen etc.) to run the passenger/cargo terminal.

Novo Runway is a 3000 m long prepared strip on the blue ice. The runway is marked with markers throughout the entire length of the runway, supplemented with landing lights, mostly at the end of the season. In addition to the ice runway itself Novo Runway consists of radio room and accommodation associated with these operations, located primarily in buildings still standing from the earlier days of operation at the airbase. Some vehicles were also associated with the technical operations, ie. for removal of snow from runway, aircraft fuelling etc. The technical facilities

(buildings and vehicles) still seem to be of some age. ALCI has available equipment at the Airbase (such as various vehicles, portable lightning system, portable firefighting system, etc.) which is used and maintained by ALCI for the DROMLAN operations at the location. A sled drawn water tank is used for firefighting purposes, although indications were made that there is a future intent to get a fire engine located to the runway as a safety measure.

The traffic at Novo Airfield increased substantially since the last inspection. In current year (2017-18) 26 intercontinental flights took place (as compared to 12-16 such flights during each of the previous 8 seasons) and an estimated 600-900 intracontinental flights had taken place with Novo as hub. Just before the inspection team arrived an Ilyushin arrived from Perseus, and while the team was on the ground a Boeing 757 arriving from Cape Town landed. In addition, two feeder flight planes were on the ground in addition to the Basler of the inspection team.

A “passenger terminal” (ALCI Airbase) has been established at Novo Airbase. The terminal facilities has been upgraded substantially since it was last inspected, and the tents and other older structures has to a large degree been replaced by mobile container modules placed on skis which accommodate stop-over passengers while they wait for further flights, both accommodation, mess, etc. The overnight capacity of the passenger terminal is approx. 50. During high passenger traffic the need may exceed capacity, and ALCI has available capacity at Novolazarevskaya station (Russia). The inspection team was told that the desirability of the airbase personnel was to keep passengers as much as possible locally at the airbase for easy and quick transfer out to final destinations, but that the overflow capacity often was needed at peak times when many people arrive at the same time. The passenger terminal is a semi-permanent facility in so far that all container units are packed up every winter until next season.

The setup includes a small “hospital” unit. The airbase cooperates with Novolazarevskaya station (Russia) with regard to medical competence. At the time of the inspection an injured personnel from Progress station was in care at the unit, waiting for transport out that same evening.

Waste is handled within a recycling (separation) framework and returned to Cape Town for proper disposal. Daily waste is collected and stored in a separate container unit (also the only smoking unit at the camp), from where it is collected, stored and secured in larger amounts in large plastic “bags” outside, until they can be transported out by air at the end of the season. The storage method seems somewhat susceptible to wind and bad weather.

Toilet and kitchen waste water is disposed of in an ice pit near the station.

The energy production at the station is by conventional fossil fuel generators. Fuel for this energy production, as well as for flight operations, is stored in a large number of tanks and drums of varying sizes and qualities. No attempts or considerations have been made with regard to installing alternative energy sources. As observed during the 2009 inspection there still seemed to be an attraction of South Polar Skua around the facilities, which might be explained by a combination of active feeding by visitors and limitations in the waste management control. Some evidence of small fuel spills were observed throughout the camp site, although in no means of any size or extent that caused any major concern. The inspection team has post-inspection been informed that these observations corroborate the observation made by a recent South African inspection of ALCI operations, and notes that the South African government intends to have engagements with the ALCI to develop and display waste management plans and to use drip trays when refuelling.

8.4 Concluding remarks

- The inspection team noted the substantial upgrading of the camp facilities at Novo Airbase, and find the camp significantly improved with regard to safety and environment since the last inspection in 2009.
- The inspection team would encourage the camp operator to consider further upgrading the operations by including alternative energy sources to its operations. The inspection team notes that other summer only operations (such as PEA) has been successful in utilizing a high level of non-conventional sources. Reducing the need for fuel for generator operations would significantly reduce risk associated with transport of fuel, which occurs in a difficult environment for this particular operation.
- Finally, the inspection team notes with interest the level of activity at the Airbase, in particular the potential tendency toward a larger number of aircraft, which in turn increases the risk of air associated incidents and the need for robust coordination between actors in the area. This should also be seen in concert with the addition of the Perseus Runway (see chapter 7).

9 SANAE IV

9.1 About the inspection

The inspection team arrived at SANAE IV on 17 February 2018 at 12:30 local time (UTC). The station was informed about the inspection, and the planned date, by e-mail a few days ahead of the inspection (7 February).). Due to the skiway at SANAE IV being unprepared at time of planned arrival, followed by incoming bad weather, it was not possible for the Norwegian inspection team to conduct inspection at the station on 10 February as initially indicated, neither on 14 February when further attempts were made. On 17 February 2018 the inspection team was led by Ms. Aud Ingvild Slettemoen, deputy director general in the Ministry of Climate and Environment.

The team was met by team leader (for the overwintering team), the chief engineer and the head of operations in the South African National Antarctic Program. The inspection team was provided a completed checklist for reference use at the start of the inspection.

The inspection lasted 3,5 hours.

SANAE IV was last inspected by the Japanese inspection in 2010.

9.2 Operator

SANAE IV is South Africa's station supporting scientific research and logistical support to scientific personnel. The station is operated by the South African National Antarctic Program (SANAP) on behalf of the Ministry of Environmental Affairs, which also provides for the financing needed to run the station. The Department of Public Works is responsible for the maintenance of the building complex, including financing.

9.3 About the facility and operations

9.3.1 Location

SANAE IV is located on the nunatak Vesleskarvet at 71°40'23.05"S, 2°50'28.64"W, approximately 200 kilometres from the coast.

9.3.2 The structure

SANAE IV was opened as an all-year station in January 1997. SANAE IV is the only South African year-round station in Antarctica.

The station consist of three large, double story interconnected buildings containing accommodation, operational facilities and scientific facilities. The building mass is raised 4 meter above ground on a steel framed structure. The buildings are clad with fibre-glass composite panels.

During the inspection, the station was in the last phase of a three year extensive refurbishment and upgrading period, which will significantly improve the standard (both technical, operational and social) and add an additional 15-20 years lifetime to the station.

In addition to the main building there are some external installations, such as an underground snow smelter entity, storage containers.

9.3.3 Energy production

The station has 3 diesel generators. Excess heat from the generators are used for water production. The annual fuel consumption for power generation is approximately 260,000 litres per year.

The inspection team saw no evidence of or documentation about active use of alternative energy at the station, despite earlier testing of wind turbines at the station as reported by the 2010 Japanese inspection. The inspection team does not have the impression that further efforts are taken to move in that direction.

9.3.4 Fuel storage

Polar diesel is the main fuel available at the station, utilized for power generation. In addition there is some Jet A1 for helicopter and aircraft use, and some petrol for snowmobiles. The main fuel depot is a set of 6 large (100,000 litre) rubber bladders encased in metal storage reservoirs, located between the station and the airfield. The storage area is inspected on a daily basis. Fuel is delivered by boat at the coast and transferred into smaller fuel tankers which transport the fuel overland to the base. Information provided to the inspection team indicates that systems are in place to prevent and reduce spillage.

Jet A1 and petrol is stored in 200 litre drums at an appropriate distance from the station as not to induce risk to operations and drinking water.

9.3.5 Water production

Water for consumption is produced by melting snow. A new snow smelter has recently been installed externally to the station building, and water is pumped to bulk storage tanks inside the base. Access to water is on demand, but water is nevertheless conserved through efforts such as the newly installed vacuum sewage system which uses substantially less water than more conventional systems. According to information provided, water consumption varies between 50 to 200 litres per person per day.

9.3.6 Waste management

All waste is separated, stored and returned to South Africa for further handling and disposal. Separation and handling scheme is specified in the SANAP Waste Management Handbook (available on ats.aq). The inspection team noted that waste disposal containers were marked and available for use throughout the station.

Sewage and grey water is treated to an acceptable standard and effluent is disposed of over the cliff outside the station. Sludge is stored and returned to South Africa for disposal. With the instalment of new systems better control has been gained of the effluent standard.

The inspection team noted that the main room for waste storage and handling was a bit disorganized and could potentially be considered to be a fire hazard as it appeared at the time of the inspection. It was, however, duly noted that this was a temporary situation due to ongoing construction work. To

the inspection team it seemed particularly important to ensure fire safety with so much construction work going on.

9.3.7 Personnel

The station is built to accommodate 78 people. At the time of the inspection 42 persons were present at the station, of which 4 were (overwintering) scientists. The inspection team was informed that there was high level of non-scientific personnel due to the lateness of the season and the ongoing construction work. A team of 10 (including 4 scientists) will overwinter in the 2018 winter.

9.3.8 Transportation

A number of ground vehicles are available for use at the station and for transport between the coast and the station.

Personnel and supplies arrive by sea, normally on the program's own vessel, the Agulhas II. The vessel currently docks at Penguin Bukta, intermittently at Atka Bay (Neumayer III).

There is a helipad at the base, including two hangars. Normally helicopters are part of the outfit at the station during the peak of the summer season. There is a skiway at the station for landing aircraft on ski. This skiway is normally operational from mid-November to mid-March.

9.4 Treaty obligations

The inspection team was given complete freedom of access to all parts of SANAE IV research station.

The inspection team was informed that all personnel undergo training which includes information about the Treaty and Environmental Protocol, and that all participants are required to sign a Conservation Certificate indicating that they are familiar with the provisions of the Environmental Protocol. Nevertheless, the inspection team would at the same time question the seemingly lack of priority given to preparing the skiway when informed about the inspection, and thereby creating an obstacle for the efficient conduct of the inspection.

No weapons, military activity nor nuclear material or disposals were observed during the inspection at SANAE IV. The station leader also confirmed that they do not have such material or any weapons at the station. The inspection team was also informed that no explosives are kept at the station.

9.5 Permits and/or authorization EP obligations

All activities undertaken by SANAP in the Antarctic, including both operation of SANAE IV and the science projects, are subject to an environmental assessment procedure in accordance with the Protocol on Environmental Protection, and are authorised by the DEA. The inspection team was informed that also the extensive upgrading activities taking place at the station, primarily those parts of the upgrading that affect the exterior aspects of the station have undergone such assessment and have received the necessary approval from Department of Environmental Affairs (DEA).

9.6 Scientific research

A number of long-term observatories and instruments have been running actively at SANAE IV since it was opened in 1997. These include various space related observations, ia. cosmic ray studies

(intensity of galactic and solar cosmic rays), lightening and VLF (particle precipitation, plasma-sphere, wave-plasma), seismological observation program, meteorology. The high-frequency (HF) radars at SANAE IV forms a part of the worldwide the Super Dual Auroral Radar Network (SuperDARN) and together with Halley VI station and Syowa radars are called “the Antarctic triple”.

Scientific activity at SANAE IV comprise the following elements:

- Running of long-term time series, and maintenance of the instruments/observatories supporting these observation systems.
- Being a platform for and providing support for field projects.

A handful of projects not associated with the long-term observation series occurred at or out from SANAE IV in the 2017-18 season, including one internationally lead project.

The South African Department of Science and Technology (DST) is responsible for the science priorities and activities in the South African Antarctic program, and financing is mainly conducted through DST (National Research Foundation). South Africa has just recently prepared and adopted a strategic science framework for its Antarctic and Sub-Antarctic science programs (MARS 2016), which provides a platform funding and implementation of directed and prioritized science activity in the future. MARS builds on the outcomes of the SCAR Horizon Scan, and the priorities identified within that process.

In addition to the network role of SuperDARN noted above, it is worth mentioning that the cosmic ray monitoring program forms part of an international chain of 40 neutron monitors, and also the Lightning & VLF observations feed into an international network. SANAE IV provides seismological observations into the CTBTO.

9.7 Environment

The inspection team noted with interest the immense effort through the current reconstruction work on installing energy efficient and environmentally friendly technology into the station operations, as well as more focused waste management arrangements and other environmentally positive initiatives.

9.8 Safety and emergencies

According to the information given to the inspection team, overwintering personnel going to SANAE IV station receive basic training in search and rescue, firefighting, health and safety, etc. before deployment. Experienced personnel receive on-site training in pollution prevention and spill handling.

In case of need of evacuation of the station, both summer and winter time, the course of action would be to move the personnel to the coast (a short helicopter ride in the few weeks these are available in the summer, or a 36 hour drive) to the ship if it is in the area, or to the SANAP summer station.

The station has in principle adequate medical capabilities that consist of operating theatre, surgery, dentistry and pharmacy/office. However, during the inspection the facilities were under major reconstruction, and it was not possible to consider the quality of the facilities. External consultation

can only take place through “old fashioned” communication such as email, skype, etc. and could be hampered by limitations on band use in summer season. There is one physician available throughout season (two during hand-over). The doctor is given a fundamental/rudimentary course in basic dentistry before departure. The physician at the station during the overwintering in 2018 also had the responsibility as station leader. During its stay in the region (5-7 days) the Aghulas II acts as a secondary medical facility for the station, in which case the on-site helicopters would be used to move patient(s) to the boat. Care is taken to mirror capabilities between the two facilities, so that the SANAE IV doctor can take advantage of the equipment, etc.

As a general observation the inspection team concluded that the safety and emergency procedures seemed sufficient, but with weaknesses in the sense that there is no emergency station/shelter near the station, and that SAR relies heavily on helicopter transport or accessibility of vessel, neither of which are available for very long periods. The inspection team noted the difficulties in maintaining an operative airfield for intra-continental flights, and the implications this could have for efficient handling of emergency situations at the site. This seemed to be a particular concern in a season of heavy construction under high pressure to complete before end of season, rendering the personnel vulnerable to accidents and low level of SAR capability.

9.9 Non-governmental activities

SANAE IV station is relatively inaccessibly located, which means that the stations does not meet many or frequent inquiries from tourists. A single contact point for tourist requests has been established at the station, and administrative procedures have been developed. The station has, received some inquires for use of the station airfield for refuelling purposes. The station does not have a negative stance on cooperation with tourism actors, as long as any costs associated with assistance or such is covered.

SANAP has provided logistical support (transport of fuel, etc.) for non-governmental operators such as White Desert, under the condition that costs are covered. Station personnel did not flag any principal objections to such cooperation.

9.10 Concluding remarks

To sum up, the inspection team would like to highlight the following from the inspection of the SANAE IV research station:

- Considering the fact that the station was nearing 25 years of age, it seems understandable and timely that South Africa has upgraded the station, and thereby expand its lifespan substantially. In this context, it is encouraging to see the upgrading of the various systems to a standard that render a pre-Protocol station to move toward becoming a state of the art station operating well within the framework of the Environmental Protocol.
- The inspection team took note of indications relating to difficulties regarding financing of science at and around SANAE IV, and slightly questions the discrepancy between the substantial upgrading effort and the limited opportunity to conduct science. The inspection team hopes to see solutions to this situation in the near future.
- The inspection team notes the vulnerability of the station with regard to evacuation in emergencies when helicopters and/or boat is not present, and suggest that further

considerations should be given to strengthening that aspect of the operations. This includes the ability to operate the skiway for the purpose of evacuation through the DROMLAN network.

PART III: Reflection on trends

10 Reflections

It is the inspection team's view that through the inspections of a select number of stations and installations, one may obtain an impression of general development trends in this part of Antarctica. The inspection team therefore maintained focus on an overarching, rather on a detailed level during the inspection. The following summarises issues and aspects that the inspection team believes would be valuable for the Antarctic Treaty Parties to be aware of and to discuss.

10.1 Scientific activities

The inspection team notes that at the well-established year-round research stations emphasis is given to ensure the longevity of fundamental and important time series providing input to global observation systems. In addition, there seems to be a continuously increased focus on supporting larger internationally coordinated field based projects, as well as on increased automatization and remotely operation of data collection and observations. The inspection team also observes that science conducted at research stations that sit within a clear national program structure, which has a national strategic and prioritized science framework, to a large degree systematically contributes to advancing knowledge on issues of global importance. Research stations with looser national structures and lacking strategies may seem to have a more smaller-scale interest driven approach, defined by research interests of individual scientists.

1. ***The 2018 Norwegian inspection team notes the importance of continuing the currently ongoing discussions in the ATCM on science priorities and directions in order to support the development of robust and globally important science contributions by Parties through their national programs.***

The inspection team observes that there seems to be a fairly large degree of comparable observations ongoing at the various research stations, while at the same time there is not always a clear indication that these individual observations feed into a systematically coordinated effort. This may also raise questions with respect to optimal spatial distribution, comparability and/or complementarity of observations, the input and use in global observation systems and processes, etc.

2. ***The 2018 Norwegian inspection team notes that there could be merit in getting an overview and assessment of Antarctic observation efforts in order to enhance their use and robustness, as well as identifying gaps in observation needs.***

The inspection team notes that there are many innovative and exciting technological approaches done with regard to observation and data collection both in the physical and biological scientific field. Many of these technical solutions seem to have universal applicability and usability, while knowledge across stations seem more limited.

3. ***The 2018 Norwegian inspection team notes that there is a potential for more exchange of information on technological solutions for research and observation efforts in Antarctica.***

10.2 Station technology and management

The inspection team notes an ongoing shift towards stations implementing systems that provides for remote monitoring and operation. This means that personnel and expertise based in the home country to a much larger degree than before can provide support for the on-site personnel in providing advice in operation of and in handling system failures in complex technical systems. Such systems also enables operation of critical operational and scientific equipment in periods of station closure, thus potentially reducing required on-site activity over time. The inspection team considers that there also are risks associated with such systems, including cyber risks, communication failure, which would disable independent operations. The inspection team also notes that new technological systems seem to move in a direction of complexity that may require a larger number of highly specialised personnel that may or may not influence the wider robustness of the stations in due course.

The inspection team observes a general and universal intent and desire by research stations to implement efficient and green technologies for their operations. The inspection team notes that there still seems to be substantial room for further development in this regard, while it also is obvious that it is necessary to remain pragmatic with regard to availability of and limitation to relevant robust technology. A degree of patience is required before one can expect to see fully-fledged green all-year stations. The inspection team notes the importance of robust and tried technology to ensure operational, human and environmental safety, noting that innovative technology might render stations somewhat vulnerable to failure in times of isolation. At the same time, it is clear that green and innovative technologies in many cases likely will have cost efficient impacts for most station in the long term, and contribute to decreasing environmental risks (eg. associated with transport of fuel).

The inspection team notes that there are many new and exciting technological approaches done with regard to innovative and green technologies at the various stations. Many of these technical solutions seem to have wider applicability and usability. Recognizing the important role COMNAP has in sharing information about best technologies, there still seems to be room for further expansion of experience sharing between operational personnel.

4. ***The 2018 Norwegian inspection team encourages continued implementation of innovative and green technologies at stations, and in that respect notes the need for a continued focus on exchanging information and best practices between national programs, operators and personnel at Antarctic stations.***

10.3 Operational responsibilities

The inspection team observed a variety of organizational structures, which also includes a more complex relationship with respect to ownership and management in operations in Dronning Maud Land. The inspection team notes that since the Norwegian 2009 inspection, there has been

an increase in activity and related infrastructure/installations run by actors without formal link to national programs and/or government structures of a Treaty Party. Such development can potentially be a challenge to smooth collaboration, dialogue and communication both with respect to overarching policy, as well as on an operational and practical level, within the framework of the Antarctic Treaty. For example, the lack of information on relevant points of contacts for operations/installations made the planning of the inspection difficult on some occasions. For safety and contingency planning, it is important that such contact information is clear and available.

Furthermore, the inspection team notes that new complex ownership structures may pose challenges for an inspecting Party in getting the necessary information and correct understanding of which entities are responsible with respect to various provisions of the Antarctic Treaty (such as notification requirements, EIA procedures etc.). Lack of clear organisational structures can also impact the implementation of Treaty obligations such as exchange of information, science cooperation and coordination. These issues were also noted in the report of the 2009 Norwegian inspection. Already at that time Norway pointed to a potential shift in organisational structures, ownership and management in Dronning Maud Land.

5. ***The inspection team notes a continued shift toward more complex ownership structures and more independent operations in Dronning Maud Land, and suggests that the ATCM might want to consider how such a development may impact core functions/established mechanisms and foras for cooperation. Furthermore, the inspection team suggests that all parties consider possible implications of these trends in their effort to ensure that activities under their jurisdiction or control are carried out in accordance with the Antarctic Treaty and the Environmental Protocol.***

6. ***Treaty Parties should be encouraged to consider the possibility of establishing routines/mechanisms to ensure the availability of relevant information about ownership and management structures for all operations in Antarctica, incl. also contact points, permit information etc. to all Treaty Parties and national programs.***

10.4 Implications of new and changing activity patterns

Observations and discussions with personnel at the stations and sites visited clearly indicate an increased and more dispersed activity in Dronning Maud Land, in particular with regard to flight-based operations. This has several implications that are relevant to consider.

Firstly, the inspection team notes with concern that the observed increase and diversification in activities and actors entails a higher level of risk both with regard to environmental incidents (such as transport of fuel for flight operations) and human safety (such as large-scale air accidents). The observed emergence of parallel organizational structures makes it challenging to plan, prevent and take precautionary actions to manage these risks in an appropriate and efficient manner. It is noted that lack of crucial information regarding operations, such as contact points, location and timing of activities (eg. air traffic, location of landing facilities),

communication routines, etc. may cause serious situations and in the longer term damage the cooperative spirit of collaboration and the status of the Treaty system as a governing body.

Secondly, there are potential implications for national programs and research stations. A higher risk of incidents increases the potential need for SAR- operations. SAR efforts is not only a burden to operations and resources at the stations, but they potentially put research and operational personnel at risk in the efforts to provide assistance. The inspection team notes that this is not a new problem, but the situation on the ground has changed in a direction that indicates that the Treaty Parties need to continue to consider the implications. The inspection team also notes that national programs may increasingly encounter situations where they are forced to interact with non-governmental operators in order to avoid conflict with national operations and science programs and environment. In one particular case, this was presented to the inspection team as a potential dilemma, as advice on "don't's" may lead to questions for advice on "do's", which in practice unintentionally makes the national program act as a facilitator for non-governmental activities, regardless of its policy on the activity in question.

7. ***The inspection team notes that there is a need to look further into safety issues related to flight operations and the increasing air traffic in Dronning Maud Land, in particular in areas where multiple flight operations take place. It is essential that further efforts are taken and mechanisms put in place to ensure an appropriate level of transparency and cooperation between all operations and operators in the Dronning Maud Land area to ensure that human and environmental risks are minimized.***

8. ***The implications of SAR burdens on national program personnel due to increased activity and associated risks in various regions of Antarctica might be an issue that the Antarctic Treaty system, as well as national programs, should focus attention on. The inspection team underscores the importance of Parties ensuring that non-governmental operators under their jurisdiction has sufficient and appropriate search and rescue capabilities at hand to cover all aspects of their activities, and that they do not rely on national operator resources for this purpose, as eg. specified in Measure 4 (2004).***

A number of new facilities and infrastructures have been established in connection with the growing non-governmental operations in Dronning Maud Land. The inspection team reflected on the current understanding that many of these installations are considered non-permanent or semi-permanent. Realizing that such infrastructure often can be removed, as can also research stations, they nevertheless are seemingly long term present and should potentially be treated as such according to the provisions of the Environmental Protocol.

9. ***The 2018 Norwegian inspection team suggest that Parties continue to consider the use and understanding of the terms non-permanent, semi-permanent and permanent in light of the EIA provisions and requirements of the Environmental Protocol.***

Finally, the inspection team notes that with a more diverse field of interests and actors, partly disassociated with national program structures, the spatial development of infrastructure,

facilities and operations in Dronning Maud Land and surrounding areas is taking place without a strategic assessment of the carrying capacity, values and operational limitations of the area. In due course it may be relevant to consider more strategically the implications of the overall development and management in light of the current trends

11 Appendices

11.1 Appendix 1

ROYAL NORWEGIAN
MINISTRY OF FOREIGN AFFAIRS

The Royal Ministry of Foreign Affairs presents its compliments to the Parties to the Antarctic Treaty and has the honour to draw their attention to the following.

In accordance with Article VII (1) of the Antarctic Treaty and article 14 of the Protocol on Environmental Protection to the Antarctic Treaty the Norwegian Government has designated the following persons as observers during the 2017/2018 Antarctic summer season:

Ambassador Anniken Krutnes	Special Adviser for Polar Affairs Ministry of Foreign Affairs
Ms Mette Strengehagen	Senior Adviser Ministry of Foreign Affairs
Mr Øystein Mortensen	Director General Ministry of Justice
Ms Aud Ingvild Slettemoen	Deputy Director General Ministry of Climate and Environment
Ms Nalan Koc	Research Director Norwegian Polar Institute
Ms Birgit Njåstad	Senior Adviser Norwegian Polar Institute
Mr John E. Guldahl	Deputy Director General Norwegian Polar Institute

It is also noted that this information has been brought to the attention of the Secretariat of the Antarctic Treaty in accordance with the terms of ATCM decision 7 (2013).

It would be appreciated if this information would be communicated expediently to the relevant authorities.

The Royal Ministry of Foreign Affairs avails itself of this opportunity to renew to the Embassies of the Parties to the Antarctic Treaty the assurances of its highest consideration. TRG

Oslo, 30 January 2018

ROYAL MINISTRY OF FOREIGN AFFAIRS