REPORT OF RUSSIA–US JOINT ANTARCTIC INSPECTION

UNDER ARTICLE VII OF THE ANTARCTIC TREATY
AND ARTICLE 14 OF THE PROTOCOL ON ENVIRONMENTAL
PROTECTION TO THE ANTARCTIC TREATY

India – Maitri
China – Zhongshan
India – Bharati
Japan – Syowa
Belgium – Princess Elisabeth
Norway – Troll

NOVEMBER 29 – DECEMBER 6, 2012

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Part I – INTRODUCTION

The U.S.-Russia Joint Antarctic Inspection was conducted from November 29 – December 6, 2012. This is the second phase of our joint inspection, which began in January 2012 based out of the United States' McMurdo Station. This is the first joint inspection by either country, the first inspection conducted by the Russian Federation and the fourteenth inspection conducted by the United States since the signing of the Antarctic Treaty in 1959. This report summarizes the observations and conclusions of the joint inspection team.

The inspection was conducted pursuant to Article VII of the Antarctic Treaty of 1959 and Article 14 of the Protocol on Environmental Protection to the Antarctic Treaty. The purpose of the inspection is to promote the objectives and ensure the observation of the provisions of the Antarctic Treaty. The U.S.-Russian team reviewed adherence by Treaty Parties to their obligations, including with respect to limiting environmental impacts, ensuring that Antarctica is used only for peaceful purposes and that Parties honor the prohibition on measures of military nature.

The joint inspection team members came from the following U.S. and Russian federal agencies and institutions: the U.S. Department of State, the Russian Ministry of Foreign Affairs, the United States National Science Foundation (NSF) and the Russian Antarctic Expedition. The team members were:

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The joint inspection team arrived in the Antarctic Treaty Area from Cape Town, South Africa on November 30. The team inspected the following stations: Maitri (India), Zhongshan (China), Bharati (India), Syowa (Japan), Princess Elisabeth (Belgium), and Troll (Norway). The inspection concluded on December 6, 2012.

The Antarctic Treaty, signed in Washington in 1959, reserves the continent of Antarctica exclusively for peaceful purposes. Moreover, it places science at the heart of international cooperation on the continent by guaranteeing freedom of scientific research, including the sharing of research and scientific information. It prohibits all military measures, including the testing of weapons, the explosion of nuclear materials, and the disposal of radioactive waste material. The Treaty also provides a mutually agreeable arrangement for the issue of territorial claims in Antarctica. The United States and Russia were architects of the Antarctic Treaty of 1959 and today conduct some of the most extensive and diverse scientific activities in Antarctica.

Today, the Treaty has 50 parties, 28 of which are conducting significant research on the continent, thus entitling them to the status of Consultative Party with the right to name observers.

The Environmental Protocol to the Antarctic Treaty, which was signed in 1991 and came into force in 1998, designates Antarctica as a "natural reserve, devoted to peace and science." It supplements the Antarctic Treaty's basic provisions applicable to human activity in Antarctica and prohibits all activities related to Antarctic mineral resources, with the exception of scientific research.

The Ministry of Foreign Affairs of the Russian Federation by legal and political means ensures implementation of the obligations of the Russian Federation arising from the legally binding instruments of the Antarctic Treaty. The Russian Antarctic Expedition, as a specialized body within the Russian Federal Service on Hydrometeorology and Environmental Monitoring, manages national governmental activities in Antarctica.

The U.S. Department of State coordinates U.S. policy on Antarctica in cooperation with the National Science Foundation, the federal agency that administers the U.S. Antarctic Program, and other federal agencies. It leads diplomatic efforts within the framework established by the Antarctic Treaty.

ACKNOWLEDGEMENTS

The inspection team greatly appreciates the support of the Russian Antarctic Expedition and the Russian Federal Service for Hydrometeorology and Environmental Monitoring, particularly the staff of Russia's Novolazarevskaya and Progress Stations, who provided essential support for phase two of the inspection.

The inspection team flew to the Russian station Novolazarevskaya (NOVO) on an Ilyushin-76 from Cape Town on November 29 and returned to Cape Town on the same aircraft on December 6. Flights to Antarctica from South Africa and back were made using the resources of the Dronning Maud Land Air Network (DROMLAN),of which RAE is an active participant. DROMLAN unites the efforts of eleven national Antarctic programs (Belgium, Finland, Germany, India, Japan, the Netherlands, Norway, Russia, South Africa, Sweden and the United Kingdom). The operator of the aircraft was the Cape Town-based Antarctic Logistics Centre International (ALCI), the air operator of the DROMLAN program. The aircraft was operated by a Russian aircrew from the Ilyushin Test Center.

Flights of the inspection team between Antarctic bases were made using a BT-67 Turbo Basler aircraft (a modification of the venerable DC-3) with the following schedule:

December 1
– NOVO – S17 – Progress Station (Russia);

December 4 – Progress – S17;

December 5 – S17 – Princess Elisabeth Station (Belgium) – NOVO;

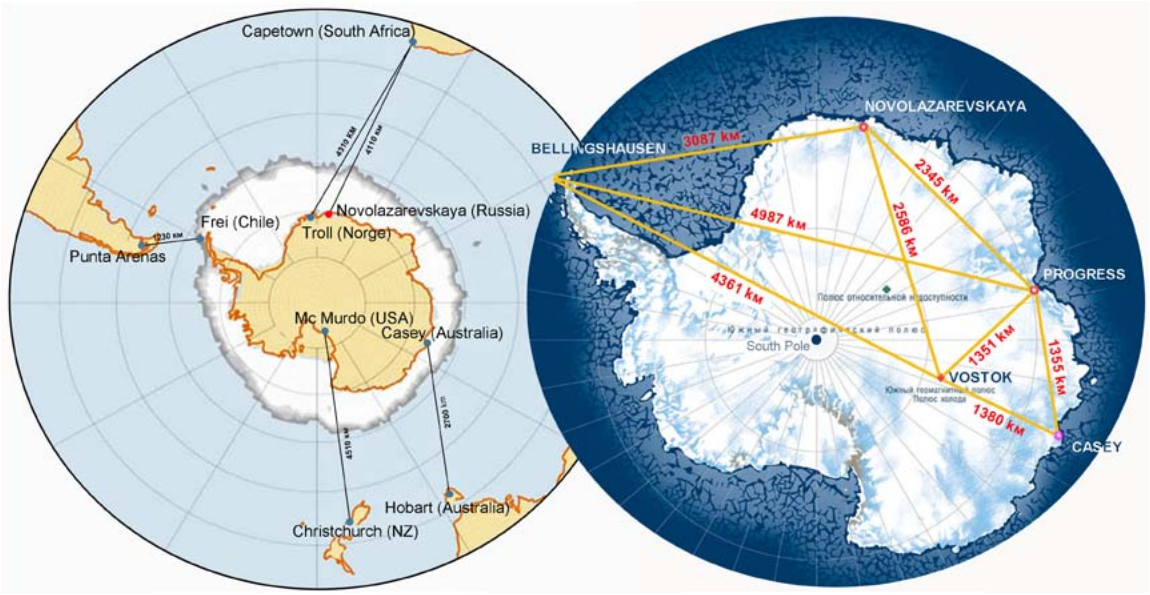
December 6 – Novo – Troll station (Norway) – NOVO.

S17 is a field ice airstrip located approximately 35 km south of Japan's Syowa station and operated by the Japanese Antarctic Expedition (JARE).

Total BT-67 flight hours for the support of the inspection were 20 hours 25 minutes, and the distance covered was 5789 km.

Ground transportation for the inspection team was provided by RAE and JARE. A Kamov-32 helicopter operated by the Indian Antarctic Expedition and piloted by a Russian aircrew (Avialift-Vladivostok) provided transportation of the team from Progress Station to the Indian Bharati Station.


TRANSAVIAEXPORT
IL-76 TD
ALCI


Capetown (South Africa)
Novolazarevskaya (Russia)
Troll (Norge)
Frei (Chile)
Punta Arenas
Mc Murdo (USA)
Casey (Australia)
Hobart (Australia)
Christchurch (NZ)
BELLINGSHAUSEN
NOVOLAZAREVSKAYA
PROGRESS
VOSTOK
CASEY
South Pole
3087 км
2345 км
2586 км
4987 км
4361 км
1351 км
1355 км
1380 км


ALCI

Part II – INSPECTION OVERVIEW

The six stations inspected were of different age and design philosophies and demonstrated different approaches to logistics support and scientific research. The team benefitted from this opportunity to understand the extent of different nations' Antarctic activities and observance of the relevant provisions of the Antarctic Treaty and its Environmental Protocol.

All of the stations inspected, with the exception of China's Zhongshan, are active participants in DROMLAN. The Belgian and Norwegian stations also participate in Dronning Maud Land Shipments (DROMSHIP, a shipping network that includes Belgium, Finland, Germany, Norway, South Africa and Sweden) and rely on those programs for logistical support. The Indian program also charters a Russian icebreaker and an ice enhanced cargo vessel as well as helicopters for its logistical operations, while the Chinese station is wholly supplied by the Chinese Antarctic Program.

All six stations inspected were constructed on outcroppings of rock. Some auxiliary structures are placed on ice. Troll, Syowa and Princess Elisabeth operate compacted snow or ice runways. Syowa has two runways: one located on the sea ice near the station and the S17 compacted snow runway some 35 km inland. Maitri, Zhongshang and Bharati use runways located at Russia's NOVO and Progress Stations. Zhongshang and Bharati stations also have permanent concrete helipads.

The Bharati, Syowa and Zhongshang stations are located very close to the coastline which greatly simplifies the transfer of cargo from support vessels to the stations, while Maitri, Princess Elisabeth and Troll stations are located 100-150 km from the coast which necessitates the organization of tractor traverses for cargo delivery from vessels.

All stations inspected with the exception of Princess Elisabeth operate year-round. Scientists usually are present for the summer period, while scientific data gathering in wintertime is carried out by a small number of technicians or automatic devices. Over-wintering personnel are generally engaged in maintenance of station equipment, environmental monitoring and servicing various scientific equipment. Automatic data gathering devices are widely used throughout the stations visited. Typically, data are transmitted to national science centers in real-time or near real-time, although in some cases physical samples (e.g. air or ice-core samples) must be transported to national laboratories for further analysis.

Most station personnel undergo training in emergency response, fire fighting and first aid prior to their deployment to Antarctica. While the time and organization of the training varied from station to station, most stations appeared well-prepared for a fire emergency. All stations also have detailed emergency response plans and/ or manuals. All personnel also undergo medical screening, including psychological evaluations for overwintering personnel.

At all stations visited the main focus of research carried out during the summer season was concentrated on meteorology, upper atmospheric and ionospheric physics, geophysics, polar biology, glaciology, geology and GPS-aided geotectonics. Coastal stations carry out oceanographic and sea ice research. At Zhongshan, Maitri and Troll, summer intra-continental scientific traverses were carried out. The Chinese and Japanese Antarctic programs also utilize traverses to supply their interior stations Kunlun (Dome A) and Dome Fuji respectively.

Syowa and Maitri were the oldest stations inspected, the former being founded for

research under the First International Geophysical Year in 1957-58, while the latter was inaugurated in 1988. Troll entered year-round service in 2005, Zhongshang's station overwintering facility was completely rebuilt in 2009-2010, Princess Elisabeth was constructed from 2005 to 2008 and Bharati is expected to be completed in early 2013, though used since last season for year-round operation. Syowa has been extensively modernized and expanded, both to bring the station facilities to modern standards and to accommodate new scientific projects.

All stations have modern satellite communications facilities providing, inter alia, Internet access, as well as HF and VHF radio for communications with national Antarctic program headquarters, aircraft, ships, field camps and between stations. DROMLAN publishes an updated communications list for member stations and programs at the start of each summer season.

All stations had qualified medical staff, as well as medical facilities and supplies. Princess Elisabeth, Syowa and Troll utilize telemedicine.

The six stations operate a wide range of ground vehicles for transportation and construction purposes, including tracked vehicles, wheeled vehicles and snowmobiles. All visited stations have improved roads, including for airfield access, although the remoteness of airfields or vessels' anchorage points vary from station to station. Temporary sea ice and snow tracks are also widely used.

Power generation is mainly provided by diesel-generating plants and some alternative energy sources. The most progress in utilizing renewable energy has been achieved at Princess Elisabeth Station, which uses solar power and wind turbines for the majority of its power needs.

The main types of fuel used at the stations include winter diesel, Jet A-1, gasoline and LPG gas. Fuel storage and handling facilities at the stations inspected were generally adequate and compliant with the provisions of the Environmental Protocol. The capacity of storage tanks is dictated by the needs of station operation, power generation, transportation, etc. Fuel is transferred to the coastal stations directly from ships and to the inland stations using tractor traverses. Fuel is being fed to generating plants from storage either by fixed pipelines or using ground transport. Most station personnel were trained to deal with fuel spill emergencies.

All stations inspected utilize up-to-date waste management facilities which that correspond to the provisions of the Environmental Protocol. The inspection has noted, however, that the general knowledge and understanding of the role of environmental impact assessments (EIAs) in station operations and management differ from station to station.

At stations located near Antarctic Specially Protected Areas (ASPAs) or Antarctic Specially Managed Areas (ASMAs), station leaders informed the team that personnel were aware of the relevant codes of conduct. Some printed material was also available.

The personnel at all six inspected stations visited stated that there are no tourist visits or activities currently undertaken at their stations. All station leaders stated specifically that they did not encourage tourist or NGO activities.

The station personnel informed the inspection team that no armaments or military equipment were present. There was no research for military purposes reported. There was no military logistical support or military personnel reported at the stations with the exception of Syowa, which on occasion utilizes naval personnel from the Japanese Maritime Self-Defense Force icebreaker SHIRASE during its annual resupply mission.

Part III – GENERAL CONCLUSIONS

The inspection team had an opportunity to visit a broad cross section of different stations, including newly constructed and long-established, small and large, and station with various levels of government funding. All were found to be very highly functioning and generally compliant with Parties' obligations under the Antarctic Treaty and its Environmental Protocol.

The inspection team found that some station personnel lacked familiarity with the Annex 1 of the Protocol regarding Environmental Impact Assessment procedures. While personnel generally understood the EIA requirement, stating that the EIAs are being done by the involved government and they are directly involved in the process, some individuals were unfamiliar with past conducted or future plans for EIAs for station or expedition activities. This included at stations that were currently undergoing construction works. In some cases, station leaders in particular would benefit from a more in-depth understanding of this Annex of the Protocol given its direct connection to station operations and Parties' obligations to comply with this Annex.

Most of the stations inspected currently conduct or have plans to conduct environmental monitoring to investigate the impact of station activities on its surroundings. Monitoring of key environmental indicators is required by Article 5 of Annex 1 of the Protocol following completion of a Comprehensive Environmental Evaluation (CEE), but more broadly environmental monitoring of potential impacts station activities, such as wastewater discharge, emissions, physical disturbance, impacts on local fauna and flora, etc. are a best practice that more stations should consider adopting as part of their scientific activities.

The inspection team notes that there are non-governmental entities active at some stations, notably the non-profit entity the International Polar Foundation that operates Princess Elisabeth and the for-profit quasi-governmental Kongsberg Satellite Services' (KSAT) which has operations at Troll. These examples present somewhat new variations on non-governmental activities at science stations, and the latter presents a type of large-scale commercial activity that some may choose to replicate in other contexts in the future. The interrelationship between government and non-government actors at government-owned Antarctic research stations presents a policy issue worth considering.

The team was grateful for the cooperation provided by all six inspected stations.

India – Maitri

70°45.56'S, 11°44.8'E
November 30, 2012

Maitri is one of two year-round stations operated by India in the Antarctic Treaty area. It was opened in 1989 near the site of India's now-abandoned first station, Dakshin Gangotri, in the eastern part of the Schirmacher Oasis. The National Centre for Antarctic and Ocean Research (NCAOR) manages the station, which is staffed by employees of a number of Indian government science agencies, including the Snow and Avalanche Study Establishment, Indian Institute of Geomagnetism, the Indian Meteorological Department, among others. NCAOR is an agency working under the Indian Ministry of Earth Sciences.

The joint team conducted a three-hour inspection on Friday, November 30, 2012, and provided 36-hours advance notification of the inspection. Uttam Chand, the outgoing 2011-12 Expedition Leader, and P.S. Negi, the incoming 2012-13 Expedition Leader, briefed the team on the station's activities and provided a comprehensive tour.

PHYSICAL DESCRIPTION

Maitri consists of one main year-round station building, which includes offices, operations equipment, staff lodging, dining area, and medical and social facilities. A nearby summer camp area is home to additional scientific laboratories and lodging for summer season staff. The station's power generators, fuel storage plant, wastewater treatment facilities, garage/workshop, an earth station, and additional storage containers are located on the grounds around the main station building.

Maitri Station is located approximately two km from Russia's Novolazarevskaya Station, and a four km marked vehicle route connects the two stations and the centrally located Novo Runway. The main station building is constructed on a slight hill near the margin of the continental ice and overlooks the rest of the station's facilities, a large freshwater lake and other smaller lakes.

The wastewater treatment plant was undergoing significant improvements during the inspection (see the waste management section below), but no other construction was planned or underway.

PERSONNEL

There were 59 personnel on station at the time of the inspection. The station can accomodate a maximum of 80 people during the summer season, and personnel were beginning to arrive for the 2012-13 season. According to station management, logistical staff members outnumber scientific personnel by an approximately 2:1 ratio. Indian annual expedition staff average 13-15 month deployments, with summer season personnel staying 3-4 months from November to February. At the time of the inspection, 65% of the personnel were engaged in logistics and 35% in science. One Swiss scientist affiliated with an American museum had recently arrived to collaborate on the meteorite collection program.

The station is staffed with two doctors – one of whom is always a surgeon. The station's medical room is equipped with x-ray capabilities, EKG, anesthetic equipment, medications, and other equipment. The inspection team was advised that the station also has a dental suite. Doctors receive basic dental training to supplement their extensive medical training.

All personnel undergo a three-part pre-deployment process that begins with a medical qualification, including psychological evaluations for overwintering staff. Personnel then receive two days cold weather training in the Indian Himalayas before attending a final NCAOR training session that includes an introduction to the Antarctic Treaty and Environmental Protocol and safety and emergency training, including fire fighting and first aid.

NCAOR has issued a manual of Antarctic operations guidelines for station staff. Overwintering personnel also receive on-the-job training from their predecessors during the several weeks' overlap period each summer.

SCIENTIFIC RESEARCH

Maitri has research programs in a variety of atmospheric and earth sciences, including Antarctic surface geomagnetism, magnetospheric-ionospheric studies, seismotectonics, glaciology, meteorology, studies of atmospheric ozone, and a program to search for meteorites on the East Antarctic ice sheet. There are also studies of Antarctic ecology, botany and human biology and medicine.

The main station building houses most of the research facilities and office space. The station is also equipped with several laboratories and separate buildings housing environmental monitoring observatories. The inspection team saw scientific stations that monitor local geomagnetic fields, atmospheric currents, regional and tele-seismic signals, atmospheric dust, upper atmospheric ozone measurements via radio sonde, and an CADI-made ionosonde for measuring day to day behavior of ionospheric parameters.

The station also conducts long term monitoring of atmospheric aerosols and ozone using a solar photometer. All of the data collected is sent via Internet to the National Centre for Atmospheric and Oceanic Research, which is an agency working under the Indian Ministry of Earth Sciences.

At the time of the inspection, most of the personnel operating the monitoring stations were technicians, not scientists with advanced degrees. They were part of the crew who had stayed overwinter. The inspection team was told that other more senior scientists would be arriving within a few weeks as the station turned over for the summer season.

Of the 59 personnel at the station at the time of the inspection, roughly 35% were scientists or technicians. Roughly 25 personnel are present over the winter, and 80 will be there during the summer.

The inspection team met with a PhD glaciologist, who also had experience working in the Arctic and India Himalayas. The scientists represented a number of Indian agencies, which all fall under the auspices of the NCAOR: GSI, SASE, NGRI,

and GSA the Geological Survey of India, the National Geophysical Research Institute, and the Snow and Avalanche Study Establishment.

The Indian NCAOR, which is a member of the DROMLAN network, sponsored all of the station's research. At the time of the inspection, one

Swiss scientist employed by the Chicago Field Museum in the United States was present; he was there to search for meteors on the ice containing dust grains containing heavy metals formed in stellar nuclear synthesis in the pre-solar nebula.

The inspection team was informed there were no radio-isotopes used at the station.

TOURIST AND NGO ACTIVITIES

The station leaders indicated that Maitri did not receive any tourists or other non-governmental operators, and no non-governmental activities are carried out at the station.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

The communications unit in the main complex has telephone, fax and telex. The station is well equipped for long and short distance communication within Antarctica and is readily accessible via INMARSAT. Researchers mostly use the Internet connection, through satellite uplink, to send meteorological, seismic, and other geophysical data to the NCAOR. They also have Iridium phones and walkie-talkies.

TRANSPORT

Maitri receives one major supply per year by ship to the ice shelf, located 120 km away. The cargo ship unloads onto the shelf, and a convoy of Pisten Bullies transports the materials (especially fuel) to the station. The station maintains 10 Pisten Bullies used for its supply convoy. The station also has two Ski-Doos. The station does not maintain any boats of its own. Maitri has no permanent fixed or rotary wing aircraft, but it does have two helipads available. NCAOR contracts one or two helicopters in the summer season for resupply and scientific activities at field camps (including Lake Untersee).

FUEL STORAGE AND USE

Fuel (Jet-A1) is delivered to the station via the annual supply vessel that stops at the ice shelf approximately 120 km from the station. Fuel is transferred into double-walled steel tanks and transported to the station via sleds. The fuel is then transferred to the fuel storage system, which consists of a number of fuel tanks of various sizes. During the 2011-2012 season, six new 20 kiloliter fuel tanks were installed upon a concrete berm. Annual fuel use is approximately 200 kiloliters per year.

During the 2010-2011 season, no fuel was delivered to Bharati because the station was not yet constructed, and all the fuel was delivered to Maitri. Since Maitri had been supplied with a two-year fuel supply, all the fuel on the supply ship was delivered to Bharati during the 2011-2012 season. In the future, fuel will be delivered to each station on an annual basis. In the past, gasoil was used for the snowmobiles. As the snowmobiles are no longer in service, there is no longer any gasoil at the station.

POWER GENERATION AND MANAGEMENT

On station, there are six 62.5 kW generators which operate using Jet A-1 fuel. Only one generator is operated at a time. The total electrical load of the station is estimated at 120 kW during summer and 80 kW during winter season.

In 2008, two wind generators were installed in order to test alternative energy sources. This proved unsuccessful due to damage to the units while in use. At this time, there are no plans to replace the wind turbines.

WATER SYSTEMS

Water is pumped through heated pipes to the station to a 10,000 liter storage tank from the nearby Lake Priyadarshini. Once at the station, the water is filtered before use. Annual water quality testing is performed on site and reported to NCAOR. Daily water consumption is 40 liters per person. The station encourages water conservation through a variety of personal and station-wide procedures.

MANAGEMENT OF DANGEROUS ELEMENTS

There have been no hazardous chemicals stored on site in recent years, and the station has no permanent chemistry laboratory. Scientists who require chemicals for their work would bring such chemicals with them for research during the summer season.

The inspection team was told there were no firearms, ammunition, or explosives at the station.

EMERGENCY RESPONSE CAPABILITY

Maitri has had no emergencies in the recent past and undertakes a number of precautions to ensure staff safety and emergency preparedness. Backup power generators, extra rations and other emergency provisions are stored away from the main station building. The station keeps extra vehicles on hand during cargo offloading to provide back-up assistance. All field camp staff members take satellite phones that can be used to contact the station in the event of an emergency.

All staff members receive pre-deployment fire fighting training but also practice fire fighting exercises every two weeks. Fire extinguishers, smoke detectors, manual and electronic fire alarms, and emergency buckets are located throughout the main station building. 10,000 liters of potable water is also connected to emergency water pipes located in the station for use in the event of a fire emergency.

Station staff reported no fuel spills in the recent past. In addition to a fuel spill contingency plan, the station trains personnel on fuel management, including the use of containment trays and cleanup equipment.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

Station leaders were fully aware of the Environmental Protocol's requirement that environmental impact assessments be conducted in advance of activities. EIA requirements under the Protocol are part of the training done for all Maitri staff. The station leaders indicated that they work closely with NCAOR authorities in Goa in the event any new activities with impacts were planned. However, they were not aware of the details of any past EIAs at Maitri or when the last one had been undertaken for any activity.

It is understandable that particular officers would not be aware of EIA procedures undertaken before their arrival at the station. Nevertheless, the inspection team felt that it would be helpful for station leaders to be aware of at least recent EIAs undertaken, given the important role EIAs play in the Protocol and station operations.

CONSERVATION OF FLORA AND FAUNA

The Schirmacher Oasis area, where the station is situated, contains a diverse terrestrial and freshwater community, consisting of mosses, bryophytes, lichen, fungi, bacteria and cyanobacteria. Adélie penguins have been observed several kilometers away from the station. A south polar skua nesting area has been observed approximately three km away from Maitri. Station personnel have received environmental instruction that they are not to disturb any fauna they encounter.

WASTE MANAGEMENT

Solid wastes are sorted according to a number of categories, with clearly marked bins for the various types of wastes (e.g., paper, glass, used fuel and oil, metals, food scraps, etc.). Combustible wastes, such as food scraps and paper, are incinerated and all other solid wastes, including incinerator ash, are removed from the Antarctic Treaty area on an annual basis.

The station is equipped with 10 incinerator toilet facilities, and the ash produced is collected in drums and removed from station once a year.

Urine and graywater are treated by pumping these liquids into a settling tank where a biodigestion process takes place. The effluent is then filtered and pumped into a temporary storage tank from which the liquid is periodically discharged to the environment. Past inspections by Norway (2004) and Japan (2010) noted that the discharged effluent appeared to permeate the ground and to form a stream that seemed to drain into a nearby lake. During the 2011-2012 season and the early part of the 2012-2013 season, a new system was put in place. The effluent will now be pumped into a concrete-lined settling pond where the liquid will be evaporated.

Station personnel informed the inspection team that a concrete lining is currently under construction. However, snow accumulates in the area of the settling pond. During the warmer summer, the snow melt can cause overflowing into a nearby second pond so that none of the effluent will be released into the environment. Some percentage of the pond ice is expected to evaporate naturally during the summer.

AREA MANAGEMENT

There is one protected area in the vicinity of the station, ASPA No. 163 Dakshin Gangotri Glacier. At the two entry points to the ASPA, signs have been placed to advise the location of the ASPA and the requirement for a permit to enter. Research conducted within the ASMA consists of annual measurements of glacier movement.

ARMS AND MILITARY SUPPORT

Station managers informed the inspection team that there is no military support to or military equipment at the station.

China – Zhongshan
69°22.24'S, 76°22.40'E
December 2, 2012

China's Zhongshan Station was constructed on the southeastern shore of Prydz Bay in the Larsemann Hills in 1989. It serves as the logistical hub for Chinese activities in East Antarctica, including supply of China's inland Kunlun Station, and functions on a year-round basis. Zhongshan's activities are jointly managed by the Chinese Arctic and Antarctic Administration (organizes Chinese Arctic and Antarctic expeditions and administers related Arctic and Antarctic affairs on behalf of the State Oceanic Administration), and the Polar Research Institute of China (manages the station and Xue Long vessel operations as well as scientific research). This is the 29th Chinese Antarctic Research Expedition (Chinare) at Zhongshan.

The inspection team arrived at the station at 10:30 a.m. local time on Sunday, December 2, 2012. The team was welcomed by deputy leader of the 29th Chinese Antarctic Research Expedition Mr. Bo Sun. The outgoing station leader for the season 2011-12 Mr. Deshang Han and the incoming station leader 2012-13 Mr. Beichen Zhang also participated in the briefing to the inspection team. Prior advance notification of more than 48 hours was provided to the station. The inspection, including lunch, lasted six hours.

Zhongshan was last inspected in 1995 by the United States.

PHYSICAL DESCRIPTION

The station consists of one main station building, power plant, incinerator, waste water treatment plant, vehicle warehouse, several science buildings and containers, new and old fuel farms, and an old living quarters building now used for storage. Many of the station's buildings are recently constructed: the main station building, the incinerator, wastewater treatment plant and fuel farm were all completed in the 2010/11 season.

At the time of the inspection, two new buildings were under construction – one for living quarters and one for a new power plant. Station personnel explained that the completion of these facilities was delayed due to problems offloading key equipment in the 2011-12 season. Personnel did not know if any environmental impact assessments were conducted for these new buildings. (See the EIA section below.)

The facility includes four small dirt roads, one of which leads to the ocean and terminates in a dock. A large antenna array utilized for the Super DARN international research program overlooks the station. Two helipads are located adjacent to a small tarn on the western side of the station.

The station operates no field camps, although it does lay temporary fuel depots during the annual supply traverse to the

inland Kunlun station. The nearest station to Zhongshan is Russia's Progress Station, which is three kilometers away.

PERSONNEL

At the time of the inspection, there were 74 staff members at Zhongshan. 17 of these were overwintering personnel. The station has 60-70 beds but its maximum capacity is 110. The tour length for overwintering personnel is 17 months. They arrive with the annual resupply vessel Xue Long in November/December and depart with the vessel in March of the following season. Approximately 40 summer season personnel also arrive and depart with the Xue Long, staying for about three months. 25 expedition staff members also participate in the inland traverse to resupply Kunlun station.

The ratio of scientific to logistical personnel varies throughout the year. Station managers advised the inspection team that the inland traverse consists of nine scientists and 16 logistical staff. During the winter, the station is staffed with seven scientific personnel and ten logisticians.

The station has no military personnel. The inspection team was advised that in the 2010/11 season, one technician from the Chinese military was on station to assist with the utilization of new fuel bladders.

All station staff members are obliged to complete mandatory Antarctic training, which includes winter survival training in Northern China for all personnel and high altitude training in Tibet for traverse staff. Chinese authorities subsequently informed the inspection team that personnel also receive stringent training on the Antarctic treaty and its Environmental Protocol, the scientific research history in Antarctica and the programs for the expedition, station facilities and the safety requirements in Antarctica. During the voyage from China, all staff members participate in "Antarctic University" training based on the station manual covering the Antarctic Treaty and Environmental Protocol. The team was advised that all Chinese expedition staff receive paper manuals on various aspects of Antarctic operations and regulations, although the station leaders told the inspection team that not all staff may be familiar with the contents.

Technicians receive pre-departure specialized training in China. Station personnel advised the team that personnel also receive fire and emergency training. All personnel undergo medical screening before leaving for Antarctica and comply with international immunization requirements.

SCIENTIFIC RESEARCH

Zhongshan station maintains active programs in the earth ionosphere and high altitude atmospheric physics, including observation of auroral phenomena as well as surface and high altitude ozone profile measurements.

The station also conducts research in glaciology, and ocean and shelf ice interaction and stability, and other research on long-term changes in the ocean, ice and atmosphere related to climate change in the Antarctic. At their interior Dome A (Kunlun) station, China conducts a program in deep ice-core drilling for monitoring short and long-term Antarctic climate change.

The station maintains a large antenna array, the High Frequency Dura Aurora Radar Network (Super DARN) that monitors disturbances and currents in the ionospheric F layer. They also maintain a collection of all-sky and small-field cameras for studying aurora phenomena.

The station conducts GPS geodesy measurement of earth crustal motion capable of measuring displacements of millimeters per year, as well as a gauge for measurement of earth and ice tides. They maintain a meteorological forecasting station with a satellite downlink

the U.S. National Oceanographic and Atmospheric Administration (NOAA).

The inspection team interviewed scientists with backgrounds in space, ionospheric and upper atmospheric physics, and glacier geophysics. In 2011, the entire Chinese Antarctic program had representatives from over 70 universities and institutions.

At the time of the inspection, all scientific personnel were affiliated only with Chinese institutions. At the time of the inspection, there was no international scientific activity at the station. All scientific personnel were affiliated only with Chinese institutions. However, the station was seeking cooperation with Australia and Japan to study Prydz Bay area and Amery Ice Shelf.

The inspection team was told there were no radioactive materials located at the station.

TOURIST AND NGO ACTIVITIES

Station leaders reported that there had been no visits by tourists or non-governmental organizations to the station.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

Most communication is done via the Internet. The station maintains voice, fax and email capabilities in its communication center. They use HF radio (159.43 MHz) for regional communication within 30km of station, particularly with supply ships. They maintain INMARSAT satellite communication and have NOAA satellite downlink capability for receiving weather forecasting information. The communication center also maintains an external web camera for monitoring the station site, and they have some capability for low-resolution teleconferencing.

TRANSPORT

The station maintains two Pisten Bullies, two tow trucks, a bull dozer, a large flatbed truck, one small car, and two Ski-Doos. The station also maintains a construction crane. The station sometimes uses two barges and a tug to transport materials during the annual supply by ship. There are no fixed wing aircraft at the station. This season two helicopters are contracted from a Korean company to the China Antarctic Research Expedition. Helicopters are used once per year during annual resupply of the station.

FUEL STORAGE AND USE

Depending on the sea ice conditions, fuel is transferred from the cargo vessel either via barge or hose line and stored in bulk tanks. During the 2011-2012 season, 12 new double-walled steel fuel tanks were constructed, each with a capacity of 55 kiloliters. The new tanks are situated on a fuel berm as secondary containment. Fuel spill clean-up equipment is stored in the new tank area, which is located at the eastern side of the station. Approximately 580 kiloliters (500 tons) can be stored in the new facility. The old facility, located at the southern end of the station, contains eight fuel tanks, which are routinely checked to ensure proper containment. Plans are being made to consolidate the fuel tanks in one area by moving the old tanks to the new tank area.

Ski-Doos parked on the snow near the edge of the station closest to the sea ice are fueled from 55 gal fuel drums. A group of approximately 15 drums for this purpose were positioned directly on the ground, one with a fuel transfer pump in place. With no drip pan below the drums, there was an increased risk of a fuel spill reaching the ground during fuel transfer operations. Upon reviewing the draft report, Chinese authorities informed the inspection team that the drums had been already taken away from the station.

There was a small pool of fuel at the ground near two fuel drums outside the door to the incinerator building. It was unclear how long the fuel had been present, but there

was no indication anyone had attempted to clean it up or contain it. Following the inspection, China reported that:

the inspection team arrived at the Station, the station was busy organizing the around-the-clock resupply activities from the vessel Xue Long, which was located miles away from the station due to the heavy sea ice. It was the busiest time in the summer. The drums on the ground noted by the inspection team were set beside the resupply route temporarily for the purpose of refueling the Pisten Bullies used for pulling the cargo sledges. The personnel were so involved with the cargo operation when the weather allowed that they neglected to take measures to prevent the oil spill. The station has already cleared the oil spilled on the ground and removed the fuel drum after the inspection. The station has been reminded to take effective measures to deal with the fuel drums and prevent potential oil spill.

In addition to the fuel required for station use, approximately 400 kiloliters (350 tons) of Jet A-1 fuel is transferred from the cargo ship into fuel bladders for the traverse to Kunlun Station. Some of this fuel is cached in route for use during the return traverse.

POWER GENERATION AND MANAGEMENT

On station, there are three 165 kW generators which operate using diesel fuel. Only one generator is operated at a time. A back-up generator is located in separate site on station. Additional power is supplied from time to time by a wind turbine. Waste heat from the generators is used to heat water for personal use.

WATER SYSTEMS

Water for generator cooling and bathing facilities is pumped from a lake west of the station area and is stored in tanks. Water for drinking is obtained by vehicle transport from the smaller Kristalnoye Lake and by melting ice and snow. Drinking water is stored in seven 5 kiloliter tanks. Summer drinking water consumption averages 2000 liters for three days. During the winter, total water consumption is 80 to 90 kiloliters (70 to 80 tons) per month for 17 people.

MANAGEMENT OF DANGEROUS ELEMENTS

Station personnel advised that there were no chemical laboratories on station and that there were no hazardous chemicals stored on station.

The inspection team was told there were no firearms, ammunition, or explosives at the station.

EMERGENCY RESPONSE CAPABILITY

Station leaders reported all staff members are provided with an emergency response plan, including for fire emergencies. Newly arrived staff members participate in fire fighting training, and overwintering personnel conduct fire fighting exercises. The station is equipped with fire extinguishers and other fire prevention equipment.
The station has an oil spill contingency plan. Personnel who will conduct the annual fuel resupply in the 2012-13 season were trained in China on how to operate the new fuel pipeline system.

In the 2011-12 season, an expedition helicopter crashed near the station. No personnel were injured, and the helicopter frame and damaged rotor were returned to China. In November 2012, there was a small fire caused by a faulty extension cord in the radome. No serious injuries or damage resulted.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

Station leaders confirmed that they were fully aware of the Protocol's requirements to conduct EIAs in advance of establishing

new activities or new construction. In the last year, they had not prepared any EIA documents. Station leaders did not have the details on when the last EIA was done, and did not know whether new ones were planned. The inspection team noted that there was much construction going on at the station, and some sort of EIA procedures might have been needed, at least to the extent the construction was being done on newly disturbed ground. Chinese officials subsequently informed the team that the EIA for the new living quarters and the new power plant was conducted during the planning process of the construction. While the English translation of the EIA report was delayed for technical reasons, China advised that the EIA would be made available as soon as possible.
Conservation of Flora and Fauna

Mosses and lichens are found in the Larsemann Hills area near Zhongshan Station. Three species of seabirds that breed within the Larsemann Hills have been observed near Zhongshan station: south polar skuas, snow petrels and Wilson's storm petrels. Occasionally, Adélie penguins have been seen in the vicinity of the station. Station personnel are informed of the environmental Code of Conduct for ASMA No. 6 Larsemann Hills and other environmental standards during the environmental training program in China. Although there is no greenhouse at present, station personnel expressed interest in developing a hydroponics system in the future.

WASTE MANAGEMENT

Combustible wastes are separated for incineration in a recently installed high-temperature, diesel-fueled incinerator with a cyclonic filtering system to reduce ash emitted. Burns are conducted approximatelyevery three to four days. Non-combustible wastes are separated into various categories (e.g., plastics, metal, glass, incinerator ash, etc.) and stored in empty fuel drums until shipment off station. The drums and bulk construction waste are placed in standard sea containers for return to China. Due to poor sea ice conditions in recent years, not all the accumulated waste could be removed. At present, there are 40 sea containers of waste awaiting transport off station.

At various points within the station, there were piles or trash stored. For example, just below the new incinerator were the remains of the old incinerator. In another area, there were several small metal containers or parts of buildings. It was unclear what plans or timetables were in place to remove this material.

Chinese officials subsequently informed the team that:
11 of the 40 containers of trash as noted by the inspection team have already been loaded on board the vessel for removal from the Antarctica. The rest of them will be removed from the station and transported to China in future voyages as soon as possible.

Black and gray water are collected and treated in the sewage treatment plant where solids are separated from the liquids and the liquids are pumped into a settling tank where a biodigestion process takes place. The effluent, which is not tested, is discharged through an insulated pipe system to a shallow saline water body that flows into the embayment which connects to the ocean. The inspection team was unable to understand whether the flushing rate of the effluent was sufficient to move the effluent to the sea in a timely manner. China subsequently reported that effluent is discharged once the water reached the quantity that could be discharged fast enough to get into the sea in a timely manner.

Twice per season, there is a clean-up campaign of the ice-free areas of the station.

The inspection team observed some trash left outside and exposed at the top of a stairway next to a communications building. The team felt that such trash

should not be left outside but put into appropriate containers for removal.

A large building in the center of the station that used to be living quarters had been abandoned in favor of new structures. Station leaders said that pipes and other connections to this structure had been removed and that the entire structure would be removed and the material taken out of Antarctica. Given the size and prominence of the building, the inspection team felt that it was important that there be a plan to remove the building and its materials within a definite period. Upon reviewing the draft report, Chinese officials informed the team that:

The personnel did not have full information about the plans for the old living quarter at the time of inspection. Dismantling the building was just one of the options that was discussed, but not the final solution. Taking into account the enormous workload for the dismantling and transporting method, the Polar Research Institute of China decided to activate the building with a plan to repair the outer steelworks and restore the water and electricity system.

AREA MANAGEMENT

Zhongshan Station is located within ASMA No. 6 Larsemann Hills. The management plan for the ASMA as well as management plans for the ASPAs in local area is found in the annual station personnel manual that is given to each participant. ASPA No.168 Mount Harding, Grove Mountains, East Antarctica was adopted by the Antarctic Treaty Consultative Meeting following a proposal by China in 2008. In recent years, no research has been conducted in ASPA No. 168.

ARMS AND MILITARY SUPPORT

There were no military personnel or equipment at the station at the time of the inspection. The inspection team was told that there was some military assistance during the construction phase of the Super DARN antenna array; they performed the initial for the excavation of the array site using a small amount of explosives (no explosive material remains at the site).

In summer 2011, one military person assisted during the supply stage with the transport of a large military-style fuel bladder.

India – Bharati

69°24.25'S, 76°11.42'E

December 3, 2012

Bharati is the newest research station in Antarctica, having broken ground in December 2011. It was still partially under construction at the time of inspection. Located on Prydz Bay in the Larsemann Hills, the station is the second of India's two year-round stations.

Like Maitri, Bharati is managed and supported by India's Ministry of Earth Sciences' the National Centre for Antarctic and Ocean Research (NCAOR), which is an agency working under the Indian Ministry of Earth Sciences. The primary purpose of the station is scientific research, and scientists come from a variety of Indian institutes.

India is part of the Dronning Maud Land Air Network, but has not yet developed logistical collaboration with other National Antarctic Programs in the Larsemann Hills area. The logistical demands of constructing a new station required India to contract an enhanced ice class cargo vessel, supply vessels, and helicopters, but NCAOR hopes to identify opportunities for logistical cooperation once Bharati begins regular operations in the 2013-14 season.

Voyage Leader Ajay Dhar briefed the inspection team, along with 2011-12 station commander Dr. Rupesh Das and newly arrived 2012-13 station commander Dr. Aditi Krishnamurthy. The inspection lasted five hours, including lunch. India also provided helicopter transportation for the inspection team from Russia's Progress Station to Bharati, and the inspection team very much appreciates this logistical support.

This was the first inspection of Bharati by any of the Consultative Parties to the Antarctic Treaty.

PHYSICAL DESCRIPTION

Bharati's construction began in 2011 after the Antarctic Treaty Consultative Meeting had completed its consideration of India's Comprehensive Environmental Evaluation. The station is designed as a single building that contains living areas, physical plants, most scientific laboratories, and garage. The station footprint includes a fuel farm, pipelines for fuel, water, and wastewater discharge, a helipad and a small road that connects the station with the water's edge. India plans to install a removable metal wharf but has yet to finalize the engineering plans.

At the time of the inspection, construction continued and was expected to be completed by the end of the 2012-13 summer season. In addition to finishing some of the interior laboratories and living areas, the construction crew was completing the station's reverse osmosis water intake pipeline. India is also developing a satellite base station and a remote sensing station on the hills south of the station.

There is a two-story container-assembled alternate construction site adjacent to the station that is likely to remain on site to serve as emergency shelter, storage and/or summer overflow lodging. The other containers surrounding the facility at the

time of inspection are slated for removal upon completion of station construction.

Bharati is located about three km from China's Zhongshan Station and 7 km from Progress Station, but the site is on an isolated promontory and is unreachable by land.

PERSONNEL

At the time of the inspection, there were 50 staff members at the station including contractors from Germany who were engaged in station construction. The number of people engaged in scientific research was about 15. It was advised that the scientists come from different institutions while the logistical staff is employed by the Indian National Centre for Antarctic and Ocean Research. The ratio of logistical to scientific personnel is roughly 70 to 30 percent respectively.

The station can house a maximum of 53 persons. The inspection team was informed that that there were going to be 17 overwintering personnel in 2012-13 compared to 13 in 2011-12. The team was told that at the height of the summer about 70 people may support the work of the station but some stay on the supply ship chartered by India. In the 2012-13 season, two naval staff seconded to the civilian hydrography agency will be deployed on the ship.

All staff members receive pre-deployment medical screening in India. The inspection team visited the two-room medical center. The station's doctor, Dr. Aditi Krishnamurthy (a community health expert), is also the 2012-13 station commander. The medical center includes two inpatient beds and a comprehensive pharmacy including a locked cabinet for narcotics, as well as oxygen and nitrous oxide. The inspection team was told that X-ray, dental chair and anesthetic equipment were arriving this season. No surgery could be performed at the station at the time of the inspection. However, the 2011-12 doctor told the inspection team that one of the exam rooms could be partitioned for surgery in the future. In case of emergency, personnel could be evacuated to the closest station.

The personnel undergoes fire fighting training, training on medical emergencies, and instructions on issues relating to the protection of the Antarctic environment, including waste disposal, before leaving for the Antarctic the staff would be sent to the Himalayas to do snow ice training (10-20 days). The Indian Ministry of Earth Sciences provides information on the provisions of the Antarctic Treaty and the Environmental Protocol. On the supply vessel, all personnel receive a handbook regarding the issues of major concern in the Antarctic Treaty area.

SCIENTIFIC RESEARCH

As Bharati Station was still under construction at the time of inspection, India's research programs were just commencing. Only two scientists were present at the time of the inspection, and a few monitoring stations were operating.

The station currently operates a digital flux meter for measuring surface geomagnetism, a GPS station for seismo-tectonic and geodesy measurements, and an automated weather station. Additional chemistry and biological laboratories are under construction. In the coming season they expect more scientists who will conduct additional research in atmospheric sciences and lake sediment microbiology.

Scientists at the station will represent a variety of Indian research institutions, most of which fall under the umbrella of the Indian National Centre for Antarctic and Ocean Research (NCAOR). All will have at least a master's degree and most a PhD in their field. The inspection team met with one scientist with a background in ionospheric and upper atmospheric physics, and another expert in geomagnetism, as well as a medical doctor.

At the time of the inspections there were no science personnel from other national programs. However, they anticipate two or three scientists from Australia will visit the station in the next summer season. At present there is no international scientific activity at the station.
The inspection team was informed there were no radio-isotopes used at the station.

TOURIST AND NGO ACTIVITIES

Station leaders indicated that as Bharati Station is new, there had been no opportunity for tourists or non-governmental visits of any kind, but that in any event the Government of India does not support tourism in Antarctica and the station would not support any such visits in the future.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

The communications unit in the main complex currently communicates through Iridium telephones and has an Iridium dome open port. They also have HF radio for regional communication. One of the operators is a Ham radio enthusiast. They currently have a modest Internet connection. The station expects a satellite base station will be constructed this season, which will give them a faster internet connection.

TRANSPORT

The station currently has four Pisten Bullies that will be used during the construction phase. There is also one construction crane and several bulldozers.

The station is supplied by ship at the beginning of the summer season. The ship stays in port throughout the summer. As the main ship port is located next to the station, the station has no small boats. Bharati has no permanent fixed wing or rotary aircraft. However, the station has use of a helicopter for personnel and light cargo transport while the supply ship is anchored in port during the summer season.

FUEL STORAGE AND USE

Power to the station is provided by Jet A-1 fuel, with a 120 kiloliter annual fuel consumption. The fuel is stored near the main station in double-walled steel tanks which are bermed. Fuel consumption is approximately 120 kiloliters per year, and there is a 270 kiloliter storage capacity. The 2 layered pipeline to the station is pressured tested and spill trays are placed under connections. The fuel line has an alarm system with automatic shut-off should a leak occur. The distance from the cargo ship to the fuel farm is approximately 20 meters and the distance from the ship to the station is 50-100 m. A team of four supervisors are responsible for fuel transfers. Diesel fuel is used for vehicles.

POWER GENERATION AND MANAGEMENT

Power is supplied by three 100 kW generators, with one being used, one in sleep mode, and one in standby mode. Thus, two generators are operational at a time, with a change in generators after 200 hours' use. During the construction period, there is a back-up 75 kW generator, and there are two 2 kW generators for use at field camps. Heating of the station is provided by thermal radiators heated by waste heat. Emissions from power generation are filtered before release and then measured on a regular basis. A detailed monitoring system for energy (as well as water) use and production is managed by one person.

Future plans are to create a "green station" within 7 years supplying 70% of the station power needs from solar and wind power.

WATER SYSTEMS

Water is produced through a high pressure reverse osmosis system that was being completed at the time of the inspection and snow melting. There is a daily production

rate of 2000 liters with quality measured at the production plant. 12,000 liters of water is stored on site. Water usage for 13 people during the overwinter period was 1000 liters per day.

MANAGEMENT OF DANGEROUS ELEMENTS

No laboratory chemicals are on site, as laboratory construction is still underway. A small quantity of industrial chemicals is contained storage outside the station.

The inspection team was told there were no firearms, ammunition or explosives located at the station.

EMERGENCY RESPONSE CAPABILITY

In addition to pre-deployment training in India, overwintering personnel conducted a number of emergency response exercises every 15 days during the 2012 season. This included search and rescue, fire fighting and spill response exercises. Such regular emergency response drills are a best practice, and the inspection team hopes that Bharati will be able to continue regular exercises as it begins full operations.

The station has a detailed fire and spill response plan, including team assignments. The station is equipped with fire alarms, smoke and heat detectors, fire blankets and sprinklers. In addition, the walls of the station's technical plant are fire resistant for 45 minutes and living areas for 30 minutes. The station is also equipped with fire doors.

The station practices fuel spill response by spilling water in place of fuel. Four members of the overwintering staff had additional fuel handling training.

There had been no accidents requiring emergency response at the station to date. However, the station did provide support to neighboring Zhongshan Station when a Chinese helicopter crashed during the 2011-12 season. Bharati sent its helicopter and doctor to the site of the crash and transported the Chinese personnel to Zhongshan. In the summer season, Bharati's helicopter is stocked with a mobile emergency kit including first aid materials, rations, tents and sleeping bags.

Station procedures require all incidents be reported to the station manager, who transmits a report of any incidents to NCAOR.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

Station leaders were fully aware of the Environmental Protocol's requirement that environmental impact assessments be conducted in advance of activities. EIA requirements under the Protocol are part of the training done for all Bharati staff. As Bharati is a new station, the only relevant EIA is the Comprehensive Environmental Evaluation done in advance of construction of the station. The station leaders indicated that they would work closely with NCAOR authorities in Goa in the event any new activities with impacts were planned. Environmental monitoring of the local area was begun several years prior to the initiation of station construction and is continuing in an effort to understand the potential environmental impact of the station and its activities.

CONSERVATION OF FLORA AND FAUNA

Three species of seabird, south polar skuas, snow petrels and Wilson's storm petrels, breed within the Larsemann Hills, but none of these breed in the vicinity of the station. Terrestrial vegetation is sparse in the Larsemann Hills area, and consists mainly of lichens, bryophytes and algae. Various species of phytoplankton as well as cyanobacterial mats are found in the numerous lakes in the Larsemann Hills. Weddell seals have been observed along the Larsemann Hills coast in the vicinity of the cargo ship offload area.

Environmental training to minimize potential impact to fauna and flora and to avoid the importation of non-native species is conducted in India with more detailed local instruction conducted upon arrival to the station.

WASTE MANAGEMENT

Black water is sent to the wastewater treatment plant where membrane filtration and biodegradation of urine and solids are utilized in processing. Gray water from the kitchen is filtered, subjected to a grease separation process and then sent into the waste water treatment plant. The effluent is discharged to the ocean. Gray water from bathing and laundry use is collected in a tank and aerated and filtered before being recycled for use in toilets. The dewatered compressed sludge from the treatment plant as well as the solids from gray water processing is placed in drums for removal from Antarctica. Two engineers manage the wastewater treatment processes. For the 13 overwinter populations, two 50 l canisters of activated sludge were produced.

Solid wastes are separated into various categories and stored for removal from Antarctica.

AREA MANAGEMENT

Bharati Station is located within ASMA No. 6 Larsemann Hills. Station personnel noted that the management plan for the ASMA as well as management plans for the ASPAs in local area will be onsite once the cargo ship is unloaded with summer season supplies. Several protected areas are located in the vicinity: ASPA No. 169 Amanda Bay is located about 25 km from the station. Other ASPAs in the vicinity are ASPA No. 143 Marine Plain, Mule Peninsula, Vestfold Hills, Princess Elizabeth Land and ASPA No. 167 Hawker Island Vestfold Hills, Ingrid Christensen Coast, East Antarctica.

ARMS AND MILITARY SUPPORT

The inspection team was told there is no military support to the station and that there is no military equipment held at the station.

Japan – Syowa

69°00.25'S, 39°35.01'E
December 4, 2012

Japan's year-round Syowa station was established on East Ongul Island in Lűtzow-Holm Bay in East Antarctica for the International Geophysical Year in January 1957. In addition to its primary purpose of scientific research, the station is the logistical hub for Japan's inland traverse to its Dome Fuji station. Syowa was last inspected by Australia in January 2010.

Syowa has been expanded and renovated extensively during its 55 years of operation. This season, the station is continuing construction of a 1000 antennas radar array to study the upper atmosphere, 200 of which were installed in the 2011-12 season.

On the logistical side, the station is building the first of five planned 20 kW wind turbines this season, completing the pipeline for the station's new waste water treatment facility, and constructing a new garage for maintenance of vehicles during the winter.

The Japanese Antarctic Research Expedition (JARE) is the coordinator of all Japanese Antarctic activities, through the JARE headquarters in the Science and International Affairs Bureau of the Ministry of Education, Culture, Sports, Science and Technology and chaired by the Minister. The National Institute of Polar Research (NIPR) provides operational and logistical support, including personnel, for JARE. Japan participates in DROMLAN.

Leader of the 53rd JARE overwintering personnel (and NIPR Logistics Manager) Kenji Ishizawa provided the inspection team with an introduction to the station and an extensive tour. The inspection lasted four hours, including dinner, and the inspection team overnighted at the station.

The inspection team would like to thank Japan for providing transportation from the S17 runway to the station, airplane fuel, and overnight lodging. The inspection team provided one week's notification, given the logistical support requested from the station.

PHYSICAL DESCRIPTION

The station covers an area of about 1.3 square km. The main administration building has plenty of space for quiet and loud activities, and lodging, communication, medical, dining, power and water treatment areas are interconnected by passageways. Up to 130 people can be housed at the station.

Workshops, fuel storage tanks, waste management, science support structures and snow melting facility, as well as a small solar farm are scattered around the area surrounding the main administration building. Taking into account the age of the station, some of the structures are becoming outdated and the expedition leader reported that Japan has a plan to renovate or dismantle several in the coming years. The tiny oldest building at the station constructed in 1957 was preserved as a museum commemorating the station's establishment. The station sustains one inland station and 5 field camps.

The station possesses INMARSAT and INTELSAT communication systems, an INTELSAT antenna with radome and control room, HF radar interferometer antenna array, and a number of other antennas that support scientific research. (See science section below.)

PERSONNEL

There were 31 wintering JARE personnel on station at the time of the inspection, including 12 scientists. During the 2012-13 summer season, the station is expected to house 104 personnel. The station has a maximum capacity of 130 personnel in summer and 42 in winter and generally has a logistics/science ratio of 2:1. Summer expedition personnel arrive on the Japanese Self Defense Agency icebreaker SHIRASE in December and depart in February, while overwintering personnel remain through the following February.

Approximately 20 Maritime Self Defense Force personnel crew Tthe SHIRASE is crewed by approximately 20 Navy personnel, some of whom assist the station with airport operations and power plant maintenance between December and February. Up to about 30 personnel of the SHIRASE assist with airport operations, construction/renovation of buildings and power plant maintenance in January and February.

There were two doctors in the expedition at the time of inspection. One was on station and one was traversing to Japan's inland Dome Fuji station. Syowa has a large medical facility that consists of three rooms, including a dental suite. The facility includes x-ray, CAT scan, pharmacy and other equipment. Station doctors also receive dental training and can perform some surgeries. The station leader advised the inspection team that overwintering personnel receive a comprehensive medical screening every three months, in addition to pre-deployment medical and psychological exams for all personnel.

In Japan, personnel receive training on first aid, fire fighting and environmental protection, as well as one week training and lectures on the Antarctic Treaty system. Overwintering personnel also receive survival training in northern Japan. Finally, in July, all summer and winter expedition staff members meet at NIPR to discuss station specific information. Expedition personnel also receive survival training in mountainous areas in central Japan. Station personnel have access to a number of manuals and handbooks on station operations/procedures, safety, and ASPA and ASMA management plans.

SCIENTIFIC RESEARCH

The Syowa station conducts research in a broad range of programs in geology, oceanography and geophysics, atmospheric sciences, terrestrial and marine biology, environmental monitoring, human biology and medicine. The station maintains

permanent facilities for monitoring Antarctic meteorology, atmospheric chemistry and aerosols, auroral phenomena, surface geomagnetism, upper atmosphere and ionospheric phenomena, as well as seismic signals and tides.

The station operates a number of facilities to observe the three dimensional structure of the atmosphere, as well as the interaction between atmospheric vertical layers (Mesosphere-Stratosphere-Troposphere) and the ionosphere. Vertical profiles of winds and temperature in the mesosphere and lower thermosphere are measured by an MF radar and a sodium LIDAR. Air glow measurements are made by an all sky imager and a Fabry-Perot interferometer.

The station is constructing a large VHF pulse Doppler radar array (PANSY) for studying the upper atmospheric circulation and its interaction with the ionosphere and magnetosphere. At the time of the inspection more than 1000 crossed Yagi antennas, each about 3 meters tall, had been deployed in a quasi-circular array, more than 200 of these were equipped with TR modules. The system ultimately plans for a 1045 antenna array with peak power greater than 500 kW and an effective aperture of about 18000 m2.

At the time of the inspection there were no international programs, or exchange scientists from other Antarctic programs at Syowa.

The inspection team was informed there were no radio-isotopes used at the station.

TOURIST AND NGO ACTIVITIES

A tour company had made requests to visit during the last two seasons, but the station did not agree to these requests. The station leader told the inspection team that a television crew from Japanese broadcaster NHK overwintered at the station one season. After reviewing the draft report, Japan advised the inspection team that Syowa was once visited by a tourist group organized by Quark Expeditions in December 1996.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

The station maintains a major INTELSAT and INMARSAT communication system, as well as significant HF, VHF and UHF radio band transceivers. The station also has Iridium phones. There is good Wi-Fi available throughout the station and regular communication takes place via the Internet and e-mail.

TRANSPORT

The station is resupplied once a year by the icebreaker SHIRASE. The station has a large number of ground vehicles available including: 20 Ohara snow vehicles, two bulldozers, four excavators, three terrain cranes, approximately 20 trucks, some of which are equipped with loader cranes, five forklifts, four snowmobiles, nearly 75 sledges of various types, and a small inflatable boat. In addition, the station will operate two AS350-B helicopters and one CH-101 helicopter will be operated on board the SHIRASE for 2012/2013 summer season.

FUEL STORAGE AND USE

Fuel arrives annually with the icebreaker SHIRASE. Fuel supplies include diesel for power generation and vehicles, specially blended low temperature fuel for snow vehicles and Dome Fuji, JP-5 for heating and power generation, and Jet A-1 for aircraft refueling. At the time of inspection, the station held 427 kiloliters of diesel, 64 kl of specially blended low temperature fuel, 139 kl of JP-5 and 18 kl of Jet A-1. Station management reported fuel facilities are checked weekly and after any storms. Total fuel consumption is 550 kl per year.

Diesel is stored at a large fuel farm on the east end of the station with ten 100 kl tanks and connected via pipeline to five smaller 20 kiloliter fuel tanks in front of the station's administration building. Pipelines are raised and double walled and the fuel tanks are

placed on concrete containment platforms. Japan maintains ten to fifteen 200 l drums of Jet A-1 in sledges at the nearby S17 runway for the refueling of DROMLAN aircraft and also oversees a number of fuel depots in the field.

POWER GENERATION AND MANAGEMENT

The station has two 300 kVA generators that utilize approximately 373 tons of diesel fuel per year. Only one generator is operated at a time and they are rotated monthly. Maximum consumption is 200 kW. The expedition leader reported that Japan intends to install a third generator to power the station's new antenna array.

Two 200 kW back-up generators are located in separate site on station. The station is constructing the first of five planned 20 kW wind turbines this season. There is also a 55 kW photovoltaic panel farm over a ridge on the northwestern side of the station. At present the photovoltaic arrays provide 3% of the station's power needs. In the future, wind and solar power is expected to provide 15% of the total energy requirements of the station. Annual average consumption is 180 kW.

WATER SYSTEMS

The station uses water from a nearby lake throughout the year and uses waste heat to melt snow for water during the winter. The station has one 130 kl and one 100 kl water tank on the south side of the administration building. Water consumption averages 170 l per person per day.

MANAGEMENT OF DANGEROUS ELEMENTS

Station management told the inspection team that a small amount of chemicals are utilized on station for biological and medical research and controlled by individual researchers.

The inspection team was told that there were no firearms, ammunition or explosives located at the station.

EMERGENCY RESPONSE CAPABILITY

The station appeared well prepared for emergency contingencies. Station personnel have a detailed fire and evacuation plan and conducts monthly fire exercises, in addition to pre-deployment fire training. Fire fighting equipment is readily accessible throughout the station, including personal protective gear, fire extinguishers, alarms, hoses and water pumps. Evacuation plans and escape routes are displayed throughout the station.

The station has an oil spill contingency plan, but does not conduct spill response exercises.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

The station was fully aware of the need to conduct EIAs in advance of undertaking activities or construction. The station leader indicated that EIAs are submitted to Ministry of the Environment, which then gives permission for the activity. Information is submitted to the Ministry of the Environment every year. The team was shown a very large compendium of information that constituted its last annual submission. Three IEEs had been submitted for the 54th JARE related to: construction of wind turbines and wastewater pipeline construction; the construction of an 1000 antenna radar array; and ionosphere antenna construction. An environmental monitoring program is in place and includes such parameters as emissions, gray water, seawater properties, fauna and flora, etc.

CONSERVATION OF FLORA AND FAUNA

Seals and penguins are occasionally found on the sea ice surrounding the station. In the 2011-12 season, Adélie penguins were fitted with data loggers by researchers working under a permit from the Japanese government. Scientists also sampled mosses, lichen, algae and bacteria at nearby lakes as well as in ASPA No. 141 Yukidori Valley. All personnel receive training on relevant guidelines on flora and fauna.

WASTE MANAGEMENT

The station has a biologically treatment plant and a carbonizing plant for kitchen waste, which includes food and avian products. Carbonized kitchen waste is incinerated like other burnable wastes. Solid materials are sorted into 24 separate waste categories, e.g., batteries, metals, fuel, medical, and plastics, prior to shipment back to Japan. Food wastes are incinerated and the ash returned to Japan. Approximately 250 tons of waste is removed from Antarctica annually.

Japan is completing construction of the pipeline to a new wastewater treatment plant in a building previously used as a maintenance garage. The previous modular facility on the south side of the main station complex will be removed in the 2013-14 season as winter snow accumulation has proved problematic. The new facility will have the same capacity as the current one, which processes 5000 l of wastewater per day with a microfiltration system. Station personnel test effluent, which shows a low COD, prior to discharge to the sea.

The station has an incinerator for treated kitchen waste, which includes food and avian products that are pretreated biologically prior to incineration. A second incinerator received other solid wastes. The incinerator meets domestic Japanese standards, and all ash is returned to Japan. An older landfill area remains on the station.

The inspection team noted that there were many drums and containers prepared for removal from the station. The significance of these items surrounding the station and not yet taken away might be related to the age and logistical support of the station.

AREA MANAGEMENT

ASPA No. 141 Yukidori Valley is nearby the station and the site of permitted research over the summer seasons. Ten individuals entered the ASPA in the 2011-2012 season with a permit from the Japanese Ministry of Environment. All station personnel have access to a comprehensive handbook of this and all other ASPA and ASMA management plans.

ARMS AND MILITARY SUPPORT

The inspection team was told that about 20 members of the Japan Maritime Self Defense Force assist with cargo transportation and building construction during the summer season, and some personnel of the SHIRASE assist with tasks at the station as needed. No military equipment is held at the station.


414
412
JARE


413

Belgium – Princess Elisabeth

71°57.01'S, 23°20.48'E

December 5, 2012

Princess Elisabeth, a seasonal station that is open November-February, began construction in 2007 and was inaugurated in 2009. The International Polar Foundation (IPF), a charitable non-profit foundation established by Belgian Royal Statute in 2002, is the mandated Antarctic Operator for the Belgian Polar Secretariat and oversees all day to day operations and logistics at the station. After construction made possible by public and private contributions, the station was transferred to the ownership of the Belgian State.

Station medic Doctor Jacques Richon, System Engineer Erik Verhagen, and Water Treatment Engineer Jacob Bossaer, briefed the inspection team and provided a tour of the station facilities during the team's five-hour visit, including lunch. They advised the inspection team that Expedition Leader Alain Hubert was in the field at the time of the inspection and the Environmental Officer and Station Manager had not yet arrived.
The inspection team provided 48 hours notice of the inspection.

According to station personnel, Princess Elisabeth's activities are permitted by the Belgian government and follow all applicable Belgian laws regarding Antarctic activities. Further, personnel advised that the Belgian government is legally responsible for the station's activities and provides finance insurance coverage for the station and its personnel. The Inspection Team was shown a permit from the Belgian State Secretary for Environment, Energy and Mobility that stated:

"On basis of the Belgian law of 7 April 2005 implementing the Environmental Protocol to the Antarctic Treaty (Madrid, 4 October 1991), in particular its article 5, § 2, 7 and 8, and referring to the information received from the applicant, I declare that the expedition organized by the International Polar Foundation from 07/11/2012 to 27/02/2013 in the framework of the Belgian Research station in Antarctica may be considered as covered by a permit issued by the Belgian authorities. The applicants declared that they are well aware of the Belgian legislation applicable on the respect and the protection of the environment in Antarctica".

The Belgian Polar Secretariat manages the station's activities. All Antarctic operations are executed by the mandated operator «the International Polar Foundation» in accordance with the decisions of the Belgian Polar Secretariat. Station personnel explained that the Polar Secretariat is a State's department and is the result of a public-private partnership. The inspection

team notes that Belgium has not reported the station's activities through the Antarctic Treaty Secretariat's Electronic Information Exchange System (EIES) in recent years. Annual reporting might help clarify the relationship between the various entities involved in the station's activities.

The station's primary use is to facilitate scientific research. It was last inspected in 2010 by Japan. Belgium participates in DROMLAN and DROMSHIP logistical networks.

PHYSICAL DESCRIPTION

Princess Elisabeth consists of one elevated single story 500 m² station building that includes living areas designed for 16 people, physical plant, laboratories and offices. The medical center is equipped with a full medical cabinet, a small laboratory, heart and blood pressure monitor, anesthesiology and defibrillator.

Below the station, a 1200 m² garage includes backup generators, storage areas, mechanical workshops and lodging (for 32 people) constructed of wood directly on the ice. Station personnel reported the garage has been moving with the ice and may need modification to secure it to the main building. The station's solar panels were installed on the roof of the garage, but Belgian authorities subsequently reported they are in the process of being moved to a location where they are less likely to be covered by snow.

Two small exterior science labs are located on the ends of the ridge. Nine 6-kW wind turbines have been placed near the station on the ridge where the station sits, as well as a fuel platform for 55 gallon drums. In front of the station, science traverse equipment was prepositioned, as well as containers loaded with waste, to be removed during the annual resupply.

The station has a compacted snow runway for ski-equipped aircraft, a temporary helipad that was utilized last season, and an adjacent emergency shelter. Two temporary mobile field camps for scientific research will be operated during the 2012-13 summer season.

The Polar Secretariat is considering the possibility of constructing a new science laboratory/office building to replace the two small shelters. However, this plan has yet to be finalized. Additional solar panels are also being considered.

PERSONNEL

At the time of the inspection, there were 19 people at the station, including ten IPF logistical staff members, six scientists, and three pilots supporting scientific operations. Eleven people, including three logistics personnel, were in the field conducting scientific research that day.

The maximum length of tour is 113 days, with personnel coming and going throughout the season. The station can hold as many as 48 individuals.

A large percentage of staff was non-Belgian, including nationals of Switzerland, Germany, Japan, the Netherlands, Canada and the United Kingdom, with the coordination of the Polar Secretariat. Given the variety of nationalities present on station, English is the primary language. It was not entirely clear whether and how Belgian authorities could enforce relevant laws with respect to the non-Belgian nationals.

The station has a doctor (currently a surgeon) and several paramedics who serve as field guides. The doctor, who is contracted by IPF, also developed the medical qualification questionnaire and determines if staff members are physically qualified.

The station doctor advised the inspection team that he utilizes a telemedicine system to consult with other specialists, including dentists. In the event of a severe injury, he would utilize DROMLAN assets to medevac a patient to Novo and on to Cape Town.

All IPF logistical personnel undergo field training in France in September before deployment. All participants attend a half-day IPF briefing in October. Scientists receive field training on station from the IPF field guides, who are also paramedics. This training includes search and rescue. There is no fire fighting training provided, although several of the staff members have previous fire fighting experience. Following the inspection Belgium reported that training courses in that area were under development.

Station management is currently developing a station user manual and technical manual that will include a code of conduct.

SCIENTIFIC RESEARCH

During the 2012 - 2013 season, Princess Elisabeth Station conducted various research including Antarctic meteorology, aspects of atmospheric chemistry and physics, gravimetry and seismology, geology, geomorphology and geophysics, microbiology, glaciology and in meteorite searches used in cosmochemistry studies.

Most of the measurement work is done within the main station building. On its rooftop, the station maintains a Brewer spectrophotometer to monitor for surface ozone and related trace gases, a Climel photometer to measure solar UV radiation and a nephelometer which monitors the distribution of aerosol particles.

The Station also maintains a GPS antenna for geodesy measurements, a seismometer, a magnetometer and a remote Automatic Weather Station. Upon reviewing the draft report Belgium reported that the station had longer terms plans to build a second science building to house additional equipment.
During this season, the station will host approximately 35 visiting scientists, from a variety of Belgian and foreign universities and government institutions. This includes a team of six German scientists from the Alfred Wegener Institute, which used the Polar 6 – an airborne laboratory outfitted with ice penetrating radar to map the structure and thickness of the Antarctic ice sheet. This, and related geophysical measurements, will contribute to understanding the long-term history of the Antarctic climate.

The inspection team was informed that there were no radio-isotopes used at the station.

TOURIST AND NGO ACTIVITIES

Station personnel informed the team that there were no tourist visits to the station. In addition, there had been no NGO visits, although two journalists and cameramen had visited during the prior season.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

The station maintains permanent 1 (download) + 1.5 (upload) Mb/s communication link through a commercial satellite dish (SES NSS-7) as well as INMARSAT. This is sufficient to conduct a teleconference (Skype), if necessary, and they maintain good Wi-Fi connection throughout the Station. They also have HF and VHF radio antenna for regional communication, with a VHF repeater installed on the nearby mountain.

TRANSPORT

The station is supplied by cargo ship once per year, typically at the end of December. Containers are delivered to the ice shelf approximate 220 km away. Last season the ship delivered 14 containers of materials. The station has four snow tractors, two bulldozers, 21 snow mobiles and 1 bicycle. There are no permanent fixed or rotary wing aircraft located at the station, but there are typically 20-30 feeder flights per year from the Novo or Troll stations that transport visiting scientists and equipment as well as other flights that refuel at Princess Elisabeth.

FUEL STORAGE AND USE

There are several types of fuel in use at Princess Elisabeth station. The fuel includes 340 drums of Jet A-1 for the German geophysical research flights, 104 drums of unleaded gasoline for snowmobiles, and 158 barrels of polar diesel for power generation and for land transport vehicles. Less than one barrel of white case is available for field camp stoves. The Inspection Team was shown an Oil Spill Prevention and Response Strategy Plan.

Fuel is contained in 200 liter drums. Jet A-1 fuel is stored on wooden sledges at the airfield. Fuel for station use is stored on a raised platform 200 meters from the station. There is no secondary containment under the drums. Station personnel stated that due to the drum size, a maximum fuel spill would be 200 liters. Upon reviewing the draft report, Belgian officials informed the inspection team that refuelling occurs in special areas where spill mitigation is practiced. The Inspection Team noted that, but observed that best practices to minimize release to the environment would include containment under the drums. There is no fuel stored in the field.

POWER GENERATION AND MANAGEMENT

Princess Elisabeth station was designed to operate for 100 % on renewable energy. Energy sources include nine wind turbines, solar photovoltaic panels for power generation, and solar thermal panels for snow melting for water production and heating. There are two 110 kW diesel powered generators providing full redundancy and portable generators for scientific field operations. Future plans include increasing the number of solar photovoltaic panels.

During the summer season, alternative energy sources are the main source of power, with approximately 80% of the electrical energy needs provided by solar power and wind power. Diesel fuel was for the periodic deep charging of batteries and some extra contingencies. In the winter, power to maintain minimal operation is provided mostly by wind power and energy stored in batteries. Upon reviewing the draft report, Belgian authorities advised the inspection team that:

The mean annual fuel consumption for the back up generator is 10,000 l due to reconfiguration of the building and the solar farm. This will be reduced when the technical installations are optimized in the coming seasons. Full independence from fossil fuel is possible, but in this case the battery life is compromised. As batteries are an expensive component of the station, it is considered as a necessary trade off to top off the charge on a regular basis. It is expected that eventually, the baseline consumption could be reduced to approximately 1200 litres per day for safety and the periodic deep charging of the batteries.

WATER SYSTEMS

Water is produced from snow melting via solar thermal power. Once melted, the water is stored in 3000 liter capacity tank. Drinking water from snow is filtered and minerals are added before use. Production is between 800 and 1200 liters per day, depending on sun conditions. Average water consumption is 30 to 40 liters per person per day. Subsequently, Belgium informed the inspection team that using solar thermal power for water production was an enormous energy saver for the station.

MANAGEMENT OF DANGEROUS ELEMENTS

A small amount of chemicals used in the waste water treatment plant is stored in containers to be subsequently sent to Cape Town for disposal.

The inspection team was told there were no firearms, ammunition or explosives located at the station.

EMERGENCY RESPONSE CAPABILITY

The station has an oil spill prevention and response strategy, as well as standard operating procedures for refueling and fuel transfers. Station management provided copies of fuel spill awareness materials and reporting forms. The station has fire alarms, powder suppression, extinguishers, and escapes, as well as a fire resistant facility surrounding the technical core and battery room. Fire fighting exercises are conducted once or twice per season.

The inspection team notes that, given that the station is newly constructed and includes a large amount of wood, more regular exercises and a more formal fire fighting training program would appear to be advisable.

A comprehensive emergency medical kit is prepared for field deployment. Field guides, who are also paramedics, carry iridium phones. In addition to pre-deployment emergency training, crevasse training is conducted on site annually. The station does not have a contingency plan for ship offloading.

The station doctor advised the inspection team that he utilizes a telemedicine system to consult with other specialists, including dentists. In the event of a severe injury, he would utilize DROMLAN assets to medevac a patient to Novo and on to Cape Town.

There have been no medical emergencies or evacuations at the station to date.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

The station leaders were aware of the need to conduct EIAs in advance of undertaking activities or construction. The particular personnel interviewed were not aware of the details of past or planned EIAs, indicating that the station leader had he been there would have known. Upon reviewing the draft report Belgium stated that the EIAs had been submitted annually prior to permits being issued by the Ministry of Environment of Belgium.

Prior to the development of the CEE for the construction, several sites in the local area were set aside as control areas for monitoring human impact on the local fauna, such as skuas and petrels. Other monitoring activities include measurements of air emissions, and chemical analysis of snow used in melting and excess water discharged into the crevasse.

CONSERVATION OF FLORA AND FAUNA

There are lichens in the nearby vicinity which are studied with minimal interference with the terrestrial habitat. There is a nearby breeding colony of snow petrels on Utsteinen Nunatak and skuas have been observed in the area. At present, no research on birds is being conducted. All station personnel are trained to avoid interference with the birds.

WASTE MANAGEMENT

A waste water treatment plant receives waste water from all sources within the station. Liquid wastes from the kitchen are subjected to a degreasing process. Black water is pretreated to liquefy it before being transferred to a bioreactor which produces sludge. The dewatered compressed sludge (150 kg) is collected and stored for transport out of Antarctica. Station personnel are required to use standard personal washing, dishwashing and laundry products which are selected to minimize impact on bacteria used in the waste water treatment system.

The effluent is filtered and subjected to UV treatment and then monitored chemically (COD, nitrate and phosphate concentration). This treated water is used in the toilet system and in laundry machines. Excess treated water is discharged to the

environment into a rock crevasse which appears contained and has no access to the glacier.

There are several dry toilets onsite which must be used, in particular, if someone is taking antibiotics to avoid a negative impact to the treatment plant. Waste from these toilets is collected and removed from Antarctica.

A waste minimization program is in place to reduce the amount of wastes to be removed from the station. Wastes are separated into various categories such as fuel/lubricants, plastics, treated woods, metals, food wastes, etc. for transport out of Antarctica.

Total solid waste production is approximately 1 kg per person per day.

AREA MANAGEMENT

No ASPAs or ASMAs are located in the vicinity of Princess Elizabeth Station. The nearest protected areas are ASPA No. 141 Yukidori Valley and ASPA No. 142 Svarthamaren. No research is currently being conducted in these ASPAs.

ARMS AND MILITARY SUPPORT

The inspection team was told that at the time of the inspection there was no military support, and no military equipment was held at the station. Subsequently, Belgium informed the inspection team that medical supplies were provided by the Belgian armed forces and that the Belgian army had supplied a container of tools in 2006.

Norway – Troll

72°00.07'S, 2°32.02'E

December 6, 2012

Troll is the only year-round station run by Norway in the Antarctic Treaty area. Originally set up as a summer station in 1990, Troll was officially opened as an overwintering station in February 2005. The station is located 1275 meters above sea level in Dronning Maud Land. The Norwegian Polar Institute (NPI), on behalf of the Ministry of Environment of Norway, is the operator of Norwegian Antarctic research activities and is responsible for the practical aspects of the Norwegian expeditions including proper transportation and accommodation for the participating scientists during their travel and stay in Antarctica.

The joint inspection team arrived at Troll Station at approximately 09:00 a.m. on December 6, 2012. Ken Pedersen, the 2012-13 Expedition Leader and NPI Operations Manager, welcomed the inspection team, led a briefing and a discussion of station organization and procedures and provided a two hour tour of the station's internal and external features. The inspection team provided two days' advance notice to the station. Troll has been inspected by other countries several times. Most recently, Japan inspected Troll in February 2010.

PHYSICAL DESCRIPTION

Troll occupies approximately 50,000 square meters of land on a small snow free nunatak at Jutulsessen in Dronning Maud Land. Today, station facilities consist of a number of buildings constructed over the past twenty years. The main station building includes living quarters, communication equipment, and offices. The medical center is equipped with general medical equipment and basic dentistry capabilities. The center has enjoyed telemedicine capabilities since 2006.

Exterior facilities include the power plant, satellite and antenna equipment, fuel storage, garages, and other storage containers. The station has a 3000x60 meter blue ice runway equipped with lights for night landing that operates from November-February. It serves as an alternate runway

for DROMLAN operations and is utilized for station support and medevacs as needed.

Troll supports the permanent Tor field station, which is approximately 110 km east of Troll.

The expedition leader advised that Troll's summer population significantly exceeds the lodging capacity of the station and some personnel are housed in tents. The expedition leader advised the inspection team that three construction projects are currently underway, including the building of an elevated container platform, a 20-person dormitory, and installation of additional KSAT instruments. In the 2011-12 season, a new storage garage was constructed.

Troll hosts the infrastructure for Kongsberg Satellite Services' (KSAT) TrollSat ground station that collects data from polar orbiting satellites and performs telemetry. The KSAT representative at the station advised the inspection team that KSAT is 50% owned by the governmental wholly-owned Norwegian Space Center Properties (which is a company managed by the government agency Norwegian Space Center), and 50% owned by the Ministry of Trade and Industry of Norway. It is a for-profit enterprise with a variety of public and private sector clients in Norway and abroad. The KSAT representative explained that the Norwegian government reviews all of its activities for compliance with the Antarctic Treaty system. The inspection team was advised that data from polar orbiting satellites were generally used for a range of purposes. Theoretically, data may be used for military purposes. Upon reviewing the draft report, Norwegian officials advised that it was not possible for KSAT as a ground station operator to determine all possible end users of the data collected at the TrollSat ground station, as the data is forwarded to KSAT's institutional and commercial customers.

KSAT pays the Norwegian Polar Institute for the logistical support it receives at Troll and falls under the oversight of the station manager for purposes of Treaty system compliance. During the winter season, station personnel provide logistical support to the ground station.

Troll is also home to a European Union-funded, European Space Agency-implemented Galileo system ground station, which is managed by KSAT personnel as requested by the Norwegian Space Center.

The inspection team noted with interest the collaboration between the Norwegian Government and KSAT at Troll. Tourism aside, KSAT appears to be unusual example of large-scale commercial, for-profit activity taking place at an Antarctic research station. Of course, there is no prohibition on using research stations on this continent, which is designated as a natural reserve, devoted to peace and science, for some commercial purposes that are otherwise compliant with the Antarctic Treaty system. Nevertheless, the practice focuses attention on questions related to the level of commercial activity that research stations can or should carry out, and how other commercial activities might be treated.

PERSONNEL

At the time of the inspection there were 30 persons at the station, including three scientists: one NPI scientific technician and two atmospheric physicists. The number of over-wintering personnel was six. The maximum capacity of the station includes ten beds inside its main building, eight beds at an emergency facility, and 15 beds in a temporary sleeping module. Tents are used during the summer season to house additional personnel when necessary. A maximum of 60 people could be accommodated at Troll, but the station can only sustain this number of people over a few days. The inspection team was informed that the station had no military personnel, although some staff had prior military experience.

The station sustains a high level of scientific cooperation with other countries: during summer 2009-2010 two scientists from the South Africa National Antarctic Expedition (SANAE) were based at Troll for about two weeks, conducting geomorphological and biological research. The project was aimed to investigate the relationship between active layer landforms, environmental gradients and patterns of biodiversity. During the 2010-2013 summer seasons,

the station hosted scientists from Denmark, Norway, Sweden and Finland.

Over-wintering staff members attend a two-week field course in Norway (Tromsø and Spitzbergen) about two months prior to their departure which covers general Antarctic information, first aid training, environmental regulations, glacier training (focus on crevasse rescue operations), group team building and first aid. Upon arrival, over-wintering and summer personnel receive field training (first aid, glacier training, rescue techniques), station instructions/regulations, and vehicle training. All personnel arriving at the station is also given a mandatory «Troll in brief», which provides information on station administrative issues, waste management procedures, pollution awareness, and dangerous areas in the proximity of the station. Summer team personnel are hired by NPI for the season, and 90% of the summer staff members are those who worked at the station during previous seasons.

The station possesses one doctor who has telemedicine contact with colleagues in Norway as needed. Medical facilities of the station include x-ray and anesthetic equipment. The expedition leader advised the inspection team that the doctor was accompanying the traverse team conducting station resupply efforts on the coast. This decision was taken on the basis of a risk assessment conducted by the expedition leader.

SCIENTIFIC RESEARCH

The Troll Station monitors regional atmospheric conditions and pollution, noting the seasonal and interannual variability at the site. It focuses on measuring trace aerosols, surface ozone, organic and inorganic pollutants and solar UV radiation. The building housing the Troll Atmospheric Observatory includes instruments to measure aerosol and particle size, a soot photometer, Hgmercury, ozone and CO carbon monoxide monitors and a high-volume air sampler. Troll also maintains a broadband seismic station installed into bedrock and an Automatic Weather Station. The Norwegian Polar Institute conducts an annual bird monitoring program in two snow petrel colonies close to the station.

During the inspection, two visiting scientists from the Swedish Institute of Space Physics were present and operating an atmospheric radar designed to monitor Antarctic middle atmospheric structure and turbulence. These measurements are used to improve models of vertical atmospheric transport and mixing. In previous seasons, South African and Finnish scientists have also worked at the site.

A cooperative program with the Finnish Geodetic Institute operates a geodetic station to conduct absolute gravity measurements. These measurements help improve the accuracy of the global reference frame in the polar areas, where vertical motion may be due to past glaciations or contemporary changes in the ice mass balance, and they provide accurate reference values for gravity mapping for geodetic, geological, glaciological and other geophysical applications.

The inspection team was informed that there were no radio-isotopes used at the station. However, during the tour it was pointed out that one of the atmospheric monitoring instruments to measure aerosol particle size (DMPS) does contain a very small polonium-210 source.

TOURIST AND NGO ACTIVITIES

The station leader informed the team that, per Norwegian policy, no tourists were allowed at Troll. Moreover, there had been no visits by non-governmental organizations.

LOGISTICS AND OPERATIONS

COMMUNICATIONS

Because of the presence of the KSAT satellite ground station, Troll has an extremely fast 250 Mb/s Internet connection. The station maintains a direct connection to the Norwegian national telephone phone system through the satellite link. It also has Iridium phones and HF and VHF radio communication.

The inspection team noted that Wi-Fi is available both inside and well outside the main station building.

TRANSPORT

The station is resupplied once per year by ship in mid-December and around 10 times by plane during the summer season.

The station possesses approximately 15 tracked vehicles of various types for transportation of supplies and equipment between the ice shelf and Troll as well as various station activities and scientific projects. In addition, the station has an 18t wheel loader, three excavators, 11 Ski-Doos and four ATVs.

There are no fixed or rotary aircraft maintained permanently at the station, but approximately 25 landings and take-offs occur at Troll runway during the summer season for transport of personnel and limited cargo and equipment.

FUEL STORAGE AND USE

Fuel is delivered by cargo vessel to the ice edge and transported 260 km to the station by traverse. The station uses diesel for generators and vehicles, Jet A-1 for aviation, petrol for Ski-Doos and small generators, and propane for cooking. With the delivery of this season's resupply, which was underway, the station manager reported the following quantities: diesel (500 m^3), Jet A-1 (210 kiloliters), petrol (6000 liters) and propane (1500 kg).

Diesel is stored in double walled fiberglass tanks placed in steel containers. Jet A-1 and petrol are stored in 200 liter drums placed on plastic liners. Spill kits are available for potential fuel leaks or spills.

The station maintains a number of fuel depots along the traverse route during the cargo ship offload period in order to fuel the traverse vehicles.

POWER GENERATION AND MANAGEMENT

The station operates two 240 kW generators for routine station use. In an alternate location, there are three back-up 64 kW generators. For emergency use, the station has two 48 kW back-up generators located in separate emergency power station. Annual fuel consumption is estimated at 250,000 liters. Troll is considering installing solar power in the future as an alternative energy source.

WATER SYSTEMS

Troll uses waste heat to melt snow into water, which is filtered and treated with UV radiation prior to being stored in a 3600 liter tank. Consumption averages 80-100 l per person per day.

MANAGEMENT OF DANGEROUS ELEMENTS

Small amounts of chemicals used in the workshop, in the power station, and in the sewage treatment plant are stored in the locations where they are used.

The inspection team was told that there were no firearms, ammunition or explosives located at the station.

EMERGENCY RESPONSE CAPABILITY

The station has emergency response teams, manuals and exercises. SAR training is received pre-deployment and onsite. The station conducts one SAR exercise annually.

Incoming personnel are briefed on the station's fire emergency plan and evacuation route. No fire fighting training is provided as many personnel have prior volunteer fire fighting experience in Norway. Fire drills are conducted once during the summer and once during the winter. Fire extinguishers, alarms, and smoke detectors are present throughout the station.

The station leader reported some minor fuel spills in the past. Personnel cleaned up these spills in accordance with the station's spill response plan, the Environmental Protocol, and relevant COMNAP procedures. The station has the full range of fuel spill response equipment.

There have been no major incidents at the station to date.

ENVIRONMENTAL PROTOCOL

ENVIRONMENTAL IMPACT ASSESSMENT

The station was fully aware of the need to conduct EIAs in advance of undertaking activities or construction. The station leader said he would check with authorities in Oslo and Tromsø in the event any new activities or construction were planned at the station. The team was provided with a list of EIAs related to Troll that had been done by the Norwegian Government. The team was informed of various types of environmental monitoring that were being undertaken, and that a comprehensive monitoring program was under development.

CONSERVATION OF FLORA AND FAUNA

Several snow petrel breeding colonies are found near the station as well as in areas 6 to 10 km from the station. Other birds observed in the area are Antarctic petrels and skuas. Terrestrial vegetation consists of several species each of lichens and algae. Station personnel receive training on minimizing impact on the flora and fauna. Guidelines for helicopter and aircraft operation around wildlife are utilized.

Environmental training to minimize impact to fauna and flora is given during the overwinter field course held in Norway prior to deployment. All summer personnel are provided training upon arrival at the station.

WASTE MANAGEMENT

A sewage treatment plant is installed on station, including filtration, biodegradation and UV treatment. The dried sludge is stored for removal from Antarctica. The filtrate is analyzed to ensure high quality for release into the environment. The release is onto a rocky area behind the station where it freezes. During the summer, the frozen effluent is subject to evaporation. The Inspection Team wondered whether the evaporation rate matched the output. If not, the frozen effluent discharge area (50m x 100m at present) might be expected to grow in size over time. Some of the effluent is recycled for use in the toilets.

Waste is separated into various categories, such as metals, glass, mixed solid waste, waste fuel/lubricants, batteries, etc.), and is stored in appropriate containers (15 marine containers at waste management site) or baled prior to being place in containers (15-20 tons each) for transport out of Antarctica.

Food waste is ground and dewatered, which results in a volume reduction of about 90%. The dried waste product is shipped out of Antarctica for disposal.

Approximately 2 m3 of waste (including sewage) is produced per day, with the total volume being influenced by the number of people on station and the season's activities.

AREA MANAGEMENT

ASPA No. 142 Svarhamaren is located approximately 100 km east of Troll. This nunatak is the site of a 250,000 breeding pair colony of Antarctic petrels, with total colony size including non-breeders estimated as 750,000 birds during breeding season. In addition, 500-100 pairs of snow petrels and 80 pairs of south polar skuas breed in the area. During the 2012-2013 season, five people were issued permits to enter the ASPA for scientific research.

ARMS AND MILITARY SUPPORT

The inspection team was told that there was no military support, and no military equipment is held at the station.

Appendix:

List of Acronyms

ASMA Antarctic Specially Managed Area

ASPA Antarctic Specially Protected Area

ATCM Antarctic Treaty Consultative Meeting

CEE Comprehensive Environmental Evaluation

DROMLAN Dronning Maud Land Air Network

DROMSHIP Dronning Maud Land Shipments

EIA Environmental Impact Assessment

IEE Initial Environmental Evaluation

IPF International Polar Foundation

JARE Japanese Antarctic Research Expedition

KSAT Kongsberg Satellite Services

NCAOR National Centre for Antarctic and Ocean Research (India)

NIPR National Institute of Polar Research (Japan)

NPI Norwegian Polar Institute