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Renovation of the King Sejong Korean Antarctic Station on King George Island, South Shetland Islands

Renovation of the King Sejong Korean Antarctic Research Station on King George Island, South Shetland Islands

Information Paper submitted by the Republic of Korea

Summary

The King Sejong Station, constructed in 1988, has been operated by the Republic of Korea in Barton Peninsula, King George Island off the South Shetland Islands. Since its inauguration, the King Sejong Station has saw expansion of its storage building and renovation of the main building before acquiring its present form. Most of the research and summer accommodation facilities, however, having been used for almost 30 years, are in need of repair and reconstruction. Renovations will not only address safety concerns from the outworn facilities, will further elevate quality of research support.

Summer accommodations and laboratories will be reconstructed in place of removed buildings. Some buildings are scheduled to go through repair and structural alterations to enhance the building's safety, durability and usability. In order to operate the station in more environment friendly manner, a solar power system to generate approximately 60kW of electricity will be introduced and replace the existing fuel tanks with double skinned ones.

This renovation work has been planned and proposed to enhance the research support capacity for both the Korean research community and international collaboration and to achieve safer and environmentally sounder operation of the infrastructure. The Initial Environmental Evaluation (IEE) document for the proposed activities will be submitted to the Ministry of Foreign Affairs for approval this year.

Introduction

The King Sejong Station was constructed on Barton Peninsula, King George Island off the South Shetland Islands on Antarctica in 1988, and it has served to support a variety of research fields, such as oceanography, geophysics, geology, terrestrial and marine ecosystems studies. In particular, research focusing on regional characteristics that clearly manifest the impacts of climate change was actively pursued by Korean as well as international researchers, for example ecosystem responses to climate changes.

Since its construction in 1988, certain facilities and buildings at the King Sejong Station had underwent renovations at different points in time. Before acquiring its present form, renovations included extension of the warehouse and equipment storage facilities in 1991, and rebuilding of the main building and power plant in 2008. As most of the research and summer accommodation facilities, however, have been used for almost 30 years, they are in need of repair and reconstruction with some dismantlement work. Renovations will improve both the standard of safety as well as capacity for research support.

Outline of the proposed activities

The time plan for the proposed activities

The proposed activities will proceed for two Antarctic summers, 2016/2017 and 2017/2018. During the first season, most of the planned works such as removal of the old facilities, reconstruction of new building and replacement of fuel tanks will be undertaken. Repair and improvement will mostly progress during 2017/18 season, and the King Sejong Station is expected to resume normal operation from early 2018.

The location for the proposed activities

The proposed activities include reconstructing a building that integrates the existing functions in the same location after dismantling part of the old buildings within the King Sejong Station premises in Barton Peninsula, King George Island, South Shetland Islands (62°13′ 23.07975″S, 58°47′20.93997″ W).

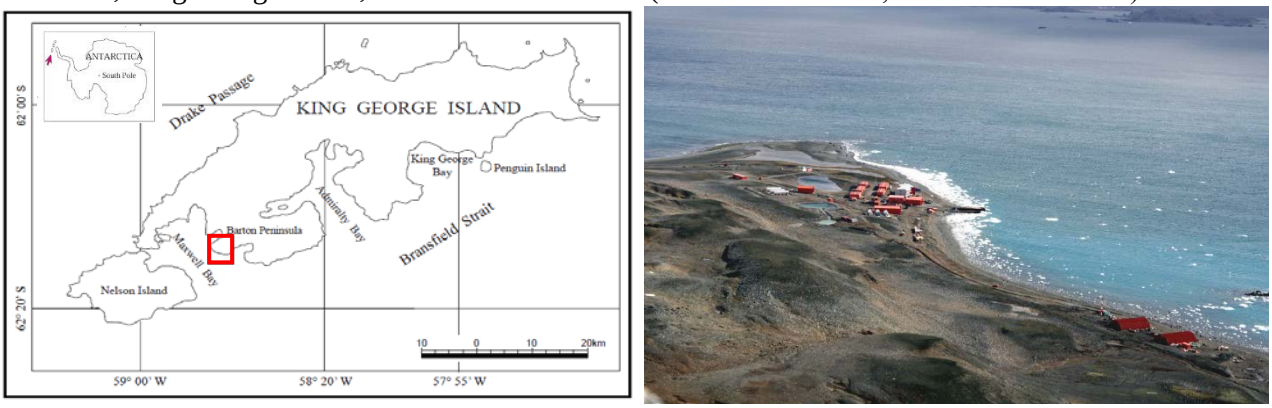

Figure 1. Map showing the location (left) and an aerial view (right) of the King Sejong Station.

Dismantlement of the old facilities

In order for the Station to continue in providing adequate support for national and international Antarctic scientific research, rebuilding of research and summer accommodation facilities are needed. In turn, safety concerns, as well as low efficiency and increasing maintenance costs with the outworn facilities will be resolved. The gross area that should be demolished of the existing buildings at the Station is about 769 m^2. The buildings are basically constructed with 20ft ISO containers.

Figure 2. Current laboratory for geology and geophysics research (left) and its deteriorating foundation.

Reconstruction of laboratories and summer accommodation facilities

The gross floor area of the new building(s) that will replace the old research and summer accommodation facilities is about 1,636 m^2. To enhance the functionality and the efficiency in maintenance and operation, the abovementioned facilities will be integrated into a single building of two stories. The minimum life expectancy is 25 years.

Figure 3. Aerial photo of the current King Sejong Station buildings (left) and a perceived image after the renovation (right).

Repair and improvement

The gross area of buildings that are expected to undergo repair and improvement, in the form of structural alterations to enhance the building's safety, durability and usability, is 1,244 m^2. In this case, the minimum life expectancy is 15 years.

Solar energy panel installation

In order to reduce the environmental impacts and the usage of fossil fuel from operating power generators, solar panels will be installed on the roof of the new summer accommodation and research facility building. The capacity of the power generation will be approximately 60kW of electricity, which should reduce approximately 11,500 liters of annual fuel consumption.

Fuel tank replacement

Fuel tanks will be replaced with double-skinned tanks in the existing bund wall. To prevent and treat any unforeseen, incidental spills during the replacement, appropriate equipment and supplies will be prepared in the station in accordance with the contingency plan.

Possible alternatives and consequences

Alternative of conducting no activity

King Sejong station has been a basecamp for more than 100 summer science personnel per season and international groups of cooperating scientists, often from nations with no access to own platforms. While this role is growing, the facilities are aging, yet expected to service more people and projects. Without the proposed renovation at the King Sejong Station, the capacity to support high quality science and international collaborative research in the surrounding area is diminishing and will be compromised, and the safety concerns of users will become greater with time.

Alternatives to change the summer accommodation building design

We considered three types of building layout. The most efficient layout was drawn up for each floor by integrating a range of functions into a two-story structure design to minimize energy consumption.

Alternatives to install the solar panels on ground than roof of the summer accommodation building

In order to minimize ground disturbance and increase the capacity of the installation, it has been decided to install the solar power system on the roof of summer accommodation building.

Natural environment around the King Sejong Station area

About half of the Barton Peninsula where the King Sejong Station is located is still covered with polar icecaps or perpetual snow, but a variety of living organisms inhabit the exposed ground, including bryophyte,

lichens, marine birds and invertebrates. However, no distinct biological communities are detected within the area of the station premises. The geographical feature of the King Sejong Station's surrounding environment is made up of mostly moraine. The roundness is very poor but consists of good pebbles along the coastline. Strong winds blow frequently, with northwesterly and easterly winds during the summer time and the easterly and northerly winds during the winter time. About 2 km off to the southeast of the station is the Antarctic Specially Protected Area No.171 called Narębski Point, which was designated to protect Gentoo Penguin and Chinstrap Penguin colonies with associated biodiversity and environmental values and to facilitate scientific research in 2009.

Possible environmental impacts and mitigation measures

The environmental impact assessment for the proposed activity has been undertaken based on the research conducted in the King Sejong Station for the past 27 years, including observational data and operating materials. We estimated the environmental impacts of major factors, including air pollutants, fuel and oil spill, wastes, sewage and noise, etc., due to the construction. To reduce the possible impact we have set up the necessary mitigation measures.

Wastes

The proposed construction activities are expected to generate mostly non-hazardous solid waste such as packaging materials, metal, plastic and wood. Some hazardous waste, including batteries, solvents and waste oil will be produced but collected and removed. The total amount of solid wastes from the activities was estimated to be 300 ton (twenty 20ft ISO containers) and waste oil from construction equipment was calculated to be 170 liters.

Waste generated from the station as well as from the proposed works will be disposed and stored according to the Korean Antarctic Station Waste Management Manual (KOPRI, revised 2015) and removed from Antarctica.

Impacts on flora, fauna, and ecosystem

In order to reduce the discharge of air pollutants, we plan to reduce the idling of the construction vehicle engines to the very minimum during the construction, and to establish a work protocol where construction equipment are not used simultaneously, while also establishing and using a route for moving equipment so as to minimize fuel consumption.

The waste water that is produced from temporary facilities during the construction will be processed through the Membrane Bio-Reactor (MBR), so that the waste water is treated and discharged to meet the water quality standards of sewage treatment (less than BOD 5mg L^{-1}, less than COD 20mg L^{-1}, and less than SS 10mg L^{-1}). In the case of noise, we plan to disperse the equipment during the construction so that it does not have significant impact on a relatively small number of skuas living near the station. Taking into consideration of the fact there are no major habitats of biota right next to the King Sejong Station, it is believed that the proposed activities will not have major impacts on the surrounding ecosystem.

Cumulative impact

Exhausted gas from fuel consumption to operate new building will be cumulative impacts on the Antarctic environment. In order to reduce the fuel consumption as much as possible during operation, we plan to take a series of measures; to minimize the envelope area and to use vacuum insulation panel on the building's wall, roof, floor and window, as well as to install highly efficient heating and ventilation equipment and a solar power system for the building.

Monitoring

An environmental monitoring plan in accordance with the guidelines of COMNAP and SCAR is being prepared. The potential environmental impacts of the proposed renovation work will be monitored throughout the renovation period. Following the culmination of renovation works, Korea Polar Research

Institute will continue on-going monitoring of any environmental impacts from the operations as an element of the project on 'Implementing Comprehensive Environmental Monitoring and Establishing Long-term Environmental Database at the Korean research stations in Antarctica'. We will continue our efforts to minimize the environmental impacts from the operations of our stations and to improve our operations to that effect.

Conclusion

This renovation work has been planned and proposed to enhance research support capacity for both the Korean research community and international collaborators, as well as to achieve safer and environmentally sounder operation of the infrastructure. The results of impact assessment for each category will be 'minor or transitory' impacts on the Antarctic environment. It is expected that the impacts will be further reduced by complying with the mitigation measures indicated on the environmental impact assessment document. Scientific benefits and environmental reward over long term will outweigh the direct and indirect impacts on the Antarctic environment by replacing and upgrading the old facilities.

Procedure for the environmental impact assessment

A draft plan of the renovation of the King Sejong Station was introduced to and considered by the relevant committee in the Ministry of Environment last December to assess the significance of the impact described in Article 1 of Annex I of the Madrid Protocol. The Ministry endorsed the activity to be preceded by an Initial Environmental Evaluation (IEE) as impacts are predicted to be minor or transitory. An IEE document will be submitted to the Ministry of Foreign Affairs for approval of the proposed renovation.