14 Environmental Background & Baseline Studies

Introduction to Situation

The project is based on the acquisition and reopening of an existing permitted mine so that baseline conditions can be taken to be a combination of the true pre-mining baseline studies undertaken from the mid 1990s until the present day and the present existing position whereby nearly 5 years of mining operations have already taken place.

Baseline Conditions

Prior to the opening of the original mine operation in 2004, a number of environmental baseline studies were carried out. The first study was on the Arctic char population in the Kirkespir River in 1988 (Boje 1989). During the exploration phase, freshwater samples from the Kirkespir River were analysed for metals and general parameters (Lakefield 1998a, b, 1999a-d). Comprehensive baseline studies were performed during 1998-2001 and collected fish, mussels, seaweed, snow crab, sea urchin, benthic macrofauna and sediments and analysed these for different metals (Glahder et al. 2005 - Appendix 14.1). The above and other studies (Appendices 14.2 and 14.3) were included in the Environmental Impact Assessment prepared for Crew by SRK Consulting (2002).

Since then, during the operations of Crew between 2004 and February 2009, a number of studies Appendices (14.4, 14.5, 14.6 14.7 and 14.8) have been carried out including the yearly NERI environmental reports, held at Appendices so that there is a good deal of baseline data ranging from the original virgin area to what is now a brownfield site.

Dust

Prior to the start up of operations, the remoteness of the site, its physical identity and the almost total lack of roads or any activity in the wider area would have meant that the area would be almost totally dust free. Mining activity, in particular the dumping of waste rock in permanent above ground tips and the travelling of mobile plant, vehicles and lorries across often bare ground, waste rock hardstandings and site roads and over the permanent

gravel access road would and did give rise to the production of fugitive dust. The strong gusty winds would also have given rise to dust blow off undressed rock slopes. The NERI Environmental Monitoring Reports for the operation for 2006, 2007 and 2008 noted that the environmental effects from the mine impacted primarily on the Kirkespir Valley and chiefly originated from dust dispersal. Elevated concentrations of copper, chromium, arsenic and cobalt above natural background levels were identified in lichens at the waste rock dump and in the camp area. All the metal concentrations showed a significant decrease with increasing distance from the road with elevated concentrations found to a distance of about 1000 m from the road. These metal elements naturally occur in very low levels in the waste rock.

Noise

Apart form the existing mine operation, there are no man-made sources of noise at Nalunaq, and no noise sensitive receptors, such as schools or hospitals, in the immediate vicinity.

Pre-mining background noise levels, measured as LAeq90 were not measured but were held to be likely to be of the order 30-35 dB(A), or less, based on noise levels measured at other remote sites. With little no activity on site at present, the area is extremely quiet with low ambient levels simlar to those indicated above.

Blasting vibration

With no activity on site, ground vibration levels are practically non-existent, although research elsewhere in Greenland reported in March 2006 by scientists from Harvard University and the Lamont-Doherty Earth Observatory at Columbia University suggested that accelerating ice flow from the main ice-cap has been accompanied by a dramatic increase in seismic activity. The report asserted that this movement of the glaciers may now generate local swarms of earthquakes up to magnitude 5.0.

Light Pollution

The area is very remote from all habitation or other activity and experiences naturally high levels of normal darkness. The present low level of activity on

the site at the present time is likely to give rise to very low levels of light pollution.

Ecology

Terrestrial Flora

The plant communities in the Kirkespir Valley are typical of those found throughout the Nanortalik region and southern Greenland. None are considered exceptional or worthy of designation and there are no statutorily protected habitats, communities or species recognised by the Ministry of Environment in the area. Nevertheless, each community is a fragile ecosystem, which is slow to develop in the prevailing climatic and soil conditions and hence vulnerable to physical damage.

The principal communities consist of the following:

- a lichen/moss community that is most prevalent on rock outcrops, particularly in the Upper Valley;
- a dwarf-shrub heath community, often with associated mosses and lichen, in the Lower Valley;
- a shrub willow community, especially in the river delta close to the shoreline;
- fen and marsh wetland associated with the lower reaches of the river; and
- areas of grass close to the shore on sandy ground.

In addition there is a small community of the Small White Orchid, which is the commonest Greenland orchid, in the Upper Valley.

The lichen *Cetraria nivalis* frequently grows directly on decaying organic material, either dead lichen thallus or moss carpets. As a result, there are limited opportunities for the lichen to absorb nutrients from the underlying rock or soil and a significant source of nourishment is from whatever falls upon it from the atmosphere, such as dust, snow or rain. This forms the basis of its use as an important bio-indicator.

Terrestrial Fauna

The range of animals and the numbers of individuals found in the Kirkespir Valley are limited by the types of plant communities and the low productivity of the habitats present. There are no species that are rare or threatened in the area and all are relatively common throughout southern Greenland. The Greenland government has not designated any nature conservation areas that require special protection and there are no migratory species that are particular to the area, or protected breeding birds. The shore line of the fjord support the greatest variety with shore birds such as wintering Brünnich's guillemots, common eiders and long-tailed ducks. Within the valley the arctic fox, alpine hare, white-tailed eagle, gyrfalcon, snow bunting, Lapland longspur, redpoll, ptarmigan, a few wader species, and raven are present. Insects, such as butterflies, e.g. clouded yellow, arctic fritillary, arctic bumblebees, blackflies, mosquitoes, and other flies are found during the warmer months.

Aquatic Flora

The principal fish present in the Upper Valley of the Kirkespir River are small sticklebacks and the benthic macroinvertebrates present will be restricted to groups such as the Stoneflies and Mayflies.
In the Lower Valley, below the waterfall, the predominant fish species is the Arctic char which species is widely distributed in southern Greenland and the Arctic in general, and breeds in most large rivers and lakes. In the Kirkespir, the species is present in both anadromous (migratory and sea-going) and nonanadromous (freshwater resident) forms. The migratory form enters the fjord in May-June and returns to spawn in September. It is larger than the resident type because food is more plentiful in the sea. Most fjords in the Nanortalik district are fished with pound nets at the mouths of the Char rivers. The population structure of Char in the Kirkespir River is not known, although it was electro-fished at the end of the 1980s, when the population was described as normal.

The 2008 NERI Monitoring report found that the impact from the mining activities on the aquatic environment was low.

Marine Fauna and Flora

DMU/NERI scientists undertook extensive surveys of the marine biota in the Saqqaa Fjord in 1998, 2000 and 2001. These investigations related to the benthic macrofauna in the deeper zones (>200m) of the fjord, the free living fish and bottom dwelling organisms in the shallower (20-200m) parts of the fjord, and the species within the littoral and shore zones.

Sampling revealed the following:

- A total of 1563 benthic animals were identified from the 75 samples and separated into 70 taxa. The faunal composition (in terms of major taxonomic groups) was typical of high latitude boreal fjord basins and all collected species have been recorded from the high boreal/low arctic areas around Greenland;
- Polychaete worms accounted for some 80 % of all the individual animals, but the major contributors to biomass was equally divided between three animal groups: Polychaeta, Mollusca and Echinodermata. In general, the fauna were characterised by deposit feeders, polychaete worms and protobranch bivalves;
- Conspicuous species with relatively large individual size were the bivalves *Yoldia hyperborea* and *Megayoldia thraciaeformis* and the sea star *Ctenodiscus crispatus* ;
- Saqqaa Fjord was poor in bottom fish, but rich in crabs including several species of sand crabs and many large snow crabs.
- Fish surveys revealed the following main species: Shorthorn Sculpin, Atlantic Cod, Greenland Cod, Eel Pout, Skate, Spotted Wolfish, Greenland Halibut and deep sea Prawn;
- The principal species of the littoral zone that have been investigated at Nalunaq are the Blue Mussel and the brown seaweed Bladder Wrack.

The 2008 NERI Monitoring report (Appendix 14.8) found that the impact on the marine environment from the mining activities was very low.

Designated Wildlife Areas

There are no BMP designated wildlife areas, RAMSAR sites, National Parks, Areas of International Importance or areas with any other special ecological or landscape designation within the area of the project including areas of special importance to wildlife or areas with valuable, sensitive or representative biotopes.

Landscape, Physical and Visual Intrusion

Prior to start up of the mining operation the project area was a virtually untouched arctic wilderness with little habitation or activity of any sort apart from some subsistence sheep grazing. The majority of the licensed area remains in a similar untouched and undisturbed condition, apart from the site of the mine and camp itself, the line of the gravel road to the harbour and the harbour facility. The mine and camp area at Nalunaq can now be thought of as a brownfield site where the industrial operations which were its reason for existence will soon be resumed. The buildings and facilities provided by the previous owner and operator are still in place but requiring refurbishment or replacement.

Whilst the mine and camp represent a degraded landscape, the areal scale of the degradation, when compared with the overwhelming physical scale of the surrounding pristine landscape, is insignificant. Thus the visual intrusion of the existing mine landscape is minimal. Also because of the remoteness of the area from habitation the there are no receptors for the visual impact.

Pollution

Prior to the mining operation the area was pristine and unpolluted. As previously noted elevated levels of some metals have been noted due to dust blow. More serious is the pollution caused by oil spillage at the 350m level generator station. No other significant pollution caused by the previous mining operations is notable.

Fresh Water Quality

Water sampling carried out prior to the start of mining in 2004 concluded that the water quality was generally very good, with near neutral pH conditions, odourless and without sediment or visible suspended solids.

Mining operations do not appear to have significantly impacted on water quality. A&R have identified and recognised that the lagoons situated prior to discharge into the Kirkespir River are totally unsuited for purpose and intend to completely refurbish them as a very early priority.

Air Quality

Pre mining surveys suggested that the concentrations of pollutant gases at the Nalunaq site were extremely low, and could be considered to be negligible. The most important sources of atmospheric pollutants are Europe and North America, through the long-range transport of gases in the upper atmosphere and their subsequent deposition with precipitation. No data are available for deposition rates at Nalunaq but river water quality and the abundance of mosses and lichens suggest acid rain deposition is not an issue.

Land-use, Agriculture and Soils

The land capability of the Kirkespir Valley is negligible, and there are no productive land uses, other than the Nalunaq mine operation. The area is undeveloped and has not been otherwise exploited in the past. In the upper valley soil development is non-existent and the climatic conditions, severe slopes and inhospitable aspects limit plant growth severely. The instability of the valley slopes and the river flows also limit the extent to which the area could be developed. In the lower valley conditions are not very much better. Climatic conditions are equally exacting, although more amenable closer to the fjord. It is here that potential productivity is highest, and the only part of the valley where soil forming materials are present in any quantity. The natural vegetation cover consists of grasses and shrubs, together with mosses

and lichens over the rockier areas. Sheep rearing is the only potentially viable commercial land use, although the area that could be used for grazing is limited and would only support a small flock of sheep. In 1997 there were eight sheep farms in the Nanortalik municipality, five on the western coastline of the Aluitsoq Fjord and three between the settlement of Tasiusaq and Lake Tasersuaq, although the owners of 4 of these supplemented their income by fishing and hunting (Glahder 2001). Four other sheep farms were closed in the period 1990-1997. The mine access road could possibly be utilised to open up the area to further subsistence sheep farming. It is A&R's intention to locally source as much of the camp food supply as possible with an emphasis on local mutton, lamb, fish and vegetables and may promote local food cooperatives to help this aim.

Materials Reception and Storage

With little activity at the mine site virtually no materials, apart from necessary food supplies, are being landed at present at the harbour. There is a stockpile of about 4000 – 5000 tonnes of ore on the pad at the harbour which will be returned to the mine for treatment in due course. A quantity of bagged ammonium nitrate prills are held in secure store at the harbour. Substantial quantities of mechanical, electrical, plant and mining spare parts and consumables are held in the warehousing facilities at the mine camp. Working quantities of welfare supplies and food are also held at the camp. Quantities of diesel fuel are held in the approved storage tanks at both the harbour and the mine.

Waste from Mine Camp

With minimal activity taking place at the mine at the moment, in practical terms, there are virtually no extant liquid or solid waste discharges from the mine camp at the present time.

Transport Issues

Transport to the site is possible by helicopter to the mine helipad or by road from the harbour which is itself only accessible by ship/boat. No heavy bunker fuel or aviation stores are held at the harbour or on site respectively at present. Quantities of diesel fuel are held in the storage tanks at both the harbour and the mine. Transport movements to and from the site are limited

to visits from the Angus & Ross project teams and advisors and the site's care and maintenance personnel, together with the occasional visits of the advisory and monitoring teams from NERI, Greenland Home Rule and BMP. Very occasional and irregular visits are made to the area by tourist ships. There is a substantial amount of local traffic by small boats involved in the fishing industry who operate in the local inshore marine waters.

It is concluded that transport issues have no measurable effects on the area at the present time in normal circumstances.

Marine Environment at Harbour

Observations have showed that water currents within the fjord are primarily tidal, and are clearly stratified into two currents, one flowing whilst the other ebbs. Sometimes a third, wind-induced current is present at the surface. As a result, the fjord is well flushed, and at prior to the start of mining showed no significant levels of pollution.

Cultural Heritage & Archaeology

The Director of the Qaqortup Katersugaasivia (Qaqortoq Museum), assisted by a graduate student, surveyed the Kirkespir Valley area during July 1988, under the auspices of the Kalaallit Nunaata Katersugaasivia, the Greenlandic National Museum (Berglund & Elling, November 1988). A walk-over survey that covered the exploration concession area was undertaken, which concentrated on the flatter areas. The boundaries of the search area were the lower slopes of the mountains or terrain within which settlements were not considered likely to occur. A number of earlier investigations have been carried out in the valley. The ruin complexes in Kirkespirdalen (the conservation numbers 60V2-II-566 and 567) were found and first described by Erik Holtved in 1932, who made a sketchy registration of the area north of the main stream. When Ove Bak, a teacher, visited the area in 1968, he discovered a new ruin group, south of the stream. Finally, in 1981, Knud Krogh visited the area because of a proposal and plan to extend the local sheep farmers' grazing areas.

The Nanortalik Kommune is recognised for the Norse settlements, but there is also evidence that Inuit have used the area intensively for the last several

thousands of years. There are registered traces of Thule people everywhere. The Norse settlement pattern in this part of 'Østerbygden' is different from elsewhere in Greenland because the exposed coastal areas have been utilised, not just the more sheltered valleys of the inner fjords, which are usually preferred.

A total of 24 ruins were identified and described. All the ruins are located on the flat plain within about 0.6 km of the shore of the fjord, and are found in a southern (3-22) and a northern (1-17) grouping. The ruins are of Norse origin and there was no evidence of Inuit or Greenlandic remains. A smaller group of Inuit ruins were located on the North side of the bay, some 500 m from the delta (high tide level). Since these were outside the concession area they have not been considered further.

The value of the ruins as a tourist attraction is very limited since they are all very decayed and difficult to discern or identify by the casual observer. Nevertheless, this does not mean that the groups of ruins are not of value. They represent a complex of residential and commercial sites with all the 'functions' characteristic of a self-sufficient Norse settlement. Whilst it is not possible to date the settlement without further investigations, it is likely the area was active in the period 1000-1500 AD.

No further investigation of the ruins has been carried out since then and it is believed that no disturbance of the ruins has occurred due to the Nalunaq Operations. Because the landscape in the vicinity of the mine has been degraded by its previous long history of industrial and minerals usage it is considered that there are no Cultural Heritage and Archaeological issues associated with the project area. The industrial history of the mine and its associated operations and infrastructure has been recorded and preserved by a fairly extensive photographic and documentary archive. The site does not contain any areas of spiritual, cultural, or other socio-economic value including areas of special importance for traditional resource use.

Public Rights of Access

There are no restrictions on local public access to the area at the present time except those imposed on the immediate mine and camp area by security and

health and safety requirements. This situation also applies to the harbour area.

Tourism

Occasional and irregular visits are made to the area by tourist cruise ships. The industrial nature of the site together with the stark and contrasting beauty of the surrounding wilderness can be of interest to tourist groups and with the easy access provided by the mine road occasional landings have been made at the harbour with trips taken up the Kirkespir valley. Some hiking trips are also undertaken. The tourist industry is, however, severely limited by the extreme weather especially in the winter and the remoteness of the area.

Existing Resources

The existing resources in and adjacent to the project area are exploited by the local people by fishing in the fjord and by limited sheep grazing on the land area Some traditional hunting of various wild fauna will also takes place. No other resources are presently exploited.

Greenhouse Gases

With the mine on a care and maintenance basis at present, the only greenhouse gases emitted from the area at the moment are associated with the occasional harbour shipping and helicopter operations taking place, together with the minor vehicle movements taking place at the mine camp. Some greenhouse gases were of course produced by the mine during its operational phase.

Consequent Additional Development Potential

At the present time there is no additional development potential in the area apart from the Angus & Ross proposals for the re-opening of the Nalunaq Gold Mine set out in the present documentation.

Cumulative Impacts

There are no cumulative impacts or cumulative impact potential relevant at the present time.

Local Social Baseline Considerations

A separate SIA will be submitted in October 2009 as part of this application which will include a Benefit and Impact Plan (BaIP) and Impact Benefit Agreement (IBA) prepared after consultation with the local community.

15 Aspects, Impacts & Mitigation

Dust Emissions to Air

Emissions to air in the form of dust and gases will be generated by a number of the activities chiefly at the Mine but also at the Camp.

Underground Sources of Dust and Other Emissions:

Dust will be produced from a number of sources within the underground mine. Dust will be produced from the primary mining operations including the blasting, loading and transportation operations. The blast-hole drilling utilises water ingress into the mine from the host rock and the dust from these mining operations will be partially controlled by the damp conditions in the mine itself. All minerals processing operations will take place within the confines of the underground mine. Dust from the process operations will be intercepted by the dust collection system. The ventilation system before exhaust to the external atmosphere will incorporate dust collection methods utilising a combination of cyclones, electrostatic collection and filters. These measures will ensure that an absolute minimum of dust generated in the underground mine will be liberated to the external environment. The internal underground environment itself will be extensively monitored to ensure that dust production does not cause a hazard to those working in the mine.

Gas emissions in the mine will be produced by:

- Diesel powered vehicles
- Blasting operations
- Gold doré production
- Maintenance operations including welding, hot cutting and brazing etc.
- "Used air"

The gases produced will include carbon dioxide, carbon monoxide, nitrous blasting fumes, and welding and hot work fumes etc. The bullion furnace will include a vent stack to extract any moisture or fumes from the smelting process out of the gold room. The emissions from this process are typical of this operation and are not harmful to personal in close vicinity. All produced

gases will be exhausted to the external atmosphere through the mine ventilation system which also of course replenishes the mine's fresh air supply.

Mitigation
The mine's working atmosphere will be the subject of continuous monitoring by the mine ventilation officers. The mine rock itself is not gassy and will not give rise to toxic, poisonous or inflammable gases. It is suggested that the emissions content of the external ventilation exhaust is monitored.

Residual Impact
Overall it is not anticipated that significant adverse effects are going to accrue from either dust or gas emissions from the mine into the external atmosphere due to the dust suppression measures utilised as part of the underground operation.

Surface Sources of Dust and Other Emissions

Dust

NERI have noted that the main effects caused by the operations of the mine in the past on the external environment have been due to dust, mainly emanating from the external waste rock tipping which was practised. With no process ore stocking or waste dumping taking place outside the mine the main cause of fugitive dust will be from vehicle use. Fugitive dust may also be produced by wind scour giving rise to dust blow in windy conditions from the camp roads, hardstandings and from the previously tipped waste rock.

Mitigation
It is anticipated that the wet climate will itself regulate the production of fugitive dust. Good housekeeping including a strictly observed site speed limit will help prevent fugitive dust production form the roads.

Residual Impact
It may be expected that small quantities of fugitive dust will be created by wind effects in dry and windy weather. It is not anticipated that these residual impacts will be significant.

Materials, Consumables and Stores Handling

All materials, consumables and stores and indeed all other items necessary for the mine's operation will be delivered by ship to the harbour area. The main items to be delivered will include: ammonium nitrate prills, detonators and primers for explosive manufacture and timber and steel for mine support purposes, together with all welfare supplies including food, drink, hygienic and living supplies, office supplies, etc. Also to be delivered by ships are all the liquid fuel supplies of diesel and gasoline (if required) together with all oils, greases, and lubrication products.

Ammonium nitrate prills will also be supplied in bulk bags and stored in containers until required. It will then be trucked to the mine.

All other materials and consumables are likely to be palletted and shrink wrapped so their handling should not give rise to any dust production.

Mitigation

The packaging of the delivered materials will prevent and minimise spillage but excellent and regular housekeeping and clean-up of any spillage will be carried out to minimise the possible generation of fugitive dust.

Residual Impact

Clean up procedures and excellent housekeeping will minimise any potential residual impact.

Transport and Vehicles

Vehicle movements including pick-ups, forklifts and telehandlers are likely to raise dust from the roads and hardstands where they are utilised or travel. Vehicle emissions are also likely to give rise to small size particulates known as PM_{10} generated from diesel exhausts. The dust monitoring proposals will also monitor these particulate emissions which are thought to be injurious to health being postulated as one of the major causes of Asthma.

Mitigation
It will not be possible to use water dust suppression methods on these areas due to the climate. Regular clean up and sweeping of the roads to minimise dust cover will be carried out. A strict site speed limit of 15 km/h will be maintained which will be obeyed by all vehicles. This will not only aid site safety but will also minimise dust mobilisation from the trafficked surfaces.

Residual Impact
Excellent housekeeping will minimise any potential residual impact.

Helicopter movements

Helicopter operations may raise dust from any areas closely over-flown.

Mitigation
The helipad itself will be kept free from dust and flight paths of the aircraft will be designed to avoid closely overflying the mine area to minimise air disturbance.

Residual Impact
Observation of flight paths will minimise any potential residual impact.

General

A key part of the dust mitigation strategy will be the institution of a dust management plan which will not only set out the mitigation requirements but also highlight the necessities and commitment needed to institute excellent practice and house keeping. A prime part of the plan will include the training of the workforce in the hazards and consequences of not maintaining good environmental practices and the appointment of an EHS Manager to oversee and be responsible and answerable for the operation of the mitigation measures.

Gases and Vapours

Greenhouse gases and/or other vapours may be produced from the electricity generation plant which will utilise diesel generators, the ships visiting the

port, the helicopters visiting the heliport, the vehicles in use at Maarmorilik, the maintenance procedures and operations at the workshops, any gas powered heating and cooking equipment, vented gas from the sewage treatment units, emissions from any waste incineration operation, decay products from domestic refuse and other wastes, and vapours released from spillage of hydrocarbons and solvents.

Mitigation
All diesel powered plant and other equipment which may produce emissions will be maintained in good condition to minimise emissions. Good housekeeping practice will be put in place to minimise any spillage of hydrocarbons and solvents and an emergency plan instituted to deal with any such spillage efficiently and timeously.

Residual Impact
Clean up procedures, good maintenance and excellent housekeeping will minimise any potential residual impact.

Emissions to Water

Emissions to Water from the Underground Mine

Water will be used at the underground mine in mining operations in drilling the rock face, washing the rock down prior to scaling activities and also for rock facing mapping by the geologist. The water to be used emanates from the host rock. The other main use of water is in the minerals process facility. All water produced from the mine will be treated in underground settlement areas and in the surface settlement ponds before discharge to the river.

Mitigation
All water discharged will be fully treated to comply with environmental requirements before discharge. A regular programme of monitoring and sampling will be instituted and agreed with BMP to ensure compliance.

Residual Impact
It is not anticipated that any residual effects will accrue.

Water Emissions to the River from the Camp

All rain and runoff from the camp area will be treated in the surface settlement ponds before discharge to the river.

Mitigation
All water discharged will be fully treated to comply with environmental requirements before discharge. A regular programme of monitoring and sampling will be instituted and agreed with BMP to ensure compliance.

Residual Impact
It is not anticipated that any residual effects will accrue.

Water Emissions to Sea at the Harbour Facility

With few activities planned to take place at the harbour apart from the reception of supplies and consumable it is likely that the only source of water contamination will be from spillage.

Mitigation
Clean up procedures, good maintenance and excellent housekeeping will minimise any potential residual impact.

Residual Impact
Clean up procedures, good maintenance and excellent housekeeping will minimise any potential residual impact.

Spillages of Ore, Chemicals, Materials or Hydrocarbons etc.

All spillages of deleterious substances and materials can cause damage to water discharges and aquifers. All good practice and efforts will be utilised to minimise the risk of spillages.

Mitigation
All spillages will be immediately reported. Emergency procedures will be put in place to identify actions to be taken in the event of spillages and to take the necessary timeous remedial action.

Residual Impact
Clean up procedures, good maintenance and excellent housekeeping will minimise any potential residual impact.

Noise

Noise will be generated by many of the activities at the mine site.

Underground Sources of Noise

Operating mines are generally noisy places with many of the activities generating locally excessive noise which can be harmful to unprotected ears and Nalunaq will be no exception to this. Indeed, many of the activities will generate enough local noise to require the operators to wear effective ear protection as a working necessity and a health and safety imperative. Noise underground will therefore form a major health and safety feature of the operation. The noise will be produced from the actual mining operation and processing operations.

Mitigation
Noise generated in the underground operation will be rapidly attenuated by the underground environment itself and, in common generally with all other underground mines, it can be anticipated that practically none of this noise impact will be felt at the mine entrance and that it will not produce a significant impact to the external environment.

Residual Impact
It is not anticipated that any residual effects will accrue.

Surface Sources of Noise

Some of the surface operations will cause noise and will require operatives working at or in the vicinity to wear suitable ear protection as a working necessity and a health and safety imperative. However no extremely noisy operations such as crushing or processing will take place at the surface as all these operations are situated underground. Noise will be generated from the following operations:

- The diesel powered electricity generation system

Mitigation
The generators will operate on a 24 hour/day, 7 days/week, 365 days/year basis. They will be sited within a building which will be fully and efficiently acoustically insulated in order to baffle the noise produced within and effectively attenuate the perceived noise received outside the building.

Residual Impact
It is not anticipated that any residual effects will accrue.

- Vehicle movements including pick-ups, forklifts and telehandlers

Mitigation
A strict site speed limit of 15 km/h will be maintained which will be obeyed by all vehicles. This will not only aid site safety but also lower vehicle engine noise levels. All vehicles will be fitted with efficient silencing equipment.

Residual Impact
Clean up procedures, good maintenance and strict observation of the site speed limit will minimise any potential residual impact.

- Helicopter movements

Mitigation
Helicopter traffic will give rise to non-continuous, irregular and limited periods of noise production. Flight paths of the aircraft will be designed to avoid overflying local communities wherever possible. With no local receptors it is not anticipated that helicopter movements will give rise to significant adverse impact.

Residual Impact
It is not anticipated that any residual effects will accrue.

Blasting Vibration

The underground mining operation at Nalunaq will require the use of explosives to break the rock. The main explosive utilised will be site mixed ANFO which is a standard mixture of ammonium nitrate and fuel oil. The ammonium nitrate will be in the form of prills with diesel being the fuel oil. The constituents of the explosive will be transported separately to the mine mixed at the point of use. The mixture does not become an explosive until it is mixed. A suitable electric initiation system will be utilised together with the necessary delay detonators and high explosive primers. Shotholes will be appropriately stemmed.

Even the most well designed and executed of blasts generates a certain amount of energy in the form of ground vibration and airborne vibration. When an explosive detonates within a shothole, stress waves are generated causing very localised distortion and cracking. Outside of this immediate vicinity however permanent deformation does not occur. Instead the rapidly decaying stress waves cause the ground to exhibit elastic properties whereby the rock particles are returned to their original position following the passage of the stress waves. Such vibration is always generated by blasting and will radiate away from the blast site attenuating as the distance increases. From experience of the rock mass and geology the vibration can be predicted. Airborne vibration in the form of air overpressure is generated in the mine atmosphere. The most effective method of control of airborne vibration is by its minimisation at source by effective stemming of the shotholes and the utilisation of electric or Nonel type detonators, avoiding the use of blasting cord.

The main effects of blasting vibration at the Nalunaq will be felt underground in the mine itself. As there is no settlement or community near the mine there will be no adverse environmental effects experienced in the local vicinity. No ecological sites of interest are situated near the project so there will also be no adverse ecological effects experienced.

Mitigation

All blasting will be carried out to international standards and will be designed to provide the optimum required rock breakage whilst minimising explosive

use and hence minimising blasting vibration. Precautions will be taken in areas known to exhibit weaknesses, such as faulting, in the rock mass. Measures will be taken within the environment to ensure the safety of the personnel working within the mine during periods of blasting which will include the full or partial clearance of the mine during blasting operations and confining blasting to certain periods of the day. A full protocol and procedure will be set out to be followed in the event of misfires.

Residual Impact
It is not anticipated that any residual effects will accrue.

Light Pollution

The general area has no light sources apart from the mine so that there will be some general intrusion into the night skies from the lighting which will be required at the site. A high level of illumination by electric lighting will be utilised at the mine. The lighting will be used at full power during all hours of darkness between dusk and dawn. Flood-lighting will be both permanently fixed on buildings and mounted on pylons as well as mounted at lower levels to illuminate the mine site operations. Mobile lighting towers will also be utilised throughout the mine operations as required and as necessary. With no settlements or communities located in the near vicinity it is not anticipated that light pollution from the operation will cause any adverse impacts.

All lighting, both permanent and mobile, will be placed and directed so that minimum impact is experienced outwith the mine site area.

Residual Impact
In the very dark natural conditions the mine site will produce some light pollution but the overall impact in the remote setting will not be significant.

Ecology

There will be a number of activities at the mine which may have an environmental impact on the ecology established in the local vicinity of the project. Some of these activities can have an impact on the wider regional and global ecological picture. The ecology can be effected by emissions to

the air such as dust and particulates and the production of gases and materials such as exhaust gases or solvents etc. It can also be effected by emissions to sea or fresh water aquifers by waste waters, contaminated runoff, leachates and chemical, gasoline or materials spillage etc. Ecology can also be affected by the other environmental health issues of noise, blasting vibration, light pollution, and by changes in land use and increased human activity. These potential impacts are dealt with generally in other parts of chapter 15 of this report. The specific effects of these impacts on the local ecology are set out here together with a specific measure to mitigate their impacts on the ecology.

Dust from the operation has been found to have affected the local land flora particularly by analysis of the reference lichen *Cetraria nivalis*. This dust has originated chiefly from wind scour producing fugitive dust from roads and undressed area. The mine is designed to specifically target environmental requirements by the proposal and employment of effective impact mitigation measures.

Mitigation

The mitigation measures proposed for the various aspects of the operation are set out under the various topic headings of this section of the report. However in order to coordinate all the various monitoring activities of the mine operation and to ensure that all environmental measures are put in place and fully practiced with effectiveness and efficiency it is proposed that an EHS Manager will be employed. This manager with his staff will be responsible for monitoring environmental matters, ensuring that agreed mitigation measures are put in place and monitoring their efficiency and effectiveness, carrying out regular sampling and analysis of dust and water and reporting to the Mine Management on environmental matters.

Residual Impact

It is anticipated that with the environmental controls proposed and good management no residual impact will occur.

Landscape, Physical and Visual Intrusion

The present landscape in the immediate vicinity of the mine is degraded by the previous operations. The project does not require a major programme of surface building works and infrastructure construction so that no further adverse impacts or visual intrusion will be created.

There are no local settlements, communities or dwellings within sight of the development. Therefore, as there is a complete absence of local visual receptors, Zone of Visual Influence (ZVI) diagrams are considered unnecessary and have not been prepared. The surrounding, naturally imposing, landscape largely overshadows the site. The overall large scale landscape does not suffer noticeable degradation due to the mine development, which can be considered to be small scale compared with the natural surroundings. There are no areas with any special or specific landscape designation including sites of potential great sensitivity or unique geomorphological characteristics within the area of the project so that there will be no impacts on this type of site.

Mitigation
It is anticipated that the development will not cause noticeable visual impact due to its remoteness. The mine closure plan will contain proposals for the rehabilitation of the site on closure so that the final cleared site will have a minimal envelope of visual impact.

Residual Impact
It is not anticipated that any residual effects will accrue.

<u>Energy Production</u>

Greenland does not have a national electricity distribution grid and the Nalunaq Mine is not connected to any national electricity provision. The main source of power will be from the use of diesel generation equipment. Several large generation sets will be required to produce the amount of energy required to run all the mine's functions. These sets will give rise to several adverse environmental impacts.

- Noise: The generation equipment produces considerable noise during operation.

  Mitigation: The units will be located within a dedicated which will be provided with full noise insulation and baffling so that the level of noise outside the building will be minimised to non-obtrusive and safe levels. Personnel working within the building will be required to wear suitable ear protection measures at all times.

  Residual Impact: Residual impacts are expected to be minimal but noise levels will be monitored.

- Exhaust Gases: The diesel engines used to power the system will produce the usual exhaust products associated with internal combustion engines. Use of diesel powered electricity generators cannot be avoided.

  Mitigation: The diesel powered generators will be maintained in good condition to minimise emissions. Good housekeeping practice will be put in place to minimise any spillage of hydrocarbons and solvents and an emergency plan instituted to deal with any such spillage efficiently and timeously.

  Residual Impact: Clean up procedures, good maintenance and excellent housekeeping will minimise any potential residual impact.

Hydrogeology and Fresh Water

Water will be discharged from the mine, from the camp as run off and from the sewage treatment system.

Mitigation
All measures necessary will be taken to manage all water prior to discharge and treat it as necessary. This will be achieved by forming settlement holding lagoons before discharge points to remove sediments together with any other chemical treatment required. Regular sampling of discharged water will be

undertaken to ensure that compliance with discharge requirements is maintained.

Residual Impact
It is anticipated that with the environmental controls proposed and good management no residual impact will occur.

Land-use, Agriculture and Soils

The immediate site of the Nalunaq Mine is a degraded brownfield area. The project will renew the use of the site. The land surrounding the mine development is sparsely vegetated and contains few mineral soils. Agricultural usage and potential is limited. The project will have no impact on existing land-use or soils.

Mitigation
It is intended that after closure the Nalunaq site will not be left derelict but will be rehabilitated to a suitable, appropriate and agreed condition.

Residual Impact
No residual impact on the surrounding area is anticipated. The rehabilitation of the site following closure will return the area to its original land use.

Materials Reception and Storage

All materials, consumables and stores and indeed all other items necessary for the mine's operation will be delivered by ship to the harbour area. The main items to be delivered will include: ammonium nitrate prills, detonators and primers for explosive manufacture, calcium chloride powder to produce brine for the drilling operation, and timber and steel for mine support purposes, together with all welfare supplies including food, drink, hygienic and living supplies, office supplies, etc. Also to be delivered by ships are all the liquid fuel supplies of diesel and gasoline (if required) together with all oils, greases, and lubrication products.

Ammonium nitrate prills will also be supplied in bulk bags and stored in containers until required and then be trucked to the mine.

All other materials and consumables are likely to be palletted and shrink wrapped so their handling should not give rise to any dust production.

Mitigation
The packaging of the delivered materials will prevent and minimise spillage but excellent and regular housekeeping and clean-up of any spillage will be carried out to minimise the possible generation of fugitive dust.

Residual Impact
Clean up procedures and excellent housekeeping will minimise any potential residual impact.

- Fuel Delivery, Storage and Transportation

All liquid fuel chiefly diesel oil will be delivered to the harbour by sea by oil tanker. A storage facility of 600,000 litres is located at the harbour. Unloading of the fuel is achieved by means of connection to a floating hose system though which the fuel oil will be pumped from the ship to the tanks. The fuel is then transferred to road tankers and transported to the mine where a new facility for fuel storage of $20m^3$ capacity will be constructed.

Mitigation
Full operating procedures will be put in place for the operation of the tanker unloading arrangements together with emergency plans in case of oil leakage into the sea at the floating reception.

All fuel storage facilities will be surrounded by an impermeable bund able to contain 110% of the tank farm capacity to contain any spillage. The bunded areas will be kept pumped free of rain or melt water on a regular basis or by the use of an automatic pumping system.

All oil spillage will be reported and the appropriate clean-up procedure put timeously into place. Good housekeeping measures will be put in place and enforced to ensure that the chance of oil spillage is minimised.

Residual Impact

Clean up procedures and excellent housekeeping will minimise any potential residual impact.

Waste from Mine Camp

The operation will result in the generation of a good deal of waste. This will be in the form of packaging, timber waste, metal waste, paper waste, etc from the mining and materials operations; waste oils, grease, lubes, replaced mechanical parts including oil, fuel and air filters, rubber pipes, old tyres, scrap equipment, etc from the mechanical and workshop functions; food waste, domestic waste and packaging, sanitary waste, clinical waste from the health centre etc, used cooking oils, domestic cleaning waste, from the kitchens, restaurant, accommodation and welfare blocks; grey and foul water and solid sewage wastes from the various living, welfare and accommodation services. It is imperative that this waste material is dealt with in a manner to keep the site clean and tidy, to minimise chances of pollution from it and in a generally hygienic manner. Final disposal of the waste should also be carried out in an environmentally friendly and sustainable way where possible.

There is no landfill site at Nalunaq. All combustible waste will continue to be burned in a make-shift incinerator 3.5km from the camp. There is no designed incinerator onsite and it has not been required by BMP. All incombustible material will be packed into the special rubbish containers located adjacent to the makeshift incinerator and periodically shipped to Qaqortoq for disposal via the harbour. Adjacent to the workshop is a large used tyres storage area. The majority of the tyres will be used to improve the road safety bunds on the road from the harbour to the mine/camp area. Upon final closure of the mine it is anticipated that BMP will permit any remaining tyres and steel scrap to be stowed in the mine.

All waste water, including grey water, run-off, foul drainage and solid sewage waste must be treated before disposal in a controlled way. Untreated water should not be allowed to leave the site in an uncontrolled manner. It will not be satisfactory to discharge untreated foul drainage and raw sewage even in storm flow conditions. Foul waste will be treated in the existing sewage

treatment system which will produce a treated water of sufficient purity to be discharged to the river without further treatment.

Mitigation
Angus & Ross intend to institute measures to increase recycling of materials in order to minimise the amount of rubbish produced and hence decrease the amount of burning and the quantities for disposal at Qaqortoq. A&R intend to minimise all waste produced and stored on the site

Residual Impact
Excellent housekeeping will minimise any potential residual impact.

Transport Issues

Transport connections to Nalunaq will be by helicopter direct to the site or by ship and up the connecting road from the harbour. There is an existing helicopter pad which will be upgraded to modern standards. There are no plans to build a runway able to take fixed wing aircraft. It will not be necessary to maintain a passport and immigration control unit or customs post at the harbour or mine as all overseas visitors arriving by air will originate from or pass through the Greenland airports at Kangerlussuaq (the main airport and the hub for domestic flights), Narsarsuaq, Nuuk or Kusuluk which have international connections with Denmark, Iceland and USA and immigration and customs requirements will be dealt with at port of entry.

All other requirements including stores, consumables and some personnel will be delivered by sea to the harbour and then trans-shipped by road.

There will be both sea and air traffic in the area associated with the mine development. This traffic is crucial and integral to the successful operation of the mine. The sea traffic will not interfere with the local sea-trades. which presently access passage through the inshore waters, including the fishing boats which operate there. Diesel powered light pick-up type vehicles will be utilised at Nalunaq for transportation within and around the site. Diesel powered fork lifts and telehandlers will also be used for materials handling. Diesel powered vehicles will be utilised underground on loading and haulage

duties. Diesel will be stored at the mine as previously. Appropriate security and anti-spillage measures will be taken.

The increased sea and air traffic will result in environmental impacts but it is anticipated that with very few local receptors these impacts will not be significant and will not result in an overall adverse impact:

- Increased shipping in the local inshore waters;
- Increased air traffic;
- Increased noise;
- Potential pollution from fuel spills;
- Production of greenhouse gases;
- Transport operations and issues will have no effect on local shipping, fishing and hunting activities in either summer or winter.

Mitigation
All transportation issues will be fully planned and monitored by the mine management so that excess and unnecessary journeys are not made.

Residual Impact
No residual impacts are anticipated.

Cultural Heritage & Archaeology

It is considered that there are no Cultural Heritage and Archaeological issues associated with the reopening of the Nalunaq Mine. No ancient monuments or buildings, sites of antiquity or other sites associated with Greenland's cultural heritage have been identified within the curtilege of the mine.

Mitigation
A watching brief will be maintained by the management of the mine and if any potential items, artefacts or areas of archaeological interest are uncovered or revealed by operations then the Greenland Museum at Nuuk will be immediately notified and invited to visit the site and carry out appropriate investigations. It is intended that a full photographic progress record will be taken and maintained for a future industrial archaeology history of the operations at Nalunaq.

Residual Impact
It is considered that there will be no residual impact.

Public Rights of Access

There are no restrictions on local public access to the mine area at the present time apart from those imposed by safety and security issues. Operational requirements, site security and health and safety considerations will considerably affect public access. In general, public (i.e. non-employee) access will be restricted to pre-arranged business appointments and emergency only. It is not believed that these restrictions will cause any adverse impacts or inconvenience to the local people.

Mitigation
A&R will attempt to minimise access restrictions to those imposed by operational, security and health and safety requirements.

Residual Impact
The above restrictions are not believed to cause unnecessary impact on public rights of access which will remain unrestricted elsewhere in the vicinity.

Tourism

As noted previously, occasional tourism opportunities by tourist cruise ships and hikers take place to the area. The tourist industry is, however, severely limited by the extreme weather especially in the winter and the remoteness of the area.

Mitigation
A&R intend to leave the harbour area in place after closure of the mine for tourist purposes and will welcome and aid where possible tourist opportunities which may arise for limited visits to the mine area where operational requirements allow.

Residual Impact
It is hoped that tourist opportunities will increase in the medium and long term.

Existing Resources

It is hoped that the additional minerals exploration programmes that will be undertaken by Angus & Ross during the life of the mine may discover other economic mineral resources in the area. In this case the life of the mine site may be extended beyond the presently expected life.

Mitigation
In view of the possible major consequences of any pollution episode and in order to ensure that no activity at the mine give rise to adverse impacts on the existing natural resources, it is imperative that all mitigation measures are fully employed and adhered to and then continually updated with the advance of knowledge, practice and environmental techniques. The appointed EHS Manager will be responsible to the Mine Management for the application of the environmental mitigation measures and their continual update.

Greenhouse Gases

The mine at Nalunaq will necessarily result in an increase in emissions of green house gases from the site. The site is at present not operating supporting little activity and therefore produces minimal amounts of carbon and greenhouse gas emissions.

The main greenhouse gases contributing to Global Warming and Climate Change are carbon dioxide, methane, nitrous oxide and ozone. Other gases contributing to Global Warming include sulphur hexafluoride, carbon monoxide, carbon tetrachloride, tetrafluoromethane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and chlorofluorocarbons (CFCs).

The sources of greenhouse gases in place at the Nalunaq Mine include:

- Electricity generation equipment;
- Diesel powered vehicles and engines;
- Shipping powered by bunker fuels (ie heavy oils);
- Aviation – helicopters;
- Ventilation gases from the underground mine operation including those produced by blasting operations;

- Gas powered heating and cooking equipment;
- Sewage treatment plant; and
- Incineration of waste.

The major source of greenhouse gases from the above list will be the generation of electricity. It is intended that the main electricity requirement for the operation will be generated by appropriately sized large diesel powered generators. The generation system will be required to produce electricity on a 24-7 basis for 365 days per year.

Diesel powered vehicles will operate during working periods. Vehicles will include pick-up trucks, forklifts and telehandlers, and other stores and materials handling equipment.

Aviation operations may show an increase. Aviation engines are recognised as a major source of greenhouse gases.

The underground mine will produce greenhouse gases through its exhaust ventilation system. This will be a combination of exhaust gases from the diesel powered mining machinery. The forced ventilation system will also deal with gases and fumes produced from the blasting operations including nitrous oxides and carbon dioxide and monoxide as well as the normal ventilation needs of the working miners for clean air. Any fumes produced by maintenance work underground such as welding and brazing, and the fumes from the doré process will also be expelled through the ventilation system. The mine is not gaseous in itself and contains no naturally occurring flammable gas such as methane.

Gas powered heating and kitchen equipment etc which may be utilised on the site in the accommodation and welfare facilities for instance will produce greenhouse gases.
The sewage treatment facility produces methane and carbon dioxide as part of its operation, being formed from the natural breakdown and degradation of the organic waste being treated. Final water discharge from the system is clean water. The sludge from the treatment is removed for disposal.

Mitigation
A&R intend to reduce their carbon footprint and their production of greenhouse gases in Greenland on a company wide basis by the use of various alternate energy sources. It is not yet known whether any of these alternate sources can be utilised at Nalunaq.

Residual Impact
The production of greenhouse gases at Nalunaq is unavoidable.

Consequent Additional Development Potential

NGM will give rise to a skilled and prosperous workforce used to well paid modern employment but still steeped in and adhering to their traditional values and way of life. At closure of the mine there will therefore be a large pool of workers available for onward employment in an industrial local setting. This skilled work force will be available for employment at mines or quarries or other industrial settings.

Mitigation
As the mine reaches the end of its productive life there will be continued liaison and discussion between the Mine Management and its stakeholders and the local authorities and the Greenland Home Rule Government to facilitate the use of the workforce resource on alternate employment.

Cumulative Impacts
The mine will provide a skilled workforce able to be employed on other similar projects or in other industrial settings.

Cumulative Impacts

There are no other commercial, industrial or mining developments within a considerable distance of this project. There can therefore be no cumulative impacts due to multiple local developments.

The cumulative impact of the various singular impacts attributable to Nalunaq must however be considered. There will be a number of impacts emanating from the various aspects of the project. Some of these impacts have the

potential to have an adverse effect if they are not properly managed. There are other aspects which conversely have the potential to impact positively.

Mitigation

The project will be professionally designed, managed and operated and all potentially adverse impacts will be fully managed and minimised. Whilst there may be the potential for the adverse impacts to have a cumulative impact it is anticipated that the first class modern management processes which will be employed will minimise this potential. Overall, it is believed that the positive economic and social benefits of exploiting the mineral resources of Nalunaq Gold Mine by far outweigh both any individual adverse impacts as well as any perceived cumulative adverse impact.

Residual Impact

No cumulative impacts are anticipated.

16 Social Aspects, Impacts and Mitigation

A separate SIA will be submitted in October 2009 as part of this application which will include a Benefit and Impact Plan (BaIP) and Impact Benefit Agreement (IBA) prepared after consultation with the local community.

17 Environmental Management Plan

The Environmental Management Plan deals with all aspects of the mining operation including the production and shipment of the gold doré bullion.

An Environmental Management Plan (EMP) can be defined as "*an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced (RSA DEAT 2004),*" and is therefore an important tool for ensuring that the management actions arising from Environmental Impact Assessment (EIA) processes are clearly defined and implemented through all phases of the project life-cycle. EMPs provide an essential tool for ensuring that the mitigation of negative impacts and enhancement of positive impacts is carried out effectively during the project life-cycle utilising continual improvement.

The objectives of an EMP should include (Hill, 2000):

- Ensuring compliance with regulatory authority stipulations and guidelines which may be local, provincial, national and/or international;
- Ensuring that there is sufficient allocation of resources on the project budget so that the scale of EMP-related activities is consistent with the significance of project impacts;
- Verifying environmental performance through information on impacts as they occur;
- Responding to changes in project implementation not considered in the EIA;
- Responding to unforeseen events; and
- Providing feedback for continual improvement in environmental performance.

In establishing objectives and targets the following issues should be considered:

- Adverse environmental impacts;
- Positive environmental impacts;

- Legislative and other standards;
- Relevant environmental standards;
- Stakeholder concerns;
- Technical issues;
- Operational requirements; and
- Financial cost.

In order to achieve the above objectives, the scope of an EMP should include the following:

- Definition of the environmental management objectives to be realized during the life of a project (i.e. pre-construction, construction, operation and/or decommissioning phases) in order to enhance benefits and minimise adverse environmental impacts;
- Description of the detailed actions needed to achieve these objectives, including how they will be achieved, by whom, by when, with what resources, with what monitoring/verification, and to what target or performance level. Mechanisms must also be provided to address changes in the project implementation, emergencies or unexpected events, and the associated approval processes;
- Clarification of institutional structures, roles, communication and reporting processes required as part of the implementation of the EMP.
- Description of the link between the EMP and associated legislated requirements; and
- Description of requirements for record keeping, reporting, review, auditing and updating of the EMP.

The EMP should address the following headings:

- Foreword and Policy
- Location and general background to the project
- Summary of the proposed project and associated activities.
- Allocation of resources
- Summary of the Project Proponent's existing policies, guidelines and commitments relating to health, safety and environment.

- Identification of the legislation, standards, guidelines and associated permits or licences that apply to the project and are related to management activities specified in the EMP.
- Identification of the environmental aspects of the mining operations and summary and details of the predicted negative and positive impacts associated with those aspects. Objectives to be achieved through the EMP and the management actions that need to be implemented to mitigate the negative impacts and enhance the benefits of the project taking into account the principles of Best Available Technology Not Entailing Excessive Costs (BATNEEC). Specification of the associated responsibilities, monitoring, criteria/targets and timeframes.
- Environmental Monitoring Requirements.
- Definition of the responsibilities for management actions contained in the EMP and the arrangements for coordination among the role players involved in implementation.
- Specification of the requirements for training and environmental awareness for all site and other project personnel to ensure that the actions specified in the EMP are implemented effectively and efficiently.
- Requirements for document handling and control system to be followed for all EMP documentation.
- Requirements for reporting procedures and practices to be followed.
- Requirements for the stakeholder engagement process including management of concerns and complaints.
- Requirements for environmental audits including scheduling, competence of auditors, recording and reporting of audit findings, and corrective actions and their verification.
- Dealing with non-compliance.
- Contractor, sub-contractors and suppliers.
- Emergency Procedures
- Hazardous Substances
- Procedures and timing of management reviews during the project and the consequent revision of the EMP through a process of continuous improvement.

A senior manager will be appointed as Environmental Health and Safety (EHS) Manager responsible and accountable for all environmental and compliance aspects of the operation together with health and safety aspects. He will be responsible for the maintenance of the Environmental Management Plan (EMP) together with all monitoring and sampling requirements for environmental purposes.

It is proposed that NGM should prepare, and put into practice, an Environmental Management System (EMS) suitable for registration under ISO 14001. This EMS then details all the projects environmental requirements and measures compliance against those requirements. It is important tool for ensuring that environmental aspects, impacts and consequences are fully taken into account in the mines operation and that the requirements are updated in the light of performance and actual practice. It is anticipated that a similar Quality Management System (QMS) to ISO 9000:2000 series will be put in place for the mines production a together with an Occupational Health and Safety Management System to OHSAS 18001. These management systems all run in parallel and help to manage and maintain all mine functions in compliance with the planned requirements. The EHS Manager is responsible for the maintenance and update of these systems and for all actions required to maintain compliance.

The EHS Manager will also be responsible for the environmental services provided by the laboratory facility at the mine. The laboratory's prime function will be ore assay for operational day to day stope grade control, the quality of ore production and quality control but will also deal with all environmental sample analysis.

As part of the ISO 14001 system there are a number of requirements which need to be fulfilled. A system of internal annual auditing must be put in place to consider operational aspects such as water management, waste, oil and diesel, dust, noise and all environmental compliance issues.

The EMS should contain procedures, for the following:

- Environmental Policy;

- Environmental Aspects – list of identified potential environmental impacts, risks, effects, etc.;
- Legal and other requirements – a register of all regulatory instruments relevant to the site and the specific permits, licenses, etc with the conditions, standards or limits imposed;
- Objectives, targets and programmes;
- Resources, roles, responsibilities and authority for environmental matters at corporate and site level;
- Competence, training and awareness;
- Communication;
- Documentation;
- Control of documents;
- Operational controls;
- Emergency preparedness and response;
- Monitoring, measurement and evaluation of compliance;
- Non-conformity, corrective action and preventive action;
- Control of records;
- Internal audit procedures; and
- Management review.

The Operational Controls comprise a number of important procedures:

- Compliance records;
- Requirements and restrictions;
- Written work instructions;
- Verbal work instructions; and
- Guidance and codes of practice.

A register of non compliance, complaints and incidents should be kept. Monthly environmental management meetings should be held to discuss environmental issues of concern and the meeting agenda should cover areas of operational control, objectives and targets, training needs, auditing and general monitoring, new issues/problems, site changes and any other business. If issues of concern are identified that need to be disseminated to a wider audience then 'toolbox talks' should be prepared by the HS&E Manager to update staff on important issues.

With regard to day-to-day environmental management, and objectives, a yearly Environmental Action Plan (EAP) can be agreed with the members of the environmental team, with a series of objectives and actions throughout the year. These include goals for environmental training, general maintenance, areas for improvement, implementation of recycling programmes, changing discharge regimes.

The ESH Manager will be responsible for liaising with external parties who are affected by operations at the site. In the event of complaints, in addition to making a formal record of the complaint, the affected party should be contacted, and appropriate measures undertaken. A community liaison forum could be instituted, to provide opportunities for stakeholder dialogue about relevant issues again organised by the ESH Manager.

The ESH Manager will also be responsible for the upkeep and update of the Contingency Plans and Emergency Procedures. These protocols and procedures will cover all aspects of the mine operations and will be maintained in concert and as part of the Risk Register and the Risk Management Strategy. Knowledge and training in all emergency procedures will be given to all mine employees along with the knowledge of the potential effects and consequences of the risks covered.

A waste minimization and recycling programme should be instituted and then the results analysed and updated on a regular basis.

It is also recommended that as part of the internal and external reporting system, environmental sections are included in internal Board management reports and external company reports.

It is anticipated that the EMP will evolve during the life of the mine in line with the principles of the DMAIC circle (Design, Measure, Analyse, Improve, Control, with Continuous Improvement) taking into account the feedback provided by the monitoring and operational progress.

18 Environmental Monitoring Proposals

The mine will appoint a senior manager to be responsible for all Environmental, Health and Safety matters. Part of the duties of this EHS Manager will be to ensure that the environmental monitoring programme is carried out, that all monitoring data is recorded and that all monitoring equipment is maintained in working order. He will also be responsible for ensuring that any adverse impacts identified by the monitoring are brought to the immediate attention of the mines management and that the appropriate remedial measures set out in the Environmental Management Plan are timeously instituted.

The following environmental monitoring programme is suggested:

General

Weather: The existing weather station should be maintained and operated. The weather station will measure temperature including diurnal maximum and minimum, wind speed and direction, barometric pressure and precipitation. All information will be continuously measured and recorded with data download taking place on a regular daily basis.

Emissions to Air

Dust: Dust could be generated at several locations within the project area at the Mine.

Underground: Due to the dust suppression measures taken within the underground workings it is not anticipated that any fugitive dust will be emitted to the open air. It is not therefore thought necessary to carry out any dust monitoring or sampling externally at the entrance to the mine. Regular testing and sampling of the mine air and its quality, including dust control testing, will, as a matter of course, be undertaken by the Mine's Ventilation Officers. Results will be passed to the HS&E Manager for analysis and file.

Surface: Dust could arise from the activities at the site. Appropriate measures will be taken to minimise fugitive dust. The main source of dust is likely to be caused by the vehicle movements around the site and dust blow. The climate is, however, generally likely to regulate these sources. To analyse dust production and gauge its significance two forms of dust monitoring will be undertaken:

- Two dust monitoring stations will be established at the Camp at convenient points. Directional dust monitors of the type marketed by Dust Scan in the UK are recommended.

- The dust monitoring by collection and analysis of lichens will continue in the same way as it has for many years. This will continue to be carried out by NERI.

Noise: Noise will be generated by activities in both the Mine itself and the Camp. Underground noise monitoring will be carried out as a matter of course by the EHS Manager. Noise monitoring in the camp is not considered necessary.

Underground: Operating mines are generally noisy places with many of the activities generating excessive noise which can be harmful to unprotected ears. All underground operatives will be required to wear ear protection as necessary and noise testing of all working places will be carried out on a regular basis, using handheld noise meters, as part of H&S analysis. The noise will be rapidly attenuated in the mine and it is not anticipated that any of the noise generated by the underground operations will be heard outwith the mine entrance. It is not therefore thought necessary to carry out any noise monitoring externally at the entrance to the mine.

Mine Camp: With no external processing taking place noise generation will be mainly confined to that produced by vehicle movement. No monitoring of this is proposed.

Emissions to Water

All discharges of water will be controlled, remedially treated as necessary and sampled on a regular basis in order to ensure that all discharged water is of a suitable quality and will not give rise to adverse impact or pollution. This will include mine water including pumped or liberated ground water, waste and foul water, and run-off from hard-standing and paved areas. Water from these sources will be sampled immediately before discharge into the river. Water samples of the discharge from the sedimentation ponds and water samples from the river will be taken both upstream of the camp/mine area and downstream of the overflow discharge area

The existing settlement ponds will be refurbished. The positions of sampling points will be selected with health and safety in mind to enable safe access to take the sample. This point will be at the exit to the lagoon. The EHS Manager will ensure that any unexpected points of discharge are identified and sampled. Discharges at times of storm run off will be specially sampled. All samples will be analysed and records kept.

NERI will continue to undertake environmental monitoring of the marine fauna in the Saqqaa Fjord and in the area of the harbour facility.

- Laboratory Facility

The laboratory facility at Nalunaq will primarily carry out ore analysis for assay and grade control purposes but will also be able to carry out environmental analysis on site.

19 Mine Closure Plan and Restoration & Rehabilitation Proposals

Planned mine closure can be expected to take place when either present reserves are exhausted and no new reserves are available, or when the economies of the mine alter because of changes in the value of the products produced due to market value fluctuations. Unplanned mine closure could be due to unexpected events such as an emergency situation forcing closure, force majeure causing temporary or full stoppage of operations, or a sudden economic crash causing economic closure. To cover all these closure exigencies, mine closure plans are required. An existing Mine Closure Programme and a security bond, in the sum of DKK16 million, exists from the previous operations by Crew. A&R are producing an replacement MCP which will be available in due course in July 2009. The existing bond will be transferred to the A&R operation. The MCP will be regularly updated throughout the mine operations prior and up to closure. The plan will allow for the requirements of planned closure and emergency unplanned closure. The MCP will set out detailed measures for closure and rehabilitation of the site, and consider long term management and monitoring requirements together with the immediate requirements to protect the environment from pollution and damage due to the effects of the closure.

The restoration and rehabilitation proposals will form a part of the mine closure plan. It has not yet been decided what the final post-closure land-use and form of the site will be. It is hoped that the Nalunaq operations will continue for many years with extended exploitation of yet to be discovered and proved additional resources. It is anticipated that the restoration strategy will evolve as the mine's life progresses and will be finalised nearer the expected time of closure.

20 Public Involvement and Comments

A separate SIA will be submitted in October 2009 as part of this application which will include a Benefit and Impact Plan (BaIP) and Impact Benefit Agreement (IBA) prepared after consultation with the local community. Public Consultation is a key part of the EIA and SIA process. Further consultation with the Statutory Bodies is ongoing and will also refer to the findings of this EIA. As part of the separate SIA process and the SIA report due to be submitted in October, detailed consultation will take place with the Community Representatives and the local people themselves. The SIA will be submitted with details of the consultations and the results of the discussions to include both the positive and negative comments, the hopes and aspirations and the doubts and fears which the community have expressed about the project, together with the answering comments and any provisions or statements made by the Company.

21 Health & Safety

The Minerals Resources Act for Greenland requires that:

"Work in the mine must be performed in accordance with the statutes, rules and regulations applicable in Greenland. In the absence of relevant rules for mining operations, the licensee may request that the National Working Environment Authority, BMP and any other relevant authorities consent to the work being carried out in accordance with a cohesive set of regulations for mining operations with which the licensee is conversant, e.g. "Management and Administration of Safety, Health in Mines, Health and Safety At Work Act, 1974" (UK)*. In that case, the provisions from time to time applicable according to such regulations must be observed. In the event that these regulations also concern matters covered by Greenland rules, the licensee must identify the most important departures from the statutes, rules and regulations applicable in Greenland with a view to discussing such departures with the competent authorities. The relevant regulations and the identified departures from the statutes, rules and regulations applicable in Greenland must be submitted to BMP as soon as possible in three copies. The licensee must submit any subsequent changes and additions as soon as possible."*

For Mining Projects in Greenland there is therefore no extant Greenland Mining Law. Therefore, failing the publication in the future of Mining Laws and Regulations by the Bureau of Minerals and Petroleum (BMP) of the Greenland Home Rule Government to regulate mining operations in Greenland, then the necessary legislative processes, instructions and regulations which are required to regulate the operations of the Nalunaq Mine will be the responsibility of the Mine Owner and will be adopted and enacted by that Mine Owner. It is proposed therefore that the Nalunaq Mine will operate in general terms under the UK Mines and Quarries Act of 1954 as variously amended by Acts of the UK Parliament together with the all associated UK Legislation pertaining to the operation.

The Owner's Procedures and Regulations will form the framework of the detailed health and safety system and include Manager's Rules and Risk Assessment protocols. The detailed Owner's Regulations will include Safe

Systems of Work for all the various operational elements of the operation put in place.

Suitable Conditions of Employment will be included in all Employment Contracts to ensure that all employees and contractors follow the required and compulsory workplace rules and systems of work.

All Owner's Procedures and Regulations are based on proven mining techniques, proven modern worldwide practice and experience and due knowledge of the necessary safety requirements.
The Owner's Regulations are based on the Mining Legislation, Regulations, Codes and Rules utilised by the mining industry of the United Kingdom, and as periodically amended and updated by the Government of the UK and its administration.

22 Risk Assessment Section

Risk Management is now the foundation process in many countries for a successful health, safety and environment programme. Many companies utilise a formal Risk Management strategy in an effort to satisfy their "duty of care" requirements under various legislative laws.

In order for Angus & Ross plc to achieve a good health, safety and environmental performance at Nalunaq Gold Mine a formal risk management process will need to be applied at the early operation phase.

The following steps need to be undertaken:

- Prepare a draft Risk Management Procedure for Angus & Ross to use when the Project starts operation;
- Prepare a template for a small risk register database to capture HSE risks associate with Angus & Ross's Black Angel Mine Project;
- Undertake a HSE risk review of the Project and populate the risk database; and
- Develop risk management processes to minimise the high level risks.

23 Conclusions

The area disturbed by the development of Angus & Ross plc's Nalunaq Gold Mine is not close to and does not involve any of the following designated areas of special interest:

- Areas or sites of potential great sensitivity or unique geomorphological characteristics
- Areas of special importance to wildlife
- Areas with valuable, sensitive or representative biotopes
- Areas of spiritual, cultural, or other socio-economic value including areas of special importance for traditional resource use.

The environmental effects of the previous mining operation have been seriously noted and marked by Angus & Ross plc. Good environmental practice has been taken into account and built into the operational design of the mine and effective mitigation measures will be enforced to minimise the potential adverse impacts of the development. Full environmental control will be maintained to limit all adverse impacts. The mitigation measures proposed will result in no significant residual adverse impacts.

The comments of the Statutory and Regulating Bodies have been taken into consideration in the formulation of this project.

The development will have significant economic and social benefits for the Nation of Greenland and the local community and Municipality of Nanortalik in particular. Well paid work will be provided together with the knock on indirect and induced economic benefits which will improve the individual, family and community economy and reduce unemployment.

It is believed that the Nalunaq Mine can successfully operate and exploit the gold resource without causing major adverse impact. It is further believed that the benefits of the project to Greenland as a whole and the local community in particular far outweigh any potential disbenefits of the project.