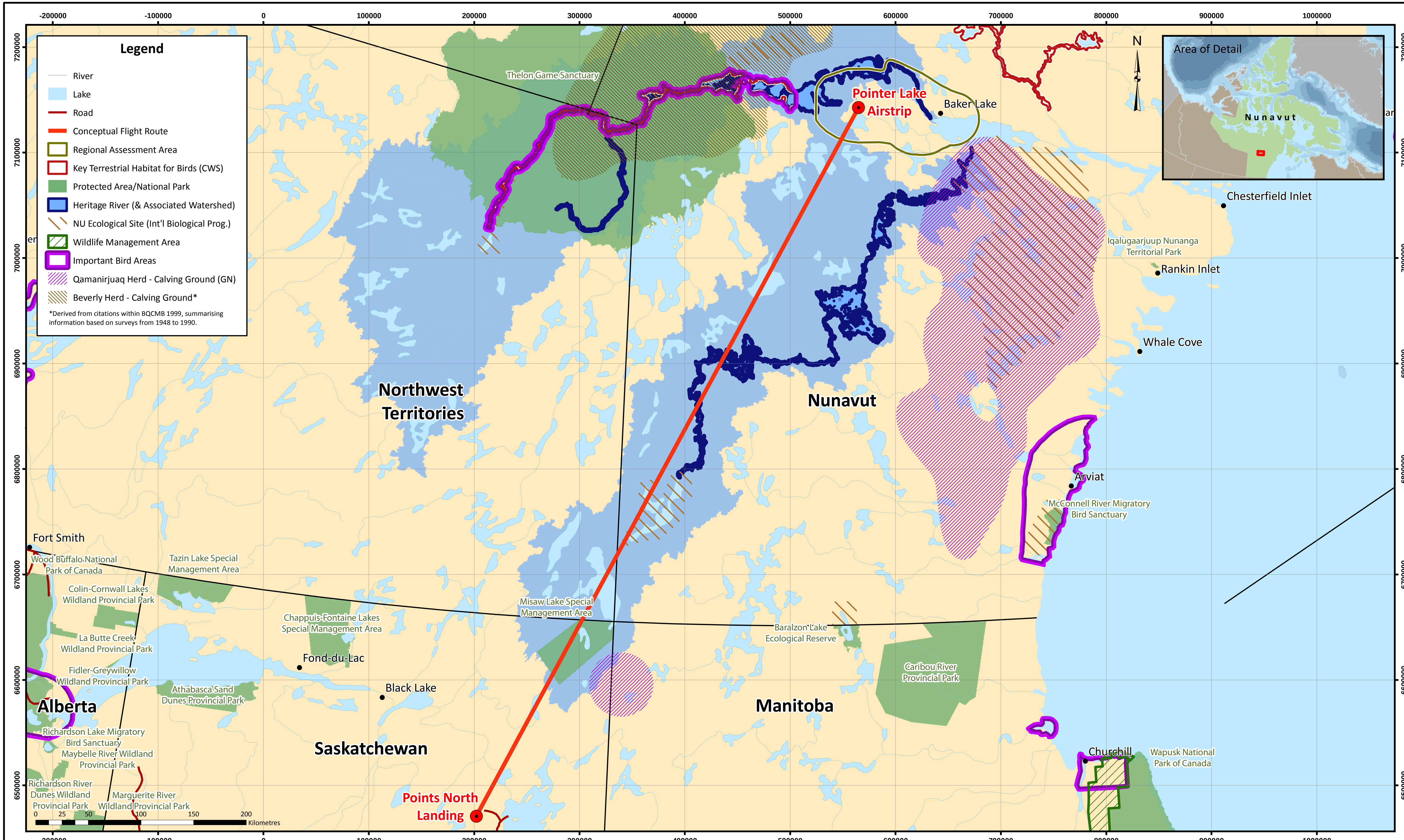

Projection: NAD 1983 UTM Zone 14N
Creator: CASLYS CONSULTING LTD.
Date: 10/07/2014 Scale: 1:3,300,000
10.6-1_Conceptual_Flight_Route.mxd
Data Sources: *Natural Resources Canada, GeoBase®, National Topographic Database, AREVA Resources Canada Inc., Gebauer & Associates, Environment Canada - CWS, Government of Nunavut, IBA Canada and Government of Manitoba.*

FIGURE 10.6-1
CONCEPTUAL FLIGHT ROUTE FOR TRANSPORT OF URANIUM CONCENTRATE BY AIR

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12.6.2 Lightly Loaded Buildings

Spread footings on granular fill may be constructed for structures where high bearing values are not required. This would require removing all ice-rich overburden and frost susceptible soils to expose competent bedrock. Some of the lightly loaded buildings/structures in the mill site area may be constructed using this type of foundation. The maximum allowable bearing capacity should not exceed 500 kPa for footings on engineered fill.

12.6.3 Accommodation Complex

The accommodation building will consist of prefabricated modular units (the complex core may be built on site). The accommodation complex and mill will be connected by an arctic corridor (utilidor). Typically lightly loaded structures such as the accommodation complex can be supported on 114 mm or 168 mm diameter pipe piles.

A clear unobstructed air space will be maintained below the bottom of the structure and the surface of the original ground or granular fill pad to reduce the potential of heat transfer into the underlying permafrost.

It is estimated that onsite construction and modules installation would require two summer seasons; during the first summer, foundations would be installed for the core and modules. The core would be erected and residential wings installed the following year.

12.6.4 Deep Overburden Conditions

Steel pipe piles grouted into bedrock would be also an alternative foundation type for structures located where there is a layer of overburden that is too thick for removal for construction of footings on bedrock or fill. Pipe size would be chosen to support the structural loads.

12.6.5 At Grade Buildings

Some structures such as warehouses and maintenance facilities will be constructed at grade to allow access by vehicles and equipment. Slabs-on-grade may be utilized for these types of structures provided that all thaw strain susceptible soils are removed and competent bedrock exists below a layer of engineered fill. The engineered fill that supports the floor slab will be placed in a manner consistent with that for engineered fill.

If the depth to bedrock is too great or the bedrock is not competent and has ice-filled fractures, this type of slab-on-grade will not be appropriate. In this case, either structural floor slabs will be required or permafrost stabilized foundations such as ventilated floor slabs or thermosyphon cooled foundation systems will have to be considered. These types of slab designs will require detailed thermal analyses to be carried out which will be provided at the time of licensing application.

12.6.6 Engineered Fill Materials

Fill materials will be required for backfilling excavations and as engineered fill for foundations and slabs. Engineered fill will consist of well-graded crushed rock that will be placed in lifts and compacted. Typically fill placement would commence with 150 mm minus engineered fill to bring the grade up to within 300 mm of the underside of footing or floor slab level. This material would be placed in lifts and compacted until the maximum density is achieved. This initial zone of compacted fill would be covered with a layer of structural fill placed and compacted to 100% of the achievable maximum dry density. A minimum of 150 mm of 20 mm minus select fill would be placed immediately below the footings and, again, compacted to 100% of the achievable maximum dry density.

12.6.7 Pad Design

Pads surrounding the various facilities at the mine site will be constructed using blast rock in a similar manner to the approach used in the construction of access and haul roads. The minimum thickness of the pad is expected to be about 1.7 m to provide thermal protection to the underlying permafrost overburden soils and rock. A specific thermal analysis will be completed and provided at the time of licensing application to determine the thickness required for optimal thermal protection.

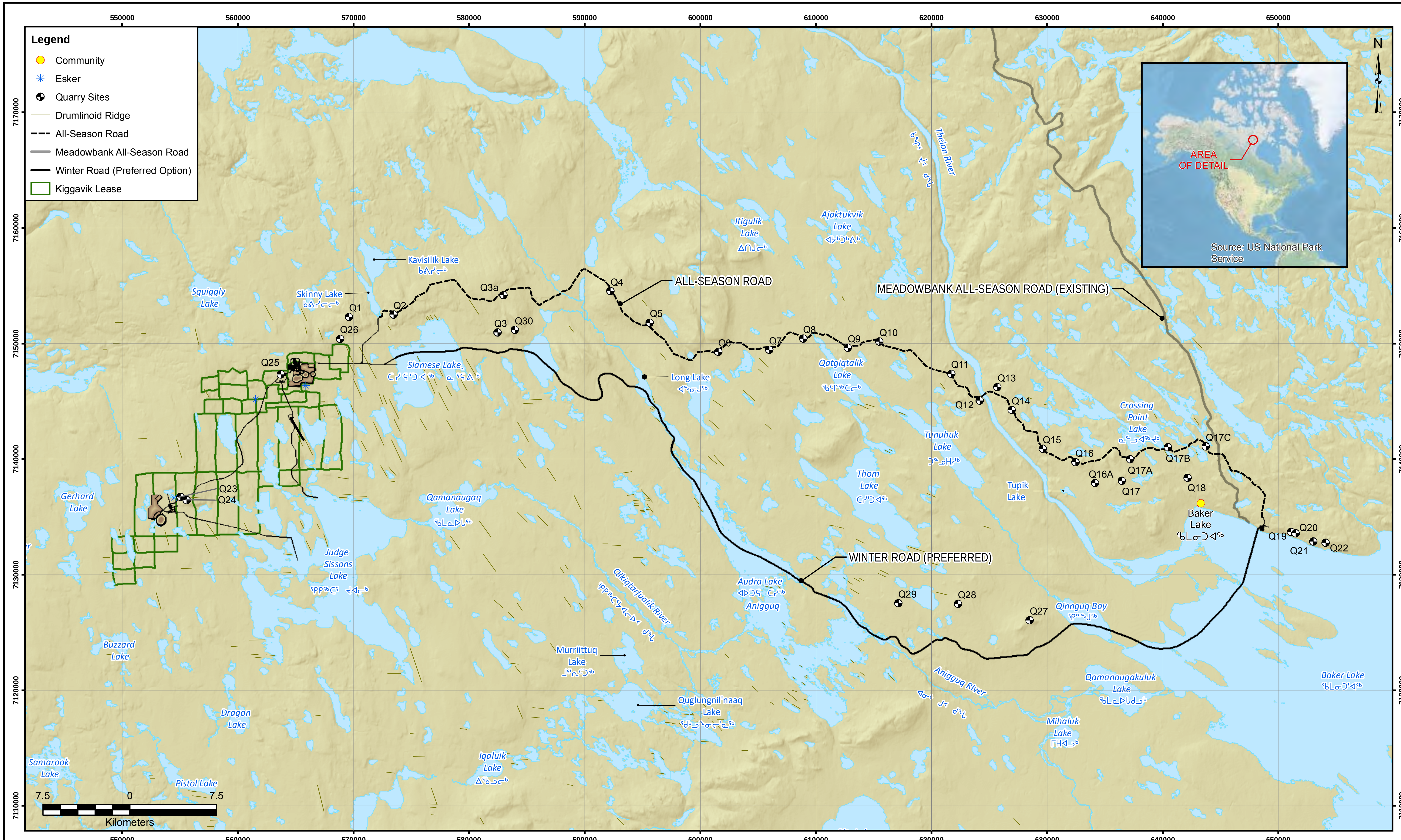
12.7 Aggregate Sources

Aggregate sources will be required for rock embankment, road surfacing, pads and fill materials. These materials will be produced from Type 1 mine rock from the purpose built-pit or subsequent pits and from quarried rock obtained from suitable sources in the vicinity of the mine site and the access roads. These materials will be crushed and processed to produce select fill as required. Later in the Project, materials for the Kiggavik Sissons access road will also be derived from open pit mine operations. Approximately potential quarries that have been identified. Each quarry is marked from 1 to 30 as Q1 to Q30, Figure 12.7-1 illustrates the proposed quarries, and the road options along with the Kiggavik lease.

The quarry selection was based upon a combination of factors, including:

- accessibility (proximity to alignment and site);
- potential quarry size (enough volume);
- ease of excavation (relief and potential face);
- amount of overburden;

- environmental constraints such as distance from known raptor nests and watercourses; and
- acid rock drainage (ARD) and metal leaching (ML) potential.
- where possible, non-calcareous materials will be used to reduce the amount of dust-prone aggregate.



Projection: NAD 1983 UTM Zone 14N
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Date: 07/10/2014 Scale: 1:300,000
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 12.7-1
QUARRY SITE LOCATIONS

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AREVA

File: Q:\SHEQ\GIS\KIGGAVIK\2014\EIS\Volume 2 - Project Description\Maps\MXD\Figure 12.7-1 quarry_site_locations_Revised.mxd

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Regarding ARD and ML potential, 33 rock samples from the potential quarry sites were collected and submitted for acid base accounting (ABA) and metals content analysis. Each sample was also subjected to simplified leach (SWEP) testing as described in Section 6 for mine rock samples. Results of ABA and metals content analyses suggest that the aggregate samples are non-acid generating, with paste pH values ranging from 6.1 to 9.4. The results of the leach tests suggest that the potential aggregate rock materials are not likely to present an issue with respect to leaching of constituents of potential concern.

Upon completion of the EA and final road routing, there will be further prioritization of sites to be used and quantities taken from each. Accessibility, haul distance, source material volume, extent of overburden and absence of acid rock drainage or metal leaching potential will continue to influence selection. Prioritization of sites will also depend on the presence of active or newly discovered raptor nests, conformation of archaeological work and other factors. Quarry location Q12 is located within close proximity to the Thelon River. If the potential effects of the quarry cannot be mitigated, the quarry will not be used.

Additional details on aggregate sources can be found in Technical Appendix 2N (Borrow Pits and Quarry Management Plan). Additional geotechnical and geochemical investigations will be conducted at the time of licensing application to further estimate volumes and quarry limits.

12.8 Freshwater Diversions and Dewatering

The primary diversion structures include the freshwater diversion channels constructed around the Kiggavik and Sissons sites and the Andrew Lake dewatering structure. Construction activities associated with the Andrew Lake dewatering structure are described in this section. However these activities will take place during the operating phase, after milling has started.

12.8.1 Freshwater Diversion Structures

Freshwater diversion structures will be constructed early in the development schedule of each site to minimize contact between Project activities and the freshwater environment (see also Section 9). There is potential for erosion and sediment transport in the constructed diversion channels and the degree to which this occurs depends on mainly soil type, channel gradient, channel geometry and flow magnitude. The diversion channels will be constructed in one of three ways depending on topography and geotechnical conditions. These are as follows:

- channel with invert at existing grade with built-up berms to contain the flow;
- channel with excavation in overburden; and
- channel with excavation in bedrock.

Geotechnical investigations along the proposed channel alignment will be undertaken and provided at the time of licensing application. However it is expected that each of the three construction cases indicated above will occur at various locations along channel alignments. The potential for erosion and sediment transport is greatest in the first two cases and is much less where the excavation occurs in bedrock. Where the channel is built-up or excavated through overburden, the soil type will be identified and evaluated with respect to erosion potential under peak flow conditions. Where peak flow velocities exceed soil material resistance (allowable shear stress), riprap armouring overlying a geotextile will be placed on the channel bottom and sideslopes. Hydraulic models will be used to determine the appropriate median diameter of the riprap to resist the flow velocity and the lift thickness will be about 1.5 times the median diameter. Rip rap will consist of clean waste rock pit run material. These measures will greatly reduce the likelihood of erosion and sediment transport in the constructed diversion channels.

As the channels are constructed in a permafrost environment there is potential for deformation in the constructed channel, and while detailed geotechnical investigations have not been conducted in the vicinity of the proposed channels, it is assumed that the average active layer thickness is about 1.5 to 2 m, and channels will be constructed according to one or more of the three cases listed above. If the channel invert is cut to or into bedrock, then there is little concern with channel deformation. If the channel is constructed in till to a depth of 1.5 to 2 m, then there is potential for melting some permafrost below the adjacent active layer. If the permafrost below the pre-construction active layer is ice-rich (contains more frozen water than is required to fill the pore spaces) then likelihood and degree of deformation in the channel is greater and a modified design is required. General design approaches for the channel construction in ice-poor vs. ice-rich till is as follows:

- Ice-poor – the channel is cut with the geometry depending on local topography and required flow capacity. If riprap is required then the channel is over excavated an addition ~0.3 m to allow space for the riprap while maintaining the required cross sectional area.
- Ice rich – The channel is over-excavated by 1 to 2 m deeper into the permafrost on the base and sides and compacted till placed in the oversized channel and built back up to the required channel geometry. Little deformation is expected in the ice-rich permafrost below the compacted fill.

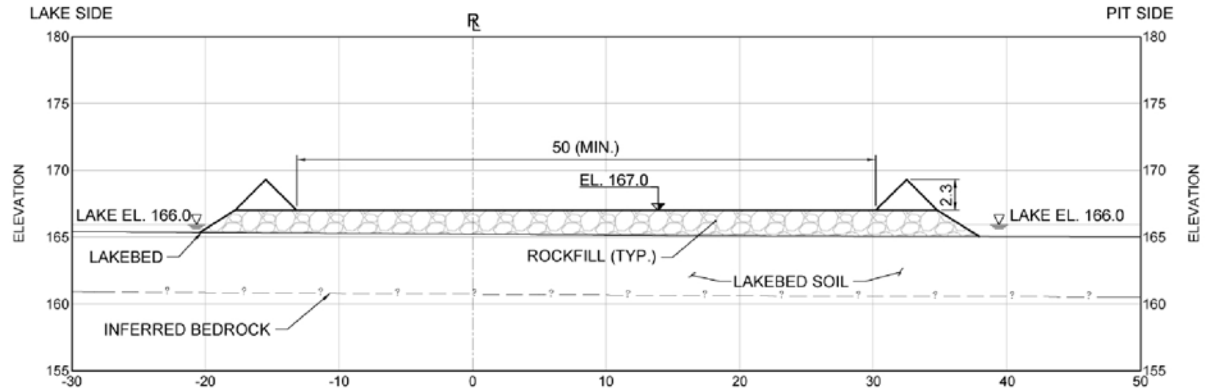
Best management practices for erosion and sediment control will be implemented with the intention of trapping sediment close to the source (i.e., silt fences, check dams in flow pathways, revegetation, etc.). These will be used during construction where required.

12.8.2 Andrew Lake Dewatering Structure

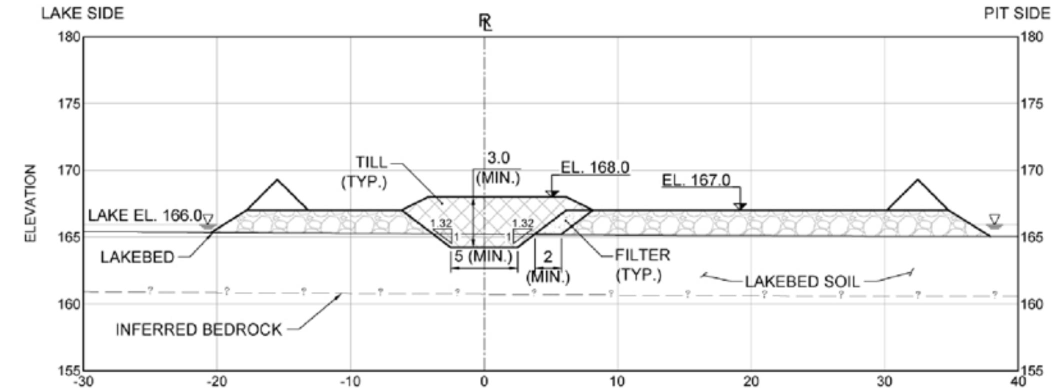
As described in Section 5, the south west portion of the Andrew Lake open pit extends into Andrew Lake and a structure is required to allow this end of the lake to be dewatered for the proposed pit development. Although Andrew Lake is a shallow lake, with an average depth of less than 1 m, aquatics studies have indicated that small fish frequent the lake and, therefore, the dyked area will be fished-out prior to dewatering. The fish-out will be done in consultation with the local communities and regulatory agencies. Approximately 135,000 m^2 of lake area, or approximately 30,000 m^3 of volume, will need to be dewatered to provide adequate buffer between the pit edge and the dyke.

The proposed design of the Andrew Lake Pit dewatering structure consists of a rockfill platform placed through Andrew Lake along the selected alignment (see Figure 12.8-1). A trench will then be excavated through the rockfill and a granular filter material will be placed underwater on the downstream face of the excavation based on material compatibility between the rockfill and till zones. Till will be placed as trench backfill under water in the excavation to act as a low hydraulic conductivity core of the structure. Selected crushed rockfill will be placed as a thermal cap over the till to promote consolidation of the till core and to reduce the thermal variation in the till zone.

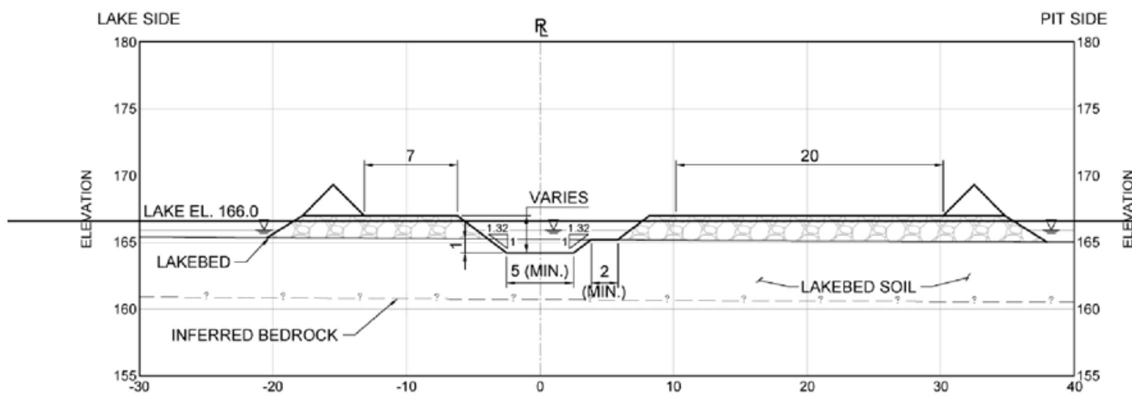
Additional details on the Andrew Lake dewatering structure are included in Technical Appendix 2F.



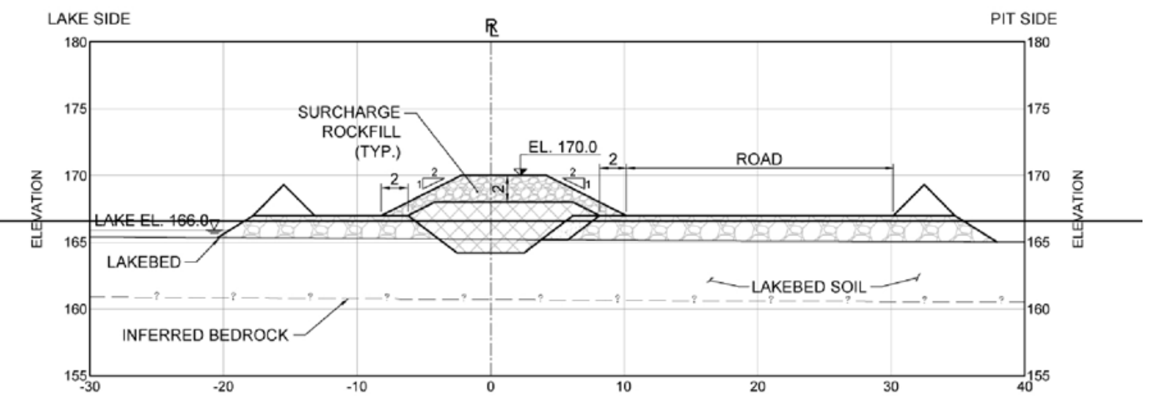
1 INITIAL ROCKFILL PLACEMENT



3 TILL PLACEMENT



2 TRENCH EXCAVATION



4 SURCHARGE ROCKFILL PLACEMENT

LEGEND

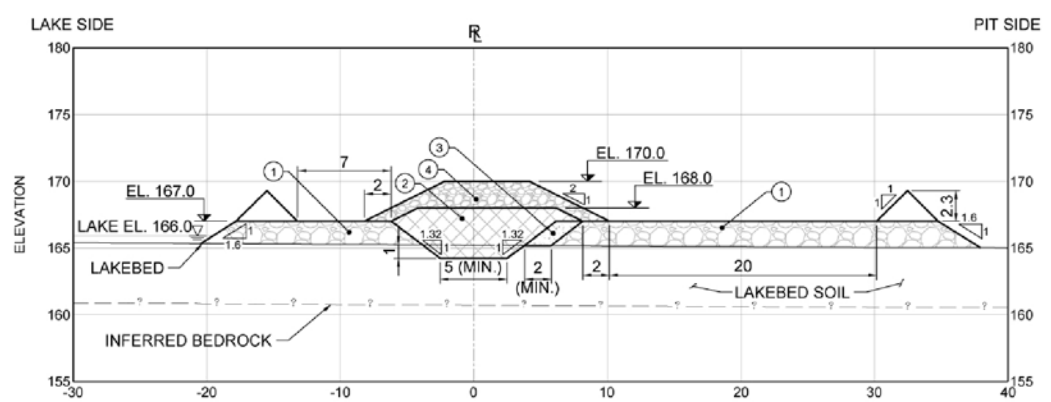
- DESIGN
- ASSUMED LAKEBED
- INFERRED BEDROCK

MATERIAL LEGEND

1. ROCKFILL
2. TILL
3. GRANULAR MATERIAL (FILTER)
4. SURCHARGE ROCKFILL

NOTES

1) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED



TYPICAL CROSS-SECTION

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Data Sources: *AREVA Resources Canada Inc.*

FIGURE 12.8-1
CONSTRUCTION DESIGN FOR ANDREW LAKE DEWATERING STRUCTURE

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12.9 Construction Support Infrastructure and Activities

12.9.1 Shipping Quantities

The current estimates of site supplies for construction are less than those required for operations (Section 10). Containerization will be used as much as practical; however it is anticipated that construction will require the movement of more bulk materials, such as steel.

12.9.2 Ice Airstrip

During the early construction phase, an ice airstrip may be constructed on Pointer Lake, approximately 3 km south of the Kiggavik site. Construction will consist of snow clearing once a suitable ice layer has formed and possibly flooding to speed ice formation. Water required for preparation of the airstrip will be drawn from Pointer Lake. Ice to land transitions will be constructed using either a snow/ice ramp or a fill pad to protect the shoreline of the lake.

12.9.3 Camp

The current 59-person Kiggavik camp and fuel cache will be expanded prior to the first construction shipping season to accommodate pre-development activities. The first winter will facilitate construction of the winter road and establishment of two temporary 43-person camps, including one adjacent to Pointer Lake. The temporary camps will be equipped with water treatment systems. Construction of the Pointer Lake airstrip and establishment of a 150-person construction camp near the mill site will then run concurrently during the first year. The 150-person camp will be significantly expanded to accommodate 750-person during the second year. This camp will continue to be used until the permanent camp is erected.

Emergency shelters will be positioned at strategic locations (i.e. airstrip, along access roads, water sources) throughout the construction period.

12.9.4 Fuel Supply, Storage and Distribution

Fuel storage capacity will be progressively increased during construction. The current fuel cache consists of 50,000 litre double walled steel EnviroTanks. The fuel cache will be expanded prior to the first construction shipping season to accommodate pre-development activities. Temporary bladder tank farms at the Baker Lake dock site and the Kiggavik site will be used in early construction, and then replaced with conventional 10 ML capacity steel fuel tanks. Construction of the permanent fuel tank farm will begin at the Baker Lake dock site during the first construction shipping season. Diesel and aviation fuel will be delivered in bulk.

12.9.5 Power Supply

Modular mobile diesel generators in containers will be used during the construction phase until the permanent power house is erected. These generators will continue to be used during operations, essentially on the Sissons site and as emergency power backup systems.

12.9.6 Laydown Area

A laydown area of approximately 85,000 m^2 will be developed during construction to store equipment and materials for construction of the mill site. This area will continue to be used during operations to store and manage containers.

12.9.7 Water Management

12.9.7.1 *Water Sources*

Water sources will be required during construction for a number of uses including potable drinking water, aggregate washing, concrete manufacture, explosives manufacture, truck wash, dust suppression, fire suppression and hydrotesting of fuel storage tanks. The fresh water pipeline from Siamese Lake to the Kiggavik site will be constructed early during the construction phase to supply fresh water required for construction.

12.9.7.2 *Potable Water*

Water will be treated by UV and filtration prior to consumption. A water truck will deliver potable water for local consumption as needed.

12.9.7.3 *Sewage Treatment*

Waste water and sewage will be collected in local holding tanks and collected via a tanker truck for treatment at a packaged sewage treatment plant.

12.9.7.4 *Water Treatment during Construction*

Water to be treated at the Kiggavik site during the construction phase will include site drainage and potentially open pit mine water (PBP and East Zone). The freshwater diversion channels will be constructed early in the construction phase in order to reduce the amount of site drainage to be treated.

There are two options for the treatment of water during construction. It may be possible to stage the construction of the permanent Kiggavik water treatment plant (WTP) to allow the chemical water treatment process to be constructed and used to treat mine water during initial development. Further development of the construction schedule will determine if this option is optimal. If it is not feasible to advance construction of the permanent WTP in time for the early stages of construction, a temporary WTP will be installed at the Kiggavik site. This temporary plant will ultimately be moved and adapted for use as the Sissons permanent WTP. The re-use of the plant would reduce logistics requirements, optimizes scheduling, and optimizes costs. The temporary WTP has been designed to treat the wastewater anticipated during both the construction and Sissons operational phases. The remainder of this section describes the temporary WTP. Refer to Section 9 for a description of the chemical water treatment process within the permanent Kiggavik WTP.

All of the temporary WTP components will be housed in customized 40-foot shipping containers. The containers will be insulated and heated for year-round operation at site conditions. Access doors and hatches will also be placed in strategic locations to facilitate maintenance activity and routine operations. The treatment operations can be generalized to require three types of container:

- reaction tank containers;
- multimedia filtration containers; and
- reagents and storage containers.

When the temporary water treatment plant is in operation, water will be segregated into mine water and contaminated run-off water. It is anticipated that mine water will require treatment for radium only while contaminated run-off water will require treatment for metals and radium.

The water treatment process has been selected to meet MMER effluent discharge criteria and meet ecological risk assessment objectives (see Section 9).

Treatment will consist of three process stages. Each process stage will be comprised of a chemical precipitation/adsorption step under controlled pH conditions followed by a solid-liquid separation step to remove the targeted contaminants as precipitated solids. The three process stages will be as follows:

- Stage 1: Removal of divalent heavy metals and uranium by precipitation at pH 9.0 using lime and sodium bisulphide (NaHS) with ferric sulphate as a flocculant and polymer coagulant; multimedia filtration for suspended solids removal;
- Stage 2: Removal of selenium and other transition metals by precipitation/co-adsorption at pH 4.5 using sulphuric acid or lime (acid or lime requirement dictated by ferric sulphate addition and water buffering capacity) and ferric sulphate with polymer coagulant; multimedia filtration for suspended solids removal; and,

- Stage 3: Removal of radium-226 by precipitation at pH 7.0 using lime and barium chloride ($BaCl_2$) with ferric sulphate as a flocculant and polymer coagulant; multimedia filtration for suspended solids removal.

Monitoring and discharge will use the same infrastructure as the permanent water treatment plant (see Section 9).

Once the permanent water treatment plant is constructed and commissioned, the temporary water treatment plant will be re-located to the Sissons site for treatment of Sissons mine and runoff waters.

Water to be treated at Sissons during the construction phase includes:

- site drainage; and
- domestic waste water.

This WTP system described above will be used during both the construction and operational phases at Sissons. Treated effluent quantities during construction are expected to be lower than during operations.

12.9.7.5 *Snow Clearing*

Snow clearing will be undertaken as needed during construction. Snow coming into contact with the construction activities on the mill site will be directed to the purpose built-pit. Snow fences will be installed as early as possible during the construction phase to protect construction areas from snow drifting.

12.9.7.6 *Waste Management*

A waste management program will be implemented throughout the life of the Project, from early construction to decommissioning; refer to Section 14.

13 Closure, Decommissioning, and Reclamation Activities

As part of the regulatory approval process, the regulatory authorities overseeing the approval and development of uranium mines in Canada require the proponent to develop and submit preliminary decommissioning plans, including financial assurance.

A preliminary decommissioning plan (PDP) has been developed for the purpose of this FEIS (see Technical Appendix 2R Preliminary Decommissioning Plan). The PDP provides preliminary plans and estimated costs for decommissioning the Kiggavik Project, as the project is described in this FEIS. The PDP includes sufficient detail to ensure that the proposed decommissioning activities are, in light of existing knowledge, technically feasible and appropriate in the interests of protection of health, safety, security, and the environment. This plan is a dynamic one in the sense that it will be updated and further reviewed as the Project advances through licensing, construction, and operation. A summary of the PDP is provided in the following sections.

13.1 AREVA Intent

Decommissioning at AREVA's uranium mining sites in Canada involves the removal or stabilization of all constructed structures and the reclamation of disturbed areas such that:

- the environment is safe for non-human biota and human use;
- long-term adverse effects are minimized;
- the reclaimed landscape is stable and self-sustaining; and,
- restrictions on future land use are minimized.

In addition, any restrictions on future land use should not prevent traditional land use including casual access with trapping, hunting, or fishing as the primary site activities.Concerns have been expressed about decommissioning and whether the land will be safe for future use at the end of the Project (EN-BL NPC June 2007[124], EN-CH OH Nov 2010[125], EN-BL OH Oct 2012[126]). The objectives described above respond fully to these concerns.

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[124] BL NPC June 2007: *If there was a uranium mine I would like this to be cleaned thoroughly before you abandon it, I don't want our game, our caribou habitat to be damaged*

AREVA's decommissioning practice is to begin clean-up and reclamation on areas soon after mining or when other operations are complete. By having a progressive reclamation program during the mining and milling operational phase, a significant portion of work described in the PDP will be complete when operations cease.

In development of Technical Appendix 2R, AREVA also relied on experience gained developing and decommissioning Saskatchewan mining projects including: dialogue with provincial and federal regulators, various EISs and support documents, preliminary decommissioning plans for the McClean Lake Operation and the decommissioning activities undertaken at the Cluff Lake Project.

AREVA has carried out extensive stakeholder consultations (Volume 3, Public Engagement and Inuit Qaujimajatuqangit, Part 1, Public Engagement), and the project plans have benefited from the knowledge and advice resulting from these consultations. Specific examples of how these comments have been factored into decommissioning planning are provided in this section. Existing processes for consulting stakeholders will be continued as the project progresses. AREVA notes that many of the comments received to date relate directly or indirectly to decommissioning and anticipates continued interest and input to this subject.

13.2 Financial Assurance

The purpose of the mine operator providing a financial assurance (FA) or financial security is to ensure neither the government (i.e. taxpayer), nor the landowner of lands leased for mining, are burdened with the cost of decommissioning a mining facility, in the event the operator becomes financially unable or unwilling to undertake or complete implementation of approved decommissioning plans. Regulatory agencies would then access the funds held in assurance and oversee the decommissioning and reclamation work.

The requirement for a FA, and that it be based on a viable PDP to meet the decommissioning objectives for the Project, addresses a broad concern which was expressed by the public during consultations (EN-RI KIA Jan 2010[127], EN-BL NIRB April 2010[128]).

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[125] EN-CH OH Nov 2010: *The most important part is the environment and returning it to its state before mining.*

[126] EN-BL OH Oct 2012: *After closing, will aboriginals be able to use the land*?

[127] EN-RI KIA Jan 2010: *There used to be a nickel mine in Rankin Inlet, but when they closed, they just left it (i.e. no decommissioning). I don't want to oppose the mine; I know that people came to Rankin Inlet because of the mine. I want to say I support it.*

A cost estimate for implementation of the Mine Closure and Reclamation Plan is not required by the NIRB Guidelines. AREVA has developed this preliminary cost estimate both to be consistent with future licensing requirements for financial assurance, and to respond to interest about the decommissioning costs. Key common requirements are listed below:

- An independent contractor carries out the work.
- The value of salvageable material and ore reserves are not credited toward the cost of decommissioning.
- Contingency allowances of up to 25% are applied to the cost estimates.

13.3 Decommissioning Planning

13.3.1 General

The preliminary decommissioning plan is designed to achieve a Project end-state that will be safe for human and non-human biota, be chemically and physically stable, allow utilization for traditional purposes, and minimize potential constraints on future land use planning decisions. By progressively reclaiming the Project site as various mining areas are completed and addressing any environmental issues that arise within those areas during the operational phase the need for care and maintenance activities and long-term institutional control can be minimized.

The preferred end state is a return to a revegetated natural setting with no visible industrial-made objects. All above ground building facilities will be removed while minimizing or eliminating immediate and long-term environmental, health, and safety hazards. This plan will return the site to an acceptable aesthetic state that is safe, physically and chemically stable, and meets radiological objectives in accordance with the CNSC Radiation Protection Regulations.

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[128] EN-BL NIRB April 2010: *Concerns with areas that have not been cleaned up properly/reclaimed. Community members, especially hunters travel everywhere on the land by ATVs/Hondas and sometimes go through old exploration sites that have not been reclaimed properly. Areas need to be reclaimed properly so that people can travel through without any incidents or concerns. Also noticed garbage around the road to Meadowbank and this should be cleaned up.*

Returning the area to a near undisturbed state is of paramount importance. To accomplish this, the following principles will be followed:

- conduct all demolition activities with due regards to, and management of, environment, health and safety hazards to workers and to the environment;
- recycle or dispose of any remaining chemicals, using existing operational practices and waste management procedures, and in accordance with all applicable territorial and federal regulations; and
- use decommissioning radiological objectives based on the need to keep future radiation doses to the general public below the regulatory limits and consistent with the ALARA (as low as reasonably achievable) principle.

13.3.2 AREVA's Integrated Approach

AREVA's approach incorporates integrated design and environmental assessment activities, as decribed in Section 17.1. Where a Project effect can be reduced through mitigation, this has been identified to the point possible and has been considered in the conceptual design, construction, operation, and decommissioning. Mitigation measures have been incorporated into the facility design and plans have been developed to actively manage mitigation measures where a design approach does not apply. Monitoring results will be compared to predicted performance, and an adaptive management approach implemented to ensure that predicted performance is achieved. Decommissioning is not an isolated phase of the project, but rather the final step in an integrated approach to environmental protection.

13.3.3 Summary of Concerns and Proposed Mitigation

Table 13.3-1 lists the significant closure and reclamation concerns and the proposed mitigation actions and provides a reference location for further detail. Further information on AREVA's integrated environmental protection framework is outlined in Section 17.1 and in Technical Appendix 2T, Environmental Management Plan.

Table 13.3-1 Significant Decommissioning Concerns and Proposed Mitigation Actions

Concern	Mitigation Type	Proposed Mitigation	Phase of Mine Life	Reference
Erosion Control	Design, Management	Erosion control incorporated into facility design Regrading of disturbed areas, restoration of natural drainage patterns, and revegetation. Progressive reclamation when practical	Construction, Operations, Decommissioning	Volume 2 – Project Description, Volume 2 Appendices, and Appendix 5O
Tailings Management				
Physical containment	Design	Conversion of mined out pits to TMFs TMF closure cover to isolate tailings from environment	Construction, Operations Decommissioning	Volume 5 - Appendix 5J
COPC containment	Design	Hydraulic containment during operations Tailings geochemical and geotechnical characteristics engineered through tailings preparation and placement processes for optimal long term performance following TMF closure. Long term performance analyzed with and without permafrost continuation	Operations Decommissioning	
Mine Rock Management				
Potential for metals leaching and/or ARD	Design	All of the mine rock will be segregated at the source for safe and environmentally sound management according to its geochemical characteristics (Type 1, Type 2, Type 3) Type 3 mine rock will be temporarily stored on a lined pad with runoff collection for treatment. Type 3 mine rock will subsequently be disposed in mined out pits (with tailings in a TMF at the Kiggavik site, and in the Andrew Lake pit at the Sissons site), Disposal below the water table to prevent exposure to atmospheric oxygen is widely recognized as best practice to minimize metals leaching and prevent ARD resulting from continuing oxidation of the mineralization in Type 3 mine rock.	Operations Operations Decommissioning	Volume 5 - Appendix 5F
Surface mine rock stockpiles	Management	Type 2 mine rock, and Type 1 mine rock surplus to construction uses does not pose environmental risk due to metals leaching and/or ARD formation, and will be managed in surface stockpiles. Surface stockpiles will either be constructed with geotecnically stable (3:1) slopes, or recontoured after completion of mining. Surface stockpiles will be contoured and revegetated for aesthetic appearance similar to the surrounding land.	Construction, Operations Decommissioning Decommissioning	
Industrial Waste Management	Management	Industrial wastes will be sorted into different categories and each category appropriately managed as per the Waste Management Plan. Materials salvaged at decommissioning for off-site recycle, reuse, or return to supplier will be monitored to confirm that regulatory requirements for removal off-site are met. Wastes resulting from dismantling/demolition of buildings, equipment and site infrastructure facilities will be disposed in a TMF at the Kiggavik site or with Type 3 mine rock in the Andrew Lake pit.	Construction, Operations, and Decommissioning Decommissioning Decommissioning	Volume 2 - Appendix 2S and Appendix 2R

13.3.4 Research Programs

Four research programs are important to validating key assumptions related to predictions of long-term performance of the decommissioned facilities:

1. Tailings Optimization and Validation Program (TOVP): To validate that produced tailings achieve the required geotechnical and geochemical characteristics and to optimize the tailings preparation and placement process (Section 8.5).
2. Mine Rock Optimization and Validation Program (MROVP): To validate that the Type 1 and Type 2 mine rock stockpiles do not pose significant environmental risk due to metals leaching or acid rock drainage and validate the Type 3 mine rock pore water characteristics (Section 6.7 and Volume 5, Aquatic Environment, Technical Appendix 5F).
3. Environmental Performance reporting: It is anticipated by AREVA that the regulatory agencies will require periodic reports which will provide a series of comprehensive "snapshots" of environmental parameters at, and near to, the Project site. Successive reports will show any changes over time relative to baseline conditions. At AREVA's northern Saskatchewan operations, these reports are called Environmental Performance reports. Although the basic Environmental Performance reports are not a research activity, AREVA uses the data collected for these reports on an iterative basis to review, and update as warranted, the models and input parameters used in the Ecologcial and Human (ERA/HRA) integrated risk assessment. From time to time, a small focused research project may be required to further clarify models and/or input parameters.
4. Revegetation: AREVA acknowledges that a site specific research program is needed to optimize revegetation of disturbed areas. AREVA's commitments with respect to vegetation are to implement progressive reclamation at the earliest practical times to establish a research program to identify and refine best practices for revegetation, specific to the project site. The research program will utilize both field experience at progressive reclamation sites, and follow-up/benchmarking with other Arctic sites. This will also be a topic in ongoing consultations with community representatives.

13.4 Decommissioing Logistics and Project Components

13.4.1 Activities and Schedule

Decommissioning the Project area will involve four stages. The first stage is progressive reclamation carried out during the operational stage. This will also include the preparation of a Detailed Decommissioning Plan (DDP) for the Kiggavik Project. The second stage will include demolition of all buildings/facilities that are not required for continued monitoring, and closure of all waste management facilities including TMFs and water treatment plants. The third stage will be monitoring of the site to ensure that decommissioning objectives have been met. This stage will conclude with the demolition of remaining buildings and facilities after water treatment objectives have been achieved. The final stage will be long-term monitoring on a campaign basis until the site is transferred to back to the landholder (institutional control).

Refer to Figure 4.5-1 for the anticipated schedule for the Kiggavik Project which indicates the anticipated 10-year period for physical decommissioning activities followed by a 5-year period of post-decommissioning monitoring. The components which will control the decommissioning schedule are decommissioning of the TMFs at the Kiggavik site and decommissioning of the Andrew Lake pit at the Sissons site. These activities are summarized in Sections 13.4.3 and 13.4.4.

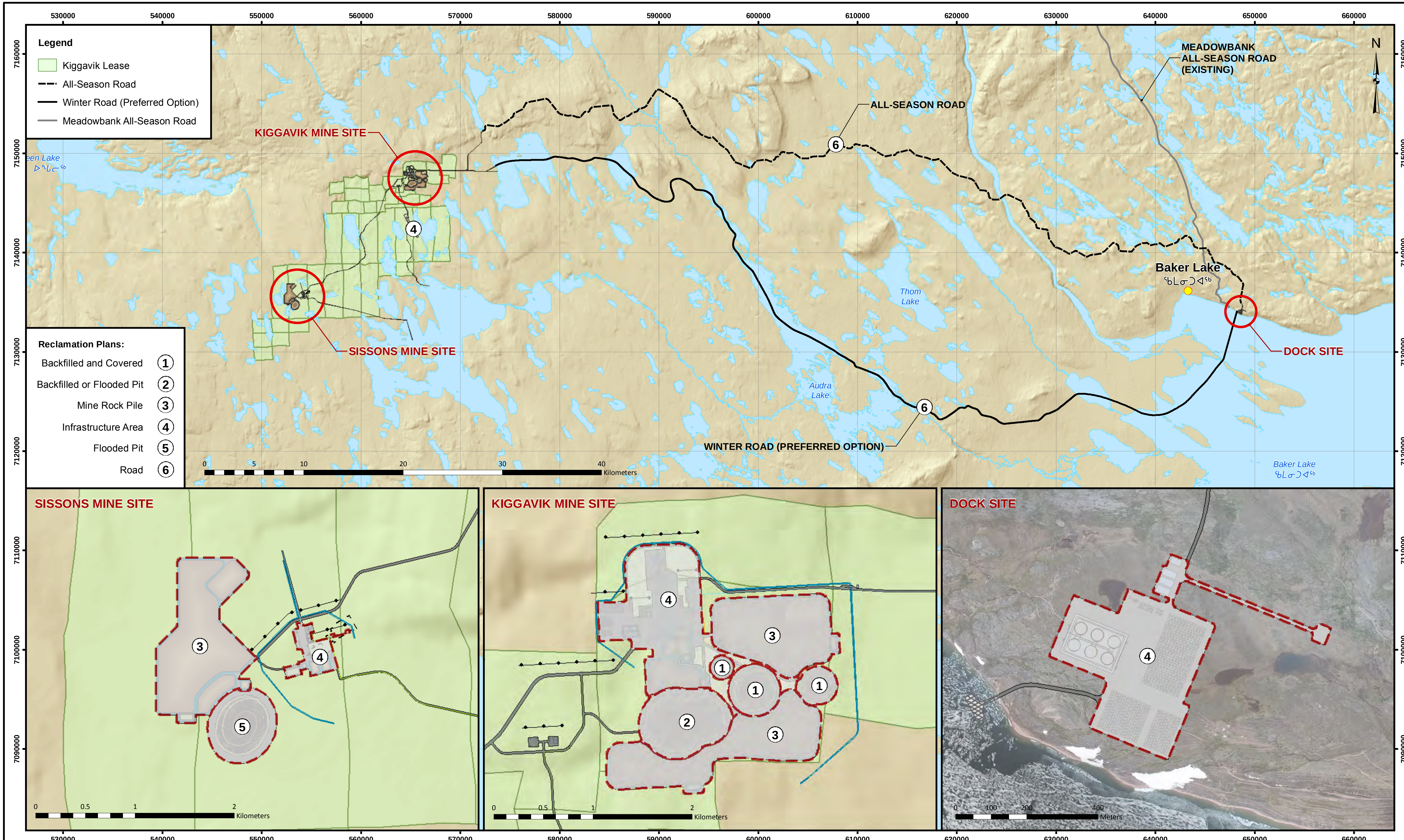
The PDP includes preliminary information and cost estimates for three planning envelopes. The planning envelopes cover the decommissioning activities associated with the following project components:

- Planning Envelope 1 – Kiggavik site
  - East and Centre Zone TMFs
  - Main Zone TMF
  - Permanent Type 1/Type 2 mine rock stockpiles
  - Mill/Camp/Maintenance complex
  - Concrete foundations and pads
  - Concrete batch plant area
  - Ore and temporary Type 3 mine rock pads
  - Kiggavik effluent treatment system
  - Solid waste management areas and facilities
  - Fuel and waste oil tanks
  - Explosive plant and magazine
  - Airstrip and associated buildings
- Planning Envelope 2 – Sissons site
  - Andrew Lake open pit
  - Buildings
  - Permanent Type 1/Type 2 mine rock stockpiles
  - Ore and temporary Type 3 mine rock pads
  - Sissons effluent treatment system
  - Solid waste management areas and facilities
  - End Grid underground mine, including portal and ventilation raises
  - Fuel and waste oil tanks
- Planning Envelope 3 – Baker Lake and Staging Facilities
  - Baker Lake dock site and storage facilities
  - Winter road
  - All-season road (if constructed)

Table 13.4-1 and Figure 13.4-1 provide an overview of planned decommissioning activities and schedule.

Table 13.4-1 Overview of Decommissioning Activities and Schedule

Phase	Timing	Key Activities
Progressive Reclamation	On-going Throughout Operations and Decommissioning	• Grading and reclamation of completed borrow pits and quarries • Ongoing characterization and segregation of mine rock produced • Tailings Optimization and Validation Program (TOVP) • Mine Rock Optimization and Validation Program (MROVP) • Closure and reclamation of East Zone and Centre Zone TMFs • Reclamation and re-vegetation of disturbed areas • Develop and obtain regulatory approval for a Detailed Decommissioning Plan (DDP) prior to end of operations
Physical Decommissioning	10 Years	*In-Water Decommissioning:* • Construct freshwater diversion structure to flood Andrew Lake Pit • Remove freshwater diversions and re-establish natural drainage • Remove and reclaim surface water containment ponds • Remove all in-water and shoreline structures • Cease freshwater withdrawal and treated effluent discharge *On-Land Decommissioning:* • Removal of salvageable equipment and materials • Demolition and removal of site buildings, foundations, and tanks • Disposal of Type 3 mine rock and contaminated materials into TMFs or pits • Backfilling of TMFs and treatment of consolidation pore water • Stabilization of underground mine workings and closure of surface access • Contouring and re-vegetation of permanent mine rock stockpiles and pads • Construct covers on industrial landfills and TMFs • Re-vegetation of reclaimed areas • Ongoing mine rock and tailings optimization and validation (MROVP/TOVP)
Post-Decommissioning	5 Years	• Remaining buildings offered to the local community • Post-decommissioning monitoring program • Radiological clearance surveys • Assess landform stability • Assess revegetation success • Complete Follow-up Program • Quantify any residual environmental effects • Transition to long-term campaign monitoring program
Long-Term Site Monitoring	As Required	• Perform long-term site monitoring program on a campaign basis until site transfer to institutional control



Projection: NAD 1983 UTM Zone 14N
Creator: CDC Revised: TL
Date: 07/03/2014 Scale:
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 13.4-1
SUMMARY OF DECOMMISSIONING PLAN

ENVIRONMENTAL IMPACT STATEMENT
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Kiggavik Project

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13.4.2 Logistics

Due to the high cost of mobilization and demobilization of heavy equipment and the logistics required due to the lack of road transport into the site, it is anticipated that the decommissioning work will be scheduled to continue throughout the entire year. The scope of work for each stage may change depending on the project status and schedule.

Similar to the construction phase, the decommissioning phase will involve the use of the ice roads from the site to a staging area at the Baker Lake Port during the winter months to ship salvageable materials in preparation for sea shipping south in the spring. Shipping containers will be used wherever possible for ease of handling and durability.

The Project includes facilities that are not directly involved in the mining and milling of uranium, such as the accommodation complex, acid plant, airstrip buildings, water supply pumphouses, and power house. These buildings and their contents are not expected to contain radioactive materials and for the most part should be salvageable. Salvageable buildings, surface structures, and equipment will be dismantled and demobilized from the site when it is economically practical to do so. Non-salvageable buildings and structures will be dismantled or demolished and disposed of in a TMF or the Andrew Lake pit.

13.4.3 Tailings Management Facilities

Closure of the TMF facilities will be implemented as a progressive closure program as tailings deposition and consolidation occur. For instance closure of the East Zone TMF will likely be completed during operation while the Main Zone TMF cannot be closed and decommissioned until termination of the milling operation. Closure activities will be conducted with the objectives of:

- stabilizing the surface of the tailings and prevent wind and water erosion;
- controlling the release of contaminants over the long-term; and
- developing sustainable landform comparable with local topography.

For East Zone and Centre Zone TMFs the conceptual decommissioning plan consists of backfilling the TMFs above the tailings mass to surface with mine rock and installing a compacted till cover.

Based on existing resources and milling schedule, the Main Zone TMF would only be partially filled with tailings upon termination of the milling activities. However there is the potential that additional ore resources will be found over the life of the project and that the Main Zone TMF will eventually be filled with tailings. Therefore, the base case for decommissioning of the Main Zone TMF assumes that it will be fully filled with tailings in a manner similar to East Zone and Centre Zone TMFs. The conceptual decommissioning plan consists of fully backfilling the TMF above the tailings mass with first Type 3 mine rock, then Type 1 / Type 2 mine rock, and installing a compacted till cover. The Type 3 mine rock is expected to be associated with some acid generation and/or metal leaching potential and/or uranium solid content greater than 250 ppm U.

In the unlikely case where no additional ore resources are found over the life of the Project, the Main Zone TMF would only be partially filled with tailings. In that case the conceptual decommissioning plan still consists of fully backfilling Main Zone TMF above the tailings mass with first Type 3 mine rock then Type 1 / Type 2 mine rock and finally installing a compacted till cover. A secondary option, the TMF would only be partially backfilled with mine rock then a compacted till cover would be installed, above which a pond would be allowed to develop. If this option were to be pursued in the future, further detailed design, and analysis of long-term pit water quality, would be conducted to support a decommissioning license application.

Figure 13.4-2 illustrates the base case decommissioning concept for the Main Zone TMF. The figure shows the tailings configuration prior to consolidation. The final configuration will have the tailngs volume reduced by consolidation and additional mine rock added to maintain the TMF fully backfilled.

The post-decommissioning and long-term behaviour of the tailings and TMFs was assessed using a number of numerical models, in particular:

- Three dimensional thermal modeling was performed using a combination of calibrated and estimated thermal properties to predict the short and long term thermal regime of the TMF area. Modeling efforts focused on estimating:

  - the short and long term effects of tailings deposition on the local permafrost regime;
  - the potential effects of climate change on the local permafrost regime within and near the pits and in the areas not affected by tailings deposition in the TMFs; and,
  - freeze back details in TMF mine rock covers.

- The geotechnical behaviour of tailings during operation and following placement of the cover was assessed through consolidation modeling. Modeling efforts focused on estimating:

  - the time rate of consolidation of tailings for a range of likely material properties and
  - the volume of tailings porewater expelled during consolidation.

- A series of geochemical models was used to model the long-term geochemical behaviour of the tailings. Modeling efforts focused on estimating:

  - mineral precipitation and surface complexation processes involved in the neutralized tailings and
  - representative long-term tailings pore water concentrations for uranium, radium and trace metals.

- The post-decommissioning flow regime of the Kiggavik area was modelled based on the regional groundwater flow model developed for the Project area. Groundwater flow simulations were performed under steady state conditions, as would exist following decommissioning. Modeling efforts focused on estimating:

  - o the hydraulic head distributions in the Kiggavik area under current and no-permafrost conditions and
  - o flow through the TMFs, including tailings and covers.

- Contaminant transport was modeled using the post-decommissioning groundwater flow model and source terms resulting from the geochemical models. Modeling efforts focused on estimating:

  - o loadings and resulting surface water concentrations to receptors.

- Two scenarios were considered for the assessment of potential long-term post-decommissioning effects. The first scenario considered persistence of current permafrost conditions. The second scenario assumed complete melting of the permafrost as a result of climate change.

These scenarios respond to the concern expressed about the effect of climate change on the tailings management facilities (EN-CI KIA Feb 2010[129]).

Other concerns were also expressed about tailings management and seepage from tailings (EN-KIV OH Oct 2009[130], EN- RB NIRB April 2010[131], EN-RI OH Nov 2010[132]). Converting mined out pits to TMFs represents best practice, and the TMFs will be designed, operated, and decommissioned as described in this FEIS to protect workers and the environment both during operation and in the long term.

The model results are described in detail in Technical Appendix 5J (Tailings Characterization, and Management). The basic conclusion is that the decommissioned TMFs will result in long-term protection of people and the environment, including a scenario where permafrost eventually ceases to exist.

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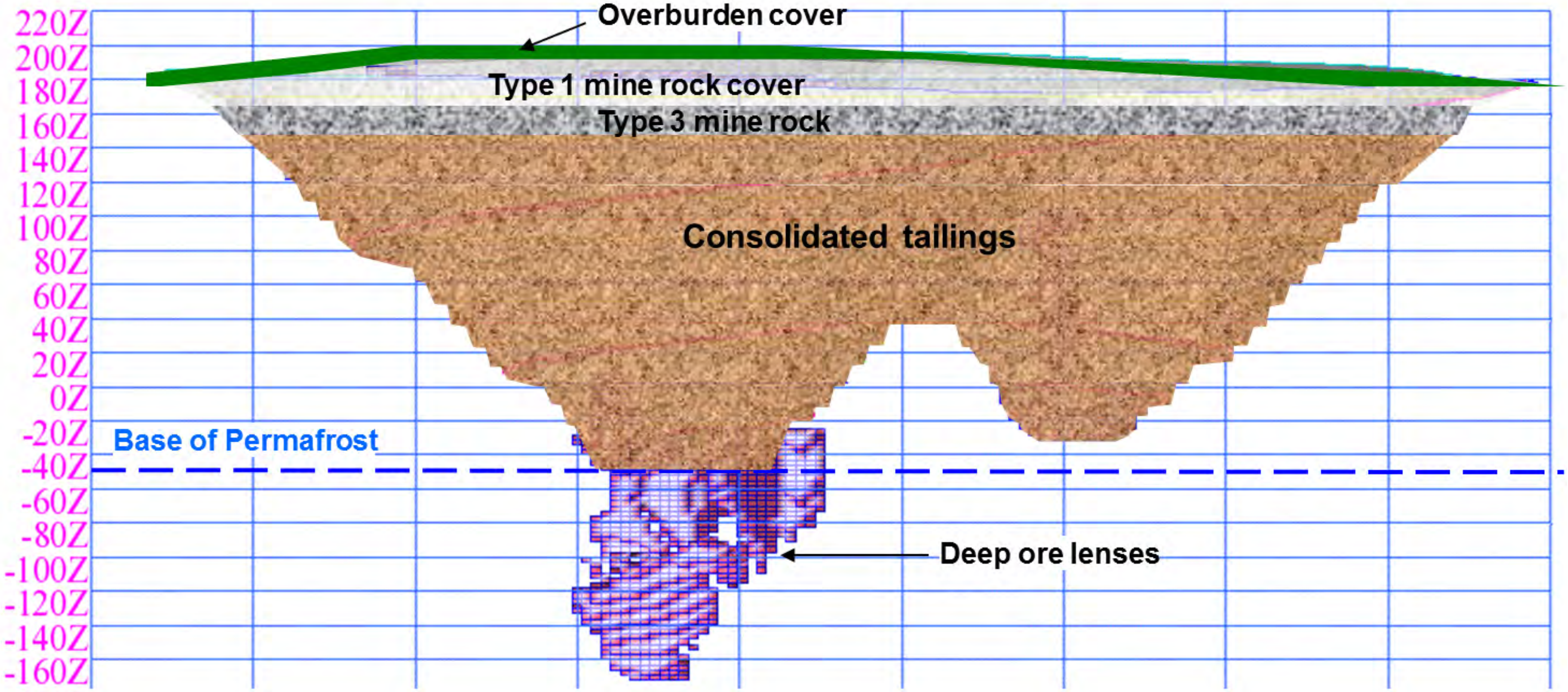
[129] EN-CI KIA Feb 2010: *Will climate change affect the tailings management facility?*

[130] EN-KIV OH Oct 2009: *Where are you going to put tailings?*

[131] EN- RB NIRB April 2010: *Concerns over the tailings facility and proper coverage to prevent radiation from releasing. Will the tailings pond be safe after it is properly covered or will it only be effective for a certain time period?*

[132] EN-RI OH Nov 2010: *Concern with groundwater contamination, how do you prevent tailings from seeping out?*



Projection: N/A
Creator: CDC
Date: 09/01/2011 Scale:
File:
Data Sources: *Areva Resources Canada Inc.*

FIGURE 13.4-2
BASE CASE DECOMMISSIONING FOR MAIN ZONE TMF

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13.4.4 Andrew Lake Open Pit

The Andrew Lake open pit will be flooded after operation to permanently store, underwater, the Type 3 Andrew Lake rock material that will be temporarily stored near the pit during operation. There are two possible scenarios for flooding after closure:

- One scenario is to allow flooding to occur naturally as a result of the accumulation of rain and snow melt and the small amount of seepage that may be expected to occur in the active layer near ground surface. At the expected natural filling rate, complete flooding is expected to require approximately 480 years.
- Alternatively, the natural filling of the pit can be complemented by flow from a larger water body, such as Andrew Lake or Judge Sissons Lake, during periods of high flow in order to shorten the flooding period.

Experience has shown that while leaching of metals and other constituents can occur while rock and pit walls are exposed to the atmosphere and natural weathering processes, such leaching tends to be insignificant to non-measurable when the same rock is submerged below water. This difference in behaviour suggests that rapid flooding may have some advantages for maintaining good water quality within and downstream of the decommissioned pit.

The Andrew Lake pit water quality was assessed by evaluating constituent loadings originating from the pit walls, rock rubble on pit floor and benches, pore water concentrations from the temporarily stored material, and the leaching of the relocated Type 3 material as the pit fills under natural conditions, as well as under accelerated pit filling conditions (see Technical Appendix 5F). These loadings were assessed to estimate the concentrations of constituents of potential concern (COPCs) in the pit water after the pit is filled.

The calculated concentrations of COPCs in the Andrew Lake pit water for a 10 year filling time were compared to CCME guidelines for the protection of freshwater aquatic life. This evaluation suggested that under this pit flooding scenario, the pit water will not represent a risk to aquatic life and pit water could discharge to surrounding surface water bodies without concern after closure.

From project management considerations, the pit should be refilled with water in less than the planned 10 year physical decommissioning period, so that confirmation of pit water quality and removal of the isolating berm from Andrew Lake can also be completed within the 10 year period. The selected approach is to divert flow from Andrew Lake during periods of high natural flow, primarily during the spring freshet. The estimated time to refill Andrew Lake pit is 6 years.

The alternatives assessed regarding backfilling and flooding scenarios for the Andrew Lake pit, potential decommissioning design considerations and effects of accelerated pit flooding, and predicted water quality are discussed in Attachment A of Technical Appendix 2R, Preliminary Decommissioning Plan.

13.4.5 Water Treatment during Decommissioning

Water to be treated at Kiggavik during the decommissioning phase includes:

- site drainage and
- porewater expelled during tailings consolidation.

The Kiggavik WTP and treated effluent discharge line as described in Section 9.5.3 will continue to operate as required during the decommissioning phase. When quantity and quality of the feed water allows, the WTP process may be adjusted such that only the chemical water treatment process would operate.

The volume of site drainage contact water is expected to progressively decrease as areas of the site footprint are decommissioned and reclaimed. The volume of tailings consolidation porewater from the TMFs will continue for a number of years following mill shutdown and then gradually decrease as tailings consolidation is completed. Therefore it is expected that feed flowrate will progressively reduce as the decommissioning phase proceeds.

Water to be treated at Sissons during the decommissioning phase includes:

- site and stockpile drainage and
- domestic waste water.

During decommissioning, sources of contact water, such as the underground mine, ore pad and Type 3 mine rock piles will be decommissioned and reclaimed. Thus, the volume of treated effluent will progressively decrease over the decommissioning period.

13.4.6 Type 1 / Type 2 Mine Rock Stockpiles

The Type 1 / Type 2 mine rock stockpiles at both the Kiggavik and Sissons sites will be re-contoured and covered to encourage revegetation and suppress the release of dust emissions. AREVA will conduct studies on mine rock test plots during the operations phase to evaluate the best methods of revegetation. Mine rock stockpiles will be progressively reclaimed where possible.

Surface drainage channels will be removed where possible and left in place where necessary to prevent ponding around the mine rock piles.

13.4.7 Waste Management during Decommissioning

A waste management program will be implemented throughout the life of the Project, from construction to decommissioning; refer to Section 14 for management practices. Waste management facilities will be closed as generation of individual waste streams ceases.

During decommissioning of the Project, all remaining contaminated landfarm materials will be sampled to determine contaminant concentrations. Those materials unsuitable for use as soil for reclamation will be disposed of in a TMF or the Andrew Lake pit.

13.5 Post-Decommissioning Monitoring and Follow-Up Programs

13.5.1 Monitoring Program

The operational monitoring plans both minimize the risk of environmental impact and provide a basis for the closure and post-closure monitoring programs. Following the completion of decommissioning activities, a post-closure monitoring program will be implemented. The objectives of the post-closure monitoring program will be to:

- monitor designated environmental parameters on an on-going basis to ensure that they conform to licence requirements with respect to environmental protection;
- verify the success of the decommissioning activities;
- demonstrate compliance with regulatory requirements and decommissioning objectives; and
- quantify any residual environmental effects.

The post-closure monitoring program will focus on key environmental indicators from the potential contaminant sources through to the atmospheric, terrestrial and aquatic environment.

Routine inspections of all areas and critical facilities will continue to be conducted during the post-closure monitoring period to ensure that decommissioning efforts continue to be successful and that the Kiggavik Project sites are environmentally secure. An on-site or Baker Lake hosted workforce will be responsible for implementing the program.

The data from the post-closure monitoring period will be evaluated prior to the end of the monitoring period to confirm decommissioning objectives have been achieved and mitigative measures are performing as designed. Once the date indicates the decommissioning objectives are achieved, the long-term monitoring program (LTMP) will be initiated.

13.5.2 Radiological Clearance

AREVA commits to achieve a safe state of closure, which meets regulatory criteria at the time of closure, and demonstrates a radiological end-state that is As Low As Reasonably Achievable (ALARA), social and economic factors considered. Radiological release criteria for decommissioning will be developed based on the results of a formal future land use assessment involving local stakeholders in the region. The approach is consistent with decommissioning objectives described in international guidance, and used in other uranium mining jurisdictions. Pre-development background radiation dose rates inform the development of site-specific decommissioning criteria along with considerations of the future use of the site, societal expectations, and economic factors. Incremental dose rate objectives are used to practically guide decommissioning activities to achieve dose based criteria with the application of the ALARA principle to ensure that decommissioning expenditures result in a corresponding increase in benefit to persons, the environment, or society. Regulatory limits are designed to protect the public and the environment; meeting these dose-based criteria ensure that residual effects are not significantly adverse. The inclusion of the ALARA concept within the decommissioning objectives acknowledges the desire to minimize impacts and to return the land to traditional uses, while considering social and economic factors.

Surveys are required to identify any surficial soils which have been affected by spillage of small amounts of ore or Type 2 or Type 3 mine rock, during hauling or temporary stockpiling of these materials. Any areas requiring remediation are readily identified by gamma radiation emitted from the uranium decay products present in these materials. Equipment and protocols for detailed surface radiological clearance surveys by AREVA, remediation if needed, and independent verification by the CNSC have been developed and implemented for decommissioning of AREVA's Cluff Lake Project. These will be established for the Kiggavik Project using the same approach.

For the Cluff Lake Project, a gamma radiation clearance process was developed and implemented which considered future use of the site and the ALARA principle to ensure no member of the general public would receive radiation exposure exceeding the public dose limit of 1 milliSievert (mSv) per year after decommissioning was complete. In addition, the analysis demonstrated application of the ALARA principle based on a dose constraint of 0.3 mSv/year to ensure the public dose limit is not exceeded. Site-wide comprehensive gamma surveys in major work areas were completed using the Surface Gamma Clearance Procedure approved by the CNSC (AREVA 2013). Surveys were conducted to ensure that residual radiation levels associated with the operation of the Cluff Lake mines and mill met criteria derived on the basis of achieving a safe, stable property that would allow utilization of the area for traditional purposes or occasional access. The Cluff Lake Project Surface Gamma Clearance Work Instruction is included for reference as Attachment C of Technical Appendix 2R.

13.5.3 Follow-up Program

The post-closure monitoring program will focus on key environmental indicators from the contaminant sources through to the atmospheric, terrestrial, and aquatic environment. In addition, a follow-up program (FUP) will be implemented to address specific mitigative measures and processes. This will confirm that the specific mitigative measures are adequate and effective in achieving decommissioning objectives.

The FUP will have specific components. A wildlife post-operation baseline will be required as a benchmark for assessing the success of reclamation activities. An aquatic decommissioning baseline will be also required, with a focus on Judge Sissons Lake.It is anticipated that other key components of the FUP will include the Tailings and Mine Rock Optimization and Validation Programs and update of the post-decommissioning source terms and contaminant transport models. Observations related to climate change over the life of the project will be incorporated in the updated models.

13.5.4 Long-Term Monitoring Program

A continuing monitoring program will be implemented at the end of the post-closure monitoring period. This long-term monitoring program (LTMP) will be conducted on a campaign basis. The objective of the program will be to confirm that mitigation measures are effective in the long term.

The focus of the LTMP will be to ensure that all information, all collection and analysis of data, and compilation of records is organized towards supporting a future application to transfer the Kiggavik site to institutional control. AREVA expects that this application will require developing a recommended scope and cost estimate for the on-going monitoring which will continue after transfer of the site.

13.6 Transition to Institutional Control

It is anticipated that an Institutional Control Program (ICP) for the decommissioned site will be formally established, similar to the program which now exists in Saskatchewan for decommissioned mines. A long-term monitoring program (LTMP) will be implemented at the end of the post-closure monitoring period. It will continue until AREVA has advanced to the point where application can be made to enter the site into the ICP. Transition from the post-closure environmental monitoring to the long-term monitoring program is expected to be gradual. The objective of the program will be to confirm that mitigation measures will remain effective in the long term. The focus of the LTMP will be to ensure that all information, all collection and analysis of data, and compilation of records is organized towards supporting a future application to transfer the Kiggavik site to the ICP.

Site activities will continue to be regulated until AREVA has advanced the information sufficiently to successfully apply for release from the long-term monitoring phase and transfer of the site back to the landholders under the ICP. The application will include a recommended scope for any on-going monitoring and/or land use controls which will continue after transfer of the site into the ICP. AREVA expects that the ICP framework will also include requirements for estimating future costs for ongoing care of the site and for funding of those future costs by AREVA as a condition for entry of the site into the ICP.

13.7 Decommissioning Costs

The estimated cost for decommissioning the Kiggavik Project is $159 million CDN. A breakdown of this total cost into the major components is provided in Technical Appendix 2R Preliminary Decommissioning Plan.

AREVA and the JV partners will provide financial assurance as required by the regulatory agencies and the landholderr. The Canadian Nuclear Safety Commission (CNSC), Kivalliq Inuit Association (KIA), and the Nunavut Water Board (NWB) will all require financial assurances to be in place for the Project to advance to construction and operation. As part of the permitting process, updated estimates will be provided based on the detailed engineering plans.

13.8 Temporary Closure

In order to temporarily close the Kiggavik Project (i.e. enter a period of care and maintenance), a detailed plan will be developed for approval by regulators prior to the period of temporary closure. AREVA has experience with this neccessity (Care and Maintenance of McClean Lake in Saskatchewan for four years while awaiting delivery of ore from an external mine) and understands the requirements to maintain sufficient full-time staff to operate and monitor critical functions, secure the facilities for the protection of the public and the environment, and facilitate resumption of operations. The Care and Maintenance Plan will be accomplished using the following framework:

13.8.1 Introduction

In the event of a temporary closure the following general measures and procedures will be adhered to in order to prepare for and maintain the temporary non-operational phase.

13.8.2 Organization and Management

Any changes to organization and management as it relates to operations will maintain numbersand qualifications required for operational needs, services and health and safety and environmental programs.

13.8.3 Maintenance of Essential Programs

Details of the extent and duration of a temporary closure will be documented and provided to regulators. Facilities undergoing shutdown and any changes to processes or programs are highly dependent on the extent and duration of the temporary closure. Essential programs that are maintained regardless of temporary closure include the following: Safety, Health, Environment and Quality Programs: Environmental Monitoring Program (EMP), Environmental Code of Practice (ECOP), Radiation Code of Practice and Radiation Protection and Monitoring Programs. .Any adjustments to programs will be identified and communicated to applicable regulators.

Emergency response capability (equipment and manpower), including spill response and industrial fire team(s) will be maintained during a cessation of production activities.

13.8.4 Effluent Treatment

The Kiggavik and Sissons water treatment plants will continue to treat any contaminated water from the dewatering of active open pits, pit tailings facilities, and water storage ponds to prevent potential surface or groundwater contamination. Appropriate freeboard will be maintained on any water holding structures to prevent potential spills. Treated effluent will continue to be discharged to Judge Sissons Lake.

The potable water and sewage treatment plants will be maintained as per operationalprocedures.

13.8.5 Waste Management

All hazardous wastes and mill reagents will continue to be managed in accordance with hazardous material protocols for operation. Should the mine subsequently move to decommissioning, hazardous materials will be managed in accordance with the approved decommissioning plan. Extended care and maintenance periods may warrant removal of certain hazardous material from site.

13.8.6 Conventional Safety

Safety management systems involving the protection of workers and property will continue as conducted during operations. In addition the following actions will be taken to minimize the risk of injury or fire:

- unnecessary propane lines will be purged with an inert gas and disconnected;

- electrical circuitry that is not required in the temporary shutdown will be physically disconnected;
- equipment that has the capacity for energy storage will be physically disconnected;
- mill circuits will be cleaned of residual ore materials and chemicals as much as practical and these substances will either be deposited in the appropriate disposal location, or suitably stored for reuse; and
- lock-out procedures for non-operational equipment will be employed and all buildings not required will be locked and signed to prevent entry.

13.8.7 Radiation Safety

All buildings, vessels and potential confined spaces, not required during the cessation of operations, but contain radioactive materials that could potentially result in unsafe radioactive atmospheres will either be ventilated as per normal operating requirements or locked and signed to prevent inadvertent and/or unnecessary radiation exposure to workers. All area and personal radiation dosimetry programs will continue as per site operating requirements.

13.8.8 Dams, Dikes and Other Containment Structures

Stability monitoring programs will be maintained for berms, dams and/or other containment structures where appropriate.

13.8.9 Site Access and Security, Pubic Safety

Appropriate measures will be implemented to control site access, to prevent unauthorized removal of materials and to ensure the identity of all persons on site will be maintained in a manner similar to that during the operating phase of the mine. In addition, the procedures and associated work instructions established in the Integrated Management System (IMS).

13.9 Premature Closure

The Preliminary Decommissioning Plan (PDP) and Financial Assurance (FA) will be progressively updated as successive stages of the Project acquire regulatory approvals. For example, at the construction licensing stage, the PDP and FA need to consider removal of the facilities constructed to that point, and restoration of the disturbed areas, but there is no need to increase the FA to that which will be required subsequently for the operational stage. The PDP and FA will also be periodically updated through the operational phase. There will be no fundamental changes to the methods approved for tailings disposal, waste rock storage and disposal, or pit backfilling and other decommissioning activities; however the specific quantities of the materials involved in decommissioning activities will change with time. For example, the number of TMFs will increase, and the volume of backfill required to decommission these TMFs will change with time. In addition to updating the PDP and FA to recognize these changes in material requirements associated with the regulatory approval being requested, any changes which would result from premature permanent closure during the time period covered by the approval will need to be included.

This approach is based on the fundamental requirement of the Financial Assurance. This is to ensure funding so that the facilities and all affected lands can be satisfactorily decommissioned is always in place, in advance and independently from the operator. The approved PDP and FA will thus reflect changes in both the scope of the work for decommissioning, and the associated liability as the Project progresses. This will extend to any changes resulting from premature closure during the time period of each successive approval.

14 Hazardous Materials and Waste Management

14.1 Hazardous Materials

Many inputs are required for mining and milling operations. Some consist of fuels and chemicals that are classified as hazardous materials. Examples include blasting materials, flammable materials, corrosive materials and oxidizing compounds.

The largest volume hazardous materials to be shipped to the Project sites include:

- Petroleum products (diesel fuel, oils, greases, antifreeze, and solvents used for maintaining operating equipment);
- Hydrogen peroxide;
- Ammonium Nitrate; and,
- Sulphur.

The largest volume hazardous materials to be shipped from the Project sites include:

- Uranium concentrate (yellowcake);
- Waste oil;
- Waste solvents/paints; and
- Spent batteries.

Hazardous materials (referred to as Dangerous Goods) transport, packaging, handling and personnel training are subject to specific regulatory requirements. Transport Canada develops and enforces safety regulations and standards; tests and promotes safety technologies; and is introducing safety management systems as a reliable and cost-effective way to prevent and manage safety risks in all modes of dangerous goods transportation. Transport Canada is responsible for ensuring air, marine, rail and road safety, as well as the safe transportation of dangerous goods.

All packages, containers, transport tanks and pressure vessels used in the transportation of dangerous goods must meet the Transport Canada *Transportation of Dangerous Goods Regulations*. All dangersous goods arriving at the Baker Lake dock facility and transported to the Project site will be stored and handled according to these regulations. All persons that are required to handle, package, ship and transport require training specific to their role. Any and all explosives transport and storage must comply with the *Canadian Explosives Act and Regulations (1985)*.

On site storage and containment of these commodities is also strictly regulated. AREVA will have an onsite Emergency Response Team that will be trained to specifically deal with emergencies including fire fighting and spill response and recovery (Tier 2 Volume 10) supported by off-site internal and contracted expertise.

Further details are provided in the Hazardous Materials Management Plan (Technical Appendix 2U) and the Explosives Management Plan (Technical Appendix 2C). Storage, handling, and shipment of uranium concentrate are also discussed in Section 10.

14.2 Waste Management Activities and Facilities

The waste management principles embrace the concepts of waste segregation and containment, diversion through reuse and recycling where appropriate, storage of materials in areas designated to minimize potential environmental interactions and/or incineration of wastes to minimize attracting wildlife. The principles build on the mine waste management initiatives that have evolved in the mining industry in northern Saskatchewan, and are in alignment with the mine waste management practices in Nunavut and elsewhere in Canada. In addition to meeting all legal requirements, the waste management principles and practices will become part of the ISO 14001 certification process for the Kiggavik Project, whichwill characterize the environmental aspects of the mine waste management plans and be subject to the continual improvement process.

Kivalliq residents have expressed concern with the management of wastes at the Kiggavik site, and the potential impacts to wildlife (EN-KIV OH Oct 2009[133], EN-BL NIRB Apr 2010[134]). AREVA considers the management of mine waste materials, such as mine rock, tailings and treated effluent, as integral components of Project design and therefore the characteristics and management of these streams have been treated elsewhere, as separate sections in thisvolume. The following section addresses additional waste materials such as recyclable and non-recyclable domestic wastes, sewage, industrial wastes, chemically/radiologically contaminated wastes, and hazardous wastes. Additional details can be found in Technical Appendix 2S (Waste Management Plan).

[133] EN-KIV OH Oct 2009: *How do you handle domestic wastes? What about industrial waste? Mining waste?*

[134] EN-BL NIRB Apr 2010: *Need to discuss in more details about the byproducts from uranium mining, not only discuss yellowcake. Byproducts are the biggest concern from the mining; what will happen to the byproducts? How will it be stored?*

Table 14.2-1 provides a summary of waste materials expected to be generated at the site during construction and operations. These quantities have been estimated by bench-marking against the McClean Lake Operation.

All waste will be identified, handled and disposed of according to a waste management program. The waste management program will be documented within the overall Integrated Management System (IMS). Each waste category will have its own waste management strategy that will be specifically designed for that particular waste product. The waste management facilities will be routinely inspected and scanned for radioactivity to ensure proper disposal and handling of waste. Recycling of wastes will be encouraged within the waste management program, wherever feasible.

Table 14.2-1 Predicted Waste Material Quantities

Material Category	Units	Predicted Annual Quantity		Retained On-site or Shipped Off-site
		Construction	Operations	
Domestic waste	m^3	7,000	1,900	Retained or incinerated
Industrial Waste	m^3	4,000	3,000	Retained
Contaminated Waste	m^3	0	3,000	Retained
Hydrocarbon Contaminated Material	m^3	600	200	Retained/Landfarmed
Used oil	m^3	100	50	Retained or incinerated
Used antifreeze	m^3	25	150	Shipped
Waste fuels	m^3	10	5	Retained or incinerated
Used cooking oil	drums	40	20	Retained
Waste grease	drums	50	50	Shipped
Used oil and fuel filters	drums	50	50	Shipped
Oil contaminated sorbal etc.	drums	6	6	Shipped
Spent aerosol containers	drums	2	5	Shipped
Batteries	cases	3	5	Shipped
Paints and Related Materials	drums	10	5	Shipped
Empty drums returned	drums	100	50	Shipped
Paper and Cardboard	m^3	50	30	Incinerated or recycled where possible
Co-mingle Recycled	m^3	50	100	Shipped
Nitrobenzene overpacks	drums	4	2	Shipped
Misc. (resin, acetone)	drums	0	10	Retained
Fluorescent lightbulbs	drums	2	5	Shipped

14.2.1 Domestic Waste Management

Domestic waste is defined as general waste materials originating from the camp and offices. The garbage will be collected either in dumpsters or recycling containers distributed around the site.

Solid domestic wastes that originate from the accommodation complex or the offices will be sorted into recyclables (paper and cans) and non-recyclables. The recyclables will be transported off-site to a recycling facility.

Domestic non-recyclables will be disposed of in landfills located in specified areas of the Kiggavik and Sissons clean waste rock piles.

The composting of food waste represents a concern due to the likelihood of attracting wildlife, therefore, all food wastes will be incinerated to minimize interactions with wildlife. Similarly, wastes such as paper, cardboard, wood, food packaging and organic matter will be incinerated. Food wastes will be placed in sealed plastic bags and inside sealed containers until they can be transported to the incinerator building for immediate incineration This is clean waste and is not contaminated. It is proposed to use a dual chamber, controlled air incinerator. The incinerator will be designed to achieve the Canada-Wide Standard for Dioxins and Furans immediately upon installation. Typically waste will be converted to gas in the primary chamber and gas from the primary chamber will be burned in the secondary chamber. It is proposed to use a used oil burner in the secondary chamber to reduce the quantity of fuel needed to operate the incinerator. Used petroleum products such as heavy lubricants and engine oil will be incinerated in the used oil furnace. The incinerator stack will have appropriate sampling ports to allow stack sampling. Stack sampling will be conducted periodically to confirm conformance with the CWS for Dioxins and Furans and the CWS for Mercury Emissions.

The incinerator will be operated in compliance with all applicable federal, territorial and local regulations. Ash resulting from the incineration of solid waste will be tested as required by the Environmental Guidelines for Industrial Waste Discharges (D of SD, 2002) and disposed of in the industrial landfill. It is not expected that this ash would be contaminated as all the waste that is burned in the incinerator is from the camp which does not contain any contaminated materials. Ash that does not meet any applicable guidelines for landfilling will be disposed into the contaminated landfill.

14.2.2 Landfills

Landfills proposed for the Kiggavik Project include two industrial landfills and one contaminated landfill for chemically/radiologically contaminated waste located on the perimeter of the Tailings Management Facility (TMF). The proposed industrial and contaminated landfills for the Kiggavik Project will be located to incorporate proposed site features that provide an additional barrier to potential contaminant migration into the surrounding environment. The Waste Management Plan (DEIS Tier 3, Volume 2, Project Description and Assessment Basis, Technical Appendix 2S, Sections 1.3 and 2.3) outlines landfill management strategies to minimize environmental interactions.

Industrial waste is defined as bulk waste materials that are non-combustible and non-contaminated originating from construction and operations. Industrial waste will be reused or recycled wherever possible. The remaining waste will be landfilled on top of the Kiggavik and Andrew Lake Type 1/ 2 mine rock piles which provide the advantage of minimizing spring freshet and storm water runoff interactions. Industrial waste will be deposited in a pit or trench such that waste is not accumulated at grade and to minimize windblown material. The industrial landfill will be covered with till periodically to further limit exposure to wind. To avoid attracting wildlife, only odourless and non-putrescible materials will be deposited in the industrial landfills. Industrial landfills will not contain contaminated materials and runoff will be directed to the mine rock sedimentation ponds. The industrial landfills will be inspected regularly to ensure proper waste segregation and monitor any wildlife presence.

The contaminated landfill will be located on the perimeter of a Tailings Management Facility (TMF) to ensure any leachate or runoff will drain to the TMF. Chemically/radiologically contaminated waste will be deposited at the bottom of a pit or trench located at the crest of a TMF, which will provide protection from wind. Periodically the contaminated landfill will be capped with glacial till to prevent infiltration of precipitation, minimize windblown material and provide shielding from interred radioactive materials. The contaminated landfill will not be lined, however, its location allows rainwater, snow, and spring freshet to drain directly into the TMF. All contact water and leachate from the contaminated landfill will report to the TMF where it will be subsequently treated at the Kiggavik water treatment plant.

Upon closure of the Project site, compacted till covers approximately one meter in depth will be constructed over the industrial landfills and the contents of the contaminated landfill will be disposed of in the TMF. Refer to Technical Appendix 2S – Waste Management Plan.

The landfills will be designed to retain sufficient waste volumes for the entire life of the mine. As areas of the industrial landfill reach capacity, they will be progressively decommissioned by the addition of a compacted till cover. Upon final decommissioning, industrial landfills will receive an additional compacted till cover, grading to redirect runoff, and subsequent revegetation. Final decommissioning of the contaminated landfill involves deposition of all waste into the TMF.

14.2.3 Hazardous Waste

In addition to the used oil burner at the incinerator, it is proposed to use dedicated waste oil burners to handle waste oil originating from oil changes on the mining equipment and light vehicles.This waste oil can be burned and used as fuel for heating purposes in shops/buildings. Hazardous substances and waste dangerous goods, consisting of waste oil/fuel filters, waste antifreeze, waste oil and waste batteries will be collected in designated containers and transported for recycling or disposal at an off site registered facility. Empty drums that typically contain product residue such as oil, antifreeze and grease will be returned to suppliers for recycling. A hazardous materials storage building and designated storage pad will be used to store the containers until there is sufficient quantity for shipment off site. The hazardous materials storage area will be designed with a secondary containment system. Non-returnable drums will be compacted and buried in the appropriate industrial landfill site.

14.2.4 Radiological Waste Management

Conventional waste materials that originate from mining, milling and water treatment areas, may be chemically or radiologically contaminated. These materials will be collected in designated areas and then transported to the Kiggavik TMFs for eventual burial.

14.2.5 Sewage Management

Sewage effluents will meet the DFO Regulations, Nunavut Public Health Regulations and any requirements stipulated by the Nunavut Water Board and the CCME Municipal Effluent Guidelines.

Sewage at both Kiggavik and Sissons will be treated in a vendor packaged plant. Sewage from the Kiggavik site, including the camp in the mill, will be treated in a sewage treatment plant located on the mill terrace. Sewage from the Sissons site will be treated in a sewage treatment plant at the Sissons site, or may be trucked for treatment in the Kiggavik sewage treatment plant. The sewage generated from the Kiggavik and Sissons sites will not be transported to Baker Lake for disposal. The sewage treatment plant will be housed in either modular units or standard 20ft or 40ft containers. It is estimated at peak manpower levels the volume of sewage requiring treatment is 200 m^3/d.

In the event that the mill/mine water treatment plant is not operating, the sewage treatment plant will still be operating to treat the sewage to meet discharge quality standards. The treated liquid sewage will be discharged to Judge Sissons Lake using the effluent discharge pipeline. The sewage treatment plant will be designed to have some level of redundancy to allow the plant to continue to operate during normal maintenance activities, as well as temporary storage in the event that the sewage treatment plant is shut down for maintenance.

A biological treatment plant is envisioned. The exact type of biological treatment plant will be selected at the detailed design stage. The sewage will be transferred to the sewage treatment plant via submersible lift pumps. Depending on the system selected, a fine screen to remove hair and fibrous material may be required to protect downstream equipment. The sewage will then be transferred to an equalization tank. The equalization tank is sized to handle the peak flows typically experienced in the mornings and evenings, and allow for a consistent feed to the sewage treatment plant. A heater will be located in the equalization tank to heat the water to the required treatment temperature of 10°C to 15°C The biological process employed in sewage treatment include oxidation of carbonaceous BOD and conversion of ammonia to nitrates. Membranes or other separation technologies may be applied to separate the sewage solids from the treated sewage liquids. The sewage treatment plant is designed to meet the criteria outlined in Table 14.2-2. It is proposed that the Waste Water Systems Effluent Regulations be used as guidance to establish the criteria, monitoring methods, volumes, parameters tested, and QA/QC requirements for sewage discharge.

Table 14.2-2 Sewage Discharge Criteria

Parameter	Quality
BOD_5	≤ 15 mg/L
TSS	≤ 15 mg/L
NH_3-N	≤ 1.25 mg/L
Chlorine	<0.02mg/L
Phosphorus	≤ 1 mg/L
Faecal Coliform	≤ 100 counts/100 mL

Sewage effluent that does not meet the discharge criteria will be recycled to the front-end of the sewage treatment plant.

Treated sewage effluent will be combined with the water treatment plant discharge (after monitoring) and discharged to Judge Sissons Lake. The sewage treatment process is expected to produce 0.03 m^3 solids/m^3 sewage at a nominal density of 3% solids. Additional sludge dewatering equipment such as a centrifuge will be provided to increase the solids density to up to 30% solids and reduce the amount of solids requiring disposal. The liquid from the sludge dewatering process will be sent back to the sewage treatment plant for re-treatment.

All sewage waste handling equipment will be in good working order and maintained through a preventative maintenance program. Operators will be trained in the proper use of equipment, loading and offloading procedures, as well as best practices for minimizing spills. In the event of a sewage spill, it will be reported to the Environment Department and cleaned up according to the Spill Contingency and Landfarm Management Plan (Tier 3, Volume 10, Accidents and Malfunctions, Technical Appendix 10B).

The preferred disposal method for solid sewage is to dispose of it on site in a dedicated sewage disposal area; the composted material would later be used in selected areas as a soil amendment for site re-vegetation. However, as sewage sludge may have the potential of attracting wildlife, burying the sewage sludge under mine rock or incinerating the sewage sludge and burying the ashes as other mines have done may be considered. The assessment considers a conservative approach when determining the effects from sewage disposal to cover the full range of possible design approaches.

Sewage at the Baker Lake dock and storage facility will be contained in an above-ground tank and hauled as needed to the Baker Lake community sewage lagoon. A loading assessment has not been conducted at this stage; however, the volume of this waste is anticipated to be low and not to adversely affect the community lagoon.

14.2.6 Landfarm

In the event of a petroleum hydrocarbon spill, the contaminated soil or ice/snow will be excavated and transported to a designated landfarm within the surface lease The proposed landfarm located on top of the Kiggavik Type 1 / 2 mine rock stockpile will be lined and designed to capture all leachate for treatment.

Landfarming is a passive form of remediation and is intended to reduce or eliminate organic compounds from the soil matrix using microbes, usually in an aerobic process. The contaminated material will likely be placed in windrows and aerated by regular turning using dozing equipment. Due to the long winters and extreme temperature at Kiggavik, the remediation process will be slow and likely require an extended period of time. Nutrient addition may be required to sustain microbial growth.

Bioremediation is increasingly viewed as an appropriate remediation technology for hydrocarbon contaminated polar soils. Experiments conducted in the Arctic indicate that landfarming and biopiles may be useful approaches (Aislabie et al. 2006). A number of studies in both Arctic and Antarctic regions have shown that microorganisms naturally occurring in harsh environments are capable of degrading petroleum hydrocarbons (Paudyn et al. 2007, McCarthy et al. 2004, Mphegko and Cloete 2004, Ferguson et al. 2003). Studies suggest that landfarming in polar regions is effective, however, microbial activity is limited by a combination of unfavourable conditions including low temperature, moisture, and nutrients. Therefore, nutrient addition and aeration of landfarmed soils during the short summer season are key components for effective remediation and are proposed operational considerations for the Kiggavik landfarm.

Recent examples of successful remediation of petroleum hydrocarbon contaminated soils in Arctic regions include the landfarming of diesel contaminated soils at the former military base at Resolution Island, Nunavut (Paudyn et al. 2007) and the successful treatment of 3,600 m3 of sandy soil by landfarming on site at Barrow, Alaska (McCarthy et al. 2004).

Recognizing that the bioremediation process is slowed by extreme environmental conditions, landfarming of hydrocarbon contaminated soils represents the best option for treatment and reuse of these soils as a result of operations at the Kiggavik Project. Reclaimed soils are proposed to be used as cover material for the industrial landfills, thereby reducing the amount of virgin soils that must be obtained during decommissioning. Refer to Technical Appendix 10B – Spill Contingency and Landfarm Management Plan for further detail.

Alternatively, contaminated soils could be stockpiled in a designated area on the mine rock pile for future disposal in the TMF upon decommissioning of the site. This offers a less intensive solution to managing hydrocarbon contaminated soils but would preclude soil remediation and re-use.

Waste management techniques for the proposed landfills and landfarm are based largely on operational experience gained at AREVA's McClean Lake Operation located in Northern Saskatchewan, as well as at Agnico Eagle's Meadowbank Project. Locations for the proposed landfills and landfarm have been selected based on operational experience and take advantage of proposed site features to provide additional barriers to potential contaminant migration into the surrounding environment. Proposed disposal and reclamation methods represent current industry practices that have been demonstrated to effectively manage domestic, industrial, and contaminated wastes. The final landfill and landfarm designs will be developed during the detailed engineering and design phase for the Kiggavik Project and will be provided at the licensing and permitting stage.

The landfarm area will incorporate a geomembrane liner in the base to prevent contaminant migration into native soils. The landfarm area will be surrounded by a berm to direct clean external runoff water away from contaminated materials. The landfarm pad will be graded towards a collection basin to ensure containment of leachate and stormwater. This water will be contained in a lined sump and treated at the Kiggavik water treatment plant.

The landfarm will be located away from sensitive areas (e.g. camp facilities) to avoid any potential air quality nuisance issues. As a result, air quality monitoring should be unnecessary.

Soil sampling will be conducted on a regular basis to assess hydrocarbon content and to optimize nutrient addition and aeration techniques.

15 Radiation Protection

15.1 Introduction

Radiation protection has been a topic of interest during public consultations. Kivalliq residents have expressed interest in having more information related to radiation and radiation protection (EN-RI NIRB May 2010[135], EN-CH OH Nov 2010[136,137]). Concerns about radiation have been expressed for mining and milling, and residents would like to see radiation safety training for site employees(EN-RB NIRB Apr 2010[138], EN-KIV OH Oct 2009[139], EN-BL EL Oct 2012[140]). Residents stated that *proper procedures will have to be put in place to ensure that employees and employers are protected and that there are no exposures to the uranium and that there are measures in place to prevent people from getting too close.* (EN-BL NIRB Apr 2010)

A Radiation Protection Plan (RPP) is implemented at uranium mine sites in order to effectively mitigate risks from radiation exposure to workers, the public and the environment. The objective of the Radiation Protection Plan is to fulfill AREVA's Radiation Protection Policy to maintain radiation doses as low as reasonably achievable (ALARA), social and economic factors considered. The RPP describes the program of activities conducted during the operational phase of the Kiggavik Project to manage, control and optimize radiation exposure.

The complete RPP is available in Technical Appendix 2Q and is organized into five (5) sections. The *Administrative Elements* describes the principles of radiation protection, classification of workers, and introduces a key document in the management of radiation protection: the Code of Practice. The subsequent RPP sections are organized around the Deming Cycle for continuous improvement of Plan, Do, Check, Act.

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[135] EN-RI NIRB May 2010: *Need more education on radon gas and the impacts it might have on the environment once it is released when uranium ore is extracted from the ground. Concerns over potential distribution of radon gas on the land due to high winds*."

[136] EN-CH OH Nov 2010: *Can you see radiation? What do you use to detect it, is it large or small (detectors)?*

[137] EN-CH OH Nov 2010: *Do you worry about getting pregnant if you work at the mines*

[138] EN-RB NIRB Apr 2010: *Concerns over exposure of uranium ore to the environment and potential release of radiation. When the uranium ore is exposed during mining, when is it dangerous, when will it be harmful to human health?*

[139] EN-KIV OH Oct 2009: *Working in the mill, what about radiation?*

[140] EN-BL EL Oct 2012: *Are you teaching radiation safety at site?*

The following sections summarize the key elements of the plan and describe radiation protection measures for specific Project components.

15.2 Administrative Elements

15.2.1 Radiation Protection Principles

The three major principles of radiation protection are:

- Justification – practices resulting in radiation exposures must have a net benefit;
- Limitation – radiation dose limits are set by regulatory bodies to control individual exposures; and,
- Optimization – exposures of workers and the general public to ionizing radiation must be optimized considering technical and economic constraints, i.e. seeking to achieve radiation doses which are As Low As Reasonably Achievable (ALARA), social and economic factors considered.

15.2.2 Nuclear Energy Workers

A Nuclear Energy Worker (NEW) is defined as a person with “a reasonable probability that the person may receive a dose (occupational) of radiation that is greater than the prescribed limit for the general public” (i.e. one milliSievert per year: 1 mSv/y). NEWs are informed in writing of their NEW designation and a written acknowledgement is obtained from the worker and kept in their training file.

NEW workers are informed of their radiation dose levels, in writing, on a quarterly basis. Their dose results are recorded in the National Dose Registry, maintained by Health Canada.

NEW workers are limited to a maximum annual effective dose of 50 mSv in a 1 year dosimetry period, not to exceed 100 mSv in a 5 year dosimetry period. Practically in uranium mining an annualized dose limit of 20 mSv per year is used for dose planning purposes.

The classification of workers, their dose limits and levels and obligations is done in accordance with CNSC’s *Radiation Protection Regulations* and *Uranium Mines and Mills Regulations*, Nunavut’s *Mine Health and Safety Regulations* and AREVA’s internal policies.

15.2.3 Code of Practice

A Code of Practice (COP) is a practical application of the As Low As Reasonably Achievable (ALARA) principle. Discrete values for radiological parameters above which intervention may be required to maintain worker doses and workplace radiological levels ALARA are defined within the COP and corresponding mitigative measures are identified.

The COP is a governing document in the administration of the radiation protection plan, and as such, is a primary reference for Radiation Protection staff in the execution of radiation protection programs. The COP is a regulatory requirement and complies with the *Uranium Mines and Mills Regulations* and Nunavut's *Mine Health and Safety Regulations*.

15.3 Planning Elements (Plan)

Planning elements used in the RP Plan include:

- radiation protection standards;
- radiation protection by design;
- dose assessment;
- radiation protection procedures;
- personal protective equipment;
- radiation work permits; and
- emergency preparedness and response.

15.4 Radiation Protection Program (Do)

The following subsections outline the elements of the Radiation Protection Program.

15.4.1 Dosimetry Monitoring

Dosimetry monitoring is conducted to document worker exposures to radiological components. The premise of radiation protection is to maintain worker doses to radiation As Low As Reasonable Achievable (ALARA). Dosimetry monitoring is required under the *Radiation Protection Regulations* and the *Uranium Mining and Milling Regulations* under the *Nuclear Safety and Control Act*. Licensees are required to record the dose received by and committed to each person who performs duties in connection with any activity that is authorized by the act or who is present at a place where that activity is carried on. Dosimetry monitoring demonstrates compliance with dose limits defined by federal regulations, territorial regulations and other regulatory instruments, e.g., license conditions.

The Dosimetry Monitoring Strategy (DMS) will address radiation doses from gamma radiation, radon progeny (RnP) and long-lived radioactive dusts (LLRD). Since dose from LLRD is already accounted for, and given the current recognized uncertainty of the uranium bioassay techniques in providing estimates of committed doses, bioassay monitoring is included as a radiological monitoring tool rather than a dosimetric tool.

15.4.2 Radiological Levels Area Monitoring

Radiological levels of gamma radiation, radon progeny (RnP), and long-lived radioactive dust (LLRD) will be monitored routinely throughout the Kiggavik Project in order to detect potentially abnormal radiological conditions promptly, estimate worker doses, and document radiological conditions.

A network of monitoring locations, parameters and frequencies will be established for each of the Kiggavik Mill, open pit mines, underground mine, and associated facilities in the Routine Radiological Monitoring Schedule procedure. This procedure complies with applicable federal and territorial regulations, identifies sample locations, parameters and frequencies; states instrument requirements and sampling methods; refers to Administrative Levels and mitigative measures; and, identifies reporting responsibilities and methods.

15.4.3 Radioactive Contamination Control

Contamination control measures will be in place to minimize the spread of radioactive materials into unintended locations. Methods used to identify and quantify radioactive contamination, determine the acceptability of the contamination relative to defined limits, and record and communicate results is given in a procedure specifically addressing radioactive contamination control.

Radioactive contamination control measures will apply to areas of the Kiggavik Project where radioactive materials may be found, exclusive of the sources on site, and to the off-site shipment or arrival of suspected contaminated material or equipment.

These radioactive contamination control measures will comply with CNSC's Nuclear Substances and Radiation Devices Regulations and Packaging and Transport of Nuclear Substances Regulations, Nunavut's Mines Regulations and internal AREVA commitments.

15.4.4 Bioassay Sampling for Uranium in Urine

Bioassay sampling of workers for uranium in urine will be part of the routine radiological monitoring program at the Kiggavik Project. The samples are conducted to identify potential abnormal intakes of uranium as workers may be potentially exposed to uranium of varying solubilities. Within the Code of Practice, triggering administrative levels are set conservatively, commensurate with the potential hazard from the uranium compounds. All NEW workers at the Kiggavik Project's mill, open pits or underground mines will be candidates for the uranium in urine monitoring program.

15.4.5 Management of Radioisotopes

In addition to the presence of radioactive material associated with uranium extraction and processing, the Kiggavik Project will use a number of nuclear substances and radiation devices. The nuclear substances or radiation devices may be used for instrument calibration, material analysis, flow and density measurement, level indication or for exploration activities. Under an operating license issued by the CNSC pursuant to the Nuclear Substances and Radiation Devices Regulations, AREVA Resources Canada Inc. would be authorized to import, possess, use, store, transfer and dispose of nuclear substances in quantities which would not exceed the possession limits identified in a controlled document, which would list the Authorized Nuclear Substances and Radiation Devices.

15.4.6 Ventilation Monitoring

15.4.6.1 *Mill and Surface Facilities*

For the purpose of the radiation protection program, ventilation monitoring consists of monitoring the systems established to protect workers from airborne radiological hazards. Monitoring includes measuring airflow volumes and velocities in the mill HVAC, process ventilation, and scrubber systems. Monitoring results will be compared to design specifications to determine system performance. Radiation protection personnel will also evaluate ventilation parameters in the investigation of any process upsets which result in elevated airborne radiological levels.

15.4.6.2 *Underground Mine*

Underground mine ventilation for underground mining at the Kiggavik Project will be monitored as part of the radiation protection program's routine radiological monitoring schedule, with additional monitoring conducted by AREVA in response to an upset. This will ensure that concentrations of radiological and non-radiological contaminants in ventilation air shall be as low as reasonably achievable complying with CNSC's *Uranium Mines and Mills Regulations*, Nunavut's *Mine Health and Safety Regulations* and AREVA's internal commitments.

The COP developed for underground mining provides performance criteria for the establishment, operation and maintenance of the underground ventilation systems and identifies corresponding responses and reporting requirements. The Mine Manager has the responsibility for the underground ventilation system and no alterations or modifications, including the starting or stopping of fans, will be made to the ventilation system without permission.

15.4.7 Shipping Radioactive Materials

The Shipping Radioactive Materials procedure addresses the various requirements for shipping radioactive materials such as uranium concentrate (yellowcake); mill tailings samples, laboratory and geology samples; and radioactive devices and sources. The procedure is developed to comply with the CNSC's *Packaging and Transport of Nuclear Substances Regulations*, the *Transportation of Dangerous Goods Regulations* and Nunavut's *Mine Health and Safety Regulations*.

The responsibility for supervising the preparation for shipment of radioactive material rests with the Radiation Protection Department.

15.4.8 Training

At the Kiggavik Project the Radiation Protection training requirements for site staff will be identified in the RP Training procedures.

Radiation Protection training programs are established to ensure that workers who are likely to be exposed to radiation receive instruction on various topics, as appropriate, depending on considerations such as the radiation risk, the type of mining or milling processes employed, and the job of the individual. Training programs are delivered to the following workers (including contractors):

- occupationally exposed workers and those assigned responsibilities in the Radiation Protection program;

sSenior management;

- non-NEW whose work may have an impact on the level of exposure of other workers;
- workers involved directly with radiation sources;
- supervisors;
- female workers; and
- all first response personnel, technical experts and representatives of appropriate authorities.

Training programs will meet requirements of the CNSC *Uranium Mines and Mills Regulations*, Nunavut's *Mine Health and Safety Regulations* and corresponding licensing requirements.

15.5 Monitoring Elements (Check)

Monitoring elements will consist of:

- review the monitoring results;
- report the results internally and externally; and

- manage change.

15.6 Continuous Improvement and Corrective Actions (Act)

Continuous improvement is achieved by:

- Identifying non-conformances relative to program commitments and implementing corrective actions;
- Practicing the ALARA principle through the implementation of management control over work practices, personnel qualification and training, control of occupational and public exposure to radiation, and planning for unusual situations;
- Annual review of the RP program to identify deficiencies and areas for improvement. Internal audit of the program will also serve to ensure program adherence to standards and to enhance effectiveness and efficiency; and.
- Objectives for program improvement, with measurable targets, are set annually and approved by the General Manager.

15.7 Radiation Protection Measures

15.7.1 Open Pit Mining

Radiation protection practices in open pit mining operations consist primarily of operational practices including preventative measures, worker training and awareness, work planning, and ongoing review and follow-up of results. The previous mining of the JEB and Sue deposits at AREVA's McClean Lake Operation has demonstrated that the worker exposures have been well managed, and below both predicted and Code of Practice levels. Average annual radiation doses experienced during open pit mining at the McClean Lake Operation were less than 1.5 mSv, with maximum annual doses typically less than 3.5 mSv. Average ore grades in the series of 4 Sue pits ranged from 0.41% in Sue A to 2.15% in Sue C, with an overall average grade of 1.37% U. It is expected that worker radiation exposures during mining of the Kiggavik pits will be controlled to, or below those recorded at the McClean Lake Operation. Further information on predicted worker doses are provided in Volume 8.

AREVA's current radiation Code of Practice, as proven through the experience of mining the JEB and Sue ore bodies, will be appropriate to use as a basis for the Kiggavik open pits as grades and mining methods will be consistent with past practices at McClean Lake Operation.

The following preventative measures are routine operational activities currently used at the McClean Lake Operation to limit exposure to radioactive materials:

- dust suppression with water;

- controlled blasting in ore zones to minimize throw of ore bearing materials;
- proper control of water to prevent radon and particle migration;
- interiors of vehicles are routinely monitored and cleaned frequently;
- exteriors of vehicles are cleaned before maintenance work is conducted, except for unexpected maintenance;
- scheduled maintenance work is conducted away from uranium-bearing materials, where practicable;
- while working on ore benches, time spent outside vehicles is minimized;
- shielding is installed, as required, in vehicles used in the pit, (i.e., haul trucks and backhoe);
- windows of vehicles are kept closed and a positive pressure ventilation system is maintained;
- air filtration devices and weather stripping in vehicles are maintained in good order;
- no eating, drinking, or smoking is permitted in the vicinity of uranium bearing materials;
- shop areas are routinely monitored and cleaned; and,
- building ventilation and containment equipment, such as fans, furnaces, doors, and windows are routinely maintained.

The following worker awareness measures are currently used at the McClean Lake Operation to educate and inform mine workers, often on a day-to-day basis, of potential exposures to radioactive materials:

- a copy of the Code of Practice manual is available, and is explained to workers. The Code of Practice provides guidance to workers in their activities if key indicator levels of radioactivity or radiation exposure are reached;
- area monitoring results are posted and available to workers through notice boards;
- workers wear direct reading dosimeters and monitor their accumulated gamma dose throughout the day;
- radiation protection training is provided to all workers;
- radiation protection staff are available 24 hrs/day to provide guidance and answer questions; and,
- radiation protection staff provide personal dosimetry results to all workers.

Mining staff currently plan work in a manner to minimize worker exposure where possible, based on the following procedures:

- regular review meetings are held with mining and radiation protection staff to review worker doses with respect to past and upcoming work;
- gamma radiation levels are monitored daily within the pit in areas of potential worker exposure and results are reviewed with respect to expected ore grades;

- worker doses, estimated by direct reading dosimeters, are recorded and reviewed by mine operations supervisors and radiation protection staff daily; and,
- potential radiation exposures not identified in individual worker dose assessments due to workers conducting non-routine activities are identified, an assessment of potential dose is conducted, and a Work-Stay permit is issued, as required. The Work Stay permit describes any constraints (e.g. time duration), and specialized equipment or procedural requirements for the non-routine activity.

15.7.2 Underground Mining

The ore grades within the End Grid ore body are relatively low compared to many of the underground mines in Saskatchewan. However, worker exposure to the radiation fields within the ore body will still need to be carefully managed. These radiation fields were carefully considered during the conceptual design of the underground End Grid mine.

Radiation protection for underground workers will be a multi-faceted approach consisting of a combination of ventilation controls, sealed and lead-lined mobile equipment cabs and shotcrete barriers.

15.7.2.1 *Ventilation*

The ventilation of all ore production areas will be separated from the main decline by ventilation doors at each level access. All ore headings will be ventilated with fresh air and exhaust air will be pulled through rigid ductwork directly to an exhaust airway so that used air is not re-circulated to other headings. All primary access ways will be maintained in fresh air and will be located in non-mineralized mine rock material. The ore stockpile bay at each access level will be ventilated with fresh air to carry all dust and radon directly to an exhaust raise connected to the end of these drives. The air quantity and velocity in ore drifts will be sufficient to ensure dilution of radon and a continuous supply of fresh air. The general principles used in the design of the End Grid Mine are:

- Auxiliary ventilation to active mine faces will be fresh air with the exhaust ducted to the mine exhaust.
- Ventilation air from any potential source of contamination (e.g., sumps, remucks, stockpiles) will be directed to the mine exhaust without contaminating other active workplaces.
- In general, each active cross cut will be provided with either a “pull” system, where clean air is fed into the working area and the contaminated air is collected in a duct and directed to a dedicated (unoccupied) exhaust drift, or a flow-through system.
- Equipment cabs will be ventilated through HEPA filters. This will reduce Long-Lived-Radioactive-Dust (LLRD) doses and, depending on the ventilation flow in the cab, radon progeny doses.

- The excavation of production stopes will begin at the downwind edge of the ore on each level. As these stopes are mined out, production will move towards fresh air. This will avoid the contamination of fresh air by radon leaking out of the older mined-out stopes.

15.7.2.2 *Gamma Shielding with Shotcrete*

Shotcrete will be used in all ore drifts to act as a gamma radiation barrier. The main ore footwall access drift on each DAF cut will receive up to 10 cm of shotcrete. Any portion of the access drift in waste rock, or adjacent to backfill, will be shotcreted as required for ground support reasons. The production ore headings will receive up to 5 cm of shotcrete applied to all ore surfaces – walls or back. Again, any portion of the production drifts that are in waste rock or adjacent to backfill will only receive shotcrete as required for ground support. The shotcrete will also be applied in the shoulder of these drifts along the backfill interface to ensure that any air gaps between the drift back and the previously backfilled wall is sealed to prevent air leakage.

15.7.2.3 *Mining Procedures and Equipment Shielding*

Mobile production equipment cabs will be lined with a thickness of lead to reduce gamma radiation. This will include drill jumbos, LHDs, trucks and bolters. Shielding the cabs will require the custom application of lead sheets to the sides, floors and roof of the cabs. It is generally accepted that workers in standard unshielded cabs are subjected to gamma radiation at about half the dose rate of workers outside the cab. Lining the equipment cabs with 2 cm of lead will improve the shielding by a factor of approximately 4.

All mining equipment will be setup for work within low-dose-rate mobilization areas outside the mineralization (access drifts and declines in waste rock). At these locations, workers can assemble their gear and fuel and check their equipment. They would then move to the active workplace, perform their assigned task and leave. All mobile equipment will be parked in these low-dose-rate areas when not in use. This practice will reduce the amount of time workers spend in the stopes outside of their shielded cabs.

All mine activities where workers cannot be within shielded cabs, such as explosives loading or changing jumbo drill bits, will be organized in such a way that the minimum practicable time is spent on each part of the cycle.

There will be a need for other workers to enter the production stopes for limited periods of time. For example, there will be short entries by geologists and radiation protection technicians. The most significant time spent in the stopes will be for blasters and workers extending the ventilation ducting and installing auxiliary fans. It is unlikely that the auxiliary ventilation system can be serviced from the shielded cabs of mobile equipment. This task will require time management. Preparation and set up for the work will be in the low radiation mobilization area. Once all the equipment preparations are complete, the workers would enter the stope, probably using a mobile scissor lift, hang the ducting, and then exit.

15.7.2.4 *Additional Measures*

Examples of additional actions that may be taken as circumstances warrant include:

- the application of additional shotcrete in localized higher grade zones;
- the application of shotcrete to the production stope face where grades are elevated;
- the use of movable steel shields at the face while loading holes;
- the use of respiratory protection for workers outside the cabs of mobile equipment; and
- careful pre-planning of higher hazard work.

15.7.3 Mill

Radiation protection objectives have been incorporated into the mill based on preliminary radiation protection design criteria. Design objectives, together with administrative controls, are intended to maintain worker radiation doses ALARA. A continuous improvement process will be used to monitor exposures and improve performance over the life of the Project.

The design is intended to:

- Meet all CNSC and Nunavut Water Board limits for effluent released to the environment.
- Provide ore containment, shielding, physical barriers and ventilation systems to meet or exceed AREVA Code of Practice standards for radiation protection.
- Provide containment systems to avoid spillages directly to the environment and facilitate rapid clean-up.
- Utilize the ALARA principal to minimize employee exposure to ionizing radiation, dust, toxic metals/materials, hazardous chemicals/reagents and other carcinogens.

The following sections describe radiation protection measures specific to the mill; these are applications of the radiation protection program framework as described in the previous sections and Technical Appendix 2Q.

15.7.3.1 *Mill Layout*

Radiation protection considerations have been incorporated into the mill layout. The ore pad, crushing and grinding, Drying/Calcining, and Packaging circuits are located downwind of the other operating areas to reduce the potential for dust exposure. Crushing and grinding circuits have been designed to operate without the need for a crushed ore stockpile, thereby removing potential source of dust and radon. Circuits have been arranged to segregate ore and tailings slurry flows (Crushing and Grinding through to Tailings Neutralization) from primarily solution flows (Elution through to Uranium Precipitation).

15.7.3.2 *Shielding*

Shielding of process vessels containing slurry, such as in grinding, leaching, resin in pulp (RIP), and tailings neutralization, will be used as required to reduce gamma exposure. Materials recommended include concrete and steel of varying thickness. Lead shielding may be required on ore pad mobile equipment and rock breakers.

15.7.3.3 *Separation and Containment*

Separation will be used throughout the mill to distance workers from radioactive materials and to control and contain materials during regular operation, and in the event of a process upset. General contamination control measures include washing facilities in control rooms and beside coffee rooms, containment of circuit materials and spills, and no open air processes.

Considerations for spill containment and prevention are incorporated into the mill design by including containment provisions and process control features. Specific separation and containment measures will include:

- Crushing is a dry process and therefore dust control measures, including dust collection, exhaust scrubbing and stringent housekeeping will be required. The hoppers, crushers, conveyors, SAG mill, ball mill, pachucas, pump boxes, and cyclones will all be vented to a dedicated scrubber system;
- The crushing and grinding areas will be separated from other process areas by appropriate concrete curbing to contain any spillage within the area. The floor will be graded such that any spill in the area is directed to sumps and pumped back to the SAG Mill and/or Ball Mill. If the circuit is shut down, clean-up material will be transferred to a storage vessel for eventual metering either into the SAG Mill or the Ball Mill;
- The leach vessels will be covered, with vent fans and ducting installed on each vessel;
- Each process area of the mill will be bermed and graded to ensure any spills and clean up water in the area are directed to a dedicated sump and pump for return to the process. Sumps and pumps will operate on level control to prevent sump overflow. Where practical, area curbing will be high enough to contain at least 110% of the largest vessel in the area for spill containment;
- Screens and tanks in the Resin Adsorption area will be covered and vented where required;
- Screens and tanks in the Resin Dewatering area will be covered and vented where required;

- Dust collected from packaging and yellowcake storage is recovered in a wet scrubber and returned to the process;
- Pipe layouts will ensure maximum distance between gamma sources and personnel, with supplementary shielding where required;
- Berms will be constructed at door accesses to prevent excursion from the mill building; and,
- The mill terrace will be graded towards site collection ponds and the tailings management facilities (TMFs).

15.7.3.4 ***Ventilation***

Mill ventilation will be a single-pass system to minimize worker exposure to airborne radiation and dust. The air-flow through the mill will be from areas of low potential contamination to areas of higher potential contamination. Exhausted air will be replaced and pressure gradients will be maintained between the process areas and the non-process areas (i.e. control rooms).

The mill facility is divided into zones. Zone 1 is occupied by personnel and is the most positively pressurized to ensure the flow of air moves towards Zone 2. Zone 2 consists of the process areas and Zone 3 the process vessels. The air is exhausted through the process vessels where it has the least pressure. The maintenance of pressurization is important to control radon gas and dust.

Vessels and sumps containing radioactive material will be maintained at lower ventilation pressure than the adjacent atmosphere, thereby preventing leaks of airborne radioactive materials into the working environment. In general, all vessels containing material that have potential to disperse radon progeny are vented and exhausted outside the mill building. When practical, process vent fan exhausts are combined to minimize roof or wall penetrations and for ease of exhaust monitoring.

Areas where the risk of dusting is high, such as Crushing, Grinding, Drying/Calcining and Packaging, will be isolated and the area negatively ventilated with respect to adjoining areas. The equipment which is the potential source of dust will be further isolated and more negatively ventilated than the area in which it is located. In the case of filters and linear screens, ducting and hoods will be used to ensure negative ventilation. All dust laden exhaust air will be scrubbed (Crushing, Grinding and Packaging areas) or high efficiency particulate air (HEPA) filtered (Drying).

Positive pressure will be used for the cabs of the ore pad mobile equipment and rock breakers.

All mill ventilation will be controlled by a central controller. Mill make-up air set points will be adjustable by operators within a given range and will automatically reset based on ambient conditions. During upset conditions, airflow to the given area will be increased by operating the areas make-up air unit at high-speed, and adjusting adjacent areas make-up air to increase ventilation. Upset conditions may be triggered automatically by high levels of radon or operated manually by operators. Offices, administration, laboratories, control rooms, and drys will be tied to the central controller with locally adjustable zone controls.

Ventilation systems operation and performance will be controlled through preventative maintenance, monitoring systems and a field monitoring program. In accordance with the ALARA principle, ventilation systems will be routinely assessed to identify areas of improvement and optimization.

15.7.3.5 ***Designated Areas***

Radiation protection administrative controls will also be implemented through the designation of areas according to potential radiological hazard or contamination control requirements. The following areas are identified:

There will be designated clean areas where the use and storage of radioactive material is not permitted. These include offices, coffee rooms, control rooms and the warehouse.

Coffee rooms will be designed to meet the criteria for *Lunch Rooms and Eating Areas* identified in Part VI, Subsection 38 of the *Uranium and Thorium Mining Regulations*, applicable at the time of construction. The coffee rooms will be supplied with hot water, heat, ventilation and hand washing and drying facilities to prevent the potential intake of radioactive materials.

Periodic monitoring (e.g. swipes, direct scans) will be conducted to ensure continued cleanliness of these areas. These areas will be cleaned frequently. Each of these areas will be supplied with special entry, boot and hand wash facilities.

Work areas are defined as areas where radioactive material is used and stored, and where radioactive contamination is anticipated and controlled. Work areas are separated into work place areas, where radioactive contamination controls are subject to ambient radiation backgrounds and where nuclear energy workers (NEW) have access without special authorization (e.g. general mill), and designated work areas where radioactive contamination controls are subject to operational ambient radiation backgrounds and where NEW access may be subject to Safe Work Permits (e.g. packaging enclosure).

Transfer areas are defined as areas where material is being transferred from potentially contaminated workplace areas to an area maintained as a clean area to prevent the egress of radioactive material offsite, such as yellowcake drum storage.

Off-Site Unrestricted Release areas are those where materials are being transferred from an area where radioactive material may have been used or stored, to a clean location on or off site.

Monitoring will be used to ensure that designated areas are used as designed, to ensure containment of contamination.

15.7.4 Transportation of Yellowcake

Air Transport in Canada is strictly regulated by Transport Canada *Canadian Aviation Regulations*. The packaging and transport of radioactive materials is subject to Transport Canada *Transportation of Dangerous Goods Regulations* and the CNSC's *Packaging and Transport of Nuclear Substances Regulations* (PTNSR). All transporters of radioactive materials in Canada require their own Radiation Protection Program. Protection of workers and the public from radiation dose associated with yellowcake is achieved primarily through containment, shielding and separation.

Further detail on the transportation of yellowcake is provided in Section 10.

15.7.5 Decommissioning and Post-Decommissioning

Future procedures and work instructions to be established under the Radiation Protection Program would apply during all mine-life phases at the Kiggavik site. These procedures and work instructions would be established to control worker radiation exposure doses using standardized methods and will be updated as required to cover special decommissioning activities.

The requirement to keep radiation exposures ALARA, social and economic factors taken into account, will be respected as an overall guiding principle during site decommissioning activities.

In association with a future application for a decommissioning license, a revised Code of Practice for Radiation Protection will be prepared to compliment the Final Decommissioning Plan. It will detail appropriate Administration and Action Levels for various work activities.

In terms of post closure radiological safety, the decommissioning objective will be to restore impacted areas to a level such that the incremental effective doses to inhabitants of the region do not exceed 1 mSv per year above natural background levels (CNSC, 2003).

For items considered salvageable, contamination control measures will be in place to minimize the spread of radioactive materials into unintended locations during operation of the mine. Methods used to identify and quantify radioactive contamination, to determine the acceptability of the contamination relative to defined limits, and to record and communicate results, will be detailed within the revised Code of Practice.

16 Occupational Health and Safety

16.1 Introduction

AREVA Resources Canada Inc. is committed to establishing and maintaining a comprehensive occupational health and safety program for the Kiggavik Project which focuses on accident prevention and risk management. Personal injury accidents, untoward incidents, property damage and occupational illnesses are not the inevitable costs of doing business.

At AREVA, the Occupational Health and Safety program is made up of several components that implement the AREVA Safety Policy and its objectives. To provide a healthy and safe workplace for employees and contractors, the program is designed to meet legislated requirements, internal AREVA Resources Canada Inc. standards and the Occupational Health and Safety Assessment Series (OHSAS) 18001 Standard.

AREVA's commitment to providing a healthy and safe workplace is guided by the following five basic principles:

- We make safety a recognized value.
- We do not compromise standards, rules and procedures.
- We lead behaviours through observation, example and explanation.
- We maintain positive control over conditions and activities.
- We recognize warning signs and don't live with problems.

16.2 Health and Safety Policy

Kivalliq residents have expressed concerns over safety of the Kiggavik project, and want assurances that the project is safe for the workers, and for the public (EN-BL KIA Feb 2010[141]). Residents believe that safety is important for all levels of the workforce (EN-BL OH Nov 2013[142]). Residents

[141] EN-BL KIA Feb 2010: *I support this project as long as certain conditions are met (including conditions of safety and wellbeing. We have a very concrete example (with Agnico) to refer to.*

[142] EN-BL OH Nov 2013: *Health and Safety needs to be something that is important to a company and coming from the top down or it is very hard to make a safe site.*

would like to know more about safety risks that are uranium-specific and arctic-specific (EN-AR OH Nov 2013[143]) Safety concerns were noted from other arctic mines, and would like to see lessons learned incorporated into the health and safety plans (EN-AR OH Nov 2013[144], EN-BL NIRB Apr 2010[145]). AREVA Resources Canada Inc. is committed to providing a healthy and safe work environment for all of its employees and contractors, and to ensuring that all work is performed in a safe and responsible manner that meets regulatory and company standards.

To meet this commitment, AREVA shall:

- comply with applicable legislation and other requirements to which AREVA subscribes;
- develop internal objectives and targets to achieve continual improvement in health and safety performance;
- measure performance against established goals;
- support all employees and contractors in fulfilling their health and safety responsibilities;
- develop, implement, maintain and test emergency procedures;
- investigate reported incidents that result or could result in employee illness or injury;
- identify and address workplace risks and hazards;
- promote and maintain dialogue with stakeholders on health and safety issues; and,
- foster a common safety culture throughout the organization.

16.3 Summary of Occupational Health and Safety Plan

All persons working at the Kiggavik Project sites will have a role in implementing the Occupational Health and Safety Plan, which will be in effect for all Project phases (Technical Appendix 2P). The Internal Responsibility System (IRS) exists in the commitment by all persons (workers and management) to provide a healthy and safe workplace by proactively identifying and solving occupational health and safety problems that occur. The commitment is internal with both workers and supervisory management sharing direct responsibility for the safe and efficient performance of work. The following groups and individual positions will have specific safety roles:

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[143] EN-AR OH Nov 2013: *What are the safety risks in uranium mining? Do accidents increase with colder temperatures?*

[144] EN-AR OH Nov 2013: *Baffinland ran into a problem when 4 pick-ups got stuck in stormy weather on road. Distance between shelters were too far and survival packs carried in pick-ups were not adequate.*

[145] EN-BL NIRB Apr 2010: *Elder's husband worked at the Rankin Inlet Nickel mine as an underground miner and became ill. Would like to see a protection plan put in place for the people, workers, wildlife and land from uranium and uranium mining.*

- Safety, Health, Environment and Quality (SHEQ) Department;
- Training Group;
- Emergency Response Team;
- Senior Management;
- Operation and Functional Managers;
- Supervision;
- Workers;
- Safety Professionals; and
- Occupational Health Committee (OHC).

The Occupational Health and Safety Plan is built around Deming's model of Plan, Do, Check, Act to ensure quality and continuous improvement in health and safety.

Planning includes risk management activities, safe work plans and procedures, change control, emergency preparedness, safety by design, and training programs.

Monitoring of performance will include the use of leading and trailing indicators, workplace inspections, industrial hygiene monitoring, incident investigations and reporting, and routine reporting requirements.

Continuous improvement is facilitated through regular program reviews and the setting of annual Health and Safety targets. Tools used for the monitoring of performance will be used to develop relevant targets.

The Plan also includes provisions for employee health and wellness, such as health monitoring and promotion, and occupational medical surveillance. There will be a Health Centre on site , situated at an appropriate location. The Centre will be managed by a site nurse. The Centre will conform with the requirements of applicable Nunavut Regulations.

16.4 Summary of Emergency Response Plan

Residents of Kivalliq, in particular Baker Lake and Chesterfield Inlet expressed the need to be prepared in the event of an emergency such as a spill or airplane crash (EN-KUG NTI May 2007[146],

[146] EN-KUG NTI May 2007: *What happens if there is an accident?*

EN-CI OH Nov 2012[147], EN-BL NIRB April 2010[148]). Residents would like to see an emergency response plan in place to protect both people and the environment (EN-BLOG Dec 2010[149], EN-AR NIRB May 2010[150]). Baker Lake residents would like AREVA to provide assistance in the event of an emergency near the Project (EN-BL HTO Mar 2009[151]). In addition to the Occupational Health and Safety Plan, there will also be a separate Emergency Response Plan created to manage all emergencies at site. It provides the organizational structure and responsibilities of personnel in the event of an emergency. There will also be a Mutual Aid Agreement that AREVA anticipates on developing with nearby sites in the event of a significant emergency where additional response personnel and resources may be needed.

The Emergency Response Plan includes discussion on management of various types of emergencies including mass causalty management. The plan includes a general list of emergency equipment that AREVA will have on its site and also key internal and external contacts. There will also be specific training requirements for emergency responders that is described in the plan. An overview of the communication system has also been provided to describe how an emergency will be managed.

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[147] EN-CI OH Nov 2012*Marine shipping - oil spills: if there is an oil spill, a shield (instrument to contain oil spills, such as a boom) should be in place near Chesterfield. There is lots of marine traffic and a narrow inlet*

[148] EN-BL NIRB Apr 2010: *What is the potential of large scale accidents for the project and what safety measures are in place to protect workers from small to large exposure?*

[149] EN-BLOG Dec 2010: *What is the extent of the emergency response, equipment, material and manpower that will exist during the ongoing operation?*

[150] EN-AR NIRB May 2010: *Concerns over potential impacts to marine wildlife and birds from accidents; community members depend on wildlife. Emergency plans need to be put in place to protect wildlife and birds.*

[151] EN-BL HTO Mar 2009: *There is a lot of fur bearing hunters who hunt around this area, if there ever was a blizzard and the hunter was being searched for. How would AREVA accommodate or help out with the search?*

17 Environmental Protection

The Environmental Management Plan (EMP), detailed in Technical Appendix 2T and summarized below, outlines AREVA's systematic approach to managing project-environment interactions and potential environmental effects throughout the life of the Kiggavik Project. It defines the sequence of policy, compliance, planning, implementation, monitoring, review, and reporting processes that will ensure the Kiggavik Project is managed in an environmentally acceptable manner. This is achieved through the development of an Integrated Management System that is adaptable, and encourages continual improvement.

Kivalliq residents want assurances that the environment will be protected(EN-RB OH Nov 2012[152], EN-BL NIRB April 2010[153]). Residents would like to see environmental monitoring for both the project site and the Baker Lake to Kiggavik road (EN-CI OH Nov 2012[154].EN-BL OH Nov 2013[155], EN-BL OH Oct 2012[156]) for the duration of the project. Some people *would like Inuit trained in environmental monitoring to monitor the project properly* (EN-AR NIRB May 2010). AREVA has incorporated residents' concerns into the development of site-specific mitigation and monitoring plans.

17.1 AREVA's Environmental Protection and Management Framework

AREVA's Values Charter put into operation our commitment to the principles of sustainable development. This commitment is reflected in our operating history in northern Saskatchewan. This history also reflects our desire to continue to improve our ability to balance social responsibility, environmental protection and economic performance. Sustainable development provides the opportunity for development to take place, the opportunity to foster stakeholder and community success, and through long-term protection of the environment, the opportunity for future generations to secure their success. Sustainable development embraces the IQ concept of Papattiniq/Munakhinik; *the obligation of guardianship or stewardship that a person may owe in relation to something that does not belong to the person* (IQ-Nunavut 2008).

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[152] EN-RB OH Nov 2012: *I am not worried about the environment because I know the Canadian government has rules and regulations. It is not like developments in countries where there are no rules. The environment is protected in Canada*.

[153] EN-BL NIRB May 2010: *Need to find balance between the land and the environment and create a harmony with the decisions we make.*

[154] EN-CI OH Nov 2012: *Are there people monitoring the environment and radiation every day?*

[155] EN-BL OH Nov 2013: *How will monitoring be done? It should be not only at the mine site but also along the road. Will it be near the site or up to a few km away that you will monitor? I need details on how land and animals are going to be monitored.*

[156] EN-BL OH Nov 2012: *Will you hire someone to ensure wildlife is not disturbed on the road? Many elders have asked me this, so I want to ask the question and know if someone will be hired full-time to make sure caribou are not disturbed on the road.*

The achievement of long-term sustainable development goals requires a framework which is precautionary, adaptable and identifies opportunities to improve performance. To ensure long-term environmental performance in support of sustainable development, AREVA has adopted a framework that embraces the principles of environmental assessment as a fundamental sustainable development tool. The framework, which is described below, ensures that the outcomes of the environmental assessment process are implemented, and that the environmental commitments and performance outlined in the environmental assessment are achieved. The framework consists of three main components: environmental assessment, continual improvement and adaptive management. Within the approach, assumptions and decisions are conservative, providing a precautionary approach, which reflects the level of information available at the time decisions are made.

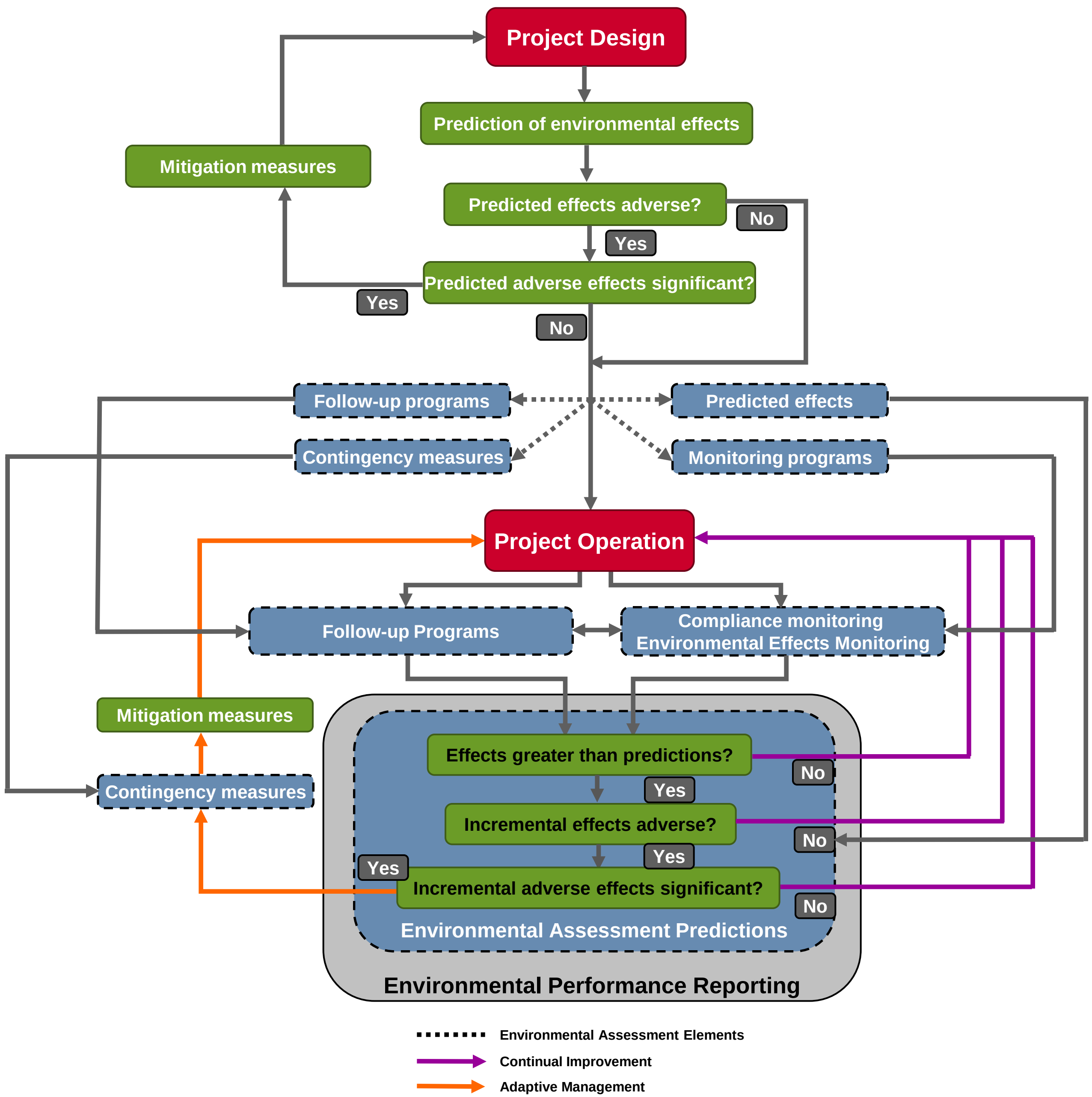
17.1.1 Environmental Assessment

The top half of Figure 17.1-1 provides a simplified flow diagram of the environmental assessment process. The environmental assessment process is a primary regulatory tool to promote sustainable development. The purpose of the environmental assessment process is to:

- identify project-environment interactions and their potential to elicit adverse environmental effects;
- gauge the significance of the effects; and
- identify mitigation measures if significant adverse effects are determined to be likely.

The process is iterative, incorporating mitigation measures and the re-evaluation of the facility design and the potential effects of the proposed activities.

As outlined in Section 4, an iterative evaluation of design alternatives was undertaken in consideration of the site-specific constraints imposed upon activities in the arctic. Key features of the alternatives analysis included environmental performance, economic viability and project operability. Project design considered environmental performance from the perspective of minimizing water and reagent use, optimizing water recycle, minimizing the project footprint, capturing and treating water that may have come in contact with operational areas and minimizing the risk of atmospheric and treated effluent emissions. The iterative evaluation process identified optimized and robust processes and infrastructure configurations which, within the context of operational and economic constraints, would minimize the residual environmental effects of the Project.



Project Design
Prediction of environmental effects
Mitigation measures
Predicted effects adverse?
No
Yes
Predicted adverse effects significant?
Yes
No
Follow-up programs
Predicted effects
Contingency measures
Monitoring programs
Project Operation
Follow-up Programs
Compliance monitoring
Environmental Effects Monitoring
Mitigation measures
Contingency measures
Effects greater than predictions?
No
Yes
Incremental effects adverse?
No
Yes
Yes
Incremental adverse effects significant?
No
Environmental Assessment Predictions
Environmental Performance Reporting
Environmental Assessment Elements
Continual Improvement
Adaptive Management

Several key outcomes flow from the environmental assessment (EA) process. These elements include:

- a set of predicted effects of the Project;
- the basis of a monitoring program incorporating regulatory compliance regimes and receiving environmental effects monitoring requirements
- the basis of a follow-up program to verify the effectiveness of mitigation measures and the accuracy of the environmental predictions; and
- possible contingency measures.

Each of these elements developed during the EA process need to be integrated into the development and operation of the Project.

17.1.2 Continual Improvement and Adaptive Management

The bottom half of Figure 17.1-1 illustrates how each of the elements developed during the EA process are integrated into the construction, operation, and decommissioning of the facility. During facility development and operation, compliance monitoring maintains operational performance standards. Environmental Effects Monitoring programs, completed in the receiving environment, provide the information necessary to determine operational effects, their geographical extent, and magnitude. The monitoring program incorporates monitoring endpoints that represent key ecosystem features which are effective at identifying unanticipated effects.

These monitoring systems provide the opportunity to examine actual effects, refine model predictions, and compare these results to the effects anticipated in the EA. The evaluation is iterative through time, which allows the identification, tracking and comparison of actual effects to the predicted effects anticipated at the time of the EA. The data and tracking of actual effects provides the necessary feedback, impetus, and information to the operation to identify and implement opportunities for continual improvement in systems performance. Results which indicate unforeseen or incremental effects beyond those predicted in the EA provide a basis to determine if a trend would, over time, lead to significant adverse effects. If so, the monitoring information also provides information upon which to develop adaptive management plans, and to facilitate detailed design of alternative mitigation or contingency measures to mitigate the significance of the incremental adverse effects.

Follow-up programs are tailored to verify the accuracy of EA predictions and to determine the effectiveness of mitigation practices. The information generated by the follow-up program is used to refine and verify the assumptions of the assessment methodology and thereby validate the predicted effects and reduce uncertainy in predictions. The feedback from the follow-up program also provides the basis for continual improvement in both the facility operation and the monitoring and follow-up programs. Unforeseen or incremental effects beyond those predicted, which indicate the future development of significantly adverse effects, provide the information necessary to implement contingency practices to mitigate the development of these effects.

AREVA's environmental protection and management framework allows the outcomes of the facility design, mitigation and environmental assessment processes to be integrated into facility construction, operation and decommissioning. The results of monitoring and follow-up programs are incorporated into evaluation processes, which facilitates the identification of continual improvement initiatives and adaptive management requirements, when necessary. This framework is consistent with the IQ concept of Pilimmaksarniq/Ayoikyumikatakhimanik; *skills must be improved and maintained through experience and practice* (IQ-Nunavut 2008).

As time progresses, uncertainties are reduced through demonstration of the physical performance of the facility, its mitigative features, and confirmation and update of the predictions supporting the environmental assessment and licensing approvals. The focus shifts from the precautionary approach initially required in the face of uncertainties to continual improvement and refinement. Optimization of operational performance, monitoring programs and follow-up programs is achieved through continual improvement based on experience.

The framework also outlines the mechanisms by which these processes and initiatives are reported and communicated to stakeholders. This communication is achieved through the publication of Environmental Performance Reports which are issued on a minimum five year basis throughout the lifecycle of the Project. This provides a suitable means for ensuring that monitoring and follow-up programs are appropriately focused.

17.2 Environmental Management Plan

Technical Appendix 2T, Environmental Management Plan, outlines how the various requirements of individual management and monitoring plans will be integrated into the environmental protection and management framework within the IMS. AREVA believes this captures the elements of the requirements of the environmental protection plans and associated management, monitoring and mitigation plans requested by the NIRB, which will be required by the NWB, the CNSC, and other regulators. The environmental protection and management framework incorporates environmental assessment, continual improvement and adaptive management. The IMS is an evolving documented system that is used for planning environmental monitoring programs, reporting environmental performance, and ensuring follow-up programs and mitigation measures are implemented.

AREVA recognizes that continued economic and social development depend on a healthy environment and incorporates environmental considerations into all company activities to ensure sustainable development. AREVA is committed to continually improve approaches and technology to minimize the effects of its activities on the environment.

To meet this commitment, AREVA shall:

- comply with applicable legislation and other requirements to which AREVA subscribes;
- minimize adverse environmental impacts of its activities by reducing consumption of natural resources, controlling releases and optimizing waste management;
- prevent pollution by using processes, practices, materials or products that avoid, reduce or control pollution;
- deal proactively with environmental issues by identifying potential impacts and implementing mitigating actions and/or developing effective contingency plans;
- develop internal objectives and targets to continually improve environmental performance;
- measure performance against established goals;
- conduct employee training, internal assessments and periodic reviews to ensure these operations and activities are conducted in compliance with documented procedures;
- communicate environmental requirements and corporate initiatives to employees and contractors to encourage their participation and compliance; and
- involve applicable stakeholders, with particular focus on those directly impacted, in initial planning, ongoing operations and decommissioning of AREVA activities through an open and transparent public involvement program.

17.2.1 Regulatory Information

In Canada, all nuclear projects are regulated and licenced by the Canadian Nuclear Safety Commission (The Commission). The Commission is an independent administrative tribunal, set up at arms length from the government. Commission decisions are made transparently and according to clear rules of procedure. The Commission is supported by more than 800 scientific, technical and professional staff. These staff members review licence applications according to regulatory requirements, make licencing recommendations to the Commission, and enforce compliance with the NSCA, regulations and any licence conditions imposed by the Commission.

For the Kiggavik Project to proceed, it must first achieve a positive environmental assessment (EA) decision and the accompanying Project Certificate, issued by the NIRB, before obtaining a licence. Along with the CNSC, responsible licensing organizations include the Nunavut Water Board, Department of Fisheries and Oceans, Environment Canada, Transport Canada and Natural Resources Canada. The CNSC licence outlines the activities the proponent is authorized to perform. The licence cross-references to a licence conditions handbook, which identifies in detail, the criteria that will be used by the CNSC staff to assess licensee compliance with licence conditions.

The CNSC provides oversight through a hierarchy of legislation, requirements and guidance, inspections and technical review of required reporting. Information on the CNSC, its responsibilities, enforcement powers, and processes are provided in Section 3.5 of Technical Appendix 2T.

17.2.2 Integrated Management System

AREVA's Integrated Management System (IMS), is designed to meet both internal requirements and the requirements of stakeholders. The IMS is based on the AREVA commitment to ensure that activities are systematically planned, controlled, monitored, and improved, as part of an ongoing cycle of improvement. AREVA's Integrated Management System is consistent with the Inuit Qaujimjatuqangit (IQ) concept of Papattiniq/Munakhinik; *the obligation of guardianship or stewardship that a person may owe in relation to something that does not belong to the person* (IQ-Nunavut 2008).

Technical Appendix 2T provides the structure which aligns the various requirements outlined in the NIRB guidelines with elements of the requirements of the Canadian Nuclear Safety Commission (CNSC) for an Integrated Management System (CNSC *REGDOC- 2.9.1 Environmental Protection* and CSA Standard *N286-12 Management System Requirements for Nuclear Facilities*). The AREVA IMS encompasses not only the management of environmental protection, but also health, safety, and quality management. The IMS provides the basis for the integration of the requirements of:

- the NIRB;
- the Nunavut Water Board (NWB), the CNSC and other regulators; and
- AREVA's policies (Environmental Protection, Health and Safety, Quality)

As noted, once implemented, the IMS is not static. The system continually evolves and adjusts to the components and activities of the Project. The IMS incorporates mechanisms that will continually improve and enhance environmental performance. These are detailed in Technical Appendix 2T and comprise:

- Environmental aspects
- Legal requirements and reporting
- Risk management
- Operational controls

The IMS will incorporate the environmental performance features of each Project component and Project activity. The IMS is developed in anticipation of each of the phases of the Project lifecycle and together with detailed project engineering, is presented as part of the detailed licensing, permitting and authorization applications. In this way, assurance is provided that the project design and mitigation measures meet or exceed those outlined in the Final Environmental Assessment (FEIS). It also provides the opportunity to revisit the environmental aspects and mitigation measures outlined for each phase in the environmental assessment and to identify additional mitigation measures based on information collected during the previous phase of the project, or evolution in our understanding of project-environment interactions.

In addition to re-evaluation at the time of licensing each phase of the Project, the IMS is also reviewed and updated in response to any major change within each project phase, as prescribed by regulation, regulatory documents and standards. This process ensures that any changes to environmental aspects are captured and appropriate mitigation is incorporated into the IMS. Thus, the IMS is a document that evolves in response to changes and phases of the Project. This is commensurate with AREVA's Environmental protection and management framework (see Section 2.2) and consistent with the Inuit Qaujimajatuqangit concept of Pilimmaksarniq/Ayoikyumikatakhimanik: *skills must be improved and maintained through experience and practice* (IQ-Nunavut 2008).

The monitoring, mitigation and management plans requested in the NIRB guidelines are provided in the following Tier 3 Technical Appendices:

- Technical Appendix 2C: Explosives Management Plan
- Technical Appendix 2H: Ore Storage Management Plan
- Technical Appendix 2I: Water Management Plan
- Technical Appendix 2J: Marine Transportation
- Technical Appendix 2M: Road Management plan
- Technical Appendix 2N: Borrow Pits and Quarry Management Plan
- Technical Appendix 2P: Occupational Health and Safety Plan
- Technical Appendix 2Q: Radiation Protection Plan
- Technical Appendix 2R: Preliminary Decommissioning Plan
- Technical Appendix 2S: Waste Management Plan
- Technical Appendix 2U: Hazardous Materials Management Plan
- Technical Appendix 4C: Air Quality Monitoring and Mitigation Plan
- Technical Appendix 4F: Noise Abatement Plan
- Technical Appendix 5F: Mine Rock Characterization and Management
- Technical Appendix 5J: Tailings Characterization and Management
- Technical Appendix 5L: Conceptual Fisheries Offsetting Plan
- Technical Appendix 5M: Aquatic Effects Monitoring Plan
- Technical Appendix 5O: Sediment and Erosion Control Plan
- Technical Appendix 6D: Wildlife Mitigation and Monitoring Plan
- Technical Appendix 9D: Archaeological Mitigation Plan
- Technical Appendix 10B: Spill Contingency and Landfarm Management Plan

These plans will be incorporated into the Kiggavik Project IMS and provided for review in anticipation of the initial NWB and CNSC licensing of the Kiggavik Project. Technical Appendix 2T outlines the structure of the IMS with an emphasis on environmental management, monitoring, mitigation and reporting plans.

18 Socio-Economics & Community

AREVA's expectations for the Kiggavik workforce, wages and benefits, and business and procurement outlined below are influenced by company experience in Northern Saskatchewan and ongoing achievements and lessons learned from Agnico Eagle's Meadowbank Project. It is expected that the IIBA negotiations will address and set forward expectations for Inuit content in the workforce and with business and procurement as well as other benefits. This section presents AREVA's expectations but further detail will be determined through IIBA negotiations, as required by the NLCA.

18.1 Operational Workforce

18.1.1 Overview

The Kiggavik Project will be a licensed nuclear facility and as such requires extensive management, technical trades and operator capabilities. AREVA is committed to working with governments and other stakeholders towards maximizing an Inuit and Nunavummiut workforce.

Nunavummiut will be given opportunities to grow on the job, through mentoring, on-site training, academic and trades training.

Kiggavik workers will preferentially be drawn from the Kivalliq Region. It will be necessary for some of the workforce to come from other geographic regions given limitations in recruitment and training. Subject to IIBA negotiations, AREVA anticipates to mobilize, in order of priority, the workforce from the following geographic regions:

- Kivalliq communities;
- the rest of Nunavut;
- Saskatchewan; and,
- the rest of Canada.

Most of the workforce from Nunavut and Saskatchewan would be flown by charter from their community to Kiggavik. Designated pick up points will be established in the Kivalliq communities. The remainder of the workforce will likely take commercial flights to Baker Lake and then take a charter between Baker Lake and the Kiggavik site.

Workforce requirements for construction will vary averaging about 750 people and potentially peaking at about 1,200 people. The work force requirement for the operations phase is estimated at

550 people (varying between 400 to 600 people, approximately half of which will be working onsite at any one time due to the rotational work schedule), of which approximately 150 will be unspecialized roles.

All jobs will be open to Nunavummiut, and all other things being equal, a qualified Nunavummiut candidate for employment will be given preference.

Based upon experience of over 30 years of working with First Nations and Métis candidates from remote communities, and being mindful of the expectations of the proposed IIBA, the table below shows a potential Nunavummiut and specifically Inuit workforce content. A labour market analysis prepared for the Kiggavik FEIS (Refer to Tier 3 Techncial Appendix 9A) concluded that 50% Inuit employment would be achievable if turnover rates are not excessive. The 10% Inuit employment during construction is a conservative value for Inuit content given higher percentages achieved during the construction of Meadowbank and an increasingly trained workforce in the region anticipated at the time of Kiggavik construction.

Table 18.1-1 Potential Workforce Inuit Content

Project Phase		Potential Inuit Content %
Pre-development		5%
Construction		10%
Operations Year	1 – 2	35%
	3 – 4	40%
	5 – 6	45%
	6 +	50%
Decommissioning		40%

18.2 Human Resource Requirements

18.2.1 Human Resources Development and Training

AREVA has considerable experience with training of workers, and of working collaboratively with government training institutions. The Saskatchewan mining industry has operated a successful Multi-Party Training Program (MPTP) for over 19 years, and it is likely that a comparable approach will prove useful in Nunavut.

Training initiatives at AREVA's northern Saskatchewan operations are a reflection of the Inuit Qaujimajatuqangit (IQ) principles principles Qanuqtuurunnarniq - *being resourceful and flexible to* *solve problems* and Pilimmaksarniq - *maintaining and improving skills through experience and practice.* Programs evolve to accommodate and better address changing needs and priorities of i) the potential and current workforce, ii) educational organizations with growing and changing capacities, and iii) the company to best realize collective and long lasting benefits, primarily the employment and retention of a northern workforce. AREVA training initiatives range from a job shadow program for grade 10 students that provides exposure and understanding of future employment opportunities to supervisor/manager in-training programs. The following list provides a summary of training initiatives at northern Saskatchewan mines at the time of FEIS writing to demonstrate the range of training.

- Job Shadow Program – two days of firsthand work/life experience at site for grade 10 students;
- Pre-Skills Training – three week job placement and skills training program;
- Trades Helper Program – one year program to work alongside several trades to determine which is best suited to the individual prior to commitment and training for a specific trade; this often leads to entry into apprenticeship program;
- Apprenticeships – onsite apprenticeship, largely focused on mill maintenance and services, with wages subsidized by an external training institute;
- Mill Operator – training on all aspects and requirements for successful employment as a Mill Operator;
- Mill Operator Peer Training – continued training, coaching, and mentorship for junior process operators to build confidence and possible job progression;
- Workplace Cooperative Education – on-the-job training in conjunction with education (certification and degree options); and
- Supervisor In-Training – temporary assignment as a supervisor following theoretical training to create pool of employees with potential to advance to supervisory positions.

Many lessons learned in Saskatchewan can be applied to training in Nunavut. Collaboration among many parties is important. Of the eight listed programs above, only two programs are solely AREVA implemented with all other programs undertaken in collaboration with other interested organizations. It is important to acknowledge and promote the importance of education and training initiatives before an individual enters the workforce and throughout his/her career to facilitate entrance into the workforce and career advancement.

The target qualifications for entry-level trainees/employees are:

- competency in the English language
- grade 12 education or equivalent experience
- a commitment to a culture of safety

Common company and worker understanding of essential skills required for various positions further contributes to overall training success. Essential skills are primarily reading text, document use, and numeracy skills. Kivalliq residents understand and value essential skills and see these skills as critical to full participation in mining projects (WC NIRB May 2010[157], BL NPC Jun 2007[158], AR KIA Apr 2007[159]). Development of these skills is essential so that individuals can meet required skill levels necessary for entrance into specific training programs. This increases the likelihood of program completion as well as individual satisfaction and further maximizes company investment. Both the piloting of careers and essential skills training prior to more advanced training can reduce employee frustration and turnover.

Training programs, similar to the ones carried out in Saskatchewan, could be implemented in Nunavut (CH OH May 2009[160]). ARVEA could possibly collaborate and undertaking initiatives with organizations such as the Mine Training Roundtable, or directly with its membership organizations including Arctic College, Kivalliq Partners in Development, and the Kivalliq Inuit Association. There may be opportunities to further liaise with the Kivalliq Mine Training Society or with programs and organizations that may be developed under the Community Readiness Program with the Northern Major Projects Office. Similar approaches with respect to piloting careers and building essential skills could be taken and adapted to take into consideration the different strengths and constraints in Nunavut. Training success can be influenced by site morale and individual well-being so community and work site initiatives among other benefits will be viewed as a whole.

AREVA accepts that a substantial training commitment is part of its Corporate Social Responsibility. Nunavummiut training will continue throughout the life of the Project as additional needs are identified. AREVA anticipates commencing off-site training at Nunavut Institutions and at the McClean Lake Operation prior to start of production for trade and technical roles and for operational trainees. The operational trainees may begin training up to four years prior to production, training would only commence following a development decision and would largely take place during the construction phase. The available workforce at the time of construction, development of multi-party

[157] I am concerned that a lot of young people do not finish school and do not have the required education to work at the mine site. Would like to see the mine succeed and have the young people employed.

[158] It is important for the younger generation to be involved in the process. We need to start educating them today and to be able to provide them a baseline study to look at. After all, if it is going to be their world, whatever we decide here in our generation.

[159] I am hoping to see high school students take part in training. I am encouraging students to finish high school. Ensure students take school seriously.

[160] We applaud the aboriginal representatives from Saskatchewan. I visited the sites in July and was impressed with the level of involvement. Not just jobs but there were people in higher jobs too. I came back and stressed training and I hope that we have the same level of involvement as Saskatchewan people.

training programs, potential benefit enhancements negotiated in the IIBA, and other considerations will influence how the pre-production training is realized.

Different skill sets will be required as the Project moves through the phases of:

- pre-development (Feasibility, Environmental Assessment and public review, Licensing, IIBA);
- construction – access; marine/Baker Lake;
- construction – mill and infrastructure;
- operations; and
- decommissioning/reclamation.

18.2.2 Construction

Construction crews are expected to work a blend of schedules with potentially longer work shifts than will be typical for the operations period. The construction schedule is expected to average four weeks in and two weeks out compared to the expected 7 days in/7 days out or 14 days in/ 14 days out operations schedule.

Experience with mine Project workforces indicates a higher turnover rate during construction and early operation ranging from an initial 35 percent in early years to 8 percent in late Project life.

Nunavummiut content is expected to grow throughout the construction phase. AREVA anticipates a construction workforce of about 750 people.

18.2.3 Operations

During the operational period, the Kiggavik Project will be organized into eight main departments, supported by allocated services from AREVA. The departments are listed below:

- Surface Mining
- Underground Mining
- Mill
- Safety, Health, Environment, and Quality
- Human Resources and Training
- Camp Services and Security
- Logistics and Materials Management
- Corporate Social Responsibility Kivalliq Region

18.2.3.1 *Surface Mining Department*

The surface mining department is headed by a manager responsible for operations, maintenance, mine engineering and mine geology. In addition a mine operations training function is identified for the early years of production to build Nunavummiut capacity. Employees in this department would be responsible for pit grade control, ore blending, andto the extent possible this department will also undertake certain reclamation activities during operations since the fleet and workforce required has much in common with stripping and ore mining.

Anticipated Nunavummiut workforce that may be achieved for occupations supporting surface mining is shown below.

Table 18.2-1 Surface Mining Workforce

Workforce Occupations	Anticipated Nunavummiut %
Driller	35%
Blaster	35%
Shovel/Loader Operator	35%
Waste Truck Driver	65%
Ore Trucker Driver	65%
Dozer Operator	65%
Grader Operator	65%
Operator Trainees	100%

The staff and non-staff employee distributions are shown in Table 18.2-2.

Table 18.2-2 Employee Distribution – Surface Mining

	Year												
Hourly	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Maintenance	12	52	52	52	52	52	52	34	34	26	18	14	14
Operations	22	112	112	112	112	112	112	60	60	60	60	44	40
Operations Support	16	36	36	36	36	36	36	20	20	20	20	20	20
Total Hourly	50	200	200	200	200	200	200	114	114	106	98	78	74
Staff													
Management and Supervision	9	25	25	25	25	25	25	19	19	19	18	15	15
Engineering	7	21	21	21	21	21	21	17	9	9	9	6	6

Geology	3	11	11	11	11	11	11	5	5	5	5	5	5
Total Staff	19	57	57	57	57	57	57	41	33	33	32	26	26

18.2.3.2 *Underground Mining Department*

The underground mine manager leads a team consisting of an Underground Superintendent, Mine Maintenance Supervisor, Chief Engineer, Chief Geologist, respective staffs, and aSafety Supervisor. This organization includes supervision of a surface backfill plant, through its delivery of cemented fill. A full complement of staff report to the Chief Engineer, and grade control responsibilities flow through the Chief Geologist.

A labour estimate for End Grid is shown in Table 18.2-3.

Table 18.2-3 Labour Estimate – Underground Mining

Position – Hourly	Shift	Total
Prod. Loader Operator	2	8
Dev't. Loader Operator	1	4
Backfill LHD Operator	1	4
Prod. Truck Operators	2	8
Dev't. Truck Operators	1	4
Prod. Jumbo Operator	2	8
Dev't Jumbo Operator	1	4
Blasters	1	4
Bolter Operator	2	8
Grader Operator	1	4
Shotcreters	1	4
Dev't. Helpers	1	4
Cement Fill Plant	4	8
Ore Haul	2	4
Mech. – fuel/lube	1	4
UG Labourers	2	8
Dry Attendant	1	2
Mechanics	3	12
Electricians	2	8
Total Hourly	**31**	**110**
Position – Staff	**Shift**	**Total**
Mine Manager	0	1
Admin. Assistant	2	2

Table 18.2-3 Labour Estimate – Underground Mining

UG Supt.	1	1
UG Supervisors	1	4
Safety Supervisor	2	2
Maint. Supervisor	1	1
Chief Mine Eng.	1	1
Sr. Mine Engineer	1	1
Mine Engineer	2	2
Rock Mech. Eng.	1	1
Ventilation Tech.	2	2
Chief Geologist	1	1
Senior Geologist	1	1
Geologists	1	2
Surveyors	1	2
Surveyor Helpers	1	2
Total Staff	**18**	**25**
Grand Total	**49**	**135**

18.2.3.3 *Mill Department*

The department will be headed by the Mill Manager and will consist of four groups:

- Mill Operations;
- Mill Maintenance;
- Mill Engineering; and
- Metallurgy and Laboratory.

The mill department will operate the mill, tailings management facilities, water treatment plant, utilities, laboratories and the acid, oxygen and power plants. A labour estimate is shown in Table 18.2-4.

Table 18.2-4 Labour Estimate – Mill Personnel

Position	Personnel
Mill Administration	
Mill Manager	1
Mill Operations General Supervisor	1
Mill Maintenance General Supervisor	1
Mill Process Supervisors	4
Mill Process Trainers	2
Instrumentation Supervisors	2
Mechanical Supervisors	2
Electrical Supervisors	2
Maintenance Engineers	2
Planners	4
Planning Clerks	2
Chief Power Engineers (1^{st} Class)	2
Mill Administration Sub-Total	**25**
Laboratory and Metallurgy	
Chief Metallurgist	1
Metallurgists	4
Chief Chemist	1
Senior Chemists	2
Lab Technicians	10
Lab Technician Trainees	2
Laboratory and Metallurgy	**20**
Mill Operating Personnel (Daily Requirement)	
Control Room Operators	4
Mill Loader Operators (Operation time = 24hr/d)	4
Crusher Operators (24hr/d)	4
Mill Feed Rock Breaker Operator (Winter Only Equivalent)	2
Grinding Operators	4
Leaching Operators	4
RIP Operators	4
Impurity, YC, Drying Operators	4
Packaging Operators	4
Tailing Neutralization Operators	4

Table 18.2-4 Labour Estimate – Mill Personnel

Position	Personnel
Effluent Treatment	4
Lime Make-up and Reagent Preparation, Line Patrol	2
Mill Trainees	8
Holiday Relief, Missed flights, sickness, etc.	16
Mill Operators Sub-total	68
Utility Operators	
Acid & Steam Plant Operators + Holiday Relief	5
Oxygen Plant and Air Supply	2
Steam Plant Operators	2
Utility Operators Sub-total	**9**
Mill Maintenance Personnel (Daily Requirement)	
Maintenance Mechanics	10
Welders	2
Welder Apprentice	1
Machinist	2
Pipefitters	4
Pipefitter Apprentice	1
Electricians	5
Carpenters	2
Instrument Technicians	5
Mill Maintenance Personnel Sub-Total	**32**
MILL PERSONNEL GRAND-TOTAL	**154**

18.2.3.4 *Safety, Health, Environment and Quality Department*

The department will be headed by a Manager, responsible for a significant number of specialist disciplines including Environment, Occupational Health and Safety, Radiation Protection and Quality. The department primary function is to verify the performance of all operations with respect to the protection of personnel and the environment.

18.2.3.5 *Human Resources and Training*

AREVA anticipates more resources required for human resources and training than typical for a mature labour pool. Additional management and training initiatives, taken in concert with government programs, are expected. Inuit Elder or Peer advisors and cross-cultural training will be provided.

18.2.3.6 *Camp Services and Security Department*

The scope of activities proposed for the department encompasses operating and maintaining the camp, access road, airstrip and wharf/tank farm areas. While much of the work is suitable for Inuit contractors, the initial assumption is that the workforce will be AREVA-based.

18.2.3.7 *Logistics and Materials Management*

The materials management group is responsible for the procurement of goods and services required for operations, operation of the warehouse, inventory control and analysis function. Oversight is also provided for air charter services, and operation of ocean and barge shipping. Inventory control at Churchill, Baker Lake and at site, given the seasonal operation of both the winter road and shipping window, requires specialized expertise.

18.2.3.8 *Corporate Social Responsibility – Kivalliq Region*

Working closely with the Manager of Logistics and Materials will be Corporate Social Responsibility staff. One focus will be to ensure optimal Nunavummiut recruitment as well as facilitation of Inuit supply and services. Additional positions may include Inuit Community Relations Coordinator(s) and an Inuit Elder or Peer Advisor.

18.2.4 Decommissioning And Reclamation

Modern mining represents a temporary use of the land, and one tenet of that philosophy is to “reclaim as you go”. It is proposed that the surface mining crew will undertake reclamation during operations and opportunities will include, for example:

- Grading of used quarry and borrow pits;
- Grading and covering of Type1/Type 2 completed portions of mine rock stockpiles;
- Closure of TMFs which have been filled with tailings; and,
- Revegetation of disturbed areas.

Upon completion of operations the major decommissioning and reclamation will be accomplished by surface mine crews, with support from camp services. Special demolition and decontamination contractors will report to the general management team and follow a detailed decommissioning plan (DDP) approved by regulatory agencies and acceptable to the landowner. It is too early to accurately predict the opportunities to recycle or reuse abandoned buildings and utilities, but experience suggests in-pit disposal of a great deal of material.

18.2.5 Post-Decommissioning Monitoring

A post-decommissioning workforce, will be required to carry out the post-decommissioning monitoring program to confirm that decommissioning objectives have been achieved. .

18.2.6 Indirect Jobs

Direct job estimates are 750 and 550 for construction and operations respectively. Indirect and induced jobs may be as high as 400 during construction and 1,300 during operations. Because the Project's employment and contracting is expected to be predominantly in the Kivalliq Region, most indirect and induced economic effects would be seen in the region. Even taking into account that many indirect jobs will have skill requirements that may not be easily met initially, a conservative interpretation of the territorial economic effects suggests that at least as many indirect and induced jobs created for Kivalliq residents in particular could be similar to the direct jobs held by Inuit during construction and operations.

18.3 Wages and Benefits

The skill set required to engineer, construct and operate the Kiggavik Project is wide-ranging. Further, given its remote location, and dispersed labour pool, competitive compensation and benefits will be appropriate. Using 2011 AREVA experience from the McClean Lake operation, the wages are estimated as provided below. Wages and benefits will be competitive at the time of construction and operation.

Table 18.3-1 Estimated Annual Base Salaries

Base Salary Ranges/Year	$ 50,000 – $ 210,000
Premiums and Allowances	21.5 – 23.0
Benefits	16.0
Vacation	16.0
Incentive Options	5.0 – 25.0%

Conventional benefit programs for comparable operations may require some flexibility and innovation to respond to Inuit needs but may include a negotiated package including:

- Medical coverage
- Dental coverage
- Eye care
- Short-term disability

- Long-term disability
- Wellness support
- Educational leave/funds
- Cultural/Bereavement leave

18.3.1 Worker Accommodation and Transport

Workers will be housed in on-site accommodations as described in Section 11.3. Work schedules may vary from 7 to 14 day shifts, with an equivalent number of days off-shift. Workers will be flown in from designated pick-up points for their shifts. Appropriate support for fly-in/fly-out workers will be developed in consultation with communities and employees.

18.4 Business Development and Procurement

It is assumed that the IIBA to be negotiated will include obligations to support and grow competitive Inuit firms from the onset of the pre-construction phase, throughout Project life.

AREVA experience in the Athabasca Basin provides examples of various strategies available to accommodate the intent of maximizing Inuit participation:

- Employ Business Development Manager(s);
- Inventory of Inuit capacity;
- Facilitate government funding for Inuit start-ups;
- Encourage formation of joint ventures, Inuit-established companies;
- Breaking up large contracts into sub-contracts suitable for Inuit;
- Encourage realistic sub-contracting;
- Offer select “sole-source” contract opportunities;
- Include Inuit content as a factor in bid evaluation;
- Provide scholarships for Entrepreneurial training; and
- Seek freight cost share/back haul savings.

Activities that could likely be conducted by contractors during operation include catering, air, marine and land transportation. Contract mining is also a possibility.

The AREVA benefits package does not extend to contractor employees.

Contractor obligations to employees are not known at this time. AREVA will have the ability to include certain obligations in bidding packages.

18.5 Economic Information

The capital cost of the Project is estimated at $2.1 billion, including contingency and sustaining capital. The operating cost is estimated at $240 million/year. This initial feasibility study will be updated and refined prior to a development decision. The market price for uranium concentrate over the last years has been within the range needed for a reasonable return on investment to its owners, however at the time of FEIS preparation was below the threshold needed for Project advancement. AREVA believes future opportunities are strong enough to encourage Project advancement with the intent of development that will coincide with viable future markets.

A 27% corporate tax rate applies to all profits from the Project (after full deduction for all operating, capital and development costs). Additional information on taxes and royalties is provided in Volume 9, Section 13.1

Steps taken by AREVA to ensure Project tax obligations will be met include an understanding of tax obligations with the Government of Nunavut (GN) through familiarity with GN requirements and in particular, familiarity with the Payroll Tax Act, C.S.N.W.T. 1993, c. 11 and the Petroleum Products Tax Act, R.S.N.W.T. 1988, c. P-5.

AREVA is committed to compliance with applicable policies and regulations as detailed in the AREVA corporate experience and operational record found in Tier 1, Volume 1, Section 1.6.4.3. Both the *Payroll Tax Act* and the *Petroleum Products Tax Act* include sections related to Offences and Punishments should a non-compliance occur.

Royalties will be paid to the Government of Canada and Nunavut Tunngavik Incorporated. The Government of Nunavut will not receive royalties under the current system. Royalties are based on the assumption that mineral rights for all the deposits will be administered by AANDC under the *Canada Mining Regulations*. Should a transfer of mineral administration for the deposits on Inuit-Owned land transfer from the Crown to NTI the royalties would require negotiation with NTI.

Total taxes and royalties to be paid on the Kiggavik project are estimated at $1 billion. The following table outlines the different entities payable and portion of the total taxes and royalties.

Table 18.5-1 Estimated Taxes and Royalties

	Nunavut Tunngavik Inc. (millions)	Territory of Nunavut (millions)	Federal Government (millions)	Total (millions)
Corporate Income Taxes	-	$267	$334	$600
Resource Royalties, Crown Land	$16	-	$136	$152

Resource Royalties, Inuit-Owned Land – Subsurface (mineral) Rights	$248	-	-	$248
TOTAL	$265	$267	$469	$1,001

The fuel tax rebate with the GN is an optional program and it is one item to be considered in the negotiation of a Development Partnership Agreement. The Development Partnership Agreement is a voluntary agreement between the GN and a proponent and it is administered by the Department of Economic Development and Transportation in cooperation with the Department of Finance. Negotiations and resulting agreements are intended to identify and capitalize on mutually beneficial infrastructure development and training initiatives for Nunavummiut. A Development Partnership Agreement must be obtained to qualify for the optional fuel tax rebate. Proponents can initiate negotiations with a letter of intent as early as a Part 5 or Part 6 project review decision under the Nunavut Land Claims Agreement. AREVA has not submitted a letter of intent to initiate negotiations, however, AREVA does intent to initiate discussions related to the Development Partnership Agreement.

18.6 Community Involvement Plan

Kivalliq residents have appreciated the opportunity to learn more about the project via information that has been shared by the Kiggavik project team and have appreciated the opportunity to be consulted prior to EIS submission(EN-CH NIRB May 2010[161], EN- AR OH Nov 2010[162], EN-BL CLC May 2011[163]). Kivalliq residents would like to be continue to be consulted for the duration of the Project.to ensure that the facilities are safe and the environment is protected (EN-AR-NIRB May 2010[164], EN-BL KIA Feb 2010[165])

[161] EN-CH NIRB May 2010: *Important for the people in the Kivalliq region be well informed to provide their input. Would like to thank the NIRB for providing the community with an opportunity to provide their concerns and input into the process before the mine is allowed to proceed and not deal with the effects afterwards*.

[162] EN-AR OH Nov 2010: *AREVA has done a good job on consulting with the Inuit, and I'm supportive of the mine because it will help the people of Arviat*.

[163] EN-BL CLC May 2011: *We want to be able to help and understand each other. To understand we need to work together. It helps now that mining companies are listening to all sides. I was glad to be included in the public forum and I learned a lot. I found out yellowcake is not dangerous, it can be used to power electric companies. If we do not ask questions we will not get the answers we want.*

[164] EN-AR NIRB May 2010: *Important to work together (Inuit and white) to ensure the Project is safe. Inuit need to participate. If we work together, can ensure that the uranium mine will be safe and good for the people for employment.*

AREVA is dedicated to conducting business in a manner that minimizes effects on the environment, provides benefits to the communities in which we do business, and creates value for our stakeholders. AREVA's community Involvement Plan is a key document in achieving greater community benefits as it outlines the methods to maintain and grow two-way communication between the company and community enabling the community to more fully participate and develop a mutually beneficial relationship.

The Community Involvement Plan encompasses engagement for the purposes of regular communication with the general public and Aboriginal groups that recognizes their interest in AREVA business, to meet regulatory requirements of the EA and licensing processes throughout the life of the Project, and to assist the Crown in fulfilling their duty to consult as appropriate. The plan will be regularly updated to reflect the needs and priorities of the community and the project through the various Project stages should the project be approved.

The Community Involvement Plan is included in Technical Appendix 3C.

18.6.1 Environmental Assessment Approval and Licensing

AREVA will continue to engage communities, associations, and members of the public using a variety of communication methods to facilitate effective public participation in the environmental assessment and licensing processes for the Kiggavik Project. Communication and involvement activities include open houses, workshops, radio shows, Community and Regional Liaison Committees, a variety of social media including use of blogs and posting of informational videos to YouTube, exploration and mine site tours and others means of engaging the community.

Engagement during this phase allows for AREVA to begin sharing proposed technical information, explains the proposed project, gauges areas of concern and identifies issues to be considered in the draft and final EIS. Engagement provides the opportunity to incorporate any mitigation features into the Project design based on feedback. AREVA provides all feedback received to the regulators; this information may be useful in beginning to assess the level of public concern expressed to date.

Engagement completed prior to submission of this EIS is presented in Volume 3.

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[165] EN-BL KIA Feb 2010: *We want to be represented. I'd like to see a law passed. Arctic residents are concerned and want to protect their land and wildlife.*

18.6.2 Life of Project

AREVA's commitment to engagement and community involvement is throughout the life of the Project and continues throughout construction, operations, decommissioning and reclamation. Community based monitoring will be a main focus of the community involvement plan following environmental assessment.

19 Potential Future Developments

19.1 Current Environmental Assessment

The current environmental assessment detailed in the EIS applies to:

- mining of the Kiggavik, Andrew Lake and End Grid deposits.
- milling, effluent discharge and tailings deposition for a maximum operating life of 25 years, or until the proposed East, Centre, and Main tailings management facilities are full.
- access and transportation activities associated with marine transport and both a winter road and all-season road with cable ferry on the Thelon.

It is recognized that exploration activities will continue in the vicinity of the Kiggavik Project and that there is the potential for additional ore resources to be discovered during the life of the Project. No facilities will be overbuilt to accommodate additional ore resources.If additional ore resources are discovered in the area, an environmental assessment approval and licensing process would be required prior to mining any additional deposits.

To address such a possibility, a potential future development scenario was developed (Table 19.1-1). A discussion of Cumulative and Transboundary Effects for the Project Inclusion List and reasonably foreseeable projects is provided in Technical Appendix 1E. The potential future development scenario considers the following assumptions and concepts:

- Additional uranium deposits are identified within a 200 km radius of the Kiggavik site.
- Experience in Saskatchewan indicates that a regional mill, whereby all deposits within a certain economic radius are milled at a single mill location is environmentally and economically preferable to multiple mill locations. For the purposes of the future development scenario presented here, it is assumed that any deposits discovered within 200 km of Kiggavik would be milled at the Kiggavik mill.
- For this future development scenario, It is assumed the additional deposits would be milled at the Kiggavik mill at the proposed maximum production rate of 4,000 tonnes U per year; such additional ore discoveries would therefore result in the extension of the life of the project. An expansion of the mill to increase production rate is not considered likely due to logistical constraints.
- Current plans for exploration on known AREVA showings have the potential to produce a new deposit within 5 years. Relative to the proposed development schedule for the Kiggavik Project, this would allow an additional 12 years for any new deposit to be evaluated through feasibility study and the environmental assessment and, licensing processes with development of the deposit to be able to be aligned with the end-of-life

production. Such alignment would support continued operation of Kiggavik Project rather than support project expansion.

- Accommodation of this future development scenario would require:
- An increase in tailings capacity. If sufficient resources were found to continue milling beyond the capacity of the 3 TMFs, it is assumed that a new TMF would be proposed (requiring environmental assessment and licensing). An additional TMF could consist of a purpose-built pit.
- Logistical restrictions through the Narrows could limit the amount of development accessed through Baker Lake given a limited number of high tides and the number of vessels that can pass the Narrows during high tide. The proposed Nu-MB road would increase accessibility, however, costs of road transport tend to be higher than marine, impacting economics.
- It is assumed that a second uranium mill would be located outside of this radius to the south-east.
- For the purposes of this assessment it is assumed that a non-uranium operation is located within the Kiggavik RSA. The Meadowbank gold operation is used as the model for this.
- It is assumed that additional resources are found in the Meadowbank area and that Meadowbank continues operation.

Table 19.1-1 Potential Future Developments Scenario

Component	Locations
Uranium Mines	3 mines within 200 km of Kiggavik
Uranium Mills	Kiggavik mill
Gold Mines	1 mine within Kiggavik RSA Meadowbank region
Gold Mills	Meadowbank Additional mill within Kiggavik RSA
Access Roads	Meadowbank Additional mill within Kiggavik RSA
Exploration	Induced exploration near the access road(s) and in the Kiggavik area

20 Assessment Basis and Project Activities For Environmental Assessments

This project description has outlined the project design basis for the Kiggavik Project based on conservative assumptions where appropriate and, for a variety of project components, the alternative means of undertaking those activities. In several cases, the alternatives analysis removed non-viable alternatives from further consideration with remaining options carried forward in the environmental assessment. This is viewed as advantageous as it provides project flexibility in the final configuration of the design as the project moves forward in the environmental assessment process, detailed engineering, and given environmental assessment approval, into the licensing stage of project development.

In order to ensure that the potential environmental and socioeconomic effects of the Kiggavik Project, are adequately considered in this environmental assessment, it was determined that it would be advantageous to develop a clear “assessment basis” for the project. The purpose of the assessment basis is to clearly and consistently articulate the bounding case of the project, based on conservative assumptions, which encompasses the potential environmental and socioeconomic effects of the project and includes the consideration those components for which more than one option has been outlined.

To address the Project design options that are inherent in the current level of study, conservative assumptions have been used throughout the environmental assessment to ensure that the effects assessments adequately bound the full range of possible design options and performance. Where specific Projects design features or activities could span a range of possible values, the most conservative values (e.g., the largest geographic scope, the longest duration, highest volumes or emission rates) were used to ensure that the effects assessments adequately bound the full range of possible design performance. In the case of assessing biophysical Project effects, the values with the greatest potential to result in an adverse effect were used. In the case of socio-economic benefits, the values with the greatest potential to result in the lowest benefit were used.

A key example of how a conservative approach was taken in the assessment basis includes use of a 25-year project life based on maximum tailings storage capacity, as opposed to 14 year operating life with current ore reserves and production rate. Another example is the assessment of fresh water usage at the full Resin-in-Pulp process usage rate, although planned permeate and site drainage recycling are estimated to reduce this usage significantly. The Base case column in the table below provides the values most likely to be realized by the project and the assessment basis provides a reasonable conservative upper bound for the assessment of potential ecosystem effects.

The purpose of the assessment basis section is to define how the expected average design parameters detailed in the Project Description and the Project options summarized in Section 4.3.2 have been bounded to ensure the effects assessments are adequately conservative.

20.1 Assessment Basis

The assessment basis is summarized in Table 20.1-1. For biophysical and some socio-economic effects, the range value with the greatest potential to result in an adverse effect is used. In the case of socio-economic benefits, the range value resulting in the lowest benefit is used. The following sections rationalize the selected assessment basis for each major project component.

In addition to the assessment basis, discipline-specific assessments also adopted a conservative approach. For example, in the air quality assessment, maximum bounding scenarios (as well as planned phased operational scenarios) were used to assess theoretical maximum air emissions and atmospheric concentrations that could result from construction and operational activities. In the case of maximum operations, the scenario assumed that all mining activities would occur simultaneously at their maximum level of operation to ensure that the assessment considered the greatest potential effect of site activities on ambient air quality so that any modifications to the production schedule would be within the bounds of the approved assessment. Additional conservatism in discipline-specific assessments is detailed in the various FEIS volumes and is noted in this section when appropriate.

Table 20.1-1 Project Assessment Basis

Project Activities/ Physical Works	Parameter	Units	Parameter/Assumption Values	
			Base Case (PD)	Assessment Case
Overall	Production Rate	Tonnes U per year	3,200 – 3,800	3,200 – 4,000
	Mill Feed Rate	Kilotonnes per year	71 – 977	1,000
	Project Operating Life	Years	2 years pre-production 12 years production	25
	Project Footprint	Hectares (ha)	938	1,102
	Access Road Route	Not applicable	Winter Road	Winter Road All-Season Road
	Dock Site Location	N/A	Site 1	Sites 1, 2, Agnico-Eagle's Meadowbank Dock site
Milling	Flowsheet	N/A	Resin in Pulp (RIP)	Resin in Pulp (RIP), possibly SX and / or calciner
	Final Product	N/A	Non-calcined uranium concentrate	Non-calcined or calcined uranium concentrate
Tailings Management	Containment volume	Million cubic metres (Mm^3)	28.4	30.0
	Total tailings volume (un-consolidated)	Million cubic metres (Mm^3)	21	30.0
	Design		Natural surround, no drain	Various design contingencies
Water Management	Kiggavik site freshwater requirements – no permeate or site drainage recycle	m^3/day	7,910	8,000
	Kiggavik site freshwater requirements – permeate and site drainage recycle	m^3/day	2,000	8,000
	Freshwater requirements – Sissons	m^3/day	60	60

Table 20.1-1 Project Assessment Basis

Project Activities/ Physical Works	Parameter	Units	Parameter/Assumption Values	
			Base Case (PD)	Assessment Case
	Treated effluent discharge at base quality – Kiggavik	m^3/day	2,707	3,000
	Treated effluent discharge – Sissons	m^3/day	1,700	1,700
Power Generation	Kiggavik peak load	MW	13.0	13.0 – 16.8
	Sissons peak load	MW	3.8	0 – 3.8
Logistics & Transportation	Number of barge trips – 5,000 t & 270 containers	Barge trips/year	9 – 31	31
	Number of barge trips – 7,500 t & 370 containers	Barge trips/year	7 – 22	22
	Number of truck trips – 56,000 L & 48 t	Truck trips/year	328 – 3,233	3,300
	Number of truck trips – 70,000 L & 60 t	Truck trips/year	243 – 2,405	2,500
	Number of yellowcake flights	Flights/year	310 – 350	355
Decommissioning	Period	Years	10	10

20.1.1 Production and Mill Feed Rates

The expected range of production for the Project is 3,200 to 4,000 tonnes U per year. The target U production rate, in addition to the ore grade, controls the amount of ore processed on an annual basis, thereby controlling the amount of site activity required to provide the mill with ore and the volume of mill effluent produced. Production rate therefore influences mining rates and mill feed rates, such that potential effects on air (via dust) and water (via mill effluent discharge) are affected. Annual transportation requirements for fuel, reagents, and supplies to site are driven by production and mill feed rates and the transport of yellowcake to market is influenced by availability of final product.

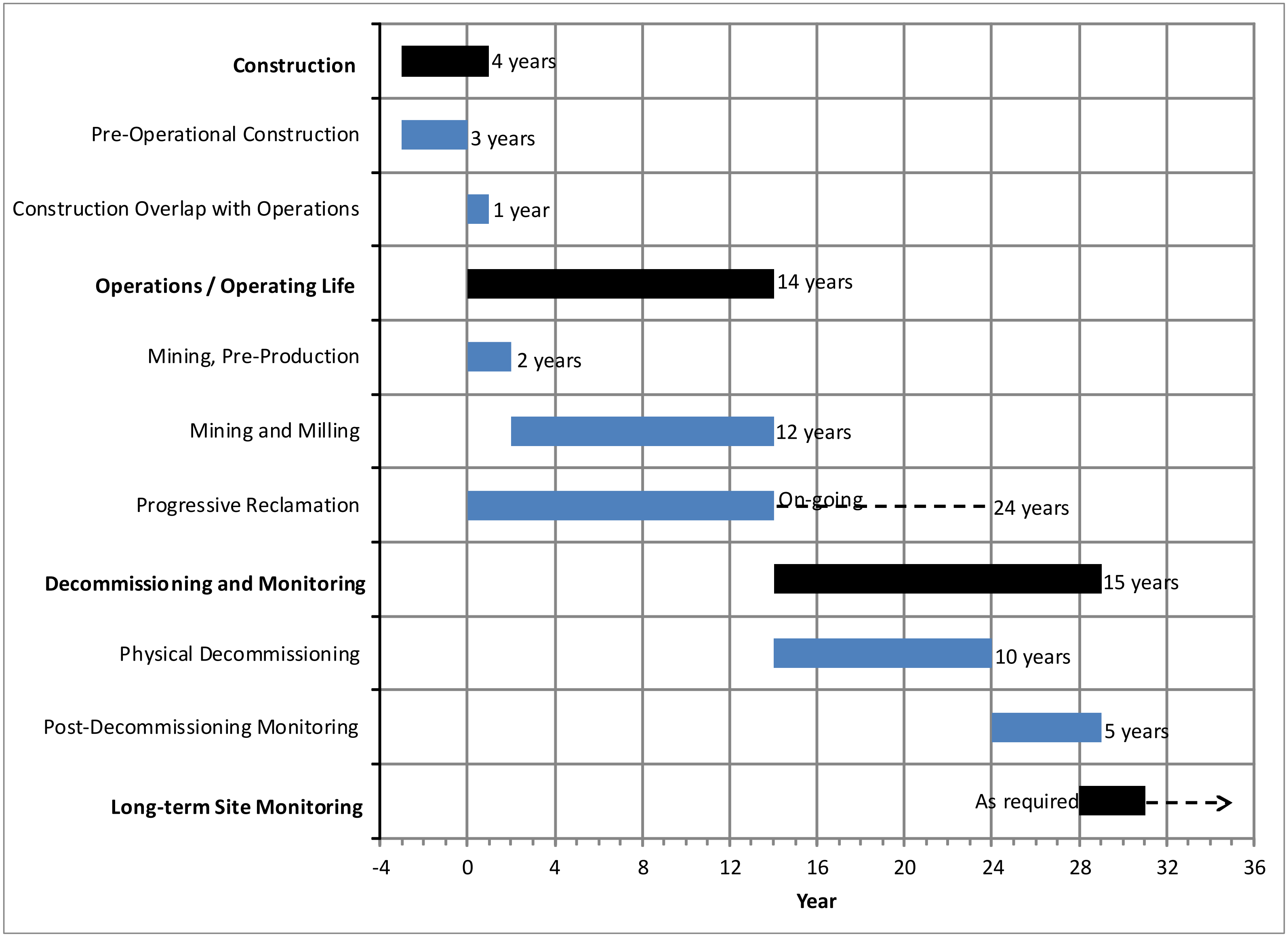
The production rate used to bound the assessment is 4,000 tonnes of U per year. This rate corresponds to the maximum rate of production achievable by the proposed mill design at an average ore grade of approximately 0.4% U. It is acknowledged that ore grades and mine production will vary throughout the life of the project; however, 4,000 tonnes U per year is the maximum average production rate that the project can achieve and therefore is considered a conservative basis for the assessment.

The mill feed rate to produce 4,000 tonnes U per year at an average grade of approximately 0.4%U is approximately 1000 kT per year.

Within the range of expected production rates for the project, socioeconomic factors, such as employment and contracting, are not expected to be substantially affected. In general, a higher production rate translates to higher economic returns, and therefore taxes and royalties would be expected to increase. Therefore to ensure a conservative assessment basis, the socio-economic assessment considers the lower production rates as bounding.

20.1.2 Project Life

The expected life of the Project is influenced by the available ore reserves and the production rate. The mine schedule, given current resources, indicates two years of pre-production (i.e. mining only), followed by 12 years of production (i.e. mining and milling) life.



Projection: NA
Compiled: TL
Drawn: LB
Date: 9/15/2014

FIGURE 20.1-1
PROJECT SCHEDULE OVERVIEW

ENVIRONMENTAL IMPACT STATEMENT
VOLUME 2

KIGGAVIK PROJECT

AREVA

AREVA Resources Canada Inc - P.O. Box 9204 - 817 - 45th Street West - Saskatoon, SK - S7K 3X5

File: Q:\SHEQ\GIS\KIGGAVIK\2014\EIS\Volume 2 - Project Description\Maps\MXD\Figure 20.1-1 Project Schedule Overview.mxd

Mineral resources are identified as the current constraint to the extension of the life of the project. However, if additional project resources are found, the next project constraint is considered to be the limitation of in-pit tailings capacity that is available at the proposed project. Based on the volume of remaining tailings capacity, an additional 11 years of operational life would be added to the project (at a production rate of 4,000 tonnes U per year) based on the current assumptions related to pit configuration and tailings consolidation.

Operation of the mill and the associated interactions with the environment have been assessed on the basis of 25 year life, until all three tailings facilities are full, assuming that mill operation, tailings discharge, and treated effluent discharge continue as described in Sections 7 to 9. For the purpose of assessing a realistic scenario, mining activities are assumed to continue during this mine life, and for simplicity, the scenario whereby End Grid and Andrew Lake mines are operating concurrently has been included in the assessment. As noted above, the discipline-specific air quality assessment further considered all mining activities to occur simultaneously at maximum levels to evaluate the greatest possible effect on air quality.

There is reasonable potential that additional resources will be discovered during the project life. It is expected that a separate Environmental Assessment and subsequent licence amendments would be required prior to development of ore bodies not included in this assessment.

An extended Project life would also extend the socio-economic benefits of the Project.

Project Life Stages	Project Life Sub-Stages	Project Life Sub-Stage Duration	FEIS Base Case	FEIS Assessment Basis	Notes
Construction	Pre-Operational Construction	3 years	4 years	4 years	
	Construction Overlap with Operations	1 years			
Operations	Mining, Pre-Production	2 years	14 years	25 years	14 years represents available known ore to process and assessment basis of 25 years represents tailings management facility capacity
	Mining and Milling, Production	12 years			
Decommissioning	Progressive Reclamation	n/a	10 years	10 years	On-going throughout operations
	Physical Decommissioning	10 years			
Monitoring	Post Decommissioning	5 years	5 years	5 years	Intense monitoring and minor physical works
	Long-Term Site Monitoring for Return to Institutional Control	As Required	As Required	As Required	

20.1.3 Project Footprint and Infrastructure Locations

The proposed Project footprint, as described in Section 4, covers about 938 ha of land, including the Kiggavik and Sissons sites, the Kiggavik-Sissons haul road, various site roads and service roads that parallel mine infrastructure (e.g. freshwater intake pipelines), and the airstrip. The area used to bound the assessment assumes a buffer around each site and road in order to encompass any adjustments required during project development. Thus the assessment is based on approximately 1,102 ha of land disturbance.

Infrastructure locations within the mine site footprint as discussed in Section 4.4 will be optimized during detailed engineering and site preparation as additional information on shallow geotechnical conditions is obtained. However, the general layout as developed based on the principles described in Section 4.4 will be maintained. The footprint of the project infrastructure is considered to be conservatively estimated, and detailed engineering will likely provide opportunities to further reduce the footprint. As such, optimization of the site layout will not influence the conclusions of the assessment.

Two road options are proposed for transporting supplies from the Baker Lake dock site facility to the Kiggavik mine site. The preferred road option is a winter road. For assessment purposes, the winter road footprint area is about 150 ha in size with about 70 ha located on land and about 80 ha located over water. If the winter road is unable to adequately support the Project, an all-season road has been included as an alternative road option. For assessment purposes, the all-season road has a footprint size of about 274 ha. As the winter and all-season access road options travel over different habitat types with different water crossings, these roads have been assessed separately.

A dock site facility will be constructed near the community of Baker Lake to receive and store supplies shipped via marine transport to support the Kiggavik Project. Three dock site facility options are presented. The preferred option is dock site facility #1 (see section 10.3.5) which is about 25 ha in size. Alternative options include dock site facility #2 and Agnico-Eagle’s existing dock site facility should Agnico-Eagle no longer require the use of this facility and appropriate transfer of ownership approvals are maintained.

20.1.4 Mining Activities

Variation in the Project production rate often results in variation in the rate of mining required to maintain mill feed. The mining rate influences the amount of equipment movement and volumes of material hauled, including ore and mine rock. These are factors used to predict air dispersion of dust.

Bounding cases have been used within the air dispersion assessment that include an overall production rate of 4,000 tonnes U per year, which corresponds to approximately 1000kT ore per year at 0.4% U. The equipment types included in the assessment are those presented in Section 5.

Further detail on the air dispersion scenarios and associated assumptions are provided in Volume 4 and Technical Appendix 4B.

20.1.5 Milling Activities

The key environmental interactions associated with milling include air dispersion (mill and acid plant emissions), water management via freshwater consumption, recycling and mill effluent, human health via radiation dose, and reagent use, which could influence accident and malfunctions and tailings behaviour.

Atmospheric emissions, treated effluent discharge and freshwater consumption are driven primarily by the mill feed rate and flowsheet design. These have been bounded at the levels required to produce 4,000 tonnes U per year. The flowsheet selected features Resin-In-Pulp (RIP) for solids liquids separation and solution purification. The RIP process was selected based on its significantly lower water consumption and effluent discharge compared to the conventional CCD-SX process.

The mill may or may not include a calcination circuit, depending on refinery preferences and transportation costs at the time of licensing. The presence of a calcination circuit may affect air emissions, potential dose and product characteristics.

The assessment basis includes a calcination circuit to account for air emissions, potential dose, and other differences between a calciner and a dryer.

A solvent extraction (SX) circuit has been considered as an option in the mill. This circuit would be required for any new ores if further purification is required following solid-liquid separation. The inclusion of an SX circuit could potentially influence tailings porewater properties, mill effluent and air emissions. Mill effluent would be treated in the water treatment plant to meet quality as outlined in Section 9.5.3. Tailings would be neutralized to meet long-term criteria as outlined in Section 8.

20.1.6 Tailings Management

The assessment basis considers tailings deposited in the East Zone, Centre Zone, and Main Zone mined out pits. The assessment basis for tailings management considers the case where additional resources are found and the three TMFs are fully backfilled with tailings. Containment for tailings is bounded by the volume of the proposed TMFs at 30 Mm^3. As the TMFs are designed to account for potential changes in long-term conditions, the assessment basis for tailings management considers a case with current permafrost conditions and a case without permafrost.

20.1.7 Water Management

Withdrawal: The assessment basis considers fresh water for the Kiggavik site to be withdrawn from Siamese Lake and fresh water for the Sissons site to be withdrawn from Mushroom Lake.

Consumption and Recycle: Fresh water consumption at the Kiggavik site in the assessment case is 8000m3/d with no water recycling. In operation, efforts will be made to minimize water consumption by recycling of water within the mill and use of site drainage.

It is anticipated that all water needs with the exception of potable water and dust suppression at the Sissons site will be met with recycled water. Some dust suppression at the Sissons site may be completed with water withdrawn at the Kiggavik site.

Water Treatment and Effluent: The base case for treated effluent volume at Kiggavik is based on the average water treatment plant flow when permeate and site drainage are recycled for use in the mill. The Kiggavik water treatment plant is designed to handle the flow expected when there is no recycling of site drainage or permeate in the mill, the value used as the assessment basis for treated effluent discharge quantity.

The base case and assessment case for treated effluent volume at Sissons is based on the design capacity of the Sissons water treatment plant capacity of 1,700m3/d. The Sissons water treatment plant is designed to treat volumes with no recycle, and with some flexibility for greater than expected inflows.

The bounding case used for treated effluent discharge is the maximum capacity of the Kiggavik and Sissons water treatment plants, designed to treat volumes with zero recycle, for a 25 year operating period, followed by a decommissioning period. Decommissioning treatment flows for Kiggavik have been based on the bounding case wherein consolidation of tailings in the Main Zone TMF occurs after operations have ceased. Water treatment plant capacity and on-site water storage facilities have been designed to manage contingency situations and these flows are considered in the assessment basis.

Sewage: Treated effluent volumes do not include the volumes of treated sewage. The volume of sewage is relatively small compared to the overall treated effluent volume and the sewage treatment plant effluent will meet all relevant guidelines for the treatment and discharge of sewage.

Effluent Discharge: Treated effluent from the Kiggavik and Sissons sites will be discharged to Judge Sissons Lake. Point of discharge options include one combined treated effluent outfall from Kiggavik and separate outfalls from both Kiggavik and Sissons to separate areas of Judge Sissons. The bounding scenario carried through the assessment was based on separate outfalls from Kiggavik and Sissons discharging to separate areas of Judge Sissons Lake. Type 1 / 2 mine rock stockpiles drainage collection systems will discharge, following sedimentation, to local watersheds at the Kiggavik and Sissons sites.

20.1.8 Power Generation

Power generating capacity as described in Section 11 is considered sufficient for 4,000 tonnes U per year and therefore this forms the assessment basis.

The proposed design as described in Section 11 is decentralized, whereby smaller power plants would be located at Kiggavik (13.0 MW peak load) and Sissons (3.8 MW peak load). The assessment basis also includes a centralized option (16.8 MW peak load), whereby all power would be generated at Kiggavik and transmitted to Sissons via overhead line.

20.1.9 Logistics and Transportation

Transportation requirements for reagents, fuel, and supplies over the life of the Project have been conservatively estimated based the proposed production schedule and include several different configurations of trucks and barges. Increasing production to 4,000 tonnes U per year is well within the scope of these estimates.

As the winter and all-season access road options travel over different types of habitat and include a range of crossings, these roads have been assessed separately.

Marine transportation of supplies will involve tug/barge arrangements meeting container ships and tankers in Chesterfield Inlet where supplies are lightered onto them for transport through the Chesterfield Inlet Narrows to the proposed dock site facility. Two different barge sizes are proposed: a 5,000 tonne barge and a 7,500 tonne barge. For assessment purposes, a total of 31 barge trips using 5,000 tonne barges are anticipated, while 21 barge trips are anticipated using 7,500 tonne barges.

Truck transport of supplies from the dock site facility at Baker Lake to the Kiggavik mine site will involve trucks pulling trailers capable of carrying dry cargo, fuel and mixed loads of fuel and cargo. With truckload estimates of truck configurations capable of carrying up to 48 tonnes of dry cargo and 56,000 litres of fuel, 3,300 truck trips are anticipated to transport supplies to maintain maximum production capabilities at the Kiggavik Project. Larger truck configurations capable of carrying up to 60 tonnes of dry cargo and 70,000 litres of fuel would require 2,500 truck trips to maintain maximum production capabilities.

Yellowcake produced at the Kiggavik Project will be transported by air to southern locations. During normal operations, it is anticipated that there will be 310 to 350 flights per year. At the assessment basis production rate of 4000t U, a conservative total of 355 flights per year are assessed.

- Under the *Nunavut Land Claims Agreement* and the *Nunavut Planning and Project Assessment Act*, the transportation of persons or goods does not trigger the definition of a transboundary project for an Article 12 Part 6 federal environmental assessment panel review unless that transportation is a substantial element of the project (NLCA 12.4.7(a)(ii) and NUPPAA 94(3)).
- All resource development projects require the transport of goods to the project site and the transport of product to market. There are existing, charted shipping lanes and flight routes throughout Canada and internationally. Projects with intense shipping programs may have increased the level of information for transportation in the project description and have assessed this in greater detail at the environmental assessment stage (e.g. Mary River), but more typically, the precedent is to focus the environmental assessment on the port or terminal area and, in some cases, immediately adjacent shipping activity (e.g. Irving Refinery, Newfoundland Transhipment, Kitimat LNG or Deltaport 3). Applying the precedent to the proposed Kiggavik Project, this would bound the assessment to include potential effects from barging in Chesterfield Narrows prior to reaching existing shipping routes in Hudson Bay and inclusion of potential accidents and malfunctions including take off and landing at the site airstrip prior to reaching altitude, but not product transport to its final destination.
- The Kiggavik Environmental Impact Statement has included additional information on both marine and air transport that would be required to obtain licensing approvals with Transport Canada and the Canadian Nuclear Safety Commission.

Marine Transport

- The Kiggavik marine assessment (Tier 2 Volume 7) has focused on the Chesterfield Inlet barging activities to Baker Lake as the main component of the environmental assessment, but has additionally provided information on potential effects to marine VECs in Hudson Bay and Hudson Strait.
- Transiting through Hudson Bay and Strait, AREVA will follow established shipping routes recommended by Transport Canada and comply with federal legislation (e.g., *Shipping Act*) and regulations including those pertaining to safe operations, ballast water management, bilge water management, transportation of dangerous goods, and emergency response preparedness.

Air Transport

- As a fundamental component of the environmental assessment, the Kiggavik accident and malfunction assessment (Tier 2 Volume 10) includes emergency response for necessities of life, personnel emergencies, natural environment-related emergencies and operational emergencies, as well as response strategies for a variety of spill scenarios. The assessment then considers the potential interactions of accidents and malfunctions with the environment and human safety taking into account the proposed mitigation measures including preventative measures and emergency response capabilities.
- In addition, AREVA has provided a risk assessment for uranium ore concentrate (UOC) that would be transported by aircraft from the Kiggavik site airstrip southward to connect with established ground transportation routes currently used for shipments of UOC from existing mines in northern Saskatchewan. The likelihood and consequence of incidents involving the air transport of UOC has been assessed considering the flight path from the Kiggavik site to the airstrip at Points North, Saskatchewan. An assessment of the likelihood and consequence of several incident scenarios occurring during subsequent ground transportation of uranium ore concentrates throughout Canada has further been included.
- Transportation of UOC will be in accordance with regulations governing the safe transport of radioactive materials including the Transportation of Dangerous Goods Regulations and the Packaging and Transport of Nuclear Substances Regulations. Development of an Emergency Response Assistance Plan (ERAP) is a post-environmental assessment requirement that must be accepted by Transport Canada prior to shipment. AREVA currently maintains an ERAP for UOC transport in Canada.

20.2 Summary of Project Activities for Environmental Assessments

To facilitate the environmental assessments of Project activities, the activities and associated infrastructure as described in the previous sections of this document have been grouped based on potential Project-environmental interactions. For instance, those construction activities that have the potential to directly interact with the aquatic environment have been grouped together.

The activities, as summarized in the following sections, form the basis for the Project-environment interactions matrices presented in the subsequent Tier 2 volumes of the EIS. The following sections provides rationale and clarification, where deemed necessary, for the categorization.

20.2.1 Construction Activities

Construction activities, as shown in Table 20.2-1, have been primarily categorized as either in-water, on-land, or support activities. Construction activities will be responsible for most of the Project interaction with the site footprint, in terms of potential for land or waterbody disturbance.

In-water activities include diversions or collection of surface flow and construction directly on a shoreline or within water. Key activities include installation of the Baker Lake dock site, installation of freshwater pumping systems, installation of the treated effluent discharge diffuser systems, construction of the Andrew Lake dewatering structure, installation of culverts and bridges, installation of the Thelon cable ferry (if the all-season road is constructed), and construction of freshwater diversion channels and ponds.

On-land activities include construction of site pads and foundations, roads, erection of buildings, and quarrying. While much of the potential interaction is with the terrestrial environment, it is recognized that these on-land activities have the potential to interact with the aquatic environment.

Support activities are those that are required to provide power, transport people and supplies, store hazardous materials, manage waste, and provide shelter. These activities will span the life of the Project.

Table 20.2-1 Summary of Construction Activities and Facilities

Activities		Project Area	Project Facilities
Economic Activities	Construction Workforce Management (hiring and training) Contracts and Taxes Advance Training of Operations Workforce		
In-Water Construction	Construct freshwater diversions and site drainage containment systems (dykes, berms, collection ponds)	Site Access	Freshwater diversions
		Mine Site	Freshwater diversions Site containment dykes and berms Andrew Lake dyke Site runoff ponds Purpose built pit
	Construct in-water/shoreline structures	Site Access	Wharf construction Ferry crossing Water crossings (culverts and clear span bridges)
		Mine Site	Water crossings (culverts and clear span bridges) Intake pipelines Effluent pipelines and diffusers

Table 20.2-1 Summary of Construction Activities and Facilities

Activities		Project Area	Project Facilities
	Water transfers and discharge	Site Access	Domestic wastewater
		Mine Site	Andrew Lake dewatering Minor ponds/standing water dewatering Domestic wastewater
	Freshwater withdrawal	Site Access	Ice flooding winter road
		Mine Site	Kiggavik site freshwater supply Sissons site freshwater supply Flooding temporary ice airstrip
On-Land Construction	Site clearing and pad construction (blasting, earth-moving, loading, hauling, dumping, crushing)	Site Access	Baker Lake port Winter road All season road Quarry development
		Mine Site	Kiggavik, including pit stripping Sissons, including pit stripping Pointer Lake Airstrip Quarry development Haul road and site roads
	Construct foundations	Site Access	Baker Lake fuel tank farm
		Mine Site	Mill and powerhouse, tank farms Accommodation complex
	Construct buildings	Site Access	Emergency shelters Warehouse
		Mine Site	Mill, powerhouse, mine shops, water treatment plants Accommodation complex and temporary camps Backfill Plant Airstrip shelter
	Install equipment	Site Access	Generators Baker Lake facility Port crane and fuel off-loading
		Mine Site	Temporary generators

Table 20.2-1 Summary of Construction Activities and Facilities

Activities		Project Area	Project Facilities
			Mill, backfill and water treatment equipment Powerhouse Utility distribution Maintenance Incinerator Communications systems
	Install and commission fuel tanks	Site Access	Baker Lake tank farm
		Mine Site	Kiggavik site tank farm Sissons fuel tanks Airstrip jet fuel tanks
	Mill dry commissioning (water only)	Mine Site	
Supporting Activities	Transport fuel and construction materials	Site Access	Transfers, barging, trucking
		Mine Site	Transfers
	Air transport of personnel and supplies	Mine Site	
	Hazardous materials storage and use	Site Access	Baker Lake storage facility
		Mine Site	Kiggavik and Sissons
	Explosives storage and use	Site Access	
		Mine Site	
	Waste incineration and disposal	Site Access	
		Mine Site	
	Industrial machinery operation	Site Access	
		Mine Site	
	Power generation	Site Access	Baker Lake storage facility
		Mine Site	Temporary generators

20.2.2 Operating Activities

Operating activities have been categorized according to the applicable Project component, such as mining, milling, and waste management, to reflect the component-specific characterization of potential emissions and potential interactions with the environment.

Table 20.2-2 Summary of Operating Activities and Facilities

Activities		Project Area	Facilities
Economic Activities	Workforce Management (hiring and training)		
	Employment		
	Contracts and Taxes		
Mining	Mining ore (blasting, loading, hauling)	Mine Site	East Zone, Centre Zone, Main Zone, Andrew Lake open pits
			End Grid Underground
			Haul Road
	Ore stockpiling	Mine Site	Kiggavik ore stockpile
			Sissons ore stockpile
	Mining Type 3 mine rock (blasting, loading, hauling)	Mine Site	East Zone, Centre Zone, Main Zone, Andrew Lake open pits
			End Grid Underground
	Type 3 mine rock stockpiling		Kiggavik Type 3 mine rock stockpile
			Sissons Type 3 mine rock stockpile
	Mining Type 1 / 2 mine rock (blasting, loading, hauling)		East Zone, Centre Zone, Main Zone, Andrew Lake open pits
			End Grid Underground
	Type 1 / 2 mine rock stockpiling	Mine Site	Kiggavik Type 1/ 2 mine rock stockpile
			Sissons Type 1 / 2 mine rock stockpile
	Mine dewatering	Mine Site	East Zone, Centre Zone, Main Zone, Andrew Lake open pits
			End Grid Underground

Table 20.2-2 Summary of Operating Activities and Facilities

Activities		Project Area	Facilities
	Underground ventilation	Mine Site	End Grid Underground
	Backfill production and underground placement	Mine Site	End Grid Underground
Milling	Transfer ore to mill	Mine Site	
	Crushing and grinding	Mine Site	
	Leaching and U Recovery	Mine Site	
	U Purification	Mine Site	
	Yellowcake drying and packaging	Mine Site	
	Tailings neutralization	Mine Site	
	Reagents Preparation and Use	Mine Site	
Tailings Management	Pumping and placement of tailings slurry	Mine Site	East Zone, Centre Zone, Main Zone TMFs; pipelines
	Consolidation of tailings	Mine Site	East Zone, Centre Zone, Main Zone TMFs
	Pumping of TMF supernatant	Mine Site	East Zone, Centre Zone, Main Zone TMFs; pipelines
	Create and maintain TMF water levels	Mine Site	East Zone, Centre Zone, Main Zone TMFs
Water Management	Freshwater withdrawal	Site Access	Ice flooding winter road
		Mine Site	Kiggavik site, potable and industrial use
			Sissons site, potable and industrial use
	Potable water treatment	Mine Site	Kiggavik
			Sissons
	Collection of site and stockpile drainage	Mine Site	Site runoff ditches and ponds
			Purpose built pit
			Snow fencing and clearing
			Stockpile drainage collection
	Water and sewage treatment	Mine Site	Kiggavik water treatment plant
			Sissons water treatment plant
			Kiggavik sewage treatment plant
			Sissons sewage treatment plant

Table 20.2-2 Summary of Operating Activities and Facilities

Activities		Project Area	Facilities
	Discharge of treated effluents (including grey water)	Site Access	Domestic wastewater
		Mine Site	Kiggavik treated effluent
			Sissons treated effluent
			Type 1/ 2 mine rock stockpile excess runoff
Waste Management	Disposal industrial waste	Mine Site	
	Management of hazardous waste	Mine Site	
	Management of radiologically contaminated waste	Mine Site	
	Disposal of domestic waste	Mine Site	
	Incineration and handling of burnables	Mine Site	Kiggavik incinerator
	Disposal of sewage sludge	Mine Site	
General Services	Generation of power	Site Access	Baker Lake Facility generator
		Mine Site	Kiggavik powerhouse
			Sissons powerhouse
			Power transmission lines
	Operate accommodations complex	Mine Site	Cafeteria, recreation areas, quarters
	Recreational activities	Mine Site	
	Maintain vehicles and equipment	Mine Site	Shops and wash bays
	Maintain infrastructure	Site Access	Roads, bridges, culverts, cable ferry, Baker Lake facility
		Mine Site	Site pads, roads, bridges, culverts, airstrip, buildings
	Operate airstrip	Mine Site	Arrivals, departures, transfer materials, planes + helicopters
	Hazardous materials storage and handling (reagents, fuel and hydrocarbons)	Site Access	Baker Lake storage
		Mine Site	Kiggavik and Sissons
	Explosives storage and handling	Site Access	Baker Lake storage
		Mine Site	Kiggavik and Sissons
Transportation	Marine transportation	Site Access	Loading barges, barging, off-loading; fuel, reagents and supplies; back-haul

Table 20.2-2 Summary of Operating Activities and Facilities

Activities		Project Area	Facilities
	Truck transportation	Site Access	Fuel, reagents and supplies; winter road and/or all-season road; cable ferry operation
	General traffic (project-related)	Site Access Mine Site	
	Controlled public traffic	Site Access	
	Air transportation of personnel, goods and supplies	Mine Site	
	Air transportation of yellowcake	Mine Site	Handling and transport of yellowcake to Points North
	General air transportation support	Mine Site	Airplanes + helicopters; medivac, inspections, exploration, monitoring
On-going Exploration	Aerial surveys	Mine Site	
	Ground surveys	Mine Site	
	Drilling	Mine Site	

20.2.3 Decommissioning and Closure Activities

Decommissioning activities have been categorized in a manner similar to construction activities. In-water and on-land infrastructure and facilities will be removed during decommissioning, with the same general potential for interaction with the environment.

In addition to the decommissioning activities listed in Table 20.2-3, assessments have been completed for potential interactions between the decommissioned tailings management facilities and the decommissioned Type 1 / 2 mine rock stockpiles during the post-decommissioning period.

Table 20.2-3 Summary of Decommissioning Activities and Facilities

Activities		Project Area	Facilities
no mic Act iviti	Decommissioning Workforce		
	Contracts and Taxes		
Support	Hazardous materials storage	Site Access	Storage at Baker Lake port
		Mine Site	Hazardous materials from Kiggavik transported to Baker
	Industrial machinery operation	Site Access	Truck transport to Baker Lake port

Table 20.2-3 Summary of Decommissioning Activities and Facilities

	Activities	Project Area	Facilities
	Ongoing withdrawal, treatment and	Mine Site	Heavy equipment for decommissioning activities
		Mine Site	Flooding Andrew Lake pit
In-Water Decommissioning	Remove freshwater diversions; re-establish natural drainage	Mine Site	Freshwater diversion channels Breach Andrew Lake dewatering structure
	Remove surface drainage containment	Site Access	Baker Lake port runoff pond
		Mine Site	Site containment dykes and berms, Kiggavik, Sissons Monitoring ponds Site runoff pond, Kiggavik, Sissons
	Remove in-water/shoreline structures	Site Access	Wharf removal Cable ferry removal Water crossings/culverts Clear span bridges
		Mine Site	Freshwater pipelines and intakes Treated effluent pipeline and diffuser
	Water transfers and discharge	Site Access	Domestic wastewater
		Mine Site	Andrew Lake flooding PBP flooding Domestic wastewater
On-Land Decommissioning	Remove/reclaim site pads (blasting, earth-moving, loading, hauling, scarify)	Site Access	Baker Lake port
			Winter road Site roads All-season road
		Mine Site	Kiggavik, including pits and stockpiles Sissons, including mines and stockpiles Airstrip Quarries Sissons-Kiggavik Haul road
	Backfill	Mine Site	Type 3 mine rock into TMFs and pits Underground mine stabilization
	Contour	Mine Site	Type 1, 2 permanent mine rock stockpiles
	Covers	Mine Site	TMFs Industrial landfills
	Revegetation	Site Access	Baker Lake port
		Mine Site	Kiggavik site pad Sissons site pad Type 1 and 2 mine rock stockpiles TMFs

Table 20.2-3 Summary of Decommissioning Activities and Facilities

Activities		Project Area	Facilities
			Airstrip
	Remove foundations	Site Access	Baker Lake fuel tank farm
		Mine Site	Mill and powerhouse buildings, Kiggavik fuel tank farm Sissons fuel tanks and water treatment plant Accommodations complex
	Remove buildings	Site Access	Emergency shelters Warehouse
		Mine Site	Kiggavik structures Sissons structures Airstrip shelter Accommodation complex and potable WTP
	Remove equipment	Site Access	Temporary generators – Baker Lake Port crane and fuel off-loading
		Mine Site	Mill equipment Power house equipment Utility distribution Incinerator
	Remove fuel tanks	Site Access	Baker Lake tank farm
		Mine Site	Kiggavik site tank farm Sissons site tank farm

21 References

AREVA Resources Canada Inc. 2008. The Kiggavik Project – Project Proposal. Submitted to the Nunavut Impact Review Board. November, 2008.

AREVA Resources Canada Inc. 2014. Kiggavik Project Field Program 2013 Annual Report. January 2014.

Canadian Nuclear Safety Commission. 2003. Comprehensive Study Report Cluff Lake Decommissioning Project. December, 2003.

Canadian Nuclear Safety Commission CNSC Regulatory Document R-52, *Design Guide for Basic and Intermediate Level Radioisotope Laboratories.*

Canadian Nuclear Safety Commission (CNSC). *Packaging and Transport of Nuclear Substances* SOR/2000-208.

Canadian Nuclear Safety Commission (CNSC) 2012a. RD/GD-370: Management of Uranium Mine Waste Rock and Mill Tailings. Available online at: http://nuclearsafety.gc.ca/eng/lawsregs/regulatorydocuments/published/html/rdgd370/index.cfm Accessed: March 15, 2012.

Canadian Nuclear Safety Commission (CNSC). 2012b. Canadian Nuclear Safety Commission Public Meeting. Transcripts from Public Meeting, February 16th, 2012. Available online at: http://www.cnscccsn.gc.ca/eng/commission/pdf/2012-02-16-Transcription-Meeting-Final-Edocs3884124.pdf Accessed: March 15, 2012.

Canadian Explosives Act & Regulations – *Explosives Act* (R.S., 1985, c. E-17)

Canadian Transportation of Dangerous Goods Act & Regulations – *Transportation of Dangerous Goods Act*, 1992 (1992, c. 34)

Canadian Council of Ministers of the Environment, Environmental Code of practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, 2003

Environment Canada (EC). 2014. Canadian Ice Services. North American Arctic Waters Seasonal Summaries. 2004 – 2014. Available online at: http://www.ec.gc.ca/glacesice/default.asp?lang=En&n=6BD77470-1 Accessed June 10, 2014.International Civil Aviation Organization. *Technical Instructions for the Safe Transport of Dangerous Goods by Air*, 2011.

International Atomic Energy Agency (2009). Safety Standards Regulations for the Safe Transport of Radioactive Material 2009 Edition for protecting people and the environment No. TS-R-1 Safety Requirements

Cogema Resources Inc. 2002 Inspections and Future Cleanup Plan for the Kiggavik Sissons Project Nunavut. October 2002.

Cogema Resources Inc. 2003. Report on Clean Up Done in July and August 2003 for the Kiggavik Sissons Projects, Nunavut. 2003.

Fisheries and Oceans Canada. Freshwater Intake End-of-Pipe Fish Screen Guideline. 1995.

Fisheries and Oceans Canada. Mineral Exploration Activities Nunavut Operational Statement Version 1.0. 2009.

Nunavut Impact Review Board. Guidelines for the Preparation of an Environmental Impact Statement for AREVA Resources Canada Inc.'s Kiggavik Project (NIRB File No. 09MN003). May 2011.

Robinson, S.V.J., Paulen, R.C., Jefferson, C.W., McClenaghan, M.B., Layton-Matthews, D., Quirt, D., and Wollenberg, P., 2014. Till geochemical signatures of the Kiggavik uranium deposit, Nunavut; Geological Survey of Canada, Open File 7550. doi:10.4095/293857

Saskatchewan Environment and Resource Management (2000). Construction Guidelines for Pollution Control Facilities at Uranium Mining and Milling Operations. 2000.

Transport Canada (2012). Aeronautical Information Manual, 2012

Transport Canada (1986). Ferry Cable Regulation. 1986.

Transport Canada (2001). Canada shipping Act, 2001

Transport Canada (2012). Vessel Pollution and Dangerous Chemicals Regulation, 2012

IQ and Engagement References

ARHT (Arviat Hunters and Trappers Organization). 2009. Excerpt from socio-economic focus group conducted by Linda Havers and Susan Ross. March 30, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment E.

ARVJ (Arviat Hunters and Elders). 2011. Summary of community review meeting conducted by Mitchell Goodjohn with five HTO members and two Elders. February 18, 2011; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment E.

AR HTO (Arviat Hunters and Trappers Organization). November 2010. Meeting Notes. November 15, 2010; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

AR KIA (Arviat – Kivalliq Inuit Association). April 2007. From “Uranium Community Tour, Kivalliq Region, April 10-14th, 2007 Questions/Comments and/or Concerns”; in Technical Appendix 3A: Public Engagement Documentation, Part 12..

AR KIA (Arviat – Kivalliq Inuit Association). January 2010. From “Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010”; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

AR KWB (Arviat - Kivalliq Wildlife Board). October 2013. Notes from questions asked about the AREVA Presentation, October 31, 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

AR NIRB (Arviat - Nunavut Impact Review Board). May 2010. From “Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB’s Review of AREVA Resources Canada Inc’s Kiggavik Project (NIRB File No. 09MN003)”; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

AR OH (Arviat Open House). November 2010. From “Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)” December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

AR OH (Arviat Open House). November 2013. From “Kivalliq Community Information Sessions 2013 Report.” May 2014; in Technical Appendix 3A: Public Engagement Documentation, Part 7.

BL04 (Baker Lake Interview 04). 2008. Summary of individual Elder IQ interview conducted by Hattie Mannik in Baker Lake, 2008; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BL09 (Baker Lake Interview 09). 2008. Summary of individual Elder IQ interview conducted by Hattie Mannik in Baker Lake, 2008; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation , Attachment B.

BL10 (Baker Lake Interview 10). 2008. Summary of individual Elder IQ interview conducted by Hattie Mannik in Baker Lake, 2008; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BL13 (Baker Lake Interview 13). 2008. Summary of individual Elder IQ interview conducted by Hattie Mannik in Baker Lake, 2008; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BL18 (Baker Lake Interview 18). 2008. Summary of individual Elder IQ interview conducted by Hattie Mannik in Baker Lake, 2008; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BLHT (Baker Lake Hunters and Trappers). 2011. Summary of community review meeting conducted by Mitchell Goodjohn with eight representatives of the Baker Lake Hunters and Trappers Organisation. February 16, 2011; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B

BLOG (Kiggavik blog). 2010. A summary of questions recorded on www.kiggavik.ca in 2010, Part 2.

BLRW (Baker Lake Rotational Workers). 2009. Excerpt from socio-economic focus group conducted by Susan Ross and Mitchell Goodjohn. March 4, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BLYA (Baker Lake Young Adults). 2009. Excerpt from socio-economic focus group conducted by Susan Ross and Mitchell Goodjohn. March 5, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment B.

BL CLC (Baker Lake Community Liaison Committee). February 2007. Meeting Notes. February 13, 2007; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). September 2007. Meeting Notes. September 20, 2007; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). May 2008. Meeting Notes. May 28, 2008; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). March 2009. Meeting Notes. March 27, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). April 2010. Meeting Notes. April 23, 2010; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). October 2010. Meeting Notes. October 26, 2010; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). January 2011. Meeting Notes. January 20, 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL CLC (Baker Lake Community Liaison Committee). May 2011. Meeting Notes. May 27, 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 1.

BL EL (Baker Lake Elders Society (Qilautimiut)). October 2012. Notes from workshop on Significance. Oct 30, 2012; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

BL HL (Baker Lake Hamlet Leaders). January 2009. Meeting Notes, Meeting in Vancouver about Road Options. January 27, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

BL HTO (Baker Lake Hunters and Trappers Organization). March 2009. Meeting Notes. March 4, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

BL NIRB (Baker Lake - Nunavut Impact Review Board). April 2010. From "Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB's Review of AREVA Resources Canada Inc's Kiggavik Project (NIRB File No. 09MN003)"; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

BL NPC (Baker Lake – Nunavut Planning Commission). June 2007. From "Report of the Uranium Mining Workshop, Baker Lake, NU, Prepared for: Nunavut Planning Commission, P.O. Box 2010, Cambridge Bay, NU, X0B 0C0, Prepared by: Nunami Jacques Whitford Limited, Rankin Inlet, Nunavut, October 2007 "; in Technical Appendix 3A: Public Engagement Documentation, Part 14.

BL OH (Baker Lake Open House). November 2010. From "Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)" December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

BL OH (Baker Lake Open House). October 2012. From “Kivalliq Community Information Sessions 2012 Report.” May 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 6.

BL OH (Baker Lake Open House). November 2013. From “Kivalliq Community Information Sessions 2013 Report.” May 2014; in Technical Appendix 3A: Public Engagement Documentation, Part 7.

CH HS (Coral Harbour High School). November 2012. Notes from a presentation and discussion with High School Students from Sakku School. November 1, 2012; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

CH KIA (Coral Harbour – Kivalliq Inuit Association). February 2010. From “Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010”; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

CH NIRB (Coral Harbour - Nunavut Impact Review Board). May 2010. From “Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB’s Review of AREVA Resources Canada Inc’s Kiggavik Project (NIRB File No. 09MN003)”; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

CH OH (Coral Harbour Open House). November 2010. From “Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)” December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

CH OH Oct 2012 (Coral Harbour Open House) October 2012. From “Kivalliq Community Information Sessions 2012 Report.” May 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 6.

CHJ (Coral Harbour Hunters and Elders). 2011. Summary of community review meeting conducted by Barry McCallum and Pamela Bennett with five representatives of the Coral Harbour HTO and three Elders. February 17, 2011; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment H.

CI01 (Chesterfield Inlet interview 01). 2009. Summary of IQ interview conducted by Mitchell Goodjohn with a family of three hunters. May 6, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C

CI04 (Chesterfield Inlet Interview 04). 2009. Summary of IQ interview conducted by Mitchell Goodjohn with individual Elder. May 6, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C.

CI05 (Chesterfield Inlet Interview 05). 2009. Summary of IQ interview conducted by Mitchell Goodjohn with individual Elder. May 6, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C.

CI07 (Chesterfield Inlet Interview 07). 2009. Summary of IQ interview conducted by Mitchell Goodjohn with individual Elder. May 7, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C.

CI08 (Chesterfield Inlet Interview 08). 2009. Summary of IQ interview conducted by Mitchell Goodjohn with individual Elder. May 7, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C.

CIHT (Chesterfield Hunters and Trappers). 2009. Excerpt from socio-economic focus group conducted by Linda Havers and Mitchell Goodjohn. May 7, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment C.

CI HTO Nov 2013CI HTO (Chesterfield Inlet Hunters and Trappers Organization). November 2013. Meeting Notes. November 18, 2013; in Technical Appendix 3A: Public Engagement documentation, Part 7.

CI KIA (Chesterfield Inlet – Kivalliq Inuit Association). February 2010. From "Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010"; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

CI NIRB (Chesterfield Inlet - Nunavut Impact Review Board). May 2010. From "Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB's Review of AREVA Resources Canada Inc's Kiggavik Project (NIRB File No. 09MN003)"; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

CI OH (Chesterfield Inlet Open House). June 2009. From "Part 4 – Kivalliq Community Information Sessions (Round 1, 2009)" December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 4.

CI OH (Chesterfield Inlet Open House). November 2010. From "Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)" December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5

CI OH (Chesterfield Inlet Open House). November 2012. From "Kivalliq Community Information Sessions 2012 Report." May 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 6.

CI OH (Chesterfield Inlet House). November 2013. From “Kivalliq Community Information Sessions 2013 Report.” May 2014; in Technical Appendix 3A: Public Engagement Documentation, Part 7.

KIV MAY (Kivalliq Mayors). February 2009. Meetings Notes from AREVA Presentation to Meeting in Coral Harbour. February 11, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

KIV OH (Kivalliq Communities Open House). October 2009. From “Part 4 – Kivalliq Community Information Sessions (Round 1, 2009)” December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 4

KUG NTI (Kugluktuk – Nunavut Tunnvavik Inc.). May 2007. From “Kugluktuk Minutes, May 29, 2007, Nunavut Tunngavik Inc., Lands Policy Advisory Committee, Uranium Policy Meeting”; in Technical Appendix 3A: Public Engagement Documentation, Part 13

RB HL (Repulse Bay Hamlet Leaders). November 2010. Meeting Notes, November 10, 2010; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RB KIA (Repulse Bay – Kivalliq Inuit Association). February 2010. From “Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010”; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

RB NIRB (Repulse Bay - Nunavut Impact Review Board). April 2010. From “Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB’s Review of AREVA Resources Canada Inc’s Kiggavik Project (NIRB File No. 09MN003)”; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

RB MC (Repulse Bay Mayor and Council). November 2013. Meeting Notes, November 15, 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RB OH (Repulse Bay Open House). November 2010. From “Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)” December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

RB OH (Repulse Bay Open House). November 2012. From “Kivalliq Community Information Sessions 2012 Report.” May 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 6

RI COC (Rankin Inlet - Kivalliq Chamber of Commerce). March 2013. Notes from AREVA Presentation. March 26, 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RI HS (Rankin Inlet High School). November 2012. Notes from a presentation and discussion with High School Students. November 6, 2012; in Technical Appendix 3A: Public Engagement Documentation, Part 2

RI KIA (Coral Rankin Inlet – Kivalliq Inuit Association). April 2007. From “Uranium Community Tour, Kivalliq Region, April 10-14th, 2007 Questions/Comments and/or Concerns”; in Technical Appendix 3A: Public Engagement Documentation, Part 12..

RI KIA (Rankin Inlet – Kivalliq Inuit Association). January 2010. From “Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010”; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

RI KWB (Rankin Inlet- Kivalliq Wildlife Board). May 2009. Notes from questions asked about the AREVA Presentation, May 13, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RI NIRB (Rankin Inlet - Nunavut Impact Review Board). May 2010. From “Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB’s Review of AREVA Resources Canada Inc’s Kiggavik Project (NIRB File No. 09MN003)”; in Technical Appendix 3A: Public Engagement Documentation, Part 11

RI OH (Rankin Inlet Open House). November 2010. From “Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)” December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

RI RLC (Rankin Inlet - Regional Liaison Committee). February 2009. Regional Liaison Committee Meeting Notes. February 24-26, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RIE (Rankin Inlet Elders). 2009. Excerpt from socio-economic focus group conducted by Susan Ross and Linda Havers. April 3, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment D.

Riewe, Rick (Editor). 1992. Nunavut Atlas. Canadian Circumpolar Institute and the Tungavik Federation of Nunavut. Edmonton, Alberta: Art Design Printing Inc.

RIHT (Rankin Inlet Hunters and Trappers Organization). 2009. Excerpt from socio-economic focus group conducted by Susan Ross and Linda Havers. April 2, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment D.

RIJ (Rankin Inlet Hunters and Elders). 2011. Summary of community review meeting conducted by Mitchell Goodjohn with nine Elders and representatives of the Rankin Inlet HTO. February 14, 2011; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment D.

RIYA (Rankin Inlet Young Adults). 2009. Excerpt from socio-economic focus group conducted by Susan Ross and Linda Havers. April 2, 2009; in Technical Appendix 3B: Inuit Qaujimajatuqangit Documentation, Attachment D.

WC CLARC (Whale Cove Community Lands and Resources Committee). November 2010. Notes from a meeting during an open house. November 12, 2010; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

WC KIA (Whale Cove – Kivalliq Inuit Association). January 2010. From "Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010"; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

WC NIRB (Whale Cove - Nunavut Impact Review Board). May 2010. From "Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB's Review of AREVA Resources Canada Inc's Kiggavik Project (NIRB File No. 09MN003)"; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

WC OH (Whale Cove Open House). November 2010. From "Part 5 – Kivalliq Community Information Sessions (Round 2, 2010)" December 2011; in Technical Appendix 3A: Public Engagement Documentation, Part 5.

WC OH (Whale Cove Open House). November 2012. From "Kivalliq Community Information Sessions 2012 Report." May 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 6.

WC OH (Whale Cove Open House). November 2013. From "Kivalliq Community Information Sessions 2013 Report." May 2014; in Technical Appendix 3A: Public Engagement Documentation, Part 7.

WCCR 2011. (Whale Cove Community Review). 2011. Summary of IQ focus group conducted by Barry McCallum with six traditional land and resource users from the Whale Cove HTO. March 21, 2011; in Appendix 3B: Inuit Qaujimajatuqangit Documentation, Appendix F.