Kiggavik Project

Environmental Impact Statement

Tier 3 Technical Appendix 2R

Preliminary Decommissioning Plan

December 2011

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1 INTRODUCTION

1.1 OVERVIEW

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 decommissioning plans, including financial security. As operator of the Kiggavik Project, AREVA Resources Canada (ARC) will be responsible for the development and maintenance of the decommissioning plans and financial assurance.

This document provides preliminary plans and associated costs for decommissioning the project site in advance of the final mine design. However this plan is a dynamic one in the sense that it will be updated as the project advances to construction and operation. The cost estimate encompasses the full development of the known uranium resource. These requirements are stated in Section 12 of *The Mineral Industry Environmental Protection Regulations, 1996* and Section 3 of the *General Nuclear Safety and Control Regulations* (Section 3(1) (l) requires a description of any proposed financial guarantee).

This document includes sufficient detail to ensure that the proposed decommissioning plan is, in light of existing knowledge, technically feasible and appropriate in the interests of health, safety, security and protection of the environment.

1.2 SCOPE

In keeping with the concept of “life-cycle” planning, this document has been prepared for the site as it will exist at the end of the uranium production phase. It is recognized that should the stage of development vary from that which is expected, the next version of the document will reflect those changes.

As per CNSC guidance (Regulatory Guide G-219) and various Nunavut guidelines (referenced at the end of the text) details regarding the following subjects will be presented in the Final Decommissioning Plan. General commitments only with respect to the following are included in this Preliminary Decommissioning Plan (PDP):

- Materials and Waste Management
- Radiological Surveys
- Human Factors
- Conventional Health Safety and Security

- Emergency Response
- Quality Assurance

This document includes decommissioning of the core storage area. However, in keeping with the *Nunavut Mineral Exploration and Mining Strategy,* March, 2007 this would not be undertaken until such time as ARC is instructed to do so by the Minister responsible.

Geographically, the Project mine site can be considered to consist of infrastructure in three main areas: Kiggavik, Sissons and the Baker Lake Port and Staging Facilities. The roads connecting these areas will also be included. Details regarding the decommissioning and reclamation approach for these areas are outlined in Sections 3 and 4 of this report.

1.3 LEGAL CONTEXT

Federal and territorial acts, regulations, objectives, standards and guidance documents have been reviewed for the preparation of this document.

The federal documentation reviewed includes the following:

- NTI Reclamation Policy, September, 2008
- Nuclear Safety and Control Act and Regulations, principally the General Nuclear Safety and Control Regulations, Uranium Mines and Mills Regulations and Class I Nuclear Facilities Regulations (CNSC);
- Regulatory Policy Statement No. P-223, Protection of the Environment (CNSC, 2001);
- Regulatory Policy Statement No. P-290, Managing Radioactive Wastes (CNSC, 2004);
- Regulatory Guide No. G-206, Financial Guarantees for the Decommissioning of Licensed Activities (CNSC, 2000c);
- Regulatory Guide No. G-219, Decommissioning Planning for Licensed Activities (CNSC, 2000d);
- Regulatory Document No. R-85, Policy Statement - Radiation Protection Requisites for the Exemption of Certain Radioactive Materials from Further Licensing Upon Transferal for Disposal (AECB, 1989);
- Regulatory Document No. R-104, Regulatory Objectives, Requirements and Guidelines for the Disposal of Radioactive Wastes – Long-term Aspects (AECB, 1987);
- Canadian Environmental Quality Guidelines (CCME, 2002) which includes guidelines for water, sediment and soil; and

1.4 CORPORATE INTENT

The ARC decommissioning policy is to begin clean-up and reclamation on areas soon after mining or when other operations are complete. By having progressive reclamation program

during the milling and mining operational phase, a significant portion of work described in the decommissioning plan will be complete when operations cease. As an overall goal, once decommissioning is complete the mine sites will:

- be physically sound;
- be safe for public use;
- meet air, soil, and water quality objectives (or agreed upon criteria) at designated locations; and
- impose no burden on future generations.
- In development of this Preliminary Decommissioning Plan, ARC also relied on experience gained developing and decommissioning Saskatchewan mining projects including: dialogue with provincial and federal regulators, various EIS's and support documents, preliminary decommissioning plans for the McClean Lake Operation and Midwest Project and the decommissioning activities undertaken at the of Cluff Lake Project.

1.5 FINANCIAL ASSURANCE

The purpose of providing a financial assurance to the Territory of Nunavut is to ensure that the taxpayer is not burdened with the cost of decommissioning a mining facility in the event the operator becomes financially unable or unwilling to undertake or complete the implementation of approved decommissioning plans. The regulatory agencies would then oversee the decommissioning and reclamation work in this scenario and the work would be completed by independent contractors. The following key information was also considered to evaluate the necessary amount of the financial assurance:

- an independent contractor carries out the work;
- the value of salvageable material and ore reserves are not credited toward the cost of decommissioning; and
- contingency allowances which vary from 5 to 25% and are applied to the cost estimates. These allowances fall within the category of accurate estimates, based on the CNSC Regulatory Guide No. G-206. We believe this is justified based on ARC's extensive experience with the recent decommissioning activities at Cluff Lake Mine and our familiarity with "actual costs" of mine reclamation in the far north. These accurate estimates are also based on the certainty of calculated volumes required for the larger tasks (TMF backfilling) and the unit costs which are based on actual contractor quotes for the Cluff Lake Project (mill demolition) plus appropriate allowance for recent increases in wages;

Section 5 summarizes the proposed level of financial assurance resulting from the current calculation of decommissioning costs. The required financial assurance resulting from this calculation is $159 million CDN.

2 DECOMMISSIONING STANDARDS, MANAGEMENT CONCEPTS AND SYSTEMS

2.1 SAFE STATE OF CLOSURE

ARC's key decommissioning objective is to remove, minimize, and control potential contaminant sources and thereby minimize the potential for adverse environmental effects associated with the decommissioned property. The decommissioning plan is designed to achieve an end-state of the properties that will be safe for human and non-human biota and, chemically and physically stable, allow utilization for traditional purposes, and that minimizes potential constraints on future land use planning decisions. ARC believes that by progressively reclaiming the site as various mining areas are completed and addressing any environmental issues that arise within those areas during the operational phase, that the need for care and maintenance activities, and long-term institutional control can be minimized.

Where relevant specific water, air or soil objectives are defined in relation to existing federal and provincial regulations or guidelines taking into consideration site specific conditions. For identified contaminants of potential concern, where federal or provincial guidelines are not available, information obtained from the scientific literature and site specific conditions will be evaluated to derive benchmarks for inclusion as decommissioning objectives.

In the absence of surface water quality guidelines under the Nunavut regulatory regime, ARC proposes the use of the Canadian Council of Ministers of the Environment (CCME) Guidelines and the Saskatchewan Surface water Quality Objectives as standards for all downstream receiving waters. If these guidelines are not appropriate for specific aspects such as open pits, a site specific risk assessment will be conducted to determine the water quality requirements for the protection of wildlife and public safety.

ARC anticipates that ALARA would be used for radiological clearance to the degree that the incremental effective doses to inhabitants of the region would not exceed 1 mSv per year above natural background levels. Radiological release criteria will be based on the results of a formal future land assessment involving local stakeholders in the region and on the program currently used at the McClean Lake Operation.

2.2 QUALITY

The Kiggavik Project will develop a quality management system, based on the McClean Lake (Northern Saskatchewan Mining Operation approach to Quality Management, which provides an overall structure for all site controlled aspects of product quality, processes and support

services. In addition, the Kiggavik Project will target ISO 14001 certification within the first few years of operation. The ISO 14001 registration ensures that Environmental Management Systems used by ARC conform to rigorous international standards and continually strive to improve environmental protection. To avoid duplication, the Integrated Quality Management system (IQMS) has been designed to address all of the requirements for products, processes and support services as well as those of environmental management.

The IQMS, including procedures and work instructions shall apply during all phases of decommissioning and reclamation in accordance with the future Kiggavik Quality Assurance management systems. Because the IQMS will be dynamic, changes and/or additions required specifically for decommissioning will be integrated as necessary, to ensure appropriate quality control over all critical activities.

2.3 REGULATIONS, CRITERIA AND GUIDELINES

Other criteria to which decommissioning activities will be subject:

- For sediment quality, Canadian Council of Ministers of the Environment (CCME) - Canadian Environmental Quality Guidelines, Interim Sediment Quality Guidelines (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) will be met at designated locations on-site, or where these objectives are not deemed appropriate, criteria will be established through negotiations and scientific literature. Site specific sediment quality specifications will be developed at the time that the Final Decommissioning Plan is prepared. This assessment and licensing process is expected to occur within the context of regional objectives and with a reliable inventory of chemical characteristics data, which will be available at that time.
- For air quality, Guideline: Air Quality Sulphur Dioxide and Suspended Particulates (Nunavut) and the Canadian National Ambient Air Quality Objectives will be met on-site;
- For open pits, criteria for in-pit water and sediment quality will be defined on a site-specific basis following further study and discussion with the regulatory agencies;
- The design criteria specified by Environmental Guidelines for Site Remediation, Department of Sustainable Development (Nunavut) for the decommissioning, cleanup and reclamation of northern mine sites;

2.4 ENVIRONMENTAL PROGRAM

The following process for commencing the final decommissioning process is based on the current Saskatchewan based uranium mine (ie McClean lake Operation) requirements under the harmonized regulatory regime involving CNSC as the federal authority and SMOE as the provincial authority. ARC envisions that the same decommissioning process may also be applicable in Nunavut under the Nunavut Water Board (NWB), Kivalliq Inuit Association (KIA), INAC and CNSC.

In a scenario where ARC remains capable of fulfilling its obligations to reclaim the site upon cessation of operations when ore supplies have been exhausted, ARC would file an application with the NWB, KIA, INAC and the CNSC for final decommissioning of the Kiggavik Project. The completed application would include a final detailed decommissioning plan ("engineered plan"). The requirement for CNSC to issue a license in response to the application currently triggers an Environmental Assessment (EA) under the Canadian Environmental Assessment Act with the development of a "Comprehensive Study Report" (CSR). The CSR includes the decommissioning standards and objectives for the program along with plans to address the concerns of all of the Communities of Interest" involved in consultations during this process. In essence it is the benchmark against which the company needs to compare to confirm tha the decommissioning process has been fully completed.

Environmental programs will measure performance of the decommissioning measures deemed to be appropriate as a result of the comprehensive environmental assessment. Monitoring will include an Environmental Monitoring Program (EMP) to ensure compliance with regulatory requirements during the period of decommissioning and immediately thereafter. There will also be a Follow-up Program (FUP) to verify the assumptions made in the environmental assessment and to ensure that the decommissioning objectives have, or will likely be achieved.

Using a similar approach to current mine in Saskatchewan, the future Kiggavik Project staff would implement Integrated Quality Management Systems (IQMS) and Operation Codes of Practice for Environmental Protection to protect both worker safety and the environment. In addition procedures and associated work instructions would be established.

The IQMS would also apply during all phases of decommissioning and reclamation. This includes standard methods for sampling, monitoring and environmental data management. Specific sampling and monitoring locations, parameters and frequencies to be used during decommissioning and post-decommissioning periods would be based on review of the operational data and future discussion with the regulatory agencies.

The decommissioning EMP will be based on the Kiggavik site operational EMP in place prior to decommissioning, which will include monitoring activities at the Midwest site. Following mine closure, the operational EMP will continue for the remainder of that monitoring year or until commencement of decommissioning activities. It is expected that the extent of the EMP will generally reflect the state of completion of site decommissioning, with reduced monitoring frequency as decommissioning is completed.

The post-decommissioning EMP (i.e. monitoring stations and frequency) depends on the results of the decommissioning EMP. It is anticipated that the post-decommissioning EMP will be substantially reduced from the current operational EMP, with the focus being on surface and groundwater quality downstream and surrounding critical facilities.

The Follow-Up-Program (FUP), a set of investigative and monitoring programs to respond to the concerns raised by the public and the regulators in the Pre-decommissioning Environmental

Assessment, will be conducted concurrently with the EMP and specifically focus on the assumptions and uncertainties utilized in the prediction of long-term environmental performance. It will continue until these uncertainties are resolved and refinements to the long-term modeling demonstrate acceptable performance for the future.

Satisfactory completion of the above will lead to an application to NWB, KIA, INAC and the CNSC to abandon and to NWB/KIA to assume institutional control. This application will trigger another complete EA under CEAA prior to the respective agencies making irrevocable decisions with regard to the abandonment application.

2.5 RADIATION PROTECTION

Again, ARC envisions that the same system for radiation protection developed at the McClean lake Operation and at the Cluff Lake Project in Saskatchewan would apply to the Kiggavik Project based on the good success of those programs historically. The procedures and work instructions established under the future IQMS for the Radiation Protection Program, Kiggavik Project 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 As Low As Reasonably Achievable (ALARA), social and economic factors taken into account, will be respected as an overall guiding principal.

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 (Cluff lake Decommissioning Project Radiological Criteria).

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.

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, are currently detailed within the IQMS.

2.6 HEALTH AND SAFETY

Conventional health and safety activities during decommissioning will be conducted in a manner appropriate for operational activities. As with the operational phase of the Kiggavik Project, protection of the health and safety of workers will remain paramount throughout all phases of decommissioning. All other considerations will remain secondary.

The procedures and work instructions established under the future IQMS for Health and Safety, and the Kiggavik Operation Mining Facility Licensing Manual, Version 3, and The Occupational Health and Safety Regulations, 1996, shall apply during all phases of decommissioning and reclamation. Because of changing manpower levels and activity types through different phases of decommissioning, it is recognized that the services provided by the Health and Safety group will change to remain appropriate during each phase.

The Kiggavik Operation will target certification under OHSAS 18001 (Health and Safety). To maintain compliance and a safe workplace and certification requires that hazard identification and risk assessments are conducted on all aspects of the operations. This management system will also apply during progressive and final decommissioning activities including the work performed by third party contractors. For each planning envelope during decommissioning, a Hazard Identification Checklist will be completed to identify what types of hazards workers are expected to encounter. This will be followed by a risk assessment of each of those hazards to determine what controls are necessary. Upon completion of the risk assessment auditing will be conducted to ensure that the necessary controls are being used and whether or not there are any other hazards that were missed during the risk assessments.

2.7 TRAINING

The procedures and work instructions established under the IQMS for training shall apply during all phases of decommissioning and reclamation. Several tasks and circumstances associated with the decommissioning phase of the mine site will be unique to that phase. It is therefore recognized that training requirements will require updating at that time for specific activities as appropriate.

2.8 EMERGENCY RESPONSE

The Emergency Response, Environmental Emergency Response and Environmental Monitoring Field Safety procedures, the Water Quality Contingency Plan (potable water) and the ARC Emergency Response Assistance Manual, Version 1 (AREVA 2010) shall apply during all phases of decommissioning and reclamation. The Emergency Response Assistance Manual provides guidance to senior management and direction to emergency response personnel for off-site transportation incidents.

2.9 SITE SECURITY

Appropriate measures required 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. The procedures and associated work instructions established under the IQMS for site security shall apply during all phases of decommissioning and reclamation.

2.10 OPERATIONAL RECORD KEEPING

Operational records will be maintained during operations for the purpose of updating future conceptual decommissioning plans and to assist in the preparation of the final decommissioning plan prior to actual decommissioning. Operational records will include:

- Records of spills and cleanups;
- Inventories of reagents and chemicals;
- Locations of waste disposal grounds and inventories of waste material;
- Locations and inventories of reusable material storage areas;
- Results of investigations and studies such as the Tailings Optimization and Validation Program;
- Locations of revegetation areas and the relative success of various revegetation efforts;
- Radiation survey data; and
- Environmental monitoring data collected as part of the EMP

2.11 END STATE

Because of the remote location of the sites, subsequent commercial land uses are not probable. The preferred end-state therefore is a return to a revegetated natural setting with no visible man-made objects above surface. After decommissioning, the sites will resemble the natural landscape, as much as reasonably possible and not be significantly different than pre-development conditions.. Security of remaining radioactive or contaminated materials will have been established by removing or adequately covering these materials with local materials. The sites will be suitable for traditional use by future generations of indigenous people.

It should be noted that due to the severe climate conditions including short growing season, high winds, and in view of the limited surface soils, revegetation of impacted areas will not occur as quickly or to the extent that we currently see in our current Northern Saskatchewan Operations. Therefore ARC will take special precautions, such as applying liners to the areas where mine operations are planned, to minimize the impact on vegetation and to reduce the reclamation required after operations cease.

For planning envelopes described in subsequent sections, Prompt Removal from site has been selected as the strategy of choice where possible for salvageable materials. For the vast

majority of materials however, the strategy of choice will be in-situ confinement. This combination of strategies will offer the greatest overall protection to the natural environment.

Greater detail is presented in the following subsections. Generally, the preferred end-state would include the following:

- Removal of all buildings by dismantling, salvaging or disposing in the TMF (Kiggavik area), or the Andrew Lake pit (Sissons area),
- Removal of all building contents; salvaging where practical and landfilling where impractical,
- Removal of all surface pipelines and culverts for salvage or disposal,
- Water from settling ponds will be treated to normal release quality,
- Slimes, and removal and burial of HDPE liners from the settling ponds will be placed into the TMFs (Kiggavik area). Kiggavik and Sissons WTP sludges produced after the tailings neutralization circuit has been dismantled, will be placed upgradient of the tailings mass, just under the final TMF surface,
- All wastes, (i.e. mill reagents and remaining materials hazardous waste pad) will be disposed of according to license and regulatory conditions or they will be returned to the supplier
- Covering all domestic and industrial landfills,
- Deposition of contaminated materials including the accumulated contents of the landfill for radiologically or chemically contaminated materials into the TMFs,
- Breaking and burial of concrete foundations and slabs,
- Re-contouring earthworks to a natural appearance with slopes generally less than 3:1
- Removal of culverts from roads and re-establishment of natural flow paths,
- Re-contouring those sections of road which have significant grades and/or ditches,
- Re-establishment of indigenous vegetation while making the best practical usage of plants which have established on their own,
- Breaching of Andrew Lake dewatering structure and re-establishment of natural flow patterns,
- Processing, continued storage or disposal of core samples dependent upon direction from the Territory.
- Confirm acceptable radiological conditions based on clearance criterion,
- Burial of water treatment plant sludges from TMF consolidation water in the TMF,
- Removal of soils with elevated radioactivity in cleared areas,
- Closure of the TMFs,
- Construction of an engineered plug for the End Grid portal (and over the End Grid mine shaft if a shaft is used)

3 ONGOING MONITORING AND PROGRESSIVE RECLAMATION ACTIVITIES

ARC's strategy is to maximize reclamation activities during the operational life of the mine site. This approach offers several distinct advantages including the opportunity to identify technically challenging issues well enough in advance that required alterations and adaptations do not become time-critical. Site reclamation will be more advanced and easier to manage should circumstances result in ARC's inability to complete reclamation activities. This on-going reclamation program will ensure that, when the entire site is ready for decommissioning at the end of the Project, AREVA will have gained valuable experience in reclamation in the Arctic environment. This Arctic experience will expand on the experience already gained from the Cluff Lake decommissioning and progressive reclamation work performed at other AREVA-operated northern mines.

With this approach, equipment and manpower will be present to perform works and to manage and tend to minor issues such as erosion over a long time span thereby producing a very stable final condition by the time decommissioning proper begins.

By tending to contamination issues such as minor petroleum or chemical spills in a complete manner at the time of occurrence, there will not be an accumulating and increasingly difficult remedial requirement into the future.

Radiological surveys will be conducted periodically and clean-up activities will be conducted accordingly to prevent accumulation or spread of contamination.

3.1 MINE ROCK

3.1.1 Mine Rock Characterization

A study was conducted to characterize the low grade material from the Kiggavik and Sissons deposits, to assess the leaching behavior and to compare the results with those from other uranium deposits in Northern Saskatchewan. The results are utilized in decisions regarding the use of mine rock, stockpile designs and decommissioning activities. The clean mine rock at Kiggavik and Sissons was also investigated to ensure that water quality from potential construction material and on-land stockpiles will not be at risk for contamination by leaching.

The mine rock characterization study was conducted mainly in the laboratory and involved chemical analyses of the rock, including metal analysis, acid base accounting (ABA), humidity cell testing, customized leach tests to assess metal leaching, and flooded column tests to evaluate the "equilibrium" concentrations of metals in pore water for an in-pit disposal scenario.

(Table 3.1-1) provides a summary of the various mine rock material expected to be excavated during the development of the Kiggavik and Sissons deposits and the segregation criteria.

Based on the mine rock characterization study result, the majority of the waste rock is expected to be suitable for general construction and will be used during the first years of mining operations in the construction of haul roads, pads, berms, etc.

3.1.2 Mine Rock Segregation

The Main Zone pit will be the largest of the three open-pits mined at Kiggavik. As such it is also proposed to use the Main Zone pit for long-term management of a portion of the mine rock resulting from open-pit mining of the Kiggavik deposits.

Segregation of mine rock will be conducted during mining operations based on the criteria presented in Table 3.1-1. This will ensure that all potentially problematic mine rock is disposed of appropriately to prevent long-term impact to the environment.

Table 3.1-1 Mine Rock Segregation Criteria

WB	Description	Criteria
Mine Rock Type 1	Mine rock that can be used as construction material	U < 40 mg/kg S < 0.1 %
Mine Rock Type 2	Mine rock that can be permanently stockpiled and managed above ground	U < 250 mg/kg S < 0.1 %
Mine Rock Type 3	Potentially problematic mine rock that requires specific management (i.e., in-pit disposal)	U > 250 mg/kg and/or S > 0.1% All material not considered to be Type 1 or Type 2 as described above or not considered to be ore
Ore	Cut-off	U >900 mg/kg pending market condition when operation starts

During open pit mining, waste rock will be segregated according to uranium grade as determined by radiometric scanning. Operational procedures will be used to ensure that special waste and clean waste rock are effectively categorized, separated and transported to the appropriate disposal area. Segregation of waste rock is based on the following:

- systematic radiometric scanning of blast hole cuttings in clean waste zones to detect anomalous radioactivity levels;

- systematic sampling of blast hole cuttings and if necessary analysis by the XRF method to detect anomalous metal content (e.g., uranium, arsenic)
- radiometric probing of blast holes in ore zones to define ore/waste boundaries;
- radiometric scanning of working faces during excavation to confirm blast hole scanning/probing results;
- overhead scanning of waste rock in the proximity of special waste or ore once loaded onto trucks;
- daily scanning of the clean waste rock disposal area to ensure that no special waste or ore was inadvertently placed; and
- systematic sampling to assess acid generation potential of clean waste rock.

The uranium content of mine rock is estimated in the field by radiometric techniques and subsequently confirmed with drill cutting assay results. In addition, XRF technology has been identified as a reliable field evaluation tool that can be used to directly determine potentially problematic metals in waste rock during mining. The XRF technology has greatly advanced in recent years, and it is generally accepted as a quantitative screening tool for environmental investigations and industrial site clean up activities.

The above measures were successfully used to segregate “special waste” and “clean waste rock” at the McClean Lake Operation and it is proposed to apply them during mining of the Kiggavik and Andrew Lake deposits. At Kiggavik, Type 1 and Type 2 mine rock material will be placed in the designated mine rock stockpiles. In the event that mine rock material may not effectively be segregated all questionable mine rock from the Kiggavik pits would be disposed in the Main Zone open pit as a mitigative method.

3.1.3 Temporary Mine Rock Stockpiles

During operation it is proposed to manage all potentially problematic mine rock excavated during the mining of the Kiggavik deposits in a surface stockpile with drainage collection, recycling, and treatment when necessary. This material will then be placed on top of the tailings in the Main Zone TMF during the decommissioning phase.

Potentially problematic mine rock (Type 3 mine rock) from the perspective of acid rock drainage and metal leaching will be segregated and temporarily stored during operation in a stockpile adjacent to the Main Zone pit. It is estimated that the volume of Type 3 mine rock will fall within the range of 925,000 to 1,400,000 m^3 (bcm).

The temporary mine rock stockpile will be located along the north perimeter of the pit. Runoff and water percolating through the pile will be collected using ditches and a holding pond, such that the water can be recycled for use in the mill and/or treated before release. During decommissioning of the site, all stockpiled problematic mine rock from the Kiggavik pits will be hauled and disposed of within the Main Zone pit.

3.1.4 Core Storage Areas

As per the mining regulations in Saskatchewan the territory of Nunavut requires that all core remain on site when operations cease and the land is returned to Nunavut and INAC. ARC proposes that the portion of the core that exceeds radiological clearance standards for reclaimed areas of the site be disposed of in the core will be processed through the Kiggavik mill or disposed of in the Main Zone TMF depending upon the timing of cessation of operations and the commencement of the decommissioning program. The racks, fences and buildings will also be disposed of in Main Zone TMF.

3.2 SOLID WASTE DISPOSAL AREAS

When usage of the Kiggavik Landfill is complete, all loose litter in the area will be retrieved and returned to the landfill pit. A compacted till cover of approximately one metre in thickness will then be constructed over the landfill and subsequently revegetated.

Any remaining recyclables in the Storage and Recycling Area and the Hazardous Materials Storage Area will be sent off site. All other non-recyclable items will be placed into the JEB TMF.

Any chemically or radiologically contaminated wastes in the Contaminated Waste Management Area which cannot be recycled, cleaned or salvaged will be disposed of in the JEB TMF. Contaminated granular and liner material will also be disposed of in the JEB TMF. The area will then be graded to stable contours and revegetated.

The majority of sewage solids in the Solid Sewage Management Area at the time of decommissioning will be composted and utilized in reclamation of the JEB waste rock pile. The anticipated volume of these materials is expected to be no more than a few cubic meters due to the nature of the sewage treatment process.

Remediated soils from the hydrocarbon contaminated land farm will be used in conjunction with revegetation. Fertilizer will be added to contaminated soil to expedite the remediation process if necessary.

3.3 TAILINGS OPTIMIZATION AND VALIDATION PROGRAM

Contingency plans are intended to address unforeseen circumstances which could result in a significant increase in the mass flux of solutes to the receptors. Extensive investigations into the chemical and physical properties of tailings has been undertaken at Kiggavik and will continue to be undertaken as part of a Tailings Optimization and Validation Program (TOVP), similar to the program that was initiated at McClean Lake Operation and has been a successful audit program for the behaviour of the tailing produced at that site in Northern Saskatchewan.

4 DECOMMISSIONING PLANS

4.1 INTRODUCTION

4.1.1 Decommissioning Objective

The preferred end state is a return to a revegetated natural setting with no visible industrial-made objects above surface. All above ground facilities will be removed while minimizing or eliminating immediate and long-term Environmental, Health and Safety hazards at the site. 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 *Canadian Environmental Assessment Act*.

4.1.2 Principles of Decommissioning

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 provincial and federal regulations, and
- The decommissioning radiological objectives are 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.

4.2 DECOMMISSIONING LOGISTICS AND SITE-WIDE COMPONENTS

4.2.1 General Procedures

The following general procedures will be adhered to throughout the decommissioning process:

- Ventilation equipment and the dust collection system will be cleaned prior to demolition

- All remaining piping will be flushed with water and blown out and disconnected at suitable locations
- All remaining contaminated areas will be washed down with clean water and those waters directed to contaminated sumps for water treatment
- Equipment will be drained of oils and coolants etc. and these will be disposed of as required in the correct disposal areas
- Propane lines will be purged with an inert gas and disconnected
- Electrical circuitry that is not required in the decommissioning process will be physically disconnected
- Equipment that has the capacity for energy storage will be physically disconnected
- Fireguards will be employed when there is a possible chance of inadvertent combustion i.e. fuel tank reduction
- Guards will be employed when overhead structures are being toppled or brought down to prevent inadvertent access into the fall zone
- During times when decommissioning is not active, all buildings will be closed up and locked to prevent inadvertent entry
- Open excavations will be marked and entrances barricaded
- Removal of culverts from roads and re-establishment of natural flow paths,
- Materials removed from site will be “green tagged” as per practice at the McClean Operation in Saskatchewan.

4.2.2 Scope of Work – Overview

Decommissioning the site area will involve four stages. The first stage will involve the completion of an Environmental Assessment which and preparation of a final decommissioning plan for the Kiggavik Project. The second stage will include demolition of all buildings/facilities that are not required for continued decommissioning and water treatment activities. The third stage will be monitoring of the site to ensure that the decommissioning objectives have been met. The final stage will include the remaining buildings/facilities after water treatment objectives have been reached.

Table 4.2-1 Overview of Decommissioning Activities and Schedule

Timing	Phase	Key Activities
Years 1 and 2	Progressive Rehabilitation	• Cap ventilation raises and portal at the Sissons Site and backfill Type 3 mine rock into Main Zone and Andrew Lake Pit • Charge main Zone Pit with mine rock and complete consolidation process • Treat consolidation porewater
Years 3 to 6	Post-Operations-Key Decommissioning Activities	• Demolish all non-essential buildings at Kiggavik and Sissons sites and dispose of debris in Main Zone TMF and Andrew Lake Pit • Dewater purpose-built pit and Main Zone TMF • Revegetation of the site and removal or covering of all surface soils that exceed radiological clearance standards • Add soil covers to East/Centre TMF's, backfill and cover purpose-built pit • Remove all culverts and water diversion structures
Years 7 to 12	Mainly Post-Decommissioning Activities	• Monitor the success of the decommissioning program • Maintenance and repair of erosion – fertilization and re-seeding where necessary • Main Zone TMF porewater treatment
Years 13 to 16	Post Decommissioning	• Pore-water treatment at main Zone TMF until consolidation is complete then drain the water cover • Backfill with mine rock and place soil cover as designed • Remaining portion of the camp/shops offered to the local community

4.2.3 Decommissioning Logistics

Due to the high cost of mobilization and demobilization of heavy equipment and logistics of starting and lack of road transport into site the work has been 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. Wherever possible shipping containers will be used 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, aerodrome, water supply, and power house;

these buildings 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. Non-salvageable buildings and structures will be dismantled or demolished and disposed of in either Center or Main TMF.

4.2.4 Winter Road Construction

The following is a typical schedule for the development, preparation and use of the winter road:

- early December — Initial profiling and pioneering of the ice crossings
- mid December — Achieve ice thickness for plough trucks and clear full road width
- early January — Achieve ice thickness for deploying partially loaded trains
- late January — Achieve ice thickness for 100% loaded B-trains and Super B trains
- early February — Achieve maximum thickness
- end April — Suspend ice crossing operations

4.2.5 Water and Contaminant Control

During all stages of the work, clean water will be utilized to reduce dust levels and wet down contaminated materials prior to transport for disposal. The plan will be to utilize the existing contaminated sumps and water collection areas as much as possible for water collection purposes.

For the purpose of the waste water management plant contact water is defined as any water that may have been physically or chemically affected by site activities. Contact water will include:

- surface runoff from the milling areas resulting from direct precipitation (rainfall and snowfall), drifting snow and un-intercepted runoff water,
- surface runoff from lined ore stockpile,
- surface runoff from lined special waste stockpile,
- surface runoff and shallow drainage from unlined clean rock piles,
- water expulsed during tailings consolidation; and
- groundwater inflows into open pits

All contact water will be intercepted, contained, analyzed and treated when required. All water released to the environment will meet the discharge quality criteria and there will be no significant physical or chemical effects associated with the release of water.

Non-contact water will be limited to runoff originating from areas unaffected by site activities and that will not come into contact with mining and milling areas. Non-contact water will be diverted from the site activities to the surrounding surface water system.

All ore haul roads will be radiologically monitored and remediated as necessary during operations minimizing the need for final reclamation during the decommissioning phase of the mine life.

4.2.6 Concrete Foundations and Pads

Concrete will be broken mechanically or with explosives on a maximum grid spacing of 3m to prevent water ponding and to allow for root penetration.

4.2.7 Site Roads

All roadways and general grounds around the mill area will be graded to remove the majority of surface contamination and the contaminated materials deposited in the main Zone TMF. Following subsequent gamma surveys, any residual contamination will be removed or covered with clean till to a depth to meet the final radiological criteria. Culverts will be removed and replaced with cross ditches. Roadways will be scarified before abandonment to promote revegetation

The following criteria will be applied

- All culverts will be removed and replaced with drive - through cross ditches;
- All slopes that exceed 65% will be reduced to 27% or less and recontoured;
- All road berms that impede natural drainage flows will be breached at regular intervals;
- All ramps will be cross-ditched at no more that 30 metre intervals or removed where practical; and
- All driving surfaces of travelways will be scarified to promote natural revegetation.

4.2.8 Area Regrading

The decommissioned areas will be regraded to a stable and aesthetic configuration. Regrading work will include the areas of out buildings/structures that will be removed such as the fuel storage and propane tank storage areas. All remaining exposed concrete will be cracked to allow drainage and root penetration prior to leaving it in place and will be covered by a minimum of 0.3 m of till material graded to mate with current undisturbed areas. All excavations that require no special treatment will be re-contoured so that they present minimal hazard to wildlife or personnel and so that the re-contouring conforms to the general area topography. Contouring of the till capping will be done so that it does not interfere with the natural drainage of the immediate surrounding areas.

4.2.9 Storm Water Management

The removal of constructed facilities will return the area to near pre-construction drainage patterns. The covering of the fractured concrete bases of these facilities will be done in a

manner so as not to interfere with the original drainage pattern of the area. The covering of the fractured bases will also be done in a manner such that water will not pool over the former building sites

4.2.10 Revegetation

Revegetation at the Kiggavik Project will be ongoing during the operational phase, as the open pits are mined out and backfilled, and as mine rock stockpiles are constructed to their desired end-state. Other disturbed areas will also be revegetated as they become available, such as areas where infrastructure is removed, where site roads are no longer needed, and where former drill sites exist. It is important to note that this section provides a general overview of expected revegetation activities that will be required for the Kiggavik Project. Revegetation plans will evolve over time, and will become more detailed closer to the time that revegetation activities commence.

Preliminary revegetation work completed at Kiggavik, on former drill sites, has indicated that a small number of native plants tend to dominate during natural revegetation (Hounjet, 2009). These plants include Polar Grass (*Arctagrostis latifolia*), Dwarf birch (*Betula glandulosa*), Bigelow's sedge (*Carex bigelowii*), Arctic willow (*Salix arctica*), and Tea_leaf willow (*Salix planifolia*). A number of other Carex grasses were also identified in 5 of 11 plots that were assessed by Hounjet (2009)), but they could not be identified to species. Seed mixtures will be created, taking into consideration the above listed plants. If willow species are selected to be planted, cuttings would have to be collected locally and grown commercially for later planting. Existing vendors that were used at the Cluff Lake Project could be contracted for such services. Test plots will be constructed as early as possible during the operational phase, as disturbed areas become eligible for revegetation. Test plots will be used to determine an optimal seed / planting mix, in terms of rapid, sustainable vegetation establishment that will increase the rate of natural succession.

ARC has gained valuable revegetation experience from its Cluff Lake Project, located in north-western Saskatchewan. This experience suggests that drill seeding, with subsequent broadcast fertilization would be a successful planting method. Drill seeding ensures that the seed penetrates into the soil cover, resulting in more successful germination, compared to broadcast seeding, where the seed is left exposed to wind, rain, and scavenging from local wildlife. Drill seeding is also much faster, more efficient, and less labour intensive than hydroseeding methods. However, hydroseeding methods should be considered for spot seeding areas where poor germination exists after the initial drill seeding is completed, and for areas that are too small (e.g. former drilling sites) to justify using drill seeding equipment. Drill seeding can be contracted through existing vendors that were used for the Cluff Lake Project.

It will likely be advantageous to fertilize the revegetated areas for one to two years after the initial seeding has been completed. This will provide the necessary nutrients for rapid, healthy plant growth. The exact fertilizer blend to be used will be determined prior to any revegetation activities, based on nutrient deficiencies in the cover material. Soil samples will be collected from the cover material and will be sent to an accredited laboratory for nutrient analysis. These results will be used in conjunction with the nutrient requirements of the species to be planted to determine an appropriate fertilizer blend.

As the various disturbed areas become available for revegetation, it is expected that additional reclamation work (compaction of waste rock, re-contouring / re-sloping, and covering) will be required prior to revegetation. Guidance for these activities will be provided by this PDP document, the experience gained from the Cluff Lake Project and the McClean Lake Operation, as well as by the following documents:

1. The Nunavut Tunngavik Incorporated Reclamation Policy (2008); and the
2. Environmental Guideline for Site Remediation (2002), prepared by the Environmental Protection Service, Department of Sustainable Development, Nunavut Government.

Gamma clearance will also be attained before revegetation proceeds. This will involve gamma surveys, and the development of ALARA objectives for clearance. These can be established using the same criteria as that used for the Cluff Lake Project (AREVA 2007).

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. 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.

4.2.11 Institutional Controls

Institutional controls may be required after the close-out of a mine/mill complex to prevent intrusion into the waste repository; to prevent removal of or interference with the waste; to ensure that the performance of the repository continues to meet the design criteria; and to ensure that necessary remedial actions are carried out" (IAEA, 1994). The decommissioning objective is to minimize or eliminate the need for institutional control.

Passive controls are to be maximized where possible. Examples of these include proper design for natural drainage, long-term security of contaminated waste material and the use of local wetlands for long-term polishing of surface water if necessary.

The institutional controls will not generate significant cost or liability for the group conducting the decommissioning, or for the provincial government after acceptance of the decommissioned property. This is due to the stringent criteria to be adopted for the decommissioning work, the long-term stability of the reclaimed site and the limited future development potential of the site due to its remote location.

4.3 PLANNING ENVELOPE 1: KIGGAVIK SITE

4.3.1 East and Centre TMF's

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 an aesthetically pleasing appearance.

The proposed Kiggavik site includes three deposits: East Zone, Center Zone and Main Zone. The proposed mine plan at the Kiggavik site is to:

- Excavate East Zone and stockpile the ore until completion of the open pit. Once this initial ore body has been mined out the pit will be converted into an in-pit tailings management facility (TMF).
- Excavate Center Zone and process the ore; the tailings produced will be disposed of in East Zone TMF. Once Centre Zone has been mined out the pit will be converted to a second TMF.

Excavate Main Zone and process the ore; the tailings produced will be disposed of in Center TMF. Once Main Zone has been mined out the pit will be converted to a third TMF to accommodate the tailings produced from the processing of Sissons ore and potential other deposits

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

A four stage progressive decommissioning plan is envisaged for East Zone and Centre Zone TMFs, commencing during operation. Centre and East Zone TMFs are approximately expected to consolidate within a 10-year period. A water cover would be kept on top of them to prevent freezing of the thin rock cover from blocking expulsion of consolidation water.

Stage 1

Placement of tailings will be controlled to achieve a level to slightly mounded tailings surface. At the same time, the water cover will be progressively reduced to achieve a uniform water cover of sufficient depth to facilitate tailings placement. The surface water pond will be pumped through the treatment plant and any sludge recovered will be discharged to the TMF. When the tailings have been levelled and distributed, and the water cover reduced, placement of the soil and rock cover will commence.

Stage 2

Experience in Northern Saskatchewan has demonstrated that waste rock can be placed directly on the tailings surface if care is exercised. The surface of the tailings can be expected to be unconsolidated and relatively soft, allowing the rock fill to sink into the tailings and displace them. This is an undesirable effect since continued placement will cause a wave of unconsolidated tailings to run ahead of the rock fill. To prevent this, it is proposed that a 2-m layer of sand fill, approximately, will be placed over the tailings surface to act as a support filter. A 2-m thick layer of rock will be placed over the sand layer. If there is standing water over the sand support layer, the rock will be placed in a uniform layer onto the ice cover during the winter. The rock will settle uniformly onto the sand surface during the following summer thaw.

A leachate collection system will also be constructed during the summer thaw to allow consolidation flows related to pore fluid seepage to be recovered and treated. The leachate collection system will consist of simple corrugated metal wells installed in a granular blanket within the fill material. HDPE pipe would be considered due to its resistance to corrosion and ability to accommodate large differential movement. Temperature and pore pressure sensors will be installed within the tailings to allow pore water pressure dissipation and temperature to be monitored during and after cover construction.

Stage 3

When the temperature sensors indicate that the tailings are thawed, the third stage of cover placement will commence. The third stage of decommissioning will consist of placement of a clean rock cover. Using the mine fleet sufficient rock will be placed in a mounded configuration to accommodate this amount of consolidation settlement. Consolidation will expel pore fluid, which will be collected in the leachate collection system at the surface of the tailings. All water from the leachate collection system will be treated before discharge and any recovered sludges disposed of by burial in a designated area on the upgradient side of the TMF.

With ongoing settlement, recontouring of the Stage 3 rock cover will be performed as required to maintain a well drained surface. Ideally placing the clean rock cover would take place in warm weather to prevent freezing the upper layer of the tailings, once the pond had been pumped down to a minimum level.

Stage 4

When pore pressure monitoring indicates that consolidation is complete (following Stage 3 cover placement), the final cover will be placed and revegetated. The final cover for the TMF will consist of clean waste rock with a compacted till cover. The tailings would be covered in one season to prevent freezing. At the same time, the water treatment plant sludge disposal area will be decommissioned, covered using a till material cover, and revegetated.

4.3.2 Post Operational Monitoring

As mentioned above, instrumentation will be installed at various locations within the tailings to monitor the rate of dissipation of induced pore water pressures during consolidation. Once pore-water pressures have reduced to normal levels (hydrostatic), the majority of the pore-water will have been expelled and the tailings mass will be consolidated to the desired endpoint.

Monitoring of pore-water chemistry will continue through the post closure period to assess the concentration of various contaminants in the tailings pore water. Pore-water will be sampled through the same vertical monitoring wells which were utilized during the operational period. Additionally, the leachate collection system installed in the top drain will be monitored for water chemistry and for volume of water removed by pumping.

4.3.3 Main Zone Tailings Management Facility

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 it is considered likely that additional resource will be found over the life of the project and that the Main Zone TMF will eventually be fully filled with tailings. Therefore, the base case for the decommissioning of Main Zone assumes that Main Zone TMF 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 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 resource would be found over the life of the project Main Zone TMF would be partially filled with tailings. In that case the conceptual decommissioning plan consists of fully backfilling Main Zone TMF above the tailings mass with first Type 3 mine rock then Type 2 mine rock and installing a compacted till cover. As an alternative, the TMF would be only partially backfilled with mine rock then a compacted till cover would be installed, above which a pond would be allowed to develop.

Experience gained during decommissioning of the East Zone and Centre Zone TMFs will benefit the decommissioning of Main Zone TMF.

4.3.4 Permanent Mine Rock Stockpiles

Mine rock not utilized for construction and deemed acceptable from the perspective of acid rock drainage and metal leaching (ie Type 2 mine rock) will be permanently stockpiled at the Kiggavik site. ARC is proposing to construct two permanent mine rock stockpiles to accommodate the material excavated during the mining of the Kiggavik deposits. Approximately 29,000,000 m^3 (unbroken) of mine rock will be generated.

Stockpile A will be located to the north of the Kiggavik pits. Stockpile B will be located to the south of the pits. Both stockpiles will be surrounded by perimeter ditches designed to collect runoff water from the stockpiles. Drainage water from the Kiggavik stockpiles will largely consist of direct precipitation (i.e., rainfall and snowfall), with minor amounts of blowing snow and surrounding catchment runoff, impinging the pile perimeter. Berms will be constructed along the outer edge of each ditch. These berms will prevent surface runoff from surrounding undeveloped areas from flowing into the perimeter ditch and mixing with runoff water from the stockpiles.

The stockpile will be constructed in order to meet appropriate physical stability criteria. A layered approach to stockpile construction is proposed to increase the overall stockpile stability. The layered placement creates a high uniform density while minimizing segregation to create a stockpile with minimal permeability to air and water penetration. The method also reduces settlement and therefore further enhances overall stockpile stability. It is expected that the stockpiles will be 40 m to 50 m high and constructed in approximately 10 - 20 m lifts with 10 - 20 m wide catchments remaining at the completion of each lift. Experience to date has indicated that this configuration will result in a stable stockpile face with an overall slope of 3:1 to 4:1. The catchments will also act as a slope break and minimize erosion caused by surface runoff.

4.3.5 Mill/Camp/Maintenance Complex

Both Prompt Removal and Deferred Removal have been chosen as the decommissioning strategies for the facilities on the Mill Terrace. All the facilities with the exception of facilities required for future decommissioning and water treatment are planned for prompt removal. Availability of knowledgeable staff and the potential for environmental impact are relevant in choosing these strategies.

All reagents and/or hazardous materials will be consumed or returned to vendors prior to beginning demolition activities. Lines which previously conveyed hazardous materials such as sulfuric acid will be flushed. All potential physical and electrical energy sources will be eliminated.

Prior to mill demolition, any loose contaminated materials inside the mill building will be removed and transported to the TMFs for disposal. Any materials which are determined to be salvageable will be monitored to ensure they meet all applicable requirements for release from the site, and then transported from the site to the Baker Lake dock site. These requirements will vary depending on future use. For example, materials with some residual contamination could be transported, with suitable packaging, to another uranium production site, but could not be released for unrestricted use. All equipment and building materials which are not salvageable will be disposed of in the TMF. Contaminated soil in the mill area will be removed and deposited in the Main Zone TMF. Whenever required, materials and structures being dismantled will be watered to control spread of contaminated dust and exposure to workers. After the buildings have been leveled, if no contamination is present, concrete pads will be decommissioned.

The outside electrical distribution system on the mill terrace will be dismantled with non contaminated materials being salvaged or placed for resale. Any materials which are contaminated or from a contaminated area will be disposed of in the Main Zone TMF. Transformers will be drained of any oils and the oils disposed of in an approved manner as per approved disposal procedures. All transformers on site will be of modern design and will not contain PCBs. Oils will be removed from the electrical equipment before burial. It is not expected that the equipment will pose a significant risk and as such, no special containment or risk assessment has been considered for this material.

Materials within the warehouse will be sold for surplus and any remaining materials will be disposed of in a TMF.

4.3.6 Concrete Foundations and Pads

The general concept for mill demolition will be to reduce the building to the ground, then load and haul the material as soon as possible to one of the TMF's.

- The exterior cladding of the buildings will be the first component to be removed to: provide natural light for interior component visibility and safety; provide better air circulation thus reducing or eliminating radon progeny concerns and allow more efficient access and egress.
- Remaining equipment oils will be drained and recycled prior to final demolition. Re-usable uncontaminated and/or decontaminated equipment will be removed and sold, where possible. Due to the high cost of decontamination and the limited resale value, the majority of equipment will be disposed of in the TMF.
- As the boilers and generators are taken out of service, they will likely be sold as they are not contaminated and have reasonable re-sale value. If a buyer can not be found, they will be disposed of in the TMF.
- Concrete that extends above the local ground surface will be removed to the surrounding ground surface level and disposed of in the TMF. This will be accomplished using a combination of the following methods: blasting, which will be conducted consistent with past practices and in full compliance with Nunavut regulations using a hydraulic ram mounted on a backhoe; or a wrecking ball.
- The concrete floors will be thick (1 m or more in some places) and heavily reinforced with rebar. Based on the location, thickness and amount of rebar this concrete might be impractical to remove. The floors will be drilled and blasted on a maximum 3 m grid to fracture the concrete or cracked on a similar pattern by use of a hydraulic ram or wrecking ball. This will promote drainage and root establishment for future vegetation. The fractured concrete of the floors etc. will be covered with a minimum of 0.3 m of till and revegetated.
- Concrete pads will be cracked and covered or broken up and removed depending on the thickness, amount of rebar and contamination.

Elevated structures will be left in a stable condition as long as possible with completion of each structure expedited once it is weakened beyond a stable condition. The area will be barricaded and guarded during the pulling down of these structures.

All reagents and/or hazardous materials will be consumed or returned to vendors prior to beginning demolition activities. Lines which previously conveyed hazardous materials such as sulfuric acid will be flushed. All potential physical and electrical energy sources will be eliminated. Electrical supply will be permanently disconnected prior to beginning demolition activities.

Equipment and process tanks in the Kiggavik mill will be decontaminated and salvaged to the extent possible. Non-salvageable equipment and tanks, including remnants from demolition of the mill buildings will be disposed of in one of the TMF's prior to final capping.

Contaminated soil in the mill area will be removed and deposited in one of the Kiggavik TMF's. Whenever required, materials and structures being dismantled will be watered to control spread of contaminated dust and exposure to workers.

4.3.7 Concrete Batch Plant Area

Typically the batch plant is owned and operated by an independent contractor and will be removed by the contractors at the end of the construction phase or at the time of decommissioning. It is a mobile batch plant and as such is easily removable

4.3.8 Ore & Temporary Mine Rock Pads

Any remaining ore will be processed through the mill. Alternatively, ore not processed will be placed into the TMF as well as any potentially problematic mine rock and the protective cover over the stockpile liners. The liners and their protective covers from both areas will be cut into manageable pieces and disposed of in the TMF. The ground below the liners will be checked for contamination, and contaminated areas removed to the TMF. After contamination clearance, the area will be scarified and revegetated.

4.3.9 Waste Stockpile

The waste stockpiles will be used to backfill any areas that require large fills. The industrial landfill will be covered with a minimum of 2 m of waste material during the re-contouring operation. Ultimately, all slopes will be less than 3:1.

4.3.10 Kiggavik Effluent Treatment System

The Kiggavik Water Treatment Plant (KWTP) includes the treatment plant, 4 lined polishing ponds and related pumps, piping, ditching and culvert. These facilities will continue to operate throughout the pre-decommissioning, decommissioning and post-decommissioning phases for as long as required to achieve agreed upon water quality discharge objectives. It is acknowledged that although specific time spans of operation have been selected for the purpose of costing, that the cessation of treatment will ultimately be determined by effluent quality as opposed to an arbitrary length of time.

The Plant will treat consolidation pore fluids from the East, Main and Centre Zone TMF's until the decommissioning criteria are met. In addition, this facility will treat all camp sewage generated during the decommissioning work. Treated effluent from all sources will be discharged to Judge Scissons Lake

Sludge from the 4 sedimentation ponds will be placed into the Tailings Management Facilities. The liner material will be cut into manageable pieces and transported to the TMF's for final disposal. Material underneath the liner will be checked for possible radiological contamination and removed to the TMF if contaminated. Contouring of the Sedimentation ponds will be done in order to ensure the topography blends into the general surroundings. Slopes will generally be maintained at less than 30 degrees. Any berm material surrounding the liner will also be recontoured and revegetated.

There is no special preparation planned for the area which will contain the KWTP sludges. The critical design parameter is not ground preparation, but rather, the location of the sludges. The area is upgradient to the tailings mass and is situated relatively near the surface of the final contoured surface, just below the soil cover. As a consequence, groundwater in the sludge will be subject to a strong downward hydraulic gradient. If for some reason the total volume of tailings in the East Zone TMF is significantly less than the current planned volume, at the time of decommissioning, backfill would be placed first such that the sludge placement location would remain unchanged. Water from sludges will mix with the water in contact with the tails mass. The effect of this minute volume of material (500 tonnes compared to 3.5 million tonnes of tailings) would not be discernible from the overall effects of the tailings mass in the groundwater model or solute transport analysis.

4.3.11 Fuel & Waste Oil Tanks

The fuel and waste oil tanks will be emptied by the fuel supply vendor and any remaining excess fuel will be transferred to the remaining site diesel tanks still in service. A licensed hauler for oil disposal will remove the excess fuel oils and waste oil. The tanks and distribution equipment will then be cleaned prior to cutting up for disposal in the TMF. Waste products from cleaning will be transferred by vacuum truck and disposed of as per current site practices. A fireguard will be maintained during the cutting up of the tanks. The concrete pad(s) will be broken up on maximum 3 m spacing and covered with a minimum of 0.3 m of clean till. Soil samples will be collected and if required hydrocarbon contaminated soil will be taken to the licensed onsite hydrocarbon land farm used for biodegradation.

4.3.12 Explosive Plant and Magazines

Typically the explosive plant and magazines are owned by the explosives contractor. The blasting contract makes provision for the contractor to demobilize their facilities upon completion of their usage. The site will then be graded to a stable configuration and revegetated. The concrete pads will be decommissioned as described above.

4.3.13 Airstrip and Small Building

Airstrip reclamation will involve removing culverts, re-contouring fill slopes for wildlife access, and scarifying the gravel surface to facilitate natural vegetation. A cover may be required for erosion and dust control. However, the airstrip will be left for others to use if requested by government agencies or by a third party willing to assume responsibility

The small air strip building will be demolished and the debris disposed of in one of the TMF's. The remaining surface soils will be checked for any contamination and if clean scarified and revegetated

4.4 PLANNING ENVELOPE 2: SISSONS SITE

4.4.1 Andrew Lake Open Pit

The preferred method of decommissioning of the Andrew Lake pit is as follows:

- Andrew Lake pit would be backfilled with the Sissons problematic mine rock and covered with till. This will result in the pit being only partially filled.
- The Andrew Lake dewatering structure would be breached and allowed to flood the pit.
- If feasible, fish habitat structures may be included in the pit to provide compensation for earlier Project impacts on fish habitat.
- The water in the pit lake would be monitored and treated as required until water quality objectives are met.

4.4.2 Buildings

Prompt removal for all buildings and facilities is the strategy due to loss of integrity of structures over time, as well as meeting end state objectives. The exceptions are facilities required for water treatment and the Utilities building.

Services such as electricity and water will be disconnected and purged as necessary prior to demolition. Oils and other lubricants will be removed from all equipment and storage facilities and disposed of in accordance with current disposal procedures.

Buildings that are within this planning envelope include the Maintenance shop, the Water Treatment Plant, the Utility building and the dry/kitchen/office building. All the buildings, with the exception of the dry/kitchen/office building, are steel frame, cladded buildings with concrete floors. The dry/kitchen/office building is comprised of trailers with wooden interfaces joining them. All the buildings and the oil storage area will be demolished and hauled to the Sue pit for disposal. Exterior cladding will be removed prior to dismantling and/or demolishing the internal components. The concrete floors will be fractured on a maximum 3 m grid and covered with a minimum of 0.3 m of clean till. The used oil tank will have its contents pumped out by a licensed hauler and the tank cut up and disposed of in the Sue pit. A fireguard will be employed during this procedure.

4.4.3 Core Storage Areas

Given the valuable technical information associated with the core, it is usually desirable that the existing core storage areas remain in place. Nonetheless, costs have being included to decommission and reclaim these areas as per the following steps.

Both mineralized and barren core will be removed and processed through the mill or disposed of in the TMF depending upon the timing of approval from the province to dispose of these materials.

Core shacks and wooden core racks will be burned. Non burnable materials will be disposed of in the Main Zone TMF.

4.4.4 Water Treatment Plant

The current plan for mine water requiring treatment is to pipe it to the Kiggavik plant however in the event that a small plant is constructed at the Sissons site the system will be reclaimed in the following manner: dismantling of the main buildling and associated equipment, and disposal of any non-salvageable non-burnable material will be in the Andrew Lake pit. The concrete foundation and slab will be broken and buried in the uncontaminated water retention pond.

4.4.5 Permanent Stockpile

At Andrew Lake it is proposed to manage the mine rock in one stockpile, a volume of 50 million m^3, approximately

To ensure long-term slope stability, recontouring will be a progressive and ongoing reclamation activity to ultimately meet a slope of 3:1. At the time of final decommissioning re-vegetation in previously contoured areas will be assessed and slopes that require further reduction to meet the 3:1 objective will be recontoured.

At End Grid it is proposed to stockpile mine rock from the ramp extraction with the Andrew Lake mine rock. Some mine rock from End Grid will be stockpiled and crushed to be used in mine backfill.

4.4.6 Temporary Stockpiles

It is proposed to manage potentially problematic mine rock from the Andrew Lake pit during operation in a temporary surface stockpile with drainage collection and treatment. This material will then be placed at the bottom of the Andrew Lake pit during the decommissioning phase.

4.4.7 Ore and Waste Pads

After all remaining ore and waste are processed or disposed of in the Andrew Lake pit all contaminated liner material will be removed from the ore and temporary waste pads and placed in the Main Zone pit at the Kiggavik site.

4.4.8 End Grid Portal and Ventilation Raises

A concrete plug will be installed in the End Grid portal to the underground mine and the mine allowed to flood. The ventilation raises will also receive concrete plugs.

4.5 PLANNING ENVELOPE # 3 BAKER LAKE PORT AND STAGING FACILITIES

4.5.1 Port Facilities

All remaining equipment, reagents and supply inventories remaining in lay-down areas will be removed and either returned to the vendors or returned to Saskatchewan. Those areas will go through the radiological clearance process and revegetated.

Any buildings will be offered to the community. If the community is not interested in taking ownership they will be dismantled and placed in the Baker Lake Landfill.

The docking facility and related equipment will also be offered to the community. If the community has no need for it the dock and landing will be demolished and all non-hazardous waste disposed of in the Baker Lake landfill. Any hazardous wastes will be removed and safely shipped back to Saskatchewan for storage or disposal.

5 PROPOSED FINANCIAL ASSURANCE

The current level of financial assurance detailed in the *Preliminary Decommissioning Plan and Financial Assurance* document is $158,624,608 (Cdn). The following table breaks out the various key areas for the Kiggavik Project Financial Assurance.

Table 5.1-1 Preliminary Decommissioning Costs

Component	**(Cdn)**
Mill Complex	$10,848,351
TMF's	$25,264,201
Effluent Treatment	$7,662,600
Kiggavik Camp Area	$724,393
Kiggavik Ancilliary Infrastructure	$7,214,198
Judge Sissons Discharge Area	$32,816
Sissons Mining Area	$1,102,466
Sissons Ancilliary Infrastructure	$20,865,662
Air Strip	$1,940,609
Baker Lake Port Infrastructure	$267,960
Camp Operating Costs	$25,281,948
Project Management	$14,373,067
Fees and Monitoring	$22,719,749
Heavy Equipment Mobilization/Demobilization	$2,800,000
Pads and liner removal	$17,526,588
Total	**$158,624,608**

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