Kiggavik Project
Final Environmental Impact Statement

Tier 3 Technical Appendix 2U:
Hazardous Materials Management Plan

September 2014

History of Revisions

Revision Number	Date	Details of Revisions
01	December 2011	First Issue with Draft Environmental Impact Statement
02	September 2014	Issued for Final Environmental Impact Statement

A management plan is a living document which is continually reviewed and revised throughout the life of the Project to ensure it meets health, safety, and environmental performance standards. This process of adaptive management and continual improvement (Tier 2, Volume 2, Section 17) is consistent with the Inuit Qaujimajatuqangit (IQ) principles of Qanuqtuurunnarniq *being resourceful and flexible to solve problems* and Pilimmaksarniq *maintaining and improving skills through experience and practice.*

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Abbreviations

HAZOPS ..... Hazard and Operability Studies

WHMIS..... Workplace Hazardous Materials Information System

MSDS..... Material Safety Data Sheet

TDG ..... Transportation of Dangerous Goods

SHEQ..... Safety, Health, Environment, and Quality

TMF..... Tailings Management Facility

CRF..... Cemented Rock Fill

1 Introduction

The AREVA Resources Canada Inc. Hazardous Materials Management Plan (Plan) will be in effect for the duration of the Kiggavik project located approximately 80km west of Baker Lake and all points located between the site and Baker Lake. In addition, the Plan will be made available at hazardous material storage and handling areas, the Site, AREVA's Baker Lake Office as well as AREVA's corporate office.

Many inputs are required for mining and milling operations. The majority consist of fuels and chemicals that are classified as dangerous goods. Examples include diesel fuel, blasting materials, flammable materials, corrosive materials, and oxidizing compounds. On-site storage and containment of these commodities is strictly regulated and must comply with all environmental regulations. AREVA has in house Emergency Response Teams that are trained to specifically deal with all manner of emergencies include fire fighting and spill response and recovery.

Hazardous materials (referred also 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 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 Dangerous Goods Regulations. All persons that are required to handle, package, ship and transport require training specific to their role. Any and all explosives transport must comply with the *Canadian Explosives Act & Regulations (1985).*

1.1 Purpose and Scope

A variety of petroleum products, mill process reagents, and explosives will be used at the Kiggavik Project, mainly during the operational period of the mine.

In conjunction with the Spill Contingency Plan (Technical Appendix 10B), Emergency Response Plan (Technical Appendix 10C) and Waste Management Plan (Technical Appendix 2S), this Plan outlines the information and protocols necessary for the safe transportation, storage, and handling of hazardous materials that may be stored and used at the Kiggavik Project. A hazardous material is defined as any material that, because of its quantity, concentration, or physical or chemical

characteristics, poses a hazard to human health or the environment when it is improperly transported, stored, used, or disposed of.

The primary objective of this plan is to help prevent or reduce the release of harmful pollutants and prevent, reduce, or eliminate any adverse effects that result or may result. As such, the Plan provides information and guidance on actions important for the prevention of hazardous material spills and procedures to detect and respond to spills when they occur. The Plan is a living document which is continually reviewed and revised throughout the life of the Project to ensure it meets health, safety, and environmental performance standards. This process of adaptive management and continual improvement (Tier 2, Volume 2, Section 17) demonstrates the Inuit Qaujimajatuqangit (IQ) principles (Nunavut 2008) of Pilimmaksarniq *maintaining and improving skills through experience and practice* and Qanuqtuurunnarniq *being resourceful and flexible to solve problems.*

This Plan is based on the following principles for best practice management of hazardous materials:

- Identify and prepare material and waste inventories
- Characterize potential environmental hazards posed by materials
- Identify responsibility for managing hazardous materials
- Describe methods for transport, storage, handling, and use
- Identify means of long term storage and disposal
- Prepare contingency and emergency response plans
- Ensure training for management, workers, and contractors who will be handling hazardous materials
- Maintain and review records of hazardous material consumption and incidents in order to anticipate and avoid impacts on human health and the environment

This Plan is to be reviewed and applied in conjunction with the Emergency Response Plan and the Spill Contingency and Landfarm Management Plan.

1.2 Applicable Legislation

AREVA's working definition of a spill is defined as any accidental discharge to the environment of a hazardous material. In addition, all employees are required to complete site orientation training, which specifies that a spill of any kind must be reported immediately to their supervisor and the Safety Department.

Federal and territorial legislation regulates the management of hazardous materials in Nunavut. A list of the acts, regulations, and guidelines that govern the handling of hazardous materials that will be used at the Kiggavik Project is provided below.

Federal:

- Explosives Act (R.S.N.W.T., 1988)
- National Fire Code
- Canadian Council of Ministers for the Environment (CCME) Guidelines for Above-Ground Storage Tanks (CCME, 1994)

Territorial:

- Environmental Guideline for General Management of Hazardous Wastes (Gov. of Nunavut, 2010)
- Contingency Planning and Spill Reporting in Nunavut: A Guide to the New Regulations
- Guideline: Contaminated Site Remediation (Gov. of Nunavut, 2009)
- Transportation of Dangerous Goods Act (R.S.N.W.T., 1992) and Regulations
- Explosives Use Act (R.S.N.W.T., 1988) and Regulations
- Fire Prevention Act (R.S.N.W.T., 1988) and Regulations
- Mine Health and Safety Act (R.S.N.W.T., 1994) and Regulations
- Safety Act (R.S.N.W.T., 1988) which includes the Work Site Hazardous Materials Information System Regulations (WHMIS)

All hazardous materials to be used at the Kiggavik Project will be manufactured, delivered, stored, and handled in accordance with all applicable federal and territorial regulations and ISO 14001 environmental management standards. AREVA is committed to preventing the inadvertent release of these substances to the environment and strives to minimize accidents from mishandling through employee training, inspections, procedural reviews, accountability, and continuous improvement objectives. Working level information regarding the transportation, storage, handling, and disposal of hazardous materials in accordance with manufacturer's recommendations and applicable regulations will be available at the time of licensing.

1.3 Roles and Responsibilities

This section is intended to identify the roles and responsibilities of the mine site personnel involved in the management of hazardous materials and hazardous wastes for the Kiggavik Project. Generic mine site positions and general responsibilities are provided below in relation to management of hazardous materials and wastes; specific titles and responsibilities will be designated and integrated into the associated Plans and provided for review at the time of Project licensing. Additional roles are provided in Tier 3, Volume 10, Accidents and Malfunctions, Technical Appendix 10C. Employee organizational charts for the operations phase are provided in Technical Appendix 9C, Attachment B.

1.3.1 Pre-Construction

Project Engineering

- Design and develop adequate storage facilities for hazardous materials on site.
- Advise on location for storage of hazardous materials on site.
- Conduct HAZOPS and review of hazardous materials facilities prior to construction to ensure all aspects are considered.

1.3.2 Construction & Operation

Construction Manager

- Accountable for the environmental performance on site.
- Establish goals and targets with AREVA for environmental performance.
- Implement environmental management plans.
- Inform the General Manager of any additional hazardous materials/waste management requirements that will be required during the construction phase.

Contractor

- Undertake hazardous materials management in accordance with Technical Appendix 2T; Technical Appendix 2U; and Technical Appendix 10B.

- Prior to handling of hazardous materials, ensure their own management plans and inspection procedures are consistent with the requirements outlined in this plan.
- Provide oversight to ensure that hazardous materials handling procedures are adhered to and adequately implemented.

Materials and Logistics Manager

- Source, purchase, and arrange transport of hazardous materials for use by the site.
- Incorporate specific hazardous material management requirements into the contracts held with individual contractors.
- Ensure all hazardous materials are properly stored, transported, and handled en route to the site.
- Ensure any hazardous materials have the required documentation prior to transport.

Warehouse Supervisors and Attendants

- Receive and manifest hazardous materials transported to site and direct shipper to offload hazardous materials accordingly.

- For shipping hazardous wastes offsite, ensure manifest is properly completed and accompanies the shipment.
- For shipping hazardous wastes offsite, ensure it is transported by a registered hazardous waste carrier to a registered receiver and that the shipment is placarded appropriately.

Site Services

- Ensure all waste material is properly segregated and transport waste to the appropriate landfills.
- Document quantity of waste that is disposed into landfills.

SHEQ Manager

- Oversee all matters related to health and safety, environment, quality, and radiation protection
- Communicate with employees and contractors regarding environmental compliance requirements.
- Supervise and conduct periodic environmental audits and inspections.
- Keep management informed on overall issues relating to the Project's environmental standards and compliance.
- Support in the provision of environmental awareness and community interaction training.
- Review of conditions following the completion of work on site.
- Implement control measures and any other corrective measures.
- Produce environmental reports as required by permits and authorizations.
- Liaise with regulatory agencies on all environmentally related issues.
- Support in planning for action to be taken in the event of spills or leakages of hazardous materials, and other environmental emergencies.

Environment Supervisors and Technicians

- Advise on environmental matters involving hazardous materials to other departments
- Conduct routine site inspections of site to ensure storage areas are adequately containing hazardous materials.
- Provide environmental training for employees and contractors including orientation and waste disposal requirements.
- Ensure the proper disposal of hazardous waste by an acceptable method and arrange for proper shipment of hazardous wastes to an off-site recycling facility.
- Maintain the operation of the hazardous waste laydown such as the correct classifying, labeling, and storing of hazardous wastes.
- Review documentation for shipment of wastes as required by regulations and ensure compliance to all regulations prior to shipping.
- Assist and advise Incident Commander during a hazardous materials incident.

Incident Commander

- Respond to and control the scene for incidents involving hazardous materials.

- Co-ordinate the emergency response team (ERT) and supporting personnel such as Services, Operations, and Environment to control incidents involving hazardous materials.
- Provide debriefing meeting for all personnel involved following the incident.

Safety Officers and Industrial Hygienist

- Evaluation of hazardous materials being brought to site to ensure they will be used in a controlled and acceptable manner.
- Advise on the controls required to use the hazardous materials (e.g. ventilation, PPE, work control practices, emergency procedures).
- Issue permits where required to ensure work is safely performed.
- Participate and facilitate job hazard assessments for unusual activities that involve hazardous materials.
- Provide training in use of hazardous materials on site.
- Manage programs involved in the safe use of hazardous materials (e.g. respiratory protection program).
- Manage WHMIS (e.g. MSDS) for all hazardous materials on site.

Emergency Response Team

- There will be trained personnel prepared to respond, manage, and clean-up hazardous materials incidents (Technical Appendix 10C).

All Managers and Supervisors

- Ensure that sufficient resources are provided to meet the requirements of this plan.
- Ensure employees are trained for all environmental requirements.
- Ensure employees comply with environmental requirements described in the associated environmental plans.
- Ensure all employees are wearing personal protective equipment when handling hazardous materials.
- Communicate site environmental issues to employees in a timely manner.
- Notify Environment personnel for spills of hazardous materials.

All Employees (Also Applicable to Contractors)

- Report hazardous materials spills or incidents to Environment personnel and supervisors.
- Comply with the requirements of the Environmental Management Plan.
- Conduct regular site inspections to ensure that regular maintenance are undertaken to minimize potential environmental impacts.
- Follow all work instructions for handling hazardous materials.
- Know the location of first aid kits, emergency equipment (e.g. fire extinguisher, emergency showers and eyewash stations, health centre) and muster points.
- Attend environmental training including orientation, proper waste segregation, handling hazardous materials (WHMIS), best management practices for handling hazardous materials and actions to take as first responders to environmental incidents.

- Participate in toolbox/tailgate meetings.

1.3.3 Closure

Decommissioning Manager

- Oversee decommissioning of the site and address any issues and incidents related to hazardous materials.

Warehouse Manager

- Operate hazardous materials management facilities in accordance with Technical Appendix 2T, Technical Appendix 2U and Technical Appendix 10B.

Environment Technicians

- Provide environmental guidance and monitoring as required.
- Submit regulatory environmental reports as required.

1.4 Mitigation and Monitoring

As outlined in Tier 3, Technical Appendix 2T, AREVA's Environmental Protection Framework provides an integrated approach to facility design, mitigation, and environmental assessment, and outlines how the outcomes of these processes are integrated into facility construction, operation and decommissioning. Furthermore, the Environmental Protection Framework outlines how the results of monitoring and follow-up programs are incorporated into evaluation processes, which facilitate the identification of continual improvement initiatives and adaptive management requirements, when necessary. The framework also outlines the mechanisms by which these processes and initiatives are communicated to stakeholders.

As part of the environmental assessment process, mitigation measures are incorporated into the Project to avoid and minimize potential adverse environmental effects. Mitigation measures consist of industry best technologies and practices and incorporate the learning-based experiences of other development projects. Mitigation measures can generally be classified as mitigation by design, and mitigation by management, as outlined below.

1.4.1 Mitigation by Design

Many facility design features have been adopted to mitigate potential environmental and health effects and ensure worker safety. The main hazardous material mitigation measures by design outlined in this plan include:

- To reduce the risk of spills, hazardous goods will be stored appropriately which will meet or exceed regulatory standards. This will include secondary containment for fuel and storing hydrogen peroxide in a strictly managed dedicated building.
- To reduce the release of SO_2 and its effect on the environment, measure will be taken to reduce the amount emitted that incorporates the use of scrubbers that will be installed on applicable exhaust stacks.
- To mitigate the environmental risks of a spill during the transportation of fuel, double-hulled tankers will be utilized. The Baker Lake dock site will use appropriate fuel transfer equipment and be equipped with Bulk Storage Spills Kits.
- To mitigate the risk of a spill of hazardous materials, waste hazardous materials will be stored in a designated dual contained area.

1.4.2 Mitigation by Management

Many management practices mitigate potential environmental and health effects and promote safety. This often includes the development, use, enforcement, and revision of codes of practice, procedures and work instructions, and staff training and auditing. The main mitigation measures by management outlined in this hazardous materials management plan include:

- All dangerous goods will be stored and handled according to the applicable regulations.
- For safety, all personnel at site will be given a formal orientation, which covers the Spill Contingency Plan along with other information regarding hazardous materials such as the locations of Material Safety Data Sheets and spill kits. Additional training will be provided to employees specific to their work area and duties.
- To track all hazardous materials used by the project, warehouse personnel will track all shipments received and crosscheck against order requisitions. Outgoing shipments of yellowcake will be tracked and adhere to TDG regulations.
- For safety, the Emergency Response Plan (Technical Appendix 10C) and Spill Contingency Plan (Technical Appendix 10B) will be enacted in the event of a spill or incident.
- To reduce the risk of fuel spills, detailed procedures will be followed during fuel handling, transfer and storage.

1.4.3 Monitoring

Results from the monitoring of facilities and operations will be evaluated against predicted performance, a process to identify design and management improvement opportunities, and adaptive management needs... The main monitoring activities outlined in this Plan include:

- To ensure spills are prevented, routine inspections of applicable facilities will be performed to ensure conformance requirements. This will involve identifying possible hazards or leaks and initiate repairs. Facilities will be inspected to ensure all materials are accurately labelled and stored.
- To track non-compliance deficiencies, inspections will be logged. These forms will be used to promote continuous improvement in environmental performance and stewardship.
- Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed.

2 Hazardous Materials

2.1 Types of Hazardous Materials

The transportation of hazardous materials (dangerous goods) is federally regulated by Transport Canada. The *Transportation of Dangerous Goods Act* (TC, 1992) classifies hazardous materials into nine main classes according to an internationally recognized system, as follows:

- Class 1 – Explosives
- Class 2 – Gases
- Class 3 – Flammable liquids
- Class 4 – Flammable solids
- Class 5 – Oxidizing substances and organic products
- Class 6 – Poisonous (toxic) and infectious substances
- Class 7 – Radioactive
- Class 8 – Corrosive
- Class 9 – Miscellaneous products or substances

All dangerous goods arriving at the Baker Lake dock facility and transported to the Project site will be stored and handled according to these regulations.

Operation of the Kiggavik Project requires the use of certain hazardous materials including:

- Petroleum Products – diesel fuel, oils, greases, antifreeze, and solvents used for maintaining operating equipment
- Mill Process Reagents – various corrosives, oxidizers, organic and inorganic solutions, and other chemicals used in the processing of ore
- Explosives – ammonium nitrate, fuel oils, and blasting materials used in the mining areas
- Laboratory Wastes – various hazardous wastes will be generated from chemicals used in the assay laboratory
- Radiologically contaminated waste – liquid effluent waste and solid waste contaminated with radionuclides from mine water, ore processing, and surface contaminated equipment and supplies.

The majority of liquid effluents, such as contaminated mine and process waters and some lab wastes will be treated onsite at the wastewater treatment plant or reprocessed in the mill with contaminants removed ultimately becoming part of the tailings. As such, these types of waste are addressed together in this plan.

The sections below provide detail on the various types of hazardous materials anticipated to be stored, handled and used at the Kiggavik Project.

2.2 Materials of Special Interest

Certain products will be used in large quantities throughout the life of the Kiggavik Project. These include diesel fuel, hydrogen peroxide, sulphuric acid, and ammonium nitrate.

2.3 Kiggavik Operation Facilities

The Kiggavik Project is located in the Kivalliq Region of Nunavut, approximately 80 km west of Baker Lake. The Project includes two sites: Kiggavik and Sissons (collectively called the Kiggavik Project). The Kiggavik site is located at approximately 64°26'36.14"N and 97°38'16.27"W. The Sissons site is located approximately 17 km southwest of Kiggavik at 64°20'17.61"N and 97°53'14.03"W.

There are four key areas where handling and/or storage of hazardous materials will take place. These include:

- Transport of hazardous materials to Baker Lake port and temporary storage at the marshalling yard;
- Truck transport of materials from Baker Lake port to the Kiggavik site over the winter road or all season road;
- Storage of hazardous materials onsite either in storage tanks within the mill or at designated storage areas; and,
- Storage of materials in designated depots (i.e. explosives magazine, fuel tank farm).

Additionally, the uranium concentrate (yellowcake) resulting from the Kiggavik Project will be flown out from the Kiggavik site to licensed facilities in southern Canada.

The subsections below provide a summary of the infrastructure for the Project. Tables 2.3-1 to 2.3-5 provide a tabular summary of the infrastructure. Within the tables, a column indicates whether the infrastructure includes containment. A facility that does not have containment indicates that there are no designed measures in place to contain material from entering the surrounding environment. Facilities that have a low spill risk or are not expected to contain any hazardous or contaminated materials do not have containment.

Facilities that contain hazardous material which, without appropriate measures, have potential to enter the surrounding environment have containment. Examples of containment include double walled tanks, buildings, bermed areas, liners, and pits. Additional means to prevent hazardous

materials from entering the surrounding environment may be considered on a material specific basis to ensure appropriate containment. The type of containment required depends on the type and location of hazardous material, applicable regulations and legislation, and available technologies. All containment structures will be designed to meet or exceed applicable regulations.

2.3.1 Baker Lake Port and Marshalling Yard

The Baker Lake dock location and layout has been selected based on natural topographic features and lake bathymetry. Infrastructure associated with the Baker Lake dock facility is summarized in Table 2.3-1 below.

Table 2.3-1 Baker Lake Dock Facility and Access Infrastructure

Facility	Containment		Potential Hazardous Materials
	Yes	No	
Temporary Dock		✓	• All hazardous materials will arrive by cargo ship at the marshalling area
Tank Farm	✓		• 7 -10 ML fuel tanks
Reagents Container Storage	✓		• All reagents used in the milling process • Sized for approximately 4200 containers stacked 4 high
Other Container Storage		✓	• Hazardous materials in varying amounts within appropriate shipping packaging stored inside sea containers • Sized for approximately 4200 containers stacked 4 high
Ammonium Nitrate Storage		✓	• Ammonium nitrate, 10,000 tonne capacity
Offices		✓	

2.3.2 Delivery from Baker Lake to the Kiggavik Project

There are currently no road connections to Nunavut communities. All goods are shipped by annual sealift (July/August to September/October) or as air cargo. For the Kiggavik Project, reagents, fuel and supplies will be containerized and shipped to Baker Lake via barge and then transported to site by truck over a winter road. An all-season road between Baker Lake and the Kiggavik Project has also been retained as a project option to account for uncertainties surrounding the potential effects of climate change over the life of the mine and in case the winter road cannot adequately support the Project through to decommissioning and closure.

All dangerous goods arriving at the Baker Lake dock facility and transported to the Project site will be stored and handled according to TDG regulations. An inventory control system will ensure that products are stored according to manufacturer's recommendations and compatibility requirements, all containers are properly labeled, and all products have a corresponding MSDS. The Emergency Response Plan (Technical Appendix 10C) and the Spill Contingency Plan (Technical Appendix 10B) will be updated prior to the construction phase of the Project to include details on spill response strategies for an incident involving hazardous materials.

Yellowcake will be shipped out to southern Canada by airlift from the proposed Kiggavik airstrip.

Proposed truck transportation routes from the Baker Lake marshalling yard to the Kiggavik mine site and for the air transport of yellowcake from the Pointer Lake airstrip are summarized in Table 2.3-2.

Table 2.3-2 Summary of Proposed Transportation Routes

Facility	Containment		Transportation Route Description
	Yes	No	
Baker Lake – Kiggavik Winter Access Road		✓	• 3 month seasonal road • Includes emergency shelters for personnel safety • 99 km long
Baker Lake – Kiggavik All-Season Access Road		✓	• All-season road with cable ferry – ice bridge crossing Thelon River • 8 month service • Includes emergency shelters for personnel safety • 110 km long
Road to Baker Lake		✓	• connects into AEM Meadowbank dock road • 1.5 km long
Pointer Lake Airstrip	✓		• Contained storage of de-icing fluid and aviation fuel • Gravel airstrip (not contained)

2.3.3 Mill Facilities

The Kiggavik site location and layout has been selected to ensure containment of the mill terrace and to take advantage of predominant wind directions. The Kiggavik Project will include the construction, operation and decommissioning of a mill facility to extract uranium concentrate from ore. Most modern uranium mills are based on hydrometallurgical processing, and are comprised of a series of circuits that separate the uranium from the other materials in the rock and then produce the packaged uranium product commonly referred to as yellowcake. Yellowcake is an intermediate

product that requires further processing before it is suitable for use as nuclear fuel. Yellowcake is the only product that will be produced at Kiggavik at a targeted production rate of up to 4,000 tonnes U per year.

The mill complex consists of a central mill building, which houses the milling process equipment and services, and several ancillary buildings which support the mill. The chemical laboratory will be used to analyze mill samples collected for metallurgical accounting and control. Analysis of environmental samples and urinalysis may also be conducted. The Kiggavik chemical laboratory will be designated as a Basic Level Radioisotope Laboratory. It will comply with CNSC Regulatory Document R-52, *Design Guide for Basic and Intermediate Level Radioisotope Laboratories.* The metallurgical laboratory will be used to prepare slurry samples for analysis in the chemical laboratory and for metallurgical test programs and optimization.

The mill and support facilities and the hazardous materials utilized or stored are summarized in Table 2.3.3.

Table 2.3-3 Summary of Mill Support Facilities

Facility	Containment		Hazardous Materials Description
	Yes	No	
Milling			
Mill	✓		• Up to 4,000 tonnes U produced per year • Various reagents will reside in appropriate storage tanks within contained sections of the mill
Acid Plant	✓		• 310 t/day 100% H_2SO_4
Oxygen Plant	✓		• 30 t/day
Peroxide Storage	✓		• 50% solution
Tailings Management	✓		• 3 in-pit TMFs : East Zone, Centre Zone, Main Zone
Laboratories			
Chemical Laboratory	✓		• Various chemicals in limited quantities including corrosives, gases, flammable substances, solvents and poisons • Radioactive sources
Metallurgical Laboratory	✓		• Various chemicals in limited quantities including corrosives, gases, flammable substances, solvents and poisons • Radioactive sources
Water Management			
Water Treatment Plant	✓		• 5,560 m3/day capacity • UF pre-treatment, RO, chemical treatment

Table 2.3-3 Summary of Mill Support Facilities

Facility	Containment		Hazardous Materials Description
	Yes	No	
Monitoring Ponds	✓		• 3 -12 h holding ponds
Fresh Water Pipe		✓	• To Siamese Lake • 8.7 km long
Treated Effluent Discharge Pipe	✓		• Discharge to Judge Sissons Lake • 14 km long
Purpose Built Pit	✓		• Storage of site drainage • Sized for 350,000 m3 water
Water Diversion Structures		✓	• Fresh water diversion
Power			
Power Plant	✓		• 20.95 MW installed (13.0MW peak load)
Tank Farm	✓		• 6 -10 ML fuel tanks
Warehousing			
Container Yard	✓		• Sized for approximately 4,200 containers stacked 4 high
Clean Storage		✓	•

2.3.4 Mining Facilities

There are five individual mines proposed for the Project: East Zone, Center Zone and Main Zone at the Kiggavik site, and End Grid and Andrew Lake at the Sissons site. The three Kiggavik deposits and the Andrew Lake deposit would be mined by truck-shovel open pit, while End Grid would be an underground mine. Tailings will be managed at in-pit tailings management facilities constructed using the mined-out East Zone, Centre Zone and Main Zone open pits at the Kiggavik site.

The Kiggavik site location and layout has been selected to ensure containment of the mill terrace and to take advantage of predominant wind directions. Infrastructure associated with the Kiggavik Site is summarized in Table 2.3-3. The mine support facilities at the Kiggavik site and the hazardous materials utilized or stored are summarized in Table 2.3-4.

Table 2.3-4 Summary of Mine Support Facilities – Kiggavik Site

Facility	Containment		Potential Hazardous Materials
	Yes	No	
Mining			
Mine Shop	✓		Lubricants, oils, grease, fuel, antifreeze
Explosive Storage		✓	10,000t capacity
Tank Farm	✓		6-10 ML Fuel Tanks

The mine support facilities at the Sissons site and the hazardous materials utilized or stored are summarized in Table 2.3-5.

Table 2.3-5 Summary of Mine Support Facilities – Sissons Site

Facility	Containment		Potential Hazardous Materials
	Yes	No	
Mining			
Mine Shop and Offices/dry	✓		• Lubricants, oils, grease, fuel, antifreeze • Services underground and surface fleets - light duty function
Cemented Rock Fill Plant		✓	• 60 tonnes CRF per hour
Water Management			
Water Treatment Plants	✓		• Chemical treatment, chlorine
Monitoring Ponds	✓		• Treated effluent
Treated Effluent Discharge Pipe	✓		• Discharge to Judge Sissons Lake • 12 km long
Power			
Power Plant	✓		• 7.65 MW (3.8MW peak load) • Diesel fuel, lubricants
Tank Farm	✓		• 2 – 10 ML fuel tanks

2.3.5 Facility Design Considerations

All facilities will be designed, fabricated and installed in such a manner that risk of loss is minimized. A comprehensive risk assessment will be performed prior to making any decisions on chemical storage facilities. The facility will conform to all regulations and ISO 14001 standards. Some of the factors that will be considered when choosing a design for the storage facility include:

- Other AREVA operations with similar facilities
- Applicable design standards
- Piping requirements
- Toxicity and hazard of the chemical
- Quantity of chemical being stored
- Secondary containment and double wall vessel requirements
- Compatibility of chemical with material of construction including corrosion protection
- Spill control equipment such as overfill protection, leak detection systems and sump design
- Safety equipment such as venting controls, emergency showers or eyewashes
- Emergency equipment responses available to handle fire, chemical leaks or spills

Factors that will be considered when choosing the location of storage facilities include:

- Vicinity of other chemical storage facilities that may lead to potential interactions should an event such as a spill, fire or explosion occur
- Potential severity of the impact to the environment should a release occur
- Consideration for spill run-off and containment
- History of environmental incidents at other sites related to storage of chemical.

In addition to the engineering risk assessment, consideration will also be given to:

- Work practices and procedures,
- Personal protective equipment (PPE) required to be worn by the operator,
- Ventilation requirements,
- Security, and Risk communication and training.

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3 Fuels and Petroleum Products

3.1 Petroleum Product Description

Products such as diesel fuel, anti-freeze, engine oil, and lubricants are vital components for power generation, heating and equipment operation. All equipment on site will be operated using common arctic grade diesel fuelled generators. A power generation unit will be required at both the Kiggavik and Sissons sites. The majority of large site equipment will operate on diesel fuel. Other fuels may be required in limited quantities.

The Kiggavik project total peak annual fuel consumption has been estimated to be 65 million liters with an average of 49 million liters over the production period. This total includes all fuel required for:

- Heat and power based on the internal combustion engine designs and
- Mobile equipment and miscellaneous loads.

The design basis for all petroleum storage on site is the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (COP), 2003.

The operational and maintenance requirements for all petroleum storage and handling on site are based on the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, 2003 and in compliance with the *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*, under the *Canadian Environmental Protection Act, 1999* (CEPA 1999).

3.1.1 Pre-development Inventory

During the exploration phase of the Kiggavik Project, the majority of hazardous materials stored and handled at the mine site are fuels used for drill rigs, helicopters, heating, and general equipment operation. Table 3.1-1 lists products used, along with the maximum amount stored, at the Kiggavik exploration camp and the how they are stored at the Project site.

Table 3.1-1 Materials Stored at the Kiggavik Exploration Site

Chemical/Material	Amount	Storage Type
Diesel Fuel	250,000 L	Secondary Containment
Jet B Fuel	223,040 L	Secondary Containment
Gasoline	1,025 L	Secondary Containment
Generator Oil	20 x 20L (400 L)	Secondary Containment
Hydraulic Oil	20 x 20L (400 L)	Secondary Containment
Engine Oil	20 x 20L (400 L)	Secondary Containment
Propane	75 x 100 lbs (7,500 lbs)	Secondary Containment
Grease	5 cases x 12 tubes (60 tubes)	Secondary Containment
Salt	50,000 lbs	Secondary Containment
Cement	15,000 lbs	Secondary Containment

A specific inventory of all petroleum and chemical products used during the field operations is recorded upon receiving the products at site. This list is kept at site and maintained on a regular basis.

3.1.2 Operational Inventory

The Baker Lake facility will receive fuel from barges during the two summer months and be able to hold enough fuel for the Project. Fuel will be transported to the Kiggavik site on a winter road during the winter months. It is estimated that during the peak consumption year fuel storage of up to 70 million litres (ML) may be required at Baker Lake; with 50 ML of fuel storage at Kiggavik site and 20 ML of fuel storage at Sissons site. Therefore seven 10 ML tanks at Baker Lake, five 10 ML tanks at Kiggavik site and two 10 ML tanks at Sissons site are required. The current design conservatively considers six tanks at Kiggavik and two tanks at Sissons to allow for flexibility in fuel storage at the Kiggavik site.

Given that detailed engineering and design has not been conducted at this stage, the estimated volume of products listed in Table 3.2-2 other than diesel fuel, have not been considered. These products are anticipated to represent a small fraction of the total fuel products estimated for the Project and will be stored, handled, and used according to applicable regulations and the product's MSDS. Estimates of all fuel products to be used for the Kiggavik Project will be presented at the time of licensing.

3.1.3 Secondary Containment Areas

Secondary containment areas required to contain fuel volume are designed according to the National Fire Code: their volume is the sum of the size of the largest tank (10 ML) and of ten percent of the volume of the remaining tanks. For a tank farm of 6 tanks of 10 ML capacity, the containment volume is therefore 15 ML. A high density polyethylene liner will be installed within each tank farm to prevent release of any spilled substances. As well, fuel transfer areas will be designed so that any spilled fuel is directed to a containment area.

The proposed temporary fuel bladder tank farms indicated in Tier 2, Volume 2, Section 12.9.4 will be needed during early construction as steel fuel tanks are being constructed. Bladder tank farms will be designed and constructed to conform to these regulations.

3.2 Product Description

Material categories, handling and storage requirements, and manufacturer recommended personal protective equipment are summarized in Tables 3.2-1 to 3.2-4.

Table 3.2-1 Fuel Products – Hazard Class and Potential Impacts

Material	Hazard Class	Potential Impact
Diesel	3	Water & Soil Contamination
Aviation Fuel	3	Water & Soil Contamination
Motor Oil	Not Classified	Soil Contamination
Hydraulic Fluid	Not Classified	Soil Contamination
Varsol	3	Soil Contamination
Ethylene Glycol	Not Classified	Soil Contamination
Deicing Fluid	Not Classified	Biodegradable
Automotive Grease	Not Classified	Negligible Risk

Table 3.2-2 Fuel Products – Storage Locations

Material	Storage Location
Diesel	Kiggavik tank farm (60 ML in lined and bermed area) Sissons tank farm (20 ML in lined and bermed area) Dockyard tank farm (70 ML in lined and bermed area)
Aviation Fuel	Air Strip and/or Kiggavik tank farm Baker Lake dock site
Motor Oil	Mechanical shop Powerhouse
Hydraulic Fluid	Mechanical shop Powerhouse
Varsol	Mechanical shop
Ethylene Glycol	Mechanical shop
Deicing Fluid	Air Strip
Automotive Grease	Mechanical shop

Table 3.2-3 Fuel Products – Safe Handling Procedures

Material	Safe Handling Procedure
Diesel	Do not get in eyes, on skin, or on clothing. Avoid breathing vapors, mist, fume, or dust. Do not swallow. May be aspirated into lungs. Wear protective equipment and/or garments if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation. Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.
Aviation Fuel	See diesel procedure.
Motor Oil	Wear protective clothing and impervious gloves when working with used motor oils. Store in a closed container.
Hydraulic Fluid	Avoid skin contact. Prolonged exposure may result in minor irritation. If hydraulic oil comes in contact with your eye, flush it thoroughly with water and seek medical attention. Store closed in original container.
Varsol	Avoid eye contact. Use with adequate ventilation. Wash thoroughly after handling. Empty container retains residue. Follow label instructions. Avoid repeated skin contact. Store in cool, ventilated area, away from ignition sources and incompatibles. Keep container tightly closed.
Ethylene Glycol	Ensure adequate ventilation. Wear protective gloves and chemical safety goggles. Keep in tightly closed container, stored in a cool, dry, ventilated area. Separate from acids and oxidizing materials. Empty containers of this product retain product residues and may be hazardous.

Table 3.2-3 Fuel Products – Safe Handling Procedures

Material	Safe Handling Procedure
Deicing Fluid	Avoid contact with skin and eyes. Avoid breathing mists and vapors when spraying. Store in tightly sealed UV resistant containers away from direct heat and strong oxidizing agents.
Automotive Grease	Minimize breathing vapour, mist, or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean before re-use; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

Table 3.2-4 Fuel Products – Personal Protective Equipment

Material	Personal Protective Equipment		
	Eyes	Skin	Respiration
Diesel	Safety goggles	Nitrile gloves; protective clothing	None usually required
Aviation Fuel	Safety goggles	Nitrile gloves; protective clothing	None usually required
Motor Oil	Safety goggles	Nitrile gloves; protective clothing	None usually required
Hydraulic Fluid	Safety goggles	None usually required	None usually required
Varsol	Safety goggles	Nitrile or rubber gloves	None usually required
Ethylene Glycol	Safety goggles	Nitrile gloves; protective clothing	None usually required
Deicing Fluid	Safety goggles	No special skin protection required	None usually required
Automotive Grease	Safety goggles	Nitrile gloves; protective clothing	None usually required

3.3 Fuel Transport to Kiggavik Project

3.3.1 Fuel Transport to Baker Lake

Fuel will be loaded at terminals in Montreal, Rotterdam or New York then transported to Ellis Island anchorage at the east end of Chesterfield Inlet using oceangoing Ice Class double hull tankers. The ocean going tankers will anchor at Ellis Island and lighter their cargoes into double hull barges. Procedures for fuel transfer will conform to Transport Canada Guidelines TP10783E. The double hull barges will also deliver fuel direct to Baker Lake from southern ports. Double Hull tankers may also deliver fuel to the tank farm in Churchill.

A containment boom will be placed between the tanker and the bow and stern of the barge as a precautionary measure to contain any fuel should a spill occur. A work boat and a barge containing oil spill equipment barge will be stationed at Ellis Island during all fuel transfers. A containment boom which will encircle the entire length of the tanker and barge will be available onsite, ready to be deployed if necessary.

The oil handling facility (OHF) will be constructed and operated in accordance with Transport Canada Arctic waters Oil Transfer Guidelines TP 10783E and Oil Handling facility Guidelines TP 12402E. The OHF supervisors will be trained in accordance with Transport Canada Supervisor of Oil Transfer Operation course TP 12402 or equivalent.

Steel piping will lead down to the loading dock from the diesel fuel tank farm at Baker Lake. The discharge hose will be a marine grade bunker hose rated at 17 bar. The discharge hose(s) will be connected to the fuel receiving manifold on the dock using a dry break coupling(s). A powered hose reel and hose crane will be fitted on the barge. All connection points will be protected with save-alls. The dock area will be well lit as required for work being conducted under low light conditions. A ready use pollution kit will be stored on the dock. A containment boom will be deployed between the dock and the barge hull during fuel transfers as a precaution to contain any fuel that may accidentally spill. Additional details on spill response are provided in Technical Appendix 10B.

A team of trained personnel will be in charge of the barge discharge equipment. Fire-fighting equipment will be fitted on the dock as well as on each barge as required by Transport Canada.

3.3.2 Fuel Delivery from Baker Lake to Kiggavik Site

Fuel will be transported to the Kiggavik site on a winter road during the winter months. There may also be an all season road however, due to weight restrictions; the winter road is the preferred route for transporting fuels.

A truck loading and fuelling station will be built at the Baker Lake dock site. All fuel being loaded onto trucks will be done at a reduced pressure, by increasing the piping from 100 mm to 150 mm diameter pipes. All personnel conducting fuel transferring will be trained in fuel handling and spill response procedures. The bulk fuel transfer procedure is detailed in section 3.4 below.

Spill kits will be available at all tank farm locations in the event of a spill. Due to the volume of fuel being stored in the fuel tank storage system and the remote nature of the sites, at least one Bulk Storage Site Spill Kit will be present for each 100,000 L of fuel being stored. Additional details on spill kits and spill response are provided in Technical Appendix 10B.

3.3.3 Fuel Truck Transfer Procedures

The Kiggavik Environmental Code of Practice discusses how to conduct activities in order to minimize the risk of a spill. In addition, the following measures will further minimize the potential for spills during fuel handling, transfer and storage:

1. Fuel transfer hoses with cam lock mechanisms to be used when transferring bulk fuel deliveries into the bulk storage tanks.
2. Carefully monitor fuel content in the receiving vessel during transfer. Always have additional absorbent pads on hand while transferring fuel.
3. Clean up drips and minor spills immediately.
4. Regularly inspect drums, tanks and hoses for leaks or potential to leak and for proper storage.
5. Create fuel caches in natural depressions that are located at least 30m from the normal high-water mark of any water body.
6. Inventory and reconciliation procedures developed to ensure tanks are not overtopped and to ensure that tank leakage is not occurring.
7. Overfill protection on tanks include visual and audible alarms; catch basins around fill pipe; additional secondary containment at transfer locations; corrosion protection
8. Train personnel, especially those who will be operators, in proper fuel handling and spill response procedures. This training will include a “mock” spill, review of spill kit contents and their use and reporting.

Any accidents or spills must be reported immediately to the mine superintendent and safety department.

3.4 Contaminated Soils

Any soils contaminated as a result of a fuel spill will be excavated and transported to the designated landfarm area for remediation. Spills of other materials, such as reagents, will be disposed of in the contaminated landfill or potentially processed through the mill tailings preparation circuit for disposal in a TMF. Refer to the Spill Contingency and Landfarm Management Plan for further details.

3.5 Petroleum Product Waste

Used oil is classified as a hazardous waste. Depending on permit approval, used oils will be incinerated in on site waste incinerators. All used petroleum products will be collected in clearly marked waste oil tanks. In the event that waste oils cannot be disposed of onsite, they will be collected and shipped in drums or tanks to an approved recycling facility.

3.6 Mine Closure and Reclamation

Upon closure of the mine and facilities, some diesel fuel storage will remain for the use of closure and reclamation activities. Small amounts of other petroleum products will also be available. Fuel transfer and spill prevention procedures will continue to be utilized during this process. Further details are provided in Technical Appendix 2R (Preliminary Decommissioning Plan).

4 Mill Reagents

4.1 Mill Process Reagents

A number of reagents will be required to operate the mill process; these reagents, their storage, handling, and the proposed methods of preparation are described. The mill will also provide some reagents to the Water Treatment Plants at Kiggavik and Sissons. The use and expected annual consumption of process reagents are shown in Table 4.1-1.

Table 4.1-1 Mill Process Reagents and Consumables

Reagent	Use	Estimated Consumption (tonnes/year)	Material Form	Storage Container
Lime (CaO)	pH modifier	33,914	Solid	Tote Bags
Sulphur	Sulphuric acid generation	23,451	Solid	Tote Bags
Hydrogen peroxide	Uranium precipitation	1,716	Liquid	ISO Containers
Sodium hydroxide	pH modifier	1,442	Solid	Drums
Ferric sulphate	Transition metal precipitation	239	Solid	Tote Bags
Barium chloride	Radium precipitation	303	Solid	Tote Bags
Sodium sulphate	Resin regeneration	632	Solid	Tote Bags
Resin	Uranium extraction	1,125	Solid	Tote Bags
Flocculants	Solid-liquid separation	104	Solid or Liquid	Tote Bags or Drums
Ferrous Sulphate	Water treatment	16	Solid	Tote Bags

Table 4.1-2 Mill Reagents – Hazard Class and Potential Impacts

Material	Hazard Class	Potential Impact
Lime (CaO)	Not regulated	Negligible with proper handling
Sulphur	9	Negligible with proper handling
Hydrogen peroxide	5.1	Negligible with proper handling
Sodium hydroxide	8	Negligible with proper handling
Ferric sulphate	8	Negligible with proper handling
Barium chloride	6	Negligible with proper handling
Sodium sulphate	Not regulated	Negligible with proper handling
Resin	Not regulated	Negligible with proper handling
Flocculants	Not regulated	Negligible with proper handling
Ferrous sulphate	9	Negligible with proper handling

Table 4.1-3 Mill Reagents – Safe Handling Procedures

Material	Safe Handling Procedure
Lime (CaO)	Store in closed container in a covered area with controlled drainage. Use in well-ventilated area. Empty containers retain product residues and may be hazardous.
Sulphur	Sulphur dust suspended in air ignites easily and can cause an explosion in confined areas. Store away from sources of ignition. Toxic gases form upon combustion. Store in cool, dry, well-ventilated area. Keep containers tightly closed. Separate from chlorates, nitrates, and other oxidizing agents.
Hydrogen peroxide	Keep container dry, well-ventilated area away from heat and sources of ignition. Keep away from combustible material. Do not breathe fumes. Never add water and keep away from incompatible materials. Store in tightly closed container.
Sodium hydroxide	Can cause severe injury to eyes, skin, and respiratory tract. Use personal protective equipment at all times. Do not contact product directly. Wash thoroughly after handling. Store in dry, well-ventilated area. Keep in original container, tightly closed. Empty containers retain product residues and may be hazardous.
Ferric sulphate	Do not breathe dust. Avoid contact with skin and eyes. Store in cool, dry, well-ventilated area.
Barium chloride	Do not ingest or breathe dust. Avoid contact with skin and eyes. Keep container tightly closed. Store in a cool well-ventilated area. Wash thoroughly after handling. Use with adequate ventilation.
Sodium sulphate	Keep in tightly closed container. Store in a cool, dry, ventilated area. Isolate from incompatible substances. Empty containers retain product residues and may be hazardous.

Table 4.1-3 Mill Reagents – Safe Handling Procedures

Material	Safe Handling Procedure
Resin	Store in a cool, dry, well-ventilated area. Keep in tightly closed containers. Avoid exposure to dust.
Flocculants	Store in a dry area on concrete floor away from any sources of ignition. Produces slippery product when wet.

Table 4.1-4 Mill Reagents – Personal Protective Equipment

Material	Personal Protective Equipment		
	Eyes	Skin	Respiration
Lime (CaO)	Safety goggles	Nitrile or rubber gloves; protective clothing	NIOSH/MSHA approved respirator
Sulphur	Safety goggles	Wash clothing after contact	NIOSH/MSHA approved respirator
Hydrogen peroxide	Face shield	Chemical gloves; protective chemical suit; rubber boots	NIOSH/MSHA approved respirator
Sodium hydroxide	Safety goggles	Neoprene or PVC gloves; protective clothing	NIOSH/MSHA approved respirator
Ferric sulphate	Safety goggles	Nitrile gloves; protective clothing	NIOSH/MSHA approved respirator
Barium chloride	Safety goggles	Nitrile gloves; protective clothing	NIOSH/MSHA approved respirator
Sodium sulphate	Safety goggles	Nitrile gloves; protective clothing	NIOSH/MSHA approved respirator
Resin	Safety goggles	Nitrile gloves; protective clothing	NIOSH/MSHA approved respirator
Flocculants	Safety goggles	Neoprene or rubber gloves; protective clothing	NIOSH/MSHA approved respirator

All reagents will be stored in a secure area within or immediately adjacent to the mill. Sodium hydroxide, ferric sulphate, barium chloride, sodium sulphate, and flocculants will be received in approved packaging such as drums or bags and stored in a covered building or in sea containers. These reagents will then be diluted with water and used in the milling process. Preparations of the remaining reagents, which require more complex storage and/or further processing, are described in the following sub-sections.

4.1.1 Sulphuric Acid

Sulphuric acid (93% H_2SO_4) will be produced in an on-site acid plant located near the mill. Acid will be supplied via pipelines to Leaching, Elution, and the Kiggavik and Sissons water treatment plants (WTP). A tote filling station will be required to provide acid to the Sissons WTP.

The production of sulphuric acid involves the process of burning sulphur in the presence of dried ambient air, reaction of the products in a catalyst bed, and recovering the reacted components in an air absorption solution to produce sulphuric acid. Waste heat in the form of superheated steam is also produced as part of the reaction. A portion of this heat may be recovered and used in the mill process.

Sulphur will be received as solid prills or agglomerated high purity solid sulphur and stored in cold storage.

The plant will be designed to emit less than 75 g SO_2 per tonne of acid produced. Emissions will be controlled by two systems:

- Excess SO2 will be absorbed in the last pass by a cesium-promoted catalyst with a lower working temperature in one or several layers
- A scrubber installed on the exhaust stack will remove particulates, acid mist and excess SO_2

4.1.2 Lime

Lime will be used for pH adjustment in Tailings Neutralization, Gypsum Precipitation, the Kiggavik WTP and the Sissons WTP. The lime preparation circuit will be located in the mill.

Quicklime (CaO) will be received as a solid and thawed indoors if required. The quicklime will be blended with steam-heated water in a lime slaking ball mill in closed circuit with a set of cyclones.

The slaked lime will then be stored in lime slurry storage tanks for use in the process. A filling station will be installed to provide lime to the Sissons WTP.

4.1.3 Hydrogen Peroxide

Hydrogen peroxide will be used in the yellowcake precipitation circuit to precipitate uranium peroxide. The reagent will be delivered in ISO containers.

Hydrogen peroxide is a strong oxidant and therefore is a risk for fire and explosion if concentrated solution is mixed organics such as oil or grease. To reduce the potential for accidents, peroxide will be stored in a dedicated building and strictly managed.

Within the hydrogen peroxide storage building, the solution will be stored in covered and vented container constructed from compatible materials. The storage containers will be located within a containment berm that can accommodate 110% of the largest container. The containment area will have a deluge system for diluting any spillage and leak detection tied into the distributed control system (DCS) and local building alarms. Safety equipment in the building will include detectors for signs of oxidation. The area will be kept clean to minimize possible sources of combustion. Entry to the building will be limited to those trained in the safe handling of concentrated peroxide.

4.1.4 Residual Organic Reagents

Flocculants are used in process clarifiers and thickeners to agglomerate and settle fine particles out of solution. Residual amounts of organic reagents are processed in the Tailings Preparation circuit for dispensation to the Tailings Management Facility (TMF).

4.2 Effluent Streams

The water treatment plants located at the Kiggavik and Sissons sites will receive all wastewater from various sources. Contaminated effluents, by either chemical constituents, metals, or radionuclides, will be treated to regulatory standards prior to release. All water released to the environment will meet the discharge quality criteria, which have been selected to ensure no significant environmental effects associated with the release of water. The water treatment process will generate sludges which are sent to tailings neutralization and are ultimately deposited along with tailings in the TMF.

4.3 Process Control

The process control philosophy includes advanced process control capabilities to reduce the likelihood of incidents resulting from operator error, but allows rapid intervention from operators if needed. There will be a central mill control room with an operator who will oversee the operation of each unit process. Each unit process will in turn have a process control station where the area operator can independently monitor and operate their circuit. The area operators will have the responsibility of ensuring the circuit and associated equipment are functioning safely and efficiently. When required the central control room operator may directly control the unit process(s) with field support from the area operator. The system has incorporated operational redundancy in order to ensure smooth operation during early years when it is expected that a large portion of the workforce will be inexperienced. This system resembles the current process control at AREVA's McClean Lake Operation in Northern Saskatchewan.

Automatic samplers will be installed at appropriate locations to monitor the performance of each unit process and overall metallurgical efficiency of the facility. The samplers are intended to supplement routine process composite and grab samples collected by operators.

5 Explosives

Further detailed information on explosives can be found in Technical Appendix 2B (Drilling and Blasting Design and Related Regulatory Considerations) and Technical Appendix 2C (Explosives Management Plan).

5.1 Product Description

Explosives will be required at the Kiggavik Project for blasting of rock and ore at the various mine locations. Transportation, storage, use, and handling of blasting materials are strictly regulated by the Federal *Explosives Act* and the *Transportation of Dangerous Goods Act*. Territorial regulations include the *Explosives Use Act* and Regulations and the *Mine Health and Safety Act* and Regulations.

Material hazard class, potential impacts, site handling and storage requirements, and recommended personal protective equipment are summarized in Tables 5.1-1 to 5.1-3.

Table 5.1-1 Explosives – Hazard Class and Potential Impacts

Material	Hazard Class	Potential Impact
Ammonium Nitrate	5.1	Water & Soil Contamination
High Explosive Detonators	1	Negligible

Table 5.1-2 Explosives – Safe Handling Procedures

Material	Safe Handling Procedures
Ammonium Nitrate	Keep away from heat and sources of ignition. Do not ingest or breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin and eyes. Store in a cool, well-ventilated area separate from acids, alkalies, reducing agents and combustibles.
High Explosive Detonators	Store under dry conditions in a cool, well-ventilated magazine in closed containers. Keep away from heat, sparks, and flames.

Table 5.1-3 Explosives – Personal Protective Equipment

Material	Personal Protective Equipment		
	Eyes	Skin	Respiration
Ammonium Nitrate	Safety goggles	Nitrile or rubber gloves; protective clothing	NIOSH/MSHA approved respirator
High Explosive Detonators	Safety goggles	Nitrile or rubber gloves; protective clothing made from cotton	None usually required

5.2 Explosives Storage

The Kiggavik Project is estimated to require a maximum of 10,000 tonnes per year of blasting materials during peak mining operations. The majority of this represents ammonium nitrate, which is not an explosive until mixed with fuel oil. For Kiggavik, to increase water resistance and the heave energy, a doped emulsion of 70/30 (70% Emulsion/ 30% AN) blend is recommended (see Technical Appendix 2B). Emulsions consist of an immiscible fuel mixed with a super saturated aqueous solution of ammonium nitrate (AN). Prills of AN can be blended with the emulsion. Emulsion and AN will be mixed in an on-site plant by qualified personnel on an as-needed basis.

All explosive materials will be stored in a designated explosives storage area away from other site facilities. AN will be stored in a warehouse in one tonne tote bags. High explosive detonators and blasting caps will be stored in a small enclosed magazine designed for this purpose apart from AN storage.

The explosives mixing plant will also be located in the designated explosives area. Although ammonium nitrate will be stored at Baker Lake prior to transport to the Project, this is not explosive until mixed with diesel fuel, therefore no active explosives will be stored at the dock site.

5.3 Explosives Use

Since the proposed open pits and underground deposits are some distance away from the explosives magazine, it will be necessary to transport prepared ANFO and blasting materials to the mine locations. Transport of ANFO and detonators will only be done by trained personnel on controlled roads under rigorous supervision.

Blasting will be carried out by a certified blasting contractor following blasting regulations and safety protocols and under the supervision of the mine supervisors.

The drilling of blast holes will be completed by mine personnel under the supervision of the mine supervisor and blasting contractor. Blastholes will be either 187 mm or 150 mm depending on final design considerations. Blasting operations will generally occur on a daily basis. Appropriate precautions will be taken to secure the area prior to blasting to ensure the safety of personnel. As well, precautions will be taken to minimize damage from flyrock and a blast clearance zone of 500 m from the pit crest has been set for the Kiggavik Project, as recommended by DFO (Technical Appendix 2B).

6 Radioactive Materials

6.1 Radioactive Sources

Kiggavik will use a number of nuclear substances and radiation devices that are designated as Class 7 dangerous goods. The nuclear substances or radiation devices will be used for instrument calibration, material analysis, flow and density measurement, level indication and 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.

The amount of radioactivity for the nuclear substance, or nuclear substance within a radiation device, shall not exceed:

- the possession limit for unsealed sources, or
- the maximum activity per sealed source or device approved by the CNSC.

6.2 Yellowcake Shipment

Air Transport in Canada is strictly regulated by Transport Canada - Canadian Aviation Regulations. The Packaging and transport of radioactive materials is subject to the Transport Canada Dangerous Goods Regulations and the Canadian Nuclear Safety Commission (CNSC) Packaging and Transport of Nuclear Substances Regulations (PTNSR). All transporters of radioactive materials in Canada require their own Radiation Protection Program.

The use of Hercules Aircraft is envisioned to transport yellowcake by air. Uranium ore concentrate would be flown from the Kiggavik airstrip likely to Points North, Saskatchewan, a distance of 800 kilometres.

Up to 4,000 tonnes of yellowcake will be produced each year at Kiggavik. The yellowcake will be packaged in steel 55-gallon (206-litre) steel drums and sealed meeting IP-1 industrial package requirements as specified in the *IAEA Regulations for the Safe Transport of Radioactive Material.* Each drum will hold approximately 434 kg of concentrate (e.g., 454 kg gross/drum minus 19.6 kg steel) or 313 kg U (based on a concentrate at 72% U).

The site will produce between 11,000 and 12,000 drums of yellowcake annually, which will be securely stowed within 20-foot ISO containers. The containers will remain sealed during transportation from the mine site to the final point of delivery.

It is expected that between 310 and 355 containers will be shipped to the south annually. Air shipment of all product containers from Kiggavik would require 6 or 7 trips per week (one container per flight). On arrival in southern Canada, yellowcake will be transferred from aircraft to truck - trailer or rail and then transported to a North American refinery or to the Port of Montreal for shipment to a European destination.

Companies who ship yellowcake require an approved Emergency Response Assistance Plan (ERAP). These plans are reviewed and approved annually by Transport Canada. These plans specify emergency response responsibilities, procedures, personnel training, response team roles, and available resources. ERAP are exercised annually and can be limited or multi-agency in scope and include live exercises.

7 Hazardous Waste

7.1 Waste Management

Waste materials such as recyclable and non-recyclable domestic wastes, sewage, industrial wastes, chemically/radiologically contaminated wastes, and hazardous wastes will be identified, handled and disposed of according to a waste management program. Each waste category will have its own waste management strategy that will be specifically designed for that particular waste product (see Technical Appendix 2S Waste Management Plan). The management of hazardous waste including chemically and/or radiologically contaminated wastes is included here.

The waste management facilities will be routinely inspected and scanned for radioactivity to ensure proper disposal and handling of waste.

7.1.1 Chemical or 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 ultimately transferred within the Kiggavik TMFs as part of decommissioning activities.

7.1.2 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. 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 and licensed 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 designed with secondary containment systems and used to store waste hazardous materials until there is sufficient quantity for shipment offsite for recycling.

8 Hazardous Material Inventory Management

There are currently no road connections to Nunavut communities. All goods are shipped by annual sealift (July/August to September/October) or as air cargo. For the Kiggavik Project, reagents, fuel and supplies will be containerized and shipped to Baker Lake via barge and then transported to site by truck over a winter road. An all-season road between Baker Lake and the Kiggavik Project has also been retained as a project option. Yellowcake will be shipped out to southern Canada by airlift from the proposed Kiggavik airstrip.

The mine superintendent and mill manager are responsible for supervising the receipt, inspection, and recording of all material inventories at site. Records of received materials will be crosschecked against order requisitions.

8.1 Inventory Management

Hazardous materials arriving at the Project will be received at the warehouse and manifests checked to ensure accuracy in goods received. Warehouse personnel maintain an inventory on all materials received including where they are stored on site. Fuel deliveries will be metered automatically during transfer to the tank farm. Metered volumes will be reconciled against tank levels measured manually.

Warehousing personnel are responsible for manifesting and tracking outgoing shipments of yellowcake by air and adhere to strict protocols and TDG regulations. The Management of Isotopes procedure and a suite of work instructions, together with the radiation protection program are prepared pursuant to Section 3, General Requirements of the Nuclear Substances and Radiation Devices Regulations and the Nunavut's Mines Regulations. The Management of Isotopes Procedure address: authorization; regulatory requirements; authorized radioisotopes; inventory of radioisotopes; supervisory responsibilities; qualifications and training; theft, loss, unauthorized use; emergency procedures; submissions and approvals.

Environment department personnel are responsible for maintaining an inventory of used hazardous waste products such as waste chemicals, used equipment fluids, and waste oil. Waste hazardous materials will be stored in a designated area that provides means of appropriate containment.

8.2 Inspection

Routine inspections are conducted to confirm conformance with requirements of the Waste Management Plan and the Environmental Management Plan. Inspections of hazardous material

storage areas, fuel tanks and fuelling stations, power generation plant, mill process equipment, and explosives storage areas will be conducted on a regular basis. All inspections will be logged with the date and time of the inspection, facility inspected, and the name of the employee making the inspection.

The environment department will conduct routine daily inspections of hazardous material storage areas, fuel tank farms, bulk chemical storage areas, and effluent pipelines and ponds to ensure any hazards or leaks are identified, repaired, and spill response is initiated as soon as possible. The environment department is responsible for the management of the hazardous materials waste products storage area. Inspection will ensure materials are accurately labelled and stored in appropriate containers according to manufacturer specifications.

Mill operations and maintenance personnel are responsible for inspecting storage tanks, process circuit piping, valves, and sumps daily and are required to report any issues to the mill manager. A significant spill of a hazardous material will trigger Emergency Response Procedures and the Spill Contingency Plan will be initiated.

The explosives contractor will be responsible for the inspection of all explosives facilities and the safe operation of all explosives equipment. Weekly reports to the mine superintendent detailing total explosives consumption, ammonium nitrate remaining onsite, other explosives, and safety concerns or incidents will be required.

8.3 Records

Inspection forms are used to document findings and actions required. These forms provide a record of leaks, spills, alarm tests, and non-compliance deficiencies. Regulations require that for certain hazardous materials, such as explosives, annual quantities present and used at the mine site are tracked. These forms will be compiled electronically and used internally as an operational management tool to promote continuous improvement in environmental performance and stewardship.

9 Training

9.1 Orientation

All personnel at camp, including AREVA employees, contractors, and visitors, will be given formal orientation upon arrival at site. The Spill Contingency Plan is reviewed during orientation by the SHEQ Group or designate including the location of the Material Safety Data Sheets, the location of spill kits, and additional supplies and tools. Training for spill contingency consists of alerting all personnel to be watchful for any leaks or spills and where these are most likely to occur, instruction in the use of equipment and materials, introduction to the protocol of chain of command, and the legal requirement to report certain spills as well as how to collect, store, and dispose of products safely and correctly.

Knowledge of handling, usage, and storage of hazardous materials is essential in the protection of workers. The Workplace Hazardous Materials Information System (WHMIS) is a three-component system that was developed in conjunction with government, labour, and industry to protect workers against exposure to hazardous materials. A material safety data sheet (MSDS) is provided for each of the currently 983 products classified as hazardous materials on site at the McClean Lake Operation. The site maintains an electronic database of all MSDSs and printed copies are maintained where computer access is unavailable. Similarly for the Kiggavik Project, all workers will be provided WHMIS training during orientation and MSDSs will be made available to all personnel.

9.2 Additional Training

All employees and contractors handling hazardous materials are to be familiar with this Plan, MSDS sheets, spill response resources at hand, the Spill Contingency Plan, and to be trained for initial spill response methods.

The following training will be administered by the SHEQ Group as it applies:

- WHMIS
- Emergency and spill response
- AREVA's fuel handling procedures (Spill Contingency Management Plan and Hazardous Materials Management Plan)
- Personal protective equipment (PPE)
- Transportation of dangerous goods (TDG)

Additional training will be provided to mill operations employees specific to their area of work and duties including safe operating practices, safe handling and storage of chemicals, and use of PPE. This training is the responsibility of AREVA. Employee training will be recorded, tracked, and kept up to date.

10 References

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