



Kiggavik Project Environmental Impact Statement

Tier 3 Technical Appendix 2S

Waste Management Plan

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1 INTRODUCTION

The AREVA Resources Canada Inc. (AREVA) Waste Management Plan (Plan) applies to the Kiggavik Project (Project) located approximately 80 km west of Baker Lake. The Plan will be in effect during the construction, operation, and decommissioning of the mine. In addition, the Plan will be made available to operational remote areas, the Project, AREVA's Baker Lake office and AREVA's corporate office.

1.1 PURPOSE AND SCOPE

The development of the waste management program is based largely on proven methods used at AREVA's McClean Lake Operation located in Northern Saskatchewan as well as at recent mining operations in Nunavut and NWT. The Plan describes the Project's planned waste facilities and waste management throughout construction, operation and decommissioning. Waste generated by the project includes domestic, industrial and chemically/radiologically contaminated wastes, sewage, and incinerator ash. The Plan also covers waste oil suitable for incineration however the management of all other hazardous wastes can be found in the Technical Appendix 2U (Hazardous Materials Management Plan). In the context of the Plan, waste does not include process waste streams such as effluent, mill tailings, or mine rock.

The Plan will be reviewed on an annual basis and updated as required to keep the information current and consistent with regulatory and procedural changes. Any changes and/or amendments to the Plan will be submitted to the appropriate regulatory agencies for approval.

1.2 ACTS, REGULATIONS AND STANDARDS

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

- Canadian Environmental Protection Act
- Northwest Territories Environment and Natural Resources Used Oil and Waste Fuel Management Regulations
- Nunavut Environmental Guideline for Industrial Waste Discharges
- CCME Canada-Wide Standards (CWS) for Dioxins and Furans
- CCME CWS for Mercury
- Environment Canada Technical Document for Batch Waste Incineration

1.2.1 Canada-Wide Standards

The CWS for Dioxins and Furans and the CWS for Mercury outlines emission limits and reporting requirements in efforts to reduce national emissions. The standards encourage facilities to use pollution prevention, waste segregation and diversions to achieve the limit of emissions.

Canada-Wide Standards for Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic, persistent, bioaccumulative, and result predominantly from human activity. Due to their extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under the *Canadian Environmental Protection Act (CEPA)*, the federal *Toxic Substances* (CCME, 2000).

Canada-Wide Standards for Mercury

Mercury is a natural and persistent bioaccumulative element which can be transported many miles in the atmosphere, mercury can have impacts many years and many miles removed from its original source. A common thread through all mercury impacts is that deposition to waterbodies from anthropogenic emissions poses a threat to human and ecosystem health, and that reduced deposition will contribute, in time, to reduced impacts (CCME, 2000).

1.2.2 Technical Document for Batch Waste Incineration

The EC Technical Document for Batch Waste Incineration provides guidance in order to meet the CWS for Dioxins and Furans and the CWS for Mercury. This guidance includes proper system selection, operation, maintenance and record keeping.

1.2.3 Used Oil and Waste Fuel Management Regulations

The NWT Used Oil and Waste Fuel Management Regulations apply to the storage, handling and disposal of used oil and waste fuel and includes sampling, records and reporting requirements.

According to the regulations, used oil is any oil, including lubrication oil, hydraulic fluid, metal working fluid and insulating fluid, that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, but does not include waste oil derived from animal or vegetable fat, a petroleum product spilled on land or water or waste from a petroleum refining operation (NWT, 2003).

Waste fuel means a flammable or combustible petroleum hydrocarbon, with or without additives, that is unsuitable for its intended purpose due to the presence of contaminants or the loss of original properties, and includes gasoline, diesel fuel, aviation fuel, kerosene, naphtha and fuel oil, but does not include paint, solvent or propane (NWT, 2003).

1.3 EXPECTED WASTES AND FACILITIES

As shown in the Project Description, Table 1.3-1 provides a summary of waste materials expected to be generated at the site. These quantities have been estimated based on the Project Description and by bench-marking against the AREVA McClean Lake site.

Waste facilities planned for the project include two industrial landfills, contaminated landfill and incinerator. The industrial landfills will be located on the edge of the Kiggavik and Andrew Lake clean waste rock piles while the contaminate landfill will be located on the perimeter of the Tailings Management Facility (TMF). It is planned that the incinerator building will be located near the accommodation complex and will house a double chamber, controlled air incinerator.

Table 1.3-1 Predicted Waste Material Quantities

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

2 MANAGEMENT PLAN

2.1 WASTE SEGREGATION

Wastes have been organized into designated categories. Each waste category has its own waste collection container and waste management facility, which is designed specifically for that particular waste product. The three R's of waste management; reduce, reuse, and recycle; will be encouraged within the waste management program to minimize the quantity of waste placed in the landfill or incinerated.

Waste must be sorted at the source by the waste generator before it can be disposed of in, or transported to, specific designated areas for proper disposal. Waste collection areas will consist of multiple bins for different types of waste, each bin will be clearly marked or color coded for domestic, industrial or contaminated materials. A similar system to the AREVA McClean Lake Operation will be followed which currently includes using recycling bins for recyclables, blue dumpsters for non-recyclable domestic waste, orange dumpsters for industrial waste and yellow dumpsters for contaminated waste. Garbage bags may also be color coded to identify contaminated materials. Proper waste segregation helps in limiting the dioxin, furan and mercury emissions from the incinerator.

A full set of operating procedures specifying how waste is collected and disposed of will be developed prior to start up. Training on waste management procedures will be provided to AREVA personnel and onsite contractors during site orientation. Refresher training will also be provided as required when there are regulatory or operational changes to procedures.

In order to ensure the appropriate designation for waste, source criteria will be used to aid identification and sorting as follows.

2.1.1 Domestic Waste

Domestic waste is defined as general waste materials originating from the accommodation complex and offices. Throughout construction and operation domestic wastes will be sorted into recyclables and non-recyclables and collected either in dumpsters or recycling containers distributed around the site.

Recyclable materials may include drinking containers (glass, metal and plastic), computer components, electronics, printer and ink cartridges, re-chargeable batteries, alkaline batteries and fluorescent light bulbs. Recyclables will be sorted and transported off-site to the appropriate recycling facility.

Non-recyclable domestic wastes, such as food wastes, clean wood, organic matter, paper and cardboard will be incinerated. Food wastes will be placed in sealed plastic bags and placed inside sealed containers until they can be transported to the incinerator building for immediate incineration. This will minimize the likelihood of attracting wildlife.

During marine transportation a similar recycling program will be in place as well as onboard incineration for domestic waste.

2.1.2 Industrial Waste

Industrial waste consists of bulk waste materials that are non-combustible and non-contaminated originating from construction and operations. Industrial waste will be reused or recycled wherever possible. The remaining waste will be land filled in designated areas of the Kiggavik and Andrew Lake clean waste rock piles. Examples of industrial waste include piping and fittings, treated wood, drywall and tires.

2.1.3 Chemically/Radiologically Contaminated Waste

Chemically/radiologically contaminated waste materials originate from the mining, milling and water treatment areas and may include used disposable coveralls, PPE and used sample containers. Contaminated material is collected in dumpsters available throughout the site and deposited in the contaminated landfill located at the perimeter of the TMF.

2.1.4 Sewage

Throughout operations, the preferred disposal method for solid sewage is to dispose of it on site in a dedicated sewage disposal area; the composted material would later be used in selected areas as a soil amendment for site re-vegetation. However, as sewage sludge may have the potential of attracting wildlife, AREVA may consider burying the sewage sludge under mine rock or incinerating the sewage sludge and bury the ashes as other mines have done. Treated sewage effluent will be combined with the water treatment plant discharge (after monitoring) and discharged to Judge Sissons Lake. Sewage effluents will meet the Nunavut Public Health Regulations and any requirements stipulated by the Nunavut Water Board and the CCME Municipal Effluent Guidelines.

Sewage at the Baker Lake dock and storage facility will be contained in an above-ground tank and hauled as needed to the Baker Lake community sewage lagoon.

During the construction phase, sewage will be incinerated.

2.1.5 Used Oil and Waste Fuels

Used oil and waste fuels will be collected and stored in approved containment facilities. Used oil will be sampled to ensure it meets the requirements of the Northwest Territories Used Oil and Waste Fuel Management Regulations and is not radiologically contaminated prior to being incinerated. Used oil that does not meet these requirements or is radiologically contaminated will be removed from site by a licensed carrier and delivered to a licensed receiver for recycling. During the construction phase, prior to the installation of the dual chamber incinerator equipped with a waste oil burner, all oil and waste fuels will be shipped off-site to a licensed facility.

2.1.6 Incinerator Ash

The incinerator will be operated in compliance with all applicable federal, territorial and local regulations. Ash resulting from the incineration of solid waste will be tested as required by the Environmental Guidelines for Industrial Waste Discharges (D of SD, 2002) and disposed of in the industrial landfills. Ash that does not meet these guidelines will be disposed within the TMF.

During construction, incinerated ash will be collected in drums and shipped offsite to a licensed facility or stored onsite until the industrial landfill is in operation.

2.1.7 Hazardous Substances and Waste Dangerous Goods

Hazardous Substances and waste dangerous goods will be collected in designated drums, tanks and other approved containers and shipped offsite for disposal at a licensed facility throughout construction and operation. Additional information on handling and disposal of hazardous substances and waste dangerous goods can be found in the Technical Appendix 2U (Hazardous Materials Management Plan).

2.2 INCINERATOR PERFORMANCE AND OPERATION

The Project will select and operate the appropriate incinerator following the EC Technical Document for Batch Waste Incineration.

2.2.1 Incinerator Technologies, Facilities and Equipment

It is proposed to use a dual chamber, controlled air incinerator. The incinerator will be designed to achieve the Canada-Wide Standard for Dioxins and Furans immediately upon installation. As PCDD/F are destroyed at temperatures in excess of 600°C the incinerator will be equipped with a large secondary chamber able to provide a residence time of at least one second at a temperature higher than 1000°C to ensure complete combustion and minimize PCDD/F emissions. The incinerator stack will have appropriate sampling ports to allow stack sampling. Stack sampling will be conducted periodically to confirm conformance with the CWS for Dioxins and Furans and the CWS for mercury. To reduce the potential of attracting wildlife and ensure

the incinerator burns at a consistent and optimal temperature throughout the year the incinerator will be located in a purpose built, heated building.

The incinerator will also be equipped with a used oil burner in the secondary chamber to reduce the quantity of fuel needed to operate the incinerator. Used petroleum products such as heavy lubricants and engine oil will be incinerated in the used oil furnace. Use of the waste oil burner will be in compliance with the NWT *Used oil and Waste Fuel Regulations* (NWT, 2003). Samples of the waste oil will be taken to ensure it is within the allowable impurity limits and has an acceptable flashpoint. It is required that waste oil/waste fuel in excess of the impurity limits or with a flash point less than 37.7 degrees Celsius are not burned or blended with other waste oil/waste fuels.

In order to monitor the incineration process and ensure the unit is burning at the optimal parameters the incinerator will be equipped with appropriate monitoring equipment which may include temperature probes, differential pressure meters and auxiliary fuel flow. The monitoring equipment will be capable of maintaining a continuous log of the data recorded. This data will be retained and available for inspection as necessary.

All marine incinerators will meet IMO MEPC76 (40) standards. They will be capable of handling solid waste, including domestic waste, oil waste and in most cases sewage. Modern marine incinerators operate at very high combustion temperatures in the range of 850° - 1200° C. Automatic combustion controls and rapid cooling of exhaust gasses maintain emissions within stringent limits of IMO MEPC.76 (40). Waste generated by tugs will be minimal and will consist of residual ash from incineration amounting to less than 10% of the total waste onboard. This residual ash will be sealed in heavy duty fabric containers loaded into a designated waste shipping container which when filled or at the end of the season will be shipped south as backhaul and disposed of at an approved receiving facility at a southern port.

2.2.2 Incinerator Operation

A full set of operating procedures specifying how to operate the incinerator will be developed prior to start up. Incinerator operation will be conducted in accordance of the EC Technical Document for Batch Waste Incineration which includes but is not limited to:

- Separating waste according to its heating value.
- Mix waste from each category to achieve the manufacturer's specified input calorific value.
- Remain present to supervise the beginning of the burn cycle to ensure unit is working optimally.
- Ensure charging door remains closed until after the burn is complete and the unit has cooled down.
- Remove ash from previous burn cycle before reloading the incinerator.
- Transport waste immediately prior to incineration as accumulation would attract wildlife.

- Incineration to take place several times daily

2.3 LANDFILL MANAGEMENT

2.3.1 Industrial Landfills

Industrial landfills will be located in a designated area of the Kiggavik and Andrew Lake permanent mine rock piles. Industrial waste will be deposited in a pit or trench such that industrial material is not accumulated at grade. This will ensure material is protected from wind, minimizing the spread of debris. The landfill will be covered with soil periodically to further limit exposure to wind. To avoid attracting wildlife, only odourless and non-putrescible materials are permitted for disposal in the industrial landfills. The industrial landfills will be inspected regularly to ensure proper waste segregation and monitor any wildlife presence.

Contact water at the Project site will be intercepted, contained, analysed and treated when required. Contact water is defined as any water that may have been physically or chemically affected by site activities and includes surface runoff and shallow drainage from the unlined clean rock piles.

In order to minimize the amount of contact water diversion channels and snow fences will be installed around the Site. Snow may also be cleared and removed from the industrial landfills prior to the spring melt. Drainage channels will be located around mine rock piles to collect runoff water for passive treatment in unlined sedimentation ponds to reduce potential suspended sediment loads prior to releasing flow to the natural receiving drainages. All water released into the environment will meet the discharge quality criteria.

2.3.2 Contaminated Landfill

Chemically/radiologically contaminated waste will be deposited at the bottom of a pit or trench located at the perimeter of the TMF, which will provide protection from wind. Material that is deposited at the surface should be covered to prevent wind blown debris. Periodically the contaminated landfill will be capped with glacial till to prevent infiltration of precipitation, minimize windblown material and provide shielding from radioactive materials. The location allows for rainwater, snow and spring freshet to drain directly into the TMF.

3 TRAINING

AREVA personnel and contractors working at the Project site will be trained in waste management. This training will be included in the site orientation given to AREVA personnel and contractors upon their arrival at site. The orientation will include the types of wastes produced at site and the appropriate waste disposal bins and dumpsters i.e. blue bins for non-recyclable domestic waste. Signage will also be placed in and around the Project site for clear identification of waste disposal facilities. Additional training will be given to AREVA personnel and contractors as required following regulatory or procedural changes, identification of misdirected waste or wildlife presence at waste facilities.

As listed in the Technical Document for Batch Waste Incineration, incinerator operators will be trained by the incinerator supplier or manufacturer. The training course will include the following elements:

- System safety including identification of hazards that the operator should recognize;
- Waste characterization and how waste composition can affect operation;
- Loading limitations, including materials that should NOT be charged to the incinerator, and the allowable quantities of different types of wastes that can be charged;
- Start-up procedures for the incinerator and the normal operation cycle;
- Operation and adjustment of the incinerator to maximize performance;
- Clean out procedures at the end of the cycle;
- Troubleshooting procedures;
- Maintenance schedule; and
- Record keeping and reporting.

Supervisors will also be involved in the training session so that continuity can be maintained with different operators.

4 MONITORING

Monitoring of the Project's waste management program will be conducted primarily by the Environment and the Radiation Groups. Monitoring will include inspections of waste collection areas and waste facilities, preparation and shipment of waste oil and ash samples, incinerator emissions testing, air quality monitoring and contact water sampling.

4.1 INSPECTIONS

The Environment Group will conduct regular inspections of the waste collection areas in and around the accommodation complex and mill site and of the waste facilities. The Radiation Group will scan the contents of the industrial landfills and dumpsters in the vicinity of the mill to confirm that contaminated and uncontaminated wastes are disposed of appropriately. During inspections of the waste disposal areas and facilities the Environment Group will be looking for:

- Proper segregation of waste at the source
- Quantity of waste being disposed of in each facility,
- Windblown debris,
- Signs of wildlife near the landfills and incinerator

4.2 WASTE OIL SAMPLING

A sample of one month's feedstock of waste oil will be tested at least once a year. The Environment Technician will collect a grab sample from the waste oil tank and will ensure that is a representative sample which will be tested for flash point and the existence/amount of impurities. Table 4.2-1 shows the maximum levels of contaminants in waste oil that can be incinerated as per the *Used Oil and Waste Fuel Management Regulations* (NWT, 2003). Waste oil that contains an impurity listed in Table 4.2-1 in excess of the maximum level for that impurity or has a flashpoint lower than 37.7 degrees Celsius will not be blended, unless for the purpose of shipment to a licensed disposal facility, or incinerated.

Table 4.2-1 Used Oil Impurity Limits

Impurity	Maximum level Allowed in Used Oil
Cadmium	2 ppm
Chromium	10 ppm
Lead	100 ppm
Total organic halogens (as chlorine)	1000 ppm
Polychlorinated biphenyls	2 ppm

Waste oil which comes from potentially radiologically contaminated areas will be scanned by the Radiation Group. Waste oil which is radiologically contaminated will be properly packaged and shipped to the appropriate waste disposal facility as per the Hazardous Materials Management Plan.

The following will be recorded for the incineration of used oil as required by the *Used Oil and Waste Fuel Management Regulations* (NWT, 2003):

- Volume of used oil generated
- Volume of used oil incinerated/consumed
- Name and address of person in charge, management or control of the used oil
- Location of production of used oil
- A summary of maintenance performed on incinerator or processing equipment
- Volume and nature of the products produced from the used oil
- The destination of the used oil products shipped from the facility

4.3 INCINERATOR EMISSIONS TESTING

To confirm conformance with the CWS for Dioxins and Furans and the CWS for Mercury, periodic stack testing will be conducted and the results will be reported to regulatory agencies in the annual report. The Guideline maximums for dioxins, furans and mercury are summarized in Table 4.3-1.

Table 4.3-1 CWS Maximum Emissions

Activity	Emission	Maximum Concentration
Municipal Waste Incineration	Dioxins and furans	80 pg I-TEQ/m ³
Sewage Sludge Incineration	Dioxins and furans	80 pg I-TEQ/m ³
Municipal Waste Incineration	Mercury	20 µg/Rm ³
Sewage Sludge Incineration	Mercury	70 µg/Rm ³

Stack concentrations are corrected to 11% oxygen content for reporting purposes (CCME, 2000)

4.4 INCINERATOR ASH SAMPLING

In accordance with the Environmental Guideline for Industrial Waste Discharge incinerator ash will be sampled monthly and analyzed using a leachate testing method. The parameters that the ash will be tested for are summarized in Table 4.4-1. Incinerator ash which meets the guidelines will be disposed in the industrial landfills while ash that does not meet the guidelines will be disposed of in the TMF and the cause will be investigated.

Table 4.4-1 Standards for Solid Waste Residuals Suitable for Landfill

Parameter	Concentration (mg/L)
Arsenic	2.5
Barium	100
Cadmium	0.5
Carbon Tetrachloride	0.5
Chromium	0.5
Cyanide (free)	20
DDT	3
Endrin	0.02
Heptachlor + Heptachlor epoxide	0.3
Lead	5
Lindane	0.4
Mercury	0.1
Methoxychlor	10
Methyl ethyl ketone	200
Metolachlor	5
PCBs	50*
Selenium	1
Silver	5
Tetrachloroethylene	3
Toxaphene	0.5
Trihalomethanes	10
2, 4, 5-TP (Silvex)	1
Zinc	500

*based on concentration by mass (D of SD, 2002)

4.5 AIR QUALITY MONITORING

Senes has completed an assessment of the projected emissions from site operations. An air monitoring program will be established to ensure emissions are equivalent to or lower than those predicted. This will include monitoring of particulates ($PM_{2.5}$ and PM_{10}) that may result from incinerator operation.

4.6 CONTACT WATER SAMPLING

Contact water found in the sedimentation ponds around the Kiggavik and Andrew Lake clean waste rock piles will be sampled as necessary to confirm that it meets discharge quality criteria.

5 REPORTING

To show compliance with regulatory requirements an annual report will be submitted to the appropriate regulatory agencies. As outlined in the Technical Document for Batch Waste Incineration, the annual report will include at minimum:

- Quantity of waste disposed of in the industrial landfills, contaminated landfill or incinerated.
- Results of stack emissions testing, waste oil and ash sampling
- Description of any changes in operation which may effect waste management.
- A list of staff who have been trained to operate the incinerator, the type of training, dates of training, and dates of refresher courses
- Preventative maintenance conducted on equipment
- Records of operation of the incinerator
- Auxiliary fuel usage
- Amount of incinerator ash generated and disposal site

The National Pollutant Release Inventory (NPRI) is a legislated, publically available inventory of pollutant releases, disposals and transfers for recycling (EC, 2007). The NPRI outlines substances to be tracked and the associated reporting requirements. Table 5.1-1 summarizes substances to be tracked and the reporting requirements of the Project.

Table 4.6-1 NPRI Reportable Substances

Criteria Air Contaminant	Required to Report When:
Hexachlorobenzene	Always
Dioxins and Furans	
Nitrogen oxides (expressed as nitrogen dioxide)	Emissions are 20 tonnes or more per annum
Sulphur dioxide	
Carbon monoxide	
Total particulate matter	
Volatile organic compounds	Emissions are 10 tonnes or more per annum
Particulate matter with a diameter less than or equal to 10 micrometres (PM ₁₀)	Emissions are 0.5 tonnes or more per annum
Particulate matter with a diameter less than or equal to 2.5 micrometres (PM _{2.5})	Emissions are 0.3 tonnes or more per annum

6 CLOSURE

During closure of the Project site, waste facilities will be decommissioned and reclaimed to the as close to pre-existing conditions as possible. This will include dismantling the incinerator and the incinerator building. Materials will be recycled where possible, demobilized from site or disposed of in the industrial landfill. Compacted till cover, approximately 1 meter in depth will be constructed over the landfill. The surface of the Kiggavik and Andrew Lake clean waste rock piles will be regraded to blend in with the surrounding terrain, and re-vegetated. Sewage solids from the sewage management area may be composted and used in reclamation of the waste rock piles. Chemically/radiologically contaminated waste located in the contaminated landfill which cannot be recycled, cleaned or salvaged will be disposed of in the TMF.

For further details on site decommissioning refer to Technical Appendix 2R (Preliminary Decommissioning Plan).

7 REFERENCES

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