Attachment 21.4

Incinerator Management Plan

De Beers
GROUP OF COMPANIES

Gahcho Kué Project
Incinerator Management Plan

May

2013

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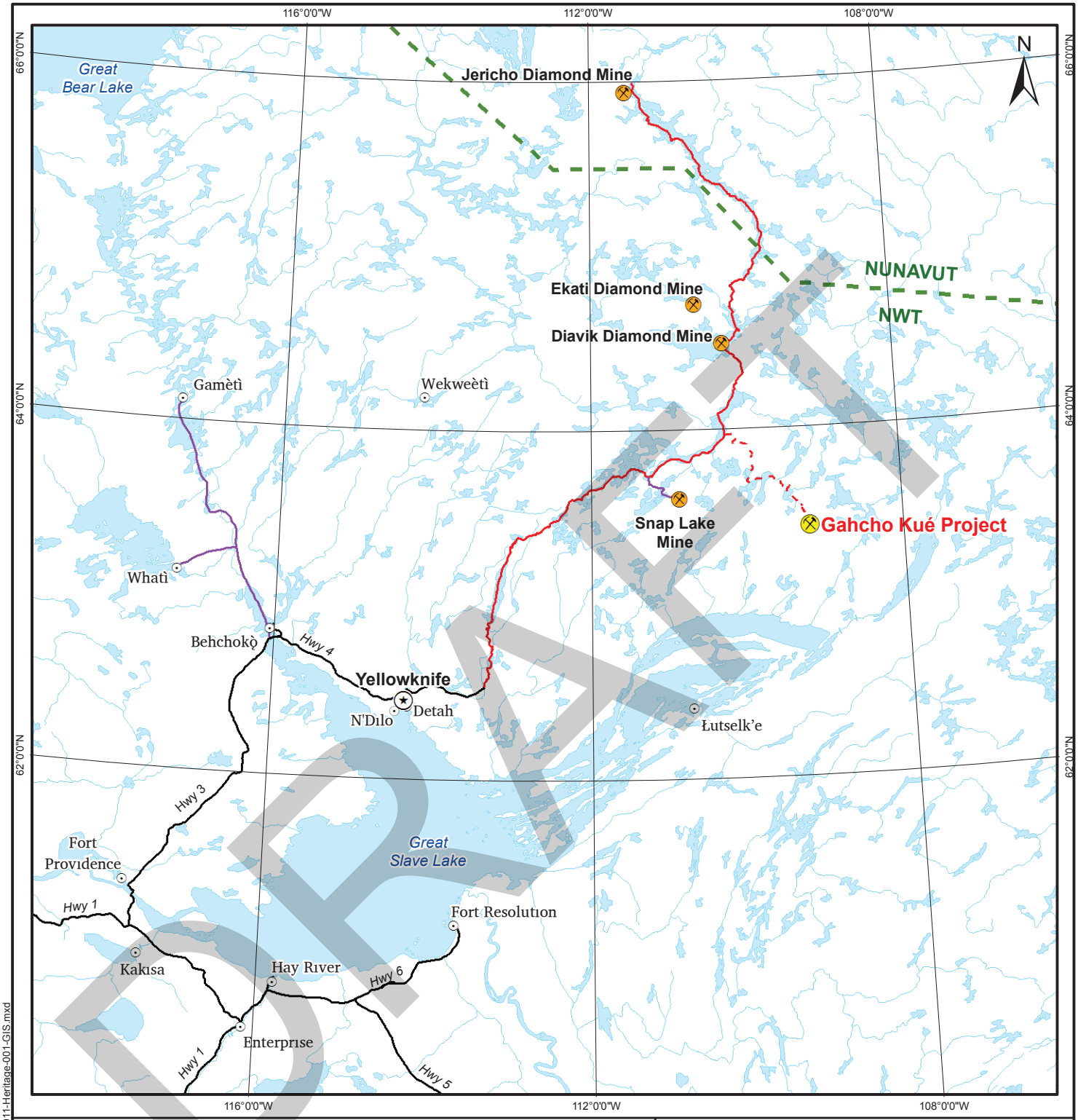
1 INTRODUCTION

De Beers Canada Inc. (De Beers) will conduct open pit mining, milling and associated activities at the Gahcho Kué Diamond Mine (Mine), located approximately 280 kilometres (km) northeast of Yellowknife, and approximately 80 km southeast of the Snap Lake Mine (Figure 1; centered at 63°25'48" N, 109°12'00" W). The three phases of the Mine life include construction (two years), operations (11 years) and closure (8+ years). Activities at the Mine will include:

- extraction of mine rock and ore from three locations (5034 Pit, Hearne Pit and Tuzo Pit);
- construction of berms and dykes for water management and dewatering/drawdown of areas within Kennady Lake;
- the development, operation and closure of site facilities and infrastructure (including the airstrip and pipelines);
- the use of water for construction, processing, operations and domestic purposes;
- disposal of waste and treated effluent;
- construction and operation of a winter road;
- the storage of fuel and explosives;
- exploration activities; and
- site closure, including progressive reclamation.

Further details on Mine activities are provided in the Consolidated Project Description (De Beers 2013a).

This document provides an initial conceptual IMP to support the Water License and Land Use Permit applications. The purpose of this document is to provide an overview of the activities involved in the operation of the incinerator at the Mine. This includes the operation of the incinerator and collection of data that will be used in the annual air quality monitoring report. The plan has been developed to align with the Environment Canada Technical Document on Batch Waste Incineration (Environment Canada 2009), and consistent with incineration management plans being produced for other developments in the north. This is a living document subject to ongoing review and revision.



LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary

NOTES
Source: Figure 1.1-1 in De Beers 2010
Base data source: The Atlas of Canada

GAHCHO KUÉ PROJECT

Location of the Gahcho Kué Project

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	
Scale: 1:3,500,000 (50 25 0 50 Kilometres)		
FILE No: B2012-Heritage-001-GIS		DATE: February 7, 2012
JOB NO: 11-1365-0012	REVISION NO: 8	
OFFICE: GOLD-CAL	DRAWN: JH	CHECK:

De Beers Canada

Figure 1

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2 LEGISLATION, REGULATORY AND POLICY REQUIREMENTS

The goal of the IMP is to comply with the applicable legislation and related corporate environmental policies and commitments that apply to the Project. In addition to the ambient air quality criteria for common combustion compounds (i.e., sulphur dioxide (SO_2), nitrous oxides (NO_X), and suspended particulates), there also exist Canada-Wide Standards for other combustion by-products, such as dioxins, furans, and mercury that may be released during on-site waste incineration. Documents that pertain to the incinerator include the Canada–Wide Standards for Dioxins and Furans (CCME 2001), the Canada-Wide Standards for Mercury Emissions (CCME 2000) and the Technical Document for Batch Waste Incineration (Environment Canada 2009).

A summary of the Canada-Wide Standards for dioxins, furans and mercury is presented in Table 1 and these apply to waste incineration at new facilities such as the Project. Compliance with the Canada-Wide Standards requires that the best economically achievable and available control techniques and equipment be used. This will include modern incineration equipment and an intentional waste management program.

Table 1 Canada-Wide Standards for Waste Incineration Emissions

Municipal Waste Incineration Compound	Emission Limit
Dioxins and Furans[(a)]	80 picograms of International Toxic Equivalents (I-TEQ) per cubic metre (*p*g/m^3)
Mercury[(b)]	20 micrograms per cubic metre (µg/m^3)

(a) CCME 2001.

(b) CCME 2000.

3 OBJECTIVES

This management plan has been developed to address the following objectives with specific relevance to emissions as they apply to the use of a waste incinerator:

- demonstrate compliance with applicable Federal and Territorial ambient air quality standards;
- track trends in ambient air quality and emissions;
- outline operational practices for the incinerator;
- reduce the amount of waste incinerated;
- document fuel use as it relates to air quality management;
- document frequency and operating parameters of the incinerator including the quantity and type of waste incinerated; and
- outline reporting requirements.

By calculating and reporting annual incinerator combustion emissions, De Beers can determine whether operational emissions are at, or below, these standards, and track changes in the use of the incinerator.

4 STRATEGIES AND PROCEDURES FOR WASTE INCINERATION

4.1 MITIGATION AND WASTE REDUCTION

An initial waste audit will be conducted at the Project to identify areas where the volume of waste that is generally incinerated can be reduced. When it is appropriate, materials will be reused and/or recycled to minimize the amount of waste sent to the incinerator. De Beers will incorporate mitigation that will be integrated into the operations phase of the Project to minimize dioxins, furans, and mercury emissions. These will include, but are not limited to, the following:

- selection of highly-efficient combustion equipment;
- operation of the incinerator at optimal conditions (e.g., manufacturer recommended temperature, pressure);
- waste segregation policies;
- worker education;
- waste diversion methods to minimize dioxins, furans, and mercury emissions from the incinerator;
- on-site recycling programs; and
- development of management plans to guide actions and documentation needs around air quality.

Implementation of these policies and practices demonstrates De Beers' ongoing commitment to reducing emissions through the use of the best available, economically feasible, technology, and systems.

4.2 EQUIPMENT AND INSTALLATION

De Beers will select an incinerator that is capable of reducing camp wastes satisfactorily while producing emissions that are compliant with the Canadian standards for batch waste incineration. The incinerator will be located inside a building to protect the equipment from external environmental conditions. Air will be provided in sufficient supply and the incinerator will be operated in a manner to ensure that low-temperature operating problems do not occur. In addition, combustible materials will be located away from the incinerator.

The incinerator will be a dual-chamber controlled air incinerator with a two-second retention time in the secondary chamber at a temperature of at least

1,000 degree Celsius (ºC). When proper operating procedures are followed, the incinerator will be capable of meeting the Canada-wide Standards for dioxins/furans (CCME 2001) and mercury (CCME 2000). Stack testing will be carried out as required to demonstrate that the regulatory limits are being met.

A scale will be used to measure the weight of all material that will be placed in the incinerator. Weights and waste types will be recorded and mixed appropriately to maximize combustion efficiency. The incinerator will also be equipped with an internal computerized process control and data acquisition system to monitor the operating parameters of the incinerator.

4.3 TRAINING

Operators will be trained in the following areas before they can operate the incinerator:

- hazard recognition;
- waste types and how waste composition affects operation;
- load limitations;
- normal incinerator start-up and operating procedures;
- normal operating parameters and adjustment procedures to maximize incinerator performance;
- clean-out procedures;
- troubleshooting procedures;
- maintenance schedule; and
- record keeping and reporting.

4.4 OPERATION

Wastes will be separated according to their heating values. Heating value refers to the amount of energy that will be released as the waste is combusted. To facilitate this separation, all wastes will be collected in transparent bags or other bags that indicate the bag's contents. Waste bags will be selected and mixed to achieve the manufacturer's specified input calorific value. Verification of correct mixing procedures will be assured through spot checks by appropriate, trained personnel from Project's management team.

As per Environment Canada (2009), the typical operation of the incinerator is expected to be as follows:

- The incinerator will be loaded and the burn cycle started.
- The start cycle will be observed for at least 15 minutes after ignition of the primary chamber burner to ensure the primary and secondary chambers operate in the temperature range specified by the manufacturer.
- When the run is completed and the unit has cooled, the ash will be removed from the incinerator before reloading the incinerator for the next burn cycle. Ash collected from the incinerator will be tested for toxicity and disposed in accordance with waste management practices as defined in the Hazardous Materials and Waste Management Plan (De Beers 2013b) and the Non-hazardous Solid Waste Management Plans (De Beers 2013c).
- Any unburned materials found in the ash will be added back into the incinerator after the air ports are cleaned.

4.5 HANDLING AND DISPOSAL OF INCINERATOR RESIDUES

Protective equipment will be used when handling the ash from the incinerator. The ash will be removed from the incinerator and placed in covered metal containers for transport to the disposal site. The ash will be weighed and recorded, and tested for toxicity prior to disposal.

The disposal site will be dependent on the results of a Toxic Characteristics Leaching Procedure (TCLP) (e.g., USEPA 1992). If the ash is characterized as non-toxic, it will be disposed in the Mine landfill. If the ash is characterized as toxic, it will be stored in suitable sealed containers in the waste transfer area prior to off-site removal for disposal, in accordance with the Hazardous Materials and Waste Management Plan (De Beers 2013b).

5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality (APHA. 2012). Since QC procedures implemented as part of the IMP are variable and program-specific, the procedures have been summarized in this section on a program-component basis.

The QA/QC procedures for incineration include the following:

- an accredited laboratory will be used for analysis of sampled emissions during monitoring;
- samples will be collected consistent with detailed written operating instructions from qualified personnel;
- qualified personnel will calculate emission concentrations for monitored air quality parameters based on laboratory results; and
- incinerator operational data including temperature, differential pressure in the primary chamber, auxiliar burner operation, fan amperage and interlocks status during start-up, operation and cool-down for every cycle at one-minute resolution will be recorded continuously at a one-minute frequency consistent with detailed written operating instructions from qualified personnel.

6 EMISSION ESTIMATE METHODS

This section describes three methods that can be used to estimate emissions (depending on the compounds). The methods are:

1) using a mass balance approach;

2) using an emission factor approach (published or calculated); or

3) using available intermittent source stack testing data.

The mass balance approach is based on the law of conservation of mass in a system. Essentially, if there is no accumulation within the system, all the materials that go into the system must come out. Fuel analysis data is a good example of the mass balance approach in predicting emissions. For example, if the sulphur content of a fuel is known, then the emissions of sulphur (in the form of SO_2) can be calculated by assuming that all of the sulphur in the gas is emitted from the system.

The second approach proposed for estimating emissions is the use of emission factors. Emission factors are available for many emission source categories and are based on the results of source tests performed at one or more facilities within an industry. An emission factor is the contaminant emission rate relative to the level of source activity. Generic emission factors are commonly used when site-specific source monitoring data are unavailable.

The use of source-specific stack testing data is appropriate for emission sources or compounds that may be difficult to characterize using either mass balance or emission factors. A stack test measures the amounts of specific compounds present in the stack exhaust gas.

The following sections provide additional information about how incinerator emissions will be determined

6.1 DIOXINS, FURANS, AND MERCURY CALCULATION METHODS

The emissions of dioxins, furans, and mercury in the Project incinerator will be highly dependent on the quantities and types of waste that will be burned. For this reason, emission estimates based on mass balance or emission factors are difficult to calculate. The proposed approach for estimating emissions from the incinerator is to use intermittent stack sampling.

6.2 FUEL USE AND WASTE SUMMARY

Fuel usage for the Project combustion sources will be documented monthly and presented in the annual air quality monitoring report. In addition to fuel usage at the site, the amount of waste burned in the incinerator will be provided in the annual report. A summary table for tracking waste tonnage and liquid fuel use in the incinerator is presented as Table 2.

Table 2 Summary Table for Tracking Monthly Waste Tonnage Burned (tonnes) and Liquid Fuel Usage (cubic metres [m^3])

Month	Waste Tonnage Burned	Liquid Fuel Usage	Total	201* Total
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Total				

7 REPORTING AND RECORD KEEPING

A maintenance log is required to be kept for regulatory review. The maintenance log should record routine maintenance activities, date completed, and by whom, any problems encountered, and any other relevant information. Any upsets or equipment failures should also be recorded. The maintenance log should also include a description of any maintenance or operational changes, the date the work was completed, and who performed the work. As part of the maintenance, operators/maintenance personnel should determine the cause of any failure to help avoid or reduce similar failures.

Operational data will be collected by a data logger and stored, at a minimum, every minute, even when the incinerator is not operating. The data is used to monitor operating conditions to ensure that normal operating parameters are not exceeded. In the event that normal operating conditions are not met, the data will be used to identify causes of failure and to optimize the system.

Prior to incineration, the type of waste in each bag will be determined, weighed and the source noted. The total weight of each type of waste will be recorded before the burn cycle is started. After the cool-down period, the ash will be removed and weighed before it is sent for disposal. This information will be stored electronically with the operational data from the incinerator. This data will also assist De Beers in determining incinerator waste generation rates at the facility, and in turn, provide data on the effectiveness of waste diversion, reduction and recycling programs.

De Beers will be required to submit an annual air quality monitoring report. To facilitate the reporting requirements for the incinerator, the incinerator reporting will be included as a component of this report. The following information will be included in the annual air quality report:

- a summary of waste incinerated, including the monthly quantity and type of waste;
- a summary of operational data that is continuously recorded all year regardless of the operational status of the incinerator. Important operational data includes temperature, carbon monoxide and oxygen levels, differential pressures, and auxiliary burner operating times;
- a summary of ash disposal, including weights, where the ash was disposed, and the name of the operator for any particular load along with notes on observations or problems experienced with the load;

- a record of any use of auxiliary fuel, (the fuel log book and the receipts for fuel shipments should be kept for verification by regulators);
- a record of staff that have been trained for use of the incinerator, including the specific training that was provided, when the training was conducted, and who conducted the training;
- any major changes to the operation of the incinerator; and
- the results of any testing undertaken on the stack emissions or ash.

All raw data records from the operation of the incinerator will be retained by De Beers for at least two years in electronic format.

8 INCINERATOR MANAGEMENT PLAN REVIEW

The IMP will be reviewed annually by De Beers and updated as required.

9 REFERENCES

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10 ACRONYMS AND GLOSSARY

10.1 ACRONYMS AND ABBREVIATIONS

CCME	Canadian Council of Ministers of the Environment
De Beers	De Beers Canada Inc.
EIS	environmental impact statement
IMP	Incinerator Monitoring and Management Plan
Mine	Gahcho Kué Diamond Mine
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NO_X	oxides of nitrogen
Project	Gahcho Kué Project
QA	quality assurance
QC	quality control
SO_2	sulphur dioxide
Water License	Class A Water License

10.2 UNITS OF MEASURE

°C	degrees Celsius
I-TEQ	International Toxic Equivalents
km	kilometre
m^3	cubic metres
*p*g/m^3	picograms per cubic metres
µg/m^3	micrograms per cubic metres

10.3 GLOSSARY

Air Emission Standard	The maximum legal quantity of pollutant permitted to be discharged from a single source.
Dioxins	A variety of chemical compounds that can be described by the chemical formula: $C_4H_4O_2$.
Furans	One of a group of colorless, volatile, heterocyclic organic compounds containing a ring of four carbon atoms and one oxygen atom.
Mercury	A heavy, silvery potentially toxic transition metal.
I-TEQ	International Toxic Equivalency Quotients (relative to 2,3,7,8 tetrachlorodibenzo-para-dioxin) are internationally established (through NATO) multiplication factors that are used to collectively express the toxicity of various dioxins, furans and co-planar PCBs (polychlorinated biphenyls) to humans, mammals, fish and birds relative to most toxic of these substances: 2,3,7,8-tetrachlorodibenzo-para-dioxin. The multiplication factors range from 0.000001 to 1.000000.
Waste incinerator	A combustion chamber that incinerates biological, medical, hazardous chemicals, household waste, etc. and converts them to ashes.