DE BEERS
CANADA

GAHCHO KUÉ PROJECT

April 2, 2012 File: S110-01-08

Chuck Hubert
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife NT X1A 2N7

Dear Mr. Hubert:

Environment Canada & Government of the NWT Joint Information Request Responses - Gahcho Kué Project Environmental Impact Review

De Beers is pleased to provide the Mackenzie Valley Environmental Impact Review Board with responses to the joint Information Requests submitted by Environment Canada and the Government of the Northwest Territories.

Sincerely,

Veronica Chisholm

Veronica Chisholm
Permitting Manager

Attachment

c: D. Ash, A/Regional Director, Environmental Protection Operations
L. Ransom, Environmental Assessment Analyst, Government of the NWT
L. Lowman, Senior EA Coordinator, EA & Marine Programs Division, EC

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: EC&GNWT_1

Source: Environment Canada and Government of the Northwest Territories (EC&GNWT)

Subject: Air Quality Modeling -- Input and Output Data

Terms of Reference Section: 5.2.2

Preamble

The quality of model predictions is dependant on the quality of the input data used in the model. The selection of model options and the configuration of model domains and grids can also affect the quality of predictions.

To provide confidence in the air quality model predictions provided in the EIS, all input data and selected model options and configurations must be reviewed.

Request

EC/GNWT requests that the proponent provide all input and control files used in the CALPUFF model to generate the air quality predictions presented in the EIS. All files should be in a format that can be used directly into CALPUFF. Please include all output files in the raw CALPUFF format.

Response

CALMET, CALPUFF, and CALPOST input and output files are provided in a model-ready format on an external hard drive for EC & GNWT.

DE BEERS CANADA

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: EC&GNWT_2

Source: Environment Canada and Government of the Northwest Territories (EC&GNWT)

Subject: Air Emissions

EIS Section: 3.5.3, 3.10.2.4, 11.4.II.3.2.3, 11.4.II.3.2.6

Terms of Reference Section: 5.2.2

Preamble

EC/GNWT requires clarifications on the project emission sources and on how the emission estimates are calculated. Haul trucks tend to be a large source of combustion emissions as well as fugitive dust. In Section 3.5.3 of the EIS, the Proponent states that depending on the phase of the project, there will between four to ten 230 tonne haul trucks and three 100 tonne haul trucks operating. How many haul trucks were assumed to be operating in the emission estimates for the Application Case?

In Section 11.4.II.3.2.3, the Proponent states that the "mining equipment was assumed to meet U.S. EPA Tier 2 emission standards for non-road diesel engines". Was it also assumed that the haul trucks would meet Tier 2 standards?

Table 11.4.II-26 list default load factors for various equipment but does not include load factors for haul trucks. What load factor was assumed for estimating emissions from haul trucks?

In Section 3.10.2.4, the Proponent states that three 2,825 kW diesel generators will be used to produce the expected 7 MW power demand for the project. What load factors were assumed in the estimating emissions from the diesel generators?

In Section 11.4.II.3.2.6, the Proponent states that fugitive dust from the expose lake bed due to the partial draining of Kennady Lake is unlikely. The Proponent supports its conclusion by citing anecdotal evidence from the Ekati Diamond

Mine through personal communication with Dan Jarret and Soren Jensen of Rescan. However, the anecdotal evidence was not provided in the EIS. It is unclear if the draining of lakes at the other diamond mines (Ekati and Diavik) are suitable analogues for this project. After the other diamond mines drained water from lakes, the fine sediments of the exposed lake bed was excavated as part of the mine pit. At other mines, such as the Meadowbank Gold Mine in Nunavut, exposed lake beds have been found to be a significant source of fugitive dust. The Proponent has estimated fugitive dust from the lake bed using a methodology developed for Aggregate Handling and Storage Piles (U.S. EPA AP-42, Section 13.2.4). Is this methodology suitable for fugitive dust from lake beds? Is this methodology likely to over-estimate or under-estimate fugitive dust from lake beds?

Request

EC/GNWT requests that the Proponent provide the following information:

1. Details on the emission calculations for each emission source from this project, including the issues noted in the Preamble and all assumptions used in the emission calculations; and

2. Discussion of potential fugitive dust from the exposed lake bed of Kennady Lake.

Response

1. Depending on the Project phase, there will be between four and ten 230-tonne haul trucks and three 100-tonne haul trucks operating. The Application Case emissions were based on a maximum of ten 230-tonne haul trucks and three 100-tonne haul trucks operating.

   The Project emissions were estimated based on the assumption that all main mining equipment including the haul trucks will meet the Tier 2 emission standards for non-road diesel engines and all supporting equipment will meet the Tier 1 emission standards. Table EC&GNWT_2-1 provides a list of the equipment, the applicable emissions tier and the annual gross operating hours.

Table EC&GNWT_2-1 Gahcho Kue Mine Fleet Summary

Mining Equipment	U.S. EPA Emission Standard	Load Factor Suggested by NONROAD Model		Annual Gross Operating Hours													
		Equipment Type	Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CAT 793D Ore	Tier 2	Crawler Dozer	0.58	0	0	2	3,220	4,890	5,939	7,027	4,140	5,439	4,249	4,962	6,577	5,434	545
CAT 793D Overburden	Tier 2	Crawler Dozer	0.58	0	0	0	2,985	0	0	0	5,188	790	476	0	0	0	0
CAT 793D Waste	Tier 2	Crawler Dozer	0.58	0	0	17,200	41,999	49,272	40,867	28,495	30,516	36,527	42,882	51,453	30,046	10,623	687
CAT 793D PK Rejects	Tier 2	Crawler Dozer	0.58	0	0	0	0	0	0	0	921	0	0	0	0	806	2,132
CAT 777F Ore	Tier 2	Crawler Dozer	0.58	0	0	0	0	0	0	0	6,514	0	5,429	2,050	0	5,586	11,322
CAT 777F Overburden	Tier 2	Crawler Dozer	0.58	0	1,014	758	0	0	0	5,199	0	0	0	0	0	0	0
CAT 777F Waste	Tier 2	Crawler Dozer	0.58	0	5,099	3,134	0	0	0	5,186	9,529	0	5,592	7,503	0	5,881	6,838
CAT 777F PK Rejects	Tier 2	Crawler Dozer	0.58	0	0	3	3,375	4,007	4,008	4,237	2,401	5,204	6,024	7,924	8,022	6,240	0
CAT 777F Water Truck	Tier 2	Crawler Dozer	0.58	0	500	500	500	500	500	500	500	500	500	500	500	500	500
Bucyrus RH340B	Tier 2	Excavator	0.53	0	0	4,646	9,969	8,660	6,480	4,221	8,789	8,908	10,089	9,937	4,279	1,730	125
RH90C	Tier 2	Excavator	0.53	0	4,974	5,151	2,582	1,000	1,000	3,126	3,302	1,257	1,403	1,262	1,000	1,069	1,659
CAT 992K	Tier 2	Rubber-tired Loader	0.48	0	4,500	3,002	3,404	2,284	2,284	2,284	1,294	2,284	2,284	2,284	2,284	1,777	1,000
CAT 994F	Tier 2	Rubber-tired Loader	0.48	0	0	1,626	3,489	3,031	2,268	1,477	3,691	3,118	3,531	3,478	1,498	921	878
CAT D10	Tier 2	Crawler Dozer	0.58	0	3,366	13,403	17,870	17,870	17,870	17,870	17,870	17,870	17,870	17,870	17,870	17,870	14,688
CAT 834 RTD	Tier 2	Rubber-tired Loader	0.48	0	0	3,351	3,351	3,351	3,351	3,351	6,701	6,701	6,701	6,701	6,701	6,701	5,508
CAT 16M Grader	Tier 2	Crawler Dozer	0.58	0	1,262	3,351	6,701	6,701	6,701	6,701	6,701	6,701	6,701	6,701	6,701	6,701	5,508
CAT 992K Ore Feed	Tier 1	Rubber-tired Loader	0.48	0	0	1,000	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	3,090
CAT 330DL	Tier 1	Excavator	0.53	1,122	1,489	2,978	745	745	745	745	745	745	745	745	745	745	3,723
CAT 330DL Ore Feed	Tier 1	Excavator	0.53	0	0	0	2,805	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	1,862
CAT 320DL	Tier 1	Excavator	0.53	0	0	0	561	745	745	745	745	745	745	745	745	745	372
CAT D6T	Tier 1	Crawler Dozer	0.58	1,403	1,489	2,978	372	372	372	372	372	372	372	372	372	372	186
CAT 930H	Tier 1	Rubber-tired Loader	0.48	1,403	2,978	6,701	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	1,489
CAT740	Tier 1	Crawler Dozer	0.58	2,244	2,978	5,957	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	745
CAT 980H	Tier 1	Rubber-tired Loader	0.48	1,823	2,792	5,585	745	745	745	745	745	745	745	745	745	745	372
Roll Off Truck	Tier 1	Crawler Dozer	0.58	1,403	745	1,489	745	745	745	745	745	745	745	745	745	745	372
Dump Truck	Tier 1	Crawler Dozer	0.58	0	745	1,489	745	745	745	745	745	745	745	745	745	745	372
Lub/Service Truck	Tier 1	Crawler Dozer	0.58	0	2,420	4,840	9,680	9,680	9,680	9,680	9,680	9,680	9,680	9,680	9,680	9,680	4,840
Welding Service Truck	Tier 1	Crawler Dozer	0.58	0	1,122	1,489	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	1,489
10 t Fuel Truck	Tier 1	Crawler Dozer	0.58	0	701	1,862	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
165 t Truck Crane Grove	Tier 1	Crawler Dozer	0.58	0	701	1,862	223	223	223	223	223	223	223	223	223	223	112
40 t All Terrain Crane Grove GMK3055	Tier 1	Crawler Dozer	0.58	140	3,723	3,723	372	372	372	372	372	372	372	372	372	372	186
5 t Fork Lift Zoom-boom Terex GTH-5519	Tier 1	Crawler Dozer	0.58	0	1,122	2,978	745	745	745	745	745	745	745	745	745	745	372
10 t Flat deck Truck c.w. 2t hydraulic crane	Tier 1	Crawler Dozer	0.58	0	281	1,489	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	1,117
40 t low-boy trailer & tractor	Tier 1	Crawler Dozer	0.58	140	372	745	372	372	372	372	372	372	372	372	372	372	186

Table EC&GNWT_2-1 Gahcho Kue Mine Fleet Summary (continued)

Mining Equipment	U.S. EPA Emission Standard	Load Factor Suggested by NONROAD Model		Annual Gross Operating Hours													
		Equipment Type	Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
5 t Flat Deck Truck	Tier 1	Crawler Dozer	0.58	0	281	745	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	745
Skid Steer Loader (1 cu.m) CAT 246C	Tier 1	Crawler Dozer	0.58	0	0	0	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	1,122	561
Tire Manipulator Hyster/IMAC 700	Tier 1	Crawler Dozer	0.58	0	140	372	372	372	372	372	372	372	372	372	372	372	186
40 Passenger Bus Freightliner	Tier 1	Crawler Dozer	0.58	0	281	745	745	745	745	745	745	745	745	745	745	745	372
24 Passenger Diesel Van Ford E450	Tier 1	Crawler Dozer	0.58	0	0	745	745	745	745	745	745	745	745	745	745	745	372
3/4 t Ambulance/Rescue Ford F450	Tier 1	Crawler Dozer	0.58	0	74	74	74	74	74	74	74	74	74	74	74	74	37
5 t Pumper/Ladder Fire Truck	Tier 1	Crawler Dozer	0.58	0	74	74	74	74	74	74	74	74	74	74	74	74	37
Diesel Lake Dewatering Pumps	Tier 1	Crawler Dozer	0.58	3,506	7,650	7,650	3,825	3,825	3,825	3,825	0	0	0	0	0	0	0
Diesel Pit Dewatering Pumps	Tier 1	Crawler Dozer	0.58	281	2,606	2,606	2,978	2,978	3,351	3,723	4,095	4,095	4,095	4,095	4,095	4,095	4,095
Pipe Fusing Machine	Tier 1	Crawler Dozer	0.58	0	421	1,683	298	298	298	298	298	298	298	298	298	298	149
Portable Diesel Light Plants	Tier 1	Crawler Dozer	0.58	1,683	8,415	11,169	11,169	11,169	11,169	11,169	11,169	11,169	11,169	11,169	11,169	11,169	5,585
Portable Diesel Heaters	Tier 1	Crawler Dozer	0.58	140	7,013	7,446	1,862	1,862	1,862	1,862	1,862	1,862	1,862	1,862	1,862	1,862	931
Vibrating Packer CAT CS56	Tier 1	Crawler Dozer	0.58	0	1,403	745	372	372	372	372	372	372	372	372	372	372	186
Mobile Crushing/Screening Plant	Tier 1	Crawler Dozer	0.58	0	4,751	5,431	638	1,034	357	505	1,088	369	351	327	260	144	180
Concrete Trucks	Tier 1	Crawler Dozer	0.58	0	3,366	1,489	0	0	0	0	0	0	0	0	0	0	0
20 t Picker truck	Tier 1	Crawler Dozer	0.58	0	1,500	1,500	300	300	300	300	300	300	300	300	300	300	300
3/4 t Diesel Crew Cab Pick -Up Ford F250	Tier 1	Crawler Dozer	0.58	1,403	9,308	27,923	37,230	37,230	37,230	37,230	37,230	37,230	37,230	37,230	37,230	37,230	18,615
3/4 t Diesel Pick -Up (Blasters Box) Ford F250	Tier 1	Crawler Dozer	0.58	701	1,862	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	3,723	1,862
DR460	Tier 2	Crawler Dozer	0.58	0	0	4,793	11,832	11,072	8,314	6,204	11,008	11,244	11,936	12,200	5,531	2,899	1,146
D25 Drills	Tier 2	Crawler Dozer	0.58	0	3,123	6,500	4,741	2,257	1,970	4,716	6,500	3,644	6,664	5,944	1,323	1,192	445
DX800	Tier 2	Crawler Dozer	0.58	2,610	4,508	233	233	233	233	233	233	233	233	233	233	233	100
Total				**20,001**	**101,149**	**188,937**	**218,727**	**219,102**	**205,454**	**205,018**	**227,117**	**211,021**	**233,149**	**241,561**	**193,056**	**176,538**	**109,671**

Table 11.4.II-26 from the 2010 EIS lists the eight load factors that the U.S. EPA NONROAD Model recommended for nonroad diesel equipment (De Beers 2010, Section 11.4, Appendix 11.4.II). The load factor for crawler dozer was applied to the haul truck as recommended by the NONROAD model (U.S. EPA 2010). The load factors used for each type of equipment are presented in Table EC&GNWT_2-1.

The diesel generator emissions were estimated based on the following methods:

- Sulphur dioxide (SO_2) emission rates were calculated based on a maximum fuel input rate and a sulphur content of 15 parts per million by weight (ppmw) in diesel.
- Nitrogen oxides (NO_X), carbon monoxide (CO), particulate matter (PM), volatile organic compound (VOC), polycyclic aromatic hydrocarbon (PAH) and trace metal emission rates were calculated based on maximum fuel input rates and emission factors from U.S. EPA Compilation of Air Pollutant Emission Factors or commonly referred as AP-42, Section 3.4 (U.S. EPA 1996).
- Greenhouse Gas emission rates were estimated based on the maximum fuel input rates and emission factors from the Environment Canada National Inventory Report: 1990-2008, Greenhouse gas Sources and Sinks in Canada (Environment Canada 2010).

The diesel generator emissions were not calculated using NONROAD model, which takes load factors into consideration. However, the estimated emissions were based on maximum fuel input rates; therefore, they can be considered to be based on the equivalent of 100% load factor.

2. The potential fugitive dust emissions from any exposed lake bed is difficult to determine accurately because the emissions are highly sensitive to the local meteorology (i.e., wind speed, precipitation and temperature) and characteristics of the erodible material on the exposed lakebed surface. The emissions are not steady-state emission rates, but rather, represent intermittent events directly affected by wind gusts. Extensive research has been done in the United States (U.S.) on quantifying wind-blown dust emissions from exposed lake beds. Owens Lake in California is an example. These U.S. research findings are

typically not applicable for estimating the potential fugitive dust emissions from an exposed lake bed in northern Canada due to the substantial differences present in the in meteorology and the lake bed material.

The potential fugitive dust emissions from the exposed Kennady Lake were estimated based on a method developed by U.S. EPA (2006) in AP-42, Section 13.2.5, not Section 13.2.4, for estimating dust emissions generated by wind erosion of aggregate storage piles and exposed areas within an industrial facility. This method is the default method used by U.S. EPA for estimating wind erosion from open areas, and it is conservative based on the following reasons which are described in more detail later in this response:

- long disturbance interval (once per year);
- short snow-free period;
- the lake bed material has a higher friction velocity than was assumed;
- lack of consideration of summer precipitation; and
- the potential for residual moisture to be present in the lake bed material.

The EPA method compares the fastest wind speed (or fastest mile of wind) at a reference anemometer height of 10 m to a predetermined threshold friction velocity. If the fastest wind speed exceeds the threshold friction velocity, there is likelihood of wind erosion to occur as represented by an erosion potential value greater than zero. The threshold friction velocity was chosen from a list of values available in Table 13.2.5-2 in the AP-42 document (U.S. EPA 2006) as shown in Table EC&GNWT_2-2. The threshold friction velocity for fine coal dust on concrete pad was chosen as a conservative assumption.

Table EC&GNWT_2-2 Threshold Friction Velocities Available from AP-42

Material	Threshold Friction Velocity [m/s]
Overburden	1.02
Scoria (roadbed material)	1.33
Ground coal (surrounding coal pile)	0.55
Uncrusted coal pile	1.12
Scraper tracks on coal pile	0.62
Fine coal dust on concrete pad	0.54

The equation for determining erosion potential (*P*) is as followed:

$$P = 58(u^* - u_t^*)^2 + 25(u^* - u_t^*)$$

$$P = 0 \; for \; u^* \leq u_t^*$$

Where:

P = erosion potential (g/m²)
u^* = friction velocity (m/s)
u^*_t = threshold friction velocity (m/s)

The friction velocity or u* can be calculated based on the following equation derived from equation (1) in AP-42, Section 13.2.5-2:

$$u(z) = \frac{u^*}{0.4} \times ln\frac{z}{z_0} \; or \; u^* = \frac{0.4 \times u(z)}{ln\frac{z}{z_0}}$$

Where:

u = wind speed (cm/s)
u^* = friction velocity (cm/s)
z = height above test surface (cm)
z_0 = roughness height (cm)
0.4 = von Karman's constant (dimensionless)

The friction velocity was calculated and compared to the threshold friction velocity on an hourly basis, and the erosion potential for each hour of a year was determined. The emission factor for wind-generated particulate emissions from mixture of erodible and non-erodible surface material subject to disturbance (AP-42, Section 13.2.5.3, equation [2]) may be expressed as:

$$Emission\ factor = k \sum_{i=1}^{N} P_i$$

Where:

k = particle size multiplier (from AP-42, Section 11.2.5)

N = number of disturbance per year (disturbance is defined as an action that results in the exposure of fresh surface material. For example, a disturbance for a storage pile is whenever the aggregate material is either added to or removed from the old surface).

P_i = erosion potential corresponding to the observed fastest mile of wind for the i^{th} period between disturbances (g/m²)

Because the exposed lake bed will not be disturbed over the course of a year, fugitive dust emissions were estimated on the assumption of only one disturbance per year. The estimated maximum hourly erosion potential (155.34 grams per square metre [g/m²]) over a course of a year was calculated and multiplied by the maximum area of exposed lake bed (732,935 m²) to derive the annual emission rates. Table EC&GNWT_2-3 provides a summary of the various parameters and the values used in the emission calculations.

Table EC&GNWT_2-3 Exposed Lake Bed Particulate Matter Emission Parameters

PM Size	Exposed Lake Bed Area [m²]	Maximum Wind Speed [m/s]	Roughness Height [cm]	Threshold Friction Velocity [m/s]	k constant	Emission Factor [g/m²]
TSP	732,935	22.74	10	0.54	1	155.3
PM_{10}					0.5	77.7
$PM_{2.5}$					0.075	11.7

m^2 = square metre; m/s = metres per second; cm = centimetres; g/m^2 = grams per square metre; TSP = total suspended particulates; PM_{10} = particulate matter of particle diameter less than 10 µm; $PM_{2.5}$ = particulate matter of particle diameter less than 2.5 µm.

The approach used to estimate the exposed lake bed emissions is conservative and is therefore considered to be an overestimate for the following reasons:

- Even though the exposed lake bed is not expected to be disturbed over the course of a year, fugitive dust emissions were estimated on the assumption of one disturbance per year.
- The lake bed is expected to be exposed only between May and September. During the rest of the year (January to April, October to December), the lake bed is expected to be frozen and/or covered by snow. Therefore, the wind-blown dust emissions have been assumed negligible outside of the period between May and September.
- The threshold friction velocity chosen is for fine coal dust on a concrete pad. The silt material on the exposed lake surface is likely to be much more difficult to entrain than coal dust on concrete pad, and will likely have a much higher threshold friction velocity.
- The estimated emissions did not consider the days with precipitation exceeding 0.2 millimetres (mm) that will occur between May and September. Fugitive dust emissions are typically to be considered negligible on days with more than 0.2 mm of precipitation by both U.S. EPA and Environment Canada. Climate normal data for the Environment Canada meteorological station at the Yellowknife Airport indicated that there are typically 44.6 days with daily precipitation exceeding 0.2 mm between May and September. Incorporating the precipitation would further reduce the annual predictions in the EIS.

- Although the lake will be drained, there may be enough residual moisture in part or all of the lake bed to occasionally or more frequently suppress the wind-blown dust emissions from the exposed surface.

References

De Beers (De Beers Canada Inc.). 2010. *Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N*. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Environment Canada. 2010. *National Inventory Report: 1990-2008, Greenhouse gas Sources and Sinks in Canada*. Issued by Greenhouse Gas Division.

U.S. EPA (United States Environmental Protection Agency). 1996. *Compilation of air pollutant emission factors: Volume 1 stationary point and area sources.* Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

U.S. EPA. 2006. *Compilation of air pollutant emission factors: Volume 1 stationary point and area sources.* Section 13.2.5 Industrial Wind Erosion, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

U.S. EPA. 2010. *Mean Life, Annual Activity and Load Factor Values for Nonroad Engine Emissions Modeling.* Report NR-005d. Assessment and Standards Division, Office of Transport and Air Quality. July 2010.

Information Request Number: EC&GNWT_3

Source: Environment Canada and Government of the Northwest Territories (EC&GNWT)

Subject: Air Quality and Emissions Management Plan

EIS Section: 11.4.9.2

Terms of Reference Section: 5.2.2

Preamble

In Section 11.4.9.2 the Proponent commits to developing and implementing an Air Quality and Emissions Management Plan. Additional detail on the management plan is required. The plan should include annual emission tracking of air pollutants and GHGs, fuel consumption, and an ambient and deposition monitoring plan. The management plan should also include mitigation and contingency plans and triggers level at which adaptive management will need to be taken.

Request

EC/GNWT request that the Proponent provide details on its Air Quality and Emissions Management Plan.

Response

De Beers will develop an air quality and emissions management plan (also including dust deposition), which will include a detailed assessment of the timing, specific technology and monitoring locations for each of the air quality parameters being considered for monitoring. The plan will be developed so that monitoring can adapt to changing conditions and influence the pertinent management decisions relating to ongoing Project operations.

The Air Quality Management Plan will be used to coordinate monitoring of ambient air quality at the Project during the construction, operations, and closure phases. Ambient air quality monitoring will be compared to applicable air quality criteria/guidelines and analyzed for trends each year in the annual report to provide an indication of the Project's performance.

Information Request Number: EC&GNWT_4

Source: Environment Canada and Government of the Northwest Territories (EC&GNWT)

Subject: GNWT Guidelines and Air Quality Monitoring

EIS Section: 11.4.2.2.3, 11.4.4.2, 11.4.4.6

Terms of Reference Section: 5.2.2

Preamble

The Proponent refers to the GNWT Guideline for Ambient Air Quality Standards in the NWT, however, has not used the most recent version. This should be updated to reflect the 2011 version of the standard.

Furthermore, the Proponent indicates that background concentrations of gaseous substances were estimated using data from measurements taken in NWT communities, which included NO_2 and Ozone measurements from the Yellowknife airport in 2006. EC/GNWT is unclear what agency conducted monitoring at the airport in 2006. Further, the Proponent indicates that no regional CO monitoring has been conducted, however, would like to clarify that CO monitoring has been ongoing at the ENR/NAPS Yellowknife station since 2003.

Request

1. EC/GNWT requests that the Proponent update all references to the GNWT Guideline for Ambient Air Quality Standards in the NWT.

2. EC/GNWT requests that the Proponent clarify the source of data for the background concentrations of NO_2 and Ozone, and consider the CO readings collected in Yellowknife for additional background concentration data.

Response

1. The 2011 Northwest Territories (NWT) Ambient Air Quality Standards (GNWT 2011) are adopted from the National Ambient Air Quality Objectives (Environment Canada 1981) and the Canada Wide Standards (CCME 2000). The 2011 NWT Ambient Air Quality Standards are identical to the combination of the 2004 NWT Ambient Air Quality Standards (GNWT 2004) and the National Ambient Air Quality Objectives that were used in the 2010 Gahcho Kué Project Environmental Impact Statement (EIS). A comparison of the 2011 NWT Ambient Air Quality Standards and the standards used in the 2010 EIS are presented in Table EC&GNWT_4-1 (De Beers 2010).

   Given the nature of the changes to the NWT Standard between 2004 and 2011, the overlap with the National Ambient Air Quality Objectives and the fact that the 2010 EIS has already been issued, references in the body of the text will not be updated (De Beers 2010). Any future documentation that may require reference to the NWT Standards will reference the 2011 version.

Table EC&GNWT_4-1: Ambient Air Quality Guidelines

Substance	2011 NWT Air Quality Standards[a]	2004 NWT Air Quality Standards[b]	Canada-Wide Standards[c]	National Ambient Air Quality Objectives[d]		
				Desirable	Acceptable	Tolerable
SO_2 (µg/m^3)						
1-Hour	450	450	–	450	900	–
24-Hour	150	150	–	150	300	800
Annual	30	30	–	30	60	–
NO_2 (µg/m^3)						
1-Hour	400	–	–	–	400	1,000
24-Hour	200	–	–	–	200	300
Annual	60	–	–	60	100	–
CO (µg/m^3)						
1-Hour	15,000	–	–	15,000	35,000	–
8-Hour	6,000	–	–	6,000	15,000	20,000
TSP (µg/m^3)						
24-Hour	120	120	–	–	120	400
Annual	60	60	–	60	70	–
PM_{10} (µg/m^3)						
24-Hour	–	–	–	–	–	–
Annual	–	–	–	–	–	–
$PM_{2.5}$ (µg/m^3)						
24-Hour	30[e]	30[e]	30[e]	–	–	–
Annual	–	–	–	–	–	–

[a] Source: GNWT (2011).

[b] Source: GNWT (2004).

[c] Source: CCME (2000).

[d] Source: Environment Canada (1981).

[e] Compliance with the GNWT standard is based on measured maximum value (Veale 2008) whereas compliance with the Canada Wide Standard is based on the 98th percentile of the annual monitored data averaged over three years of measurements.

Note: – = No guideline available; µg/m^3 = micrograms per cubic metre; SO_2 = sulphur dioxide gas; NO_2 = nitrogen dioxide; TSP = total suspended particulates; PM = particular matter; CO = carbon monoxide; GNWT = Government of the Northwest Territories; NWT= Northwest Territories.

2. The nitrogen dioxide (NO_2) and ozone background concentrations in the 2010 EIS were derived from the 2006 monitoring data collected at the Government of the Northwest Territories Department of Environment and Natural Resources/National Air Pollution Surveillance Program (GNWT's ENR/NAPS) SJ_Franklin Station located in the city of Yellowknife. This station was incorrectly referred as the Yellowknife airport station on page 11.4-14, Section 11.4.2.2.3 of SON 11.4 in the 2010 EIS (De Beers 2010, Section 11.4.2.2.3). Median monthly values were utilized for the background concentration of these pollutants. Please see Section B4.2.4 Annex B of the 2010 EIS, for detailed information on the NO_2 and ozone background concentrations (De Beers 2010, Annex B).

3. Regional carbon monoxide (CO) monitoring data were not presented nor were CO background concentrations added to the predicted CO concentrations in the 2010 EIS (De Beers 2010). However, it has been confirmed that CO monitoring data has been recorded at the SJ_Franklin Station since 2003. With respect to CO monitoring, the SJ_Franklin Station is the only publicly available air quality monitoring station in the NWT or near the Project area that has recorded CO concentrations over a relevant time period. Please see Table EC&GNWT_4-2 for a summary of government operated air quality monitoring stations in the NWT.

   To correct the oversight of not adding CO background concentrations to the 2010 EIS modelling results, CO data has been utilized from the SJ_Franklin Station to determine a background concentration to be added to the modelling results. For consistency with the 2006 data sets used for NO_2 and ozone, the same time range has been used for the CO data. The CO data collected at the SJ_Franklin Station in 2006 have a median value of 0.1 parts per million (ppm) or 116.5 micrograms per cubic metre ($\mu g/m^3$). Use of the median value for the background concentration of CO is consistent with NO_2 and ozone, which also used median concentrations calculated in a similar manner. Table EC&GNWT_4-3 shows the 1-hour CO concentration measured at the SJ_Franklin station. As the SJ_Franklin Station is located in Yellowknife, which is near to anthropogenic emission sources, the natural CO background concentration in the vicinity of the Project is expected to be lower.

Table EC&GNWT_4-2: Air Quality Monitoring Stations and Pollutants Measured in the Northwest Territories

Location	Name	Operator of Monitoring Network	General Data Period	Pollutants Measured										
Yellowknife	SJ_Franklin	NAPS/ENR	2003+	CO	-	NO	NO_2	NO_X	O_3	PM_{10}	-	SO_2	-	-
Norman Wells	NW_RegionalOffice	NAPS/ENR	2004+	-	H_2S	NO	NO_2	NO_X	O_3	PM_{10}	$PM_{2.5}$	SO_2	-	-
Fort Liard	FL_Airport	ENR	2004+	-	H_2S	NO	NO_2	NO_X	O_3	PM_{10}	$PM_{2.5}$	SO_2	-	-
Inuvik	Inuvik	NAPS/ENR	2004+	-	H_2S	NO	NO_2	NO_X	O_3	PM_{10}	$PM_{2.5}$	SO_2	-	-
Snare Rapids	SNA	CAPMoN/NAPS	1980s+ ?	-	-	-	-	-	-	-	-	-	O_3	-
Fort Simpson	Fort Simpson	ENR	2003-2004	-	-	-	-	-	-	-	-	-	-	TSP
Daring Lake	Daring Lake	ENR	2002-2009	-	-	-	-	-	-	PM_{10}	$PM_{2.5}$	-	-	-

NAPS = National Air Pollution Surveillance Program
ENR = GNWT Environment and Natural Resources
CAPMoN = Canadian Air and Precipitation Monitoring Network
CO= carbon monoxide; H_2S= hydrogen sulphide; NO= nitric oxide; NO_2= nitrogen dioxide; NOx= nitrogen oxides; O_3= ozone; PM= particulate matter; SO_2= sulphur dioxide; TSP= total suspended particulates.

Table EC&GNWT_4-3: 1-Hour Carbon Monoxide Concentrations in Yellowknife, 2006

Month	Concentration [ppm]	
	Yellowknife	
	CO	
	Median	Max
January	0.1	1.7
February	0.1	1.1
March	0.1	0.5
April	0.1	0.4
May	0	0.3
June	0	0.1
July	-	-
August	0.2	0.6
September	0.1	0.7
October	0.1	1.5
November	0.2	2.9
December	0.3	1.2
Annual	0.1	2.9

Notes: - = no data collected or invalid measurement; Source: GNWT ENR-EPD (2006); max= maximum; ppm = parts per million; CO = carbon monoxide.

A summary of the updated predicted CO concentrations including the CO background concentrations derived from the 2006 SJ_Franklin data are presented in Table EC&GNWT_4-4. All updated predicted CO concentrations remain well below GNWT Ambient Air Quality Standards.

Table EC&GNWT_4-4: Updated Carbon Monoxide Predictions including SJ_Franklin Station Background

Parameters	Baseline Case		Application Case		Construction Case	
	1-hour	8-hour	1-hour	8-hour	1-hour	8-hour
Local Study Area (LSA)						
Maximum CO predictions [μg/m³]	120.0	118.3	3,000.9	2286.7	1,930.8	1472.9
Maximum CO predictions (excluding development area) [μg/m³]	120.0	118.3	2,095.1	1808.6	1,298.4	1130.3
occurrences above GNWT AQS[a]	0	0	0	0	0	0
area above GNWT AQS[a] [ha]	0	0	0	0	0	0
Regional Study Area (RSA)						
Maximum CO predictions [μg/m³]	275.7	200.2	3,000.9	2,286.7	1,930.8	1,472.9
Maximum CO predictions (excluding development area) [μg/m³]	275.7	200.2	2,095.1	1,808.6	1,298.4	1,130.3
occurrences above GNWT AQS[a]	0	0	0	0	0	0
area above GNWT AQS[a] [ha]	0	0	0	0	0	0
GNWT AQS [μg/m³]	15,000	6,000	15,000	6,000	15,000	6,000

[a] GNWT AQS (Government of the Northwest Territories Air Quality Standards; 2011).

Notes: μg/m³ = microgram per cubic metre; CO = carbon monoxide; ha = hectare.

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