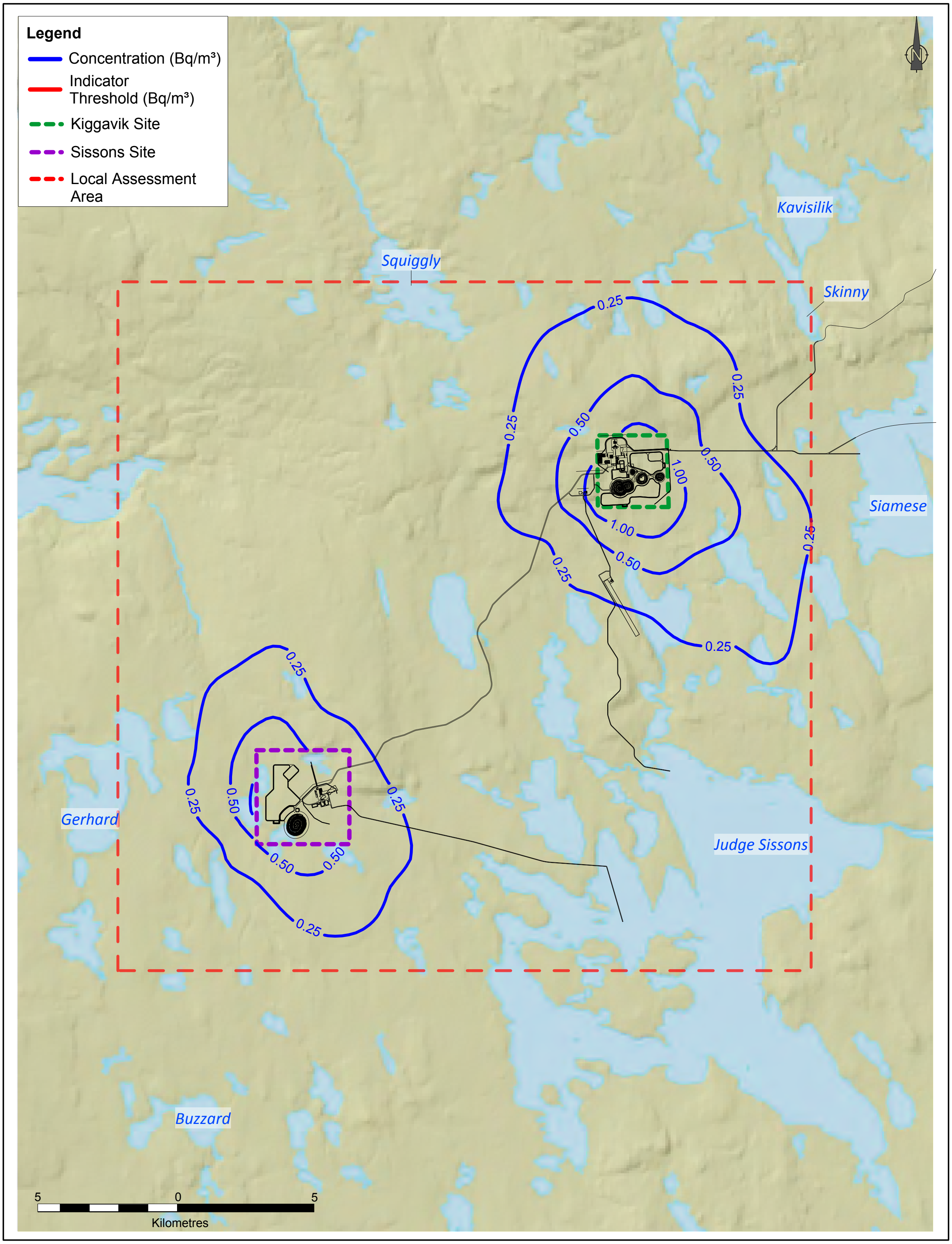

Projection: NAD 1983 UTM Zone 14N

Compiled: SENES Consultants

Date: 05/05/2014

Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 6.1-42

Post-Closure Assessment

Incremental Annual Radon Concentration (Bq/m³)

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6.1.5 Residual Effects Assessment for Change in Ambient Air Quality – Other Options

6.1.5.1 Access Road Option

An access road will be required for transporting mill reagents, fuel and other supplies to the Kiggavik Project site from Baker Lake. Currently there are two proposed options: a winter access road and an all-season road. The preferred Winter Road was discussed in Section 6.1.4.2.

As an alternative to the winter road option, the All-Season Road option was also assessed. This road will be constructed using granular fill excavated from bedrock quarries located at various locations along the route.

Comparison of Options –All-Season Road

The overall maximum TSP, NO_2 and SO_2 concentrations predicted for the All-Season Road are provided in Table 6.1-8 and compared to the Winter Road option. For both options, predicted COPC concentrations were all below their respective Indicator Thresholds. Comparing the two options, short-term (24-hour) and long-term (annual) concentrations of particulate-based COPCs (TSP, PM_{10} and $PM_{2.5}$) were highest for the All-Season Road. Since this roadway will be constructed completely out of granular fill, dust emissions are greater than the Winter Road option in which only sections of the roadway are constructed with granular fill over a frozen subgrade. In contrast, gaseous compounds have higher 1- and 24-hour concentrations predicted for the Winter Road option. This a result of higher traffic counts compared to the All-Season Road; daily traffic volumes are higher for the Winter Road option because of a narrower operating window of 90 days.

Table 6.1-18 Overall Maximum TSP, NO_2 and SO_2 Concentrations predicted for each Access Road Option

Access Road Option	Overall Maximum Concentration (µg/m³)							
	TSP		NO_2			SO_2		
	24-hr Maximum	Annual	1-hr Maximum	24-hr Maximum	Annual	1-hr Maximum	24-hr Maximum	Annual
All-Season Road	61.7	8.0	1.4E-01	7.0E-02	8.8E-03	1.0E-02	5.4E-03	6.7E-04
Winter Road	29.7	4.3	3.5E-01	2.6E-01	1.5E-02	3.0E-02	2.3E-02	1.3E-03
Background Concentration (µg/m³)	6.8	2.9	-	-	-	-	-	-
Indicator Threshold (µg/m³)	**120**	**60**	**400**	**200**	**100**	**450**	**150**	**30**

NOTES:
Concentrations of TSP include background concentrations.

6.1.5.2 Dock and Storage Facility Options

The Dock and Storage Facility option (North Shore Site 2) is greater than 6 km from the closest receptor in Baker Lake whereas the preferred Dock and Storage Facility (North Shore Site 1) is approximately 2.5 km away. As such, it is expected that the predicted ambient air concentrations would be lower than those presented previously for the Preferred Option at the Community of Baker Lake receptor (Table 6.1-14). Within the localized area surrounding the North Shore Site 2, the ambient concentrations would be the same magnitude as those predicted for the Preferred Option.

6.1.5.3 Power Plant Options

Two options have been considered for power generation at the Mine Development Area; centralized power generation (power generation at the Kiggavik mine site with transmission lines to the Sissons mine site) and de-centralized power generation (power generation at both the Kiggavik and Sissons mine sites). The de-centralized power generation option is the preferred option and includes five (one standby, one maintenance) 4,190 kW generators at the Kiggavik mine site and five (one standby, one maintenance) 1,450 kW generators at the Sissons mine site. The centralized power generation option includes five (one standby, one maintenance) 5,570 kW generators at the Kiggavik mine site.

For the purpose of this assessment, the maximum power plant output and maximum overall equipment configuration were used for each mine site (i.e., four 4,190 kW generators operating at the Kiggavik mine site and one 4,190 kW generators operating at the Sissons mine site) in the maximum bounding scenario. This scenario was considered to conservatively bound all power plant options and thus no additional modelling was undertaken.

6.1.6 Summary of Residual Effects to Air Quality

Operations of the Project facilities are predicted to result in increased ambient concentrations of dust, uranium, and NO_2 relative to baseline beyond their respective Indicator Thresholds. It is therefore concluded that there will be residual Project effects to air quality. Identified residual effects are summarized in Table 6.1-19.

As noted in Section 4.4.1, dust deposition and PAI are considered not to be indicative of air quality, but rather have been calculated for use in assessing the potential environmental effects to other VECs including the aquatic environment (Volume 5), terrestrial environment (Volume 6) and human health (Volume 8). Although the results were summarized in Section 6.1.2.2 and compared to selected Indicator Thresholds, residual effects have not been identified.

Table 6.1-19 Summary of Identified Residual Effects to Air Quality

Project Phase	Assessment Area	COPC(s) Assessed	Averaging Period	Residual Effect (Y/N?)
Construction	Quarries	Dust & gaseous COPCs	All	N
	Mine Development Area	Dust & gaseous COPCs	All	N
	Baker Lake Dock and Storage Facility	Dust & gaseous COPCs	All	N
Operations	Mine Development Area	NO_2	1-hour	Y
		NO_2, TSP, PM_{10}, $PM_{2.5}$, uranium	24-hour	Y
		Metals, radionuclides & remaining gaseous COPCs	All	N
	Baker Lake Dock and Storage Facility	NO_2	1- and 24-hour	Y
		TSP, $PM_{10,}$ $PM_{2.5}$ and SO_2	All	N
	Access Roads	Dust & gaseous COPCs	All	N
Final Closure	Mine Development Area	All COPCs	All	N

Post-Closure	Mine Development Area	Radionuclides	Annual	N

6.1.7 Determination of Significance of Residual Effects to Air Quality

As discussed in Section 4.8, a residual effect is predicted when modelled concentrations are above relevant Indicator Thresholds beyond the Project Footprint as outlined in Table 4.8-1. If a predicted concentration is greater than the relevant Indicator Threshold, the magnitude, geographic extent and frequency of exceedances of the Threshold were evaluated using the significance criteria in Table 4.9-1 to determine whether a residual effect is considered significant. The results of the significance assessment are provided in Table 6.1-20.

The residual environmental effects of operations at the Project Mine Development Area on ambient 24-hour concentrations of TSP, PM_{10}, $PM_{2.5}$, uranium and 1- and 24-hour NO_2 concentrations is predicted to be moderate to high in magnitude. However, exceedances of Indicator thresholds are all within the LAA and generally do not extend beyond 2 km from the Project Footprint. Exceedances will also be sporadic or infrequent. Similarly, the residual environmental effect of operations at the Baker Lake Dock and Storage Facility on ambient 1- and 24-hour NO_2 concentrations is predicted to be moderate to high in magnitude, but exceedances of the Indicator Thresholds will be infrequent and not occur beyond 2 km of the Project Footprint.

In all, with the implementation of proposed mitigation and environmental protection measures, all of the predicted residual Project environmental effects are not significant (see Table 6.1-20). Residual Project effects to air quality in the vicinity of the Mine Development Area and Baker Lake facilities will be localized, and occur infrequently during the period of time when mining, milling and shipping operations are occurring. Residual Project effects on air quality will be reversible once the Project ceases operations at both locations.

Table 6.1-20 Significance Assessment of Residual Effects to Air Quality

Project Phase	Constituent of Potential Concern	Averaging Period	Description of Residual Effects			Significance
			Magnitude	Geographic Extent	Frequency	
Change in Air Quality – Preferred Option						
Construction – Quarries	All	All	No residual effects			
Construction – Mine Development Area	All	All	No residual effects			

Table 6.1-20 Significance Assessment of Residual Effects to Air Quality

Project Phase	Constituent of Potential Concern	Averaging Period	Description of Residual Effects			Significance
			Magnitude	Geographic Extent	Frequency	
Operations - Mine Development Area	TSP	24-hr	M	LAA	I	NS
			H	F*	I	NS
			H	LAA	I	NS
			H	F*	S	NS
	$PM_{2.5}$	24-hr	H	F*	I	NS
	Uranium	24-hr	H	F*	I	NS
	NO_2	24-hr	H	F*	I	NS
		1-hr	H	F*	S	NS
	Other COPCs	All	No residual effects			
Operations - Winter Road	All	All	No residual effects			
Operations – Baker Lake Dock and Storage Facility	NO_2	24-hr	M	F*	I	NS
		1-hr	H	F*	I	NS
Final Closure	All	All	No residual effects			
Post-Closure	Radon	Annual	No residual effects			
Change in Air Quality – Other Options						
Operations - All-Season Road	TSP, PM_{10}, $PM_{2.5}$, NO_2, SO_2	All	No residual effects			

6.1.8 Compliance and Environmental Monitoring for Changes in Air COPCs

Recommended follow-up and environmental monitoring is outlined below. Any of these recommendations are considered to be above and beyond the mitigation measures outline in Section 1.1.1. Details regarding any recommended monitoring have been outlined in the Air Quality Monitoring and Mitigation Plan – Technical Appendix 4C.

Operations – Mine Development Area

- Implementation of dust monitoring and mitigation will include, at a minimum, sampling of total suspended particulate and dust deposition to verify the modelling results as well as the identification of the mitigation by design and mitigation by management features that have been implemented by the Project. Details are provided in Technical Appendix 4C.
- Implementation of an ambient air quality monitoring program for NO_2 and SO_2 to verify both the modelling results and compliance with air quality criteria. Details are provided in Technical Appendix 4C.
- Implement a radionuclide monitoring program to verify the modelling results . Details are provided in Technical Appendix 4C.

Operations – Baker Lake Dock and Storage Facility

- Implement an ambient air monitoring program for NO_2 monitoring to verify compliance with air quality criteria. This monitoring program would use similar methods and equipment as those recommended for use at the Mine Development Area (see Technical Appendix 4C).

For any Project phases or COPCs where monitoring requirements have not been recommended, it is suggested that monitoring be considered/implemented on a complaints basis (See Technical Appendix 4C).

6.2 Cumulative Environmental Effects to Air Quality

6.2.1 Screening for Cumulative Environmental Effects

A cumulative environmental effects assessment was conducted for those Project residual environmental effects that have the potential to overlap with other projects and/or activities that may currently or will be carried out in the future within the LAA or RAA.

Future projects and activities that may overlap with the proposed Project are identified in the Project Inclusion List. This list includes both approved and proposed projects that have been planned for the future and far future within the LAA or RAA.

A screening assessment for cumulative environmental effects was completed to determine if there is potential for a Project residual effect on air quality to interact with similar effects of other past, present and future projects and activities (i.e., the zone of influence for Project emissions overlaps with the zone of influence for emissions from other projects or activities). The screening was based on the following criteria:

- Is there a residual effect from the Project?

- Does the Project-related environmental effect overlap with those of other past, present and future projects or activities that have been or will be carried out?
- Is the Project contribution to cumulative environmental effects substantive and measurable or discernible such that there is some potential for substantive cumulative environmental effects that are attributable to the Project?

If it was determined that there is potential for a cumulative environmental effect, the potential effect was assessed to determine if it has the potential to shift a component of the atmospheric environment to an unacceptable state. Only those projects and activities that overlap with the Project residual environmental effects both spatially and temporally were included in the assessment of potential cumulative environmental effects.

An interaction table was developed to identify where Project residual effects could interact with the effects of other projects (or project types) or activities to cause a potential cumulative environmental effect on air quality (Table 6.2-1). For each project or type of activity, the likelihood of a cumulative effect occurring was evaluated and each interaction was assigned a rating of 0, 1 or 2. Justification for each of the rankings is provided following the table.

Table 6.2-1 Potential Cumulative Environmental Effects to Air Quality

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects[a]				
	Increase in TSP Concentration	Increase in PM_{10} Concentration	Increase in $PM_{2.5}$ Concentration	Increase in Uranium Concentration	Increase in NO_2 Concentration
Present & Future Mining Drilling & Exploration Projects[b]	0	0	0	0	0
Present Mines					
Meadowbank Gold Mine – Mine Site Operations	0	0	0	0	0
Meadowbank Gold Mine – Dock and Storage Facility	0	0	0	0	2
Future Mines[c]					
Doris North Projects 1 and 2	0	0	0	0	0
Meliadine Project	0	0	0	0	0
Mary River Project	0	0	0	0	0
Hackett River Project	0	0	0	0	0
Back River Project	0	0	0	0	0

Table 6.2-1 Potential Cumulative Environmental Effects to Air Quality

High Lake Project	0	0	0	0	0

NOTES:

[a] Only residual Project effects were considered as possible cumulative environmental effects

[b] Includes current projects as well as proposed projects that have been awarded leases, but not exploration permits

[c] Includes projects that are currently undergoing regulatory review or have publicly announced the intent to seek regulatory approval

0 = Project environmental effects do not act cumulatively with those of other projects and activities.

1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.

2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of project-specific or regional mitigation. Further assessment is warranted.

Based on the Project Inclusion List, there are no current or proposed drilling and exploration activities that could spatially and temporally overlap with any of the Project phases. Many of the exploration projects, particularly in the LAA, will have already undertaken their field programs or have the intention to complete planned exploration activities prior to construction of the proposed Project. Furthermore, many exploration activities are planned for locations at least 5 km away from the Project Footprint and therefore would not result in effects to air quality that would spatially overlap with Project residual effects to air quality. For these reasons, the potential for cumulative environmental effects was assigned a value of 0.

While temporal overlap may occur between Project residual effects and the effects of future projects and the Meadowbank Gold mine, emissions associated with these other projects will not interact with emissions from the Kiggavik Project since none of these are in close enough proximity (i.e., within 5 km) to interact spatially with Project residual effects on air quality. As a result, potential interactions between the Project and mining projects that are currently under regulatory review or have announced the intent to seek regulatory approval were assigned a 0. Therefore, air quality effects of mine site operations at the Meadowbank Gold Project are unlikely to act cumulatively with Project residual effects and therefore were assigned values of 0.

The Meadowbank Gold Mine will also operate a dock and storage facility located approximately 1 km west of the Project's proposed Dock, as well as an access road linking the Meadowbank mine site to its Baker Lake facilities. Although the access roads for the Project and Meadowbank mines will likely be used at the same time, there were no predicted residual effects resulting from the operation of the Project's access road options. As a result, the potential for cumulative effects on ambient dust concentrations from the access roads were assigned a value of 0.

Both construction and operations of the Project's dock and storage facility may occur while the Meadowbank dock is operating. Since no residual effects from construction of the Project's dock were anticipated (Section 6.1.6), cumulative effects with the Meadowbank facility were not considered. In contrast, the Meadowbank dock may operate concurrently with the Project's dock operations and, due to its proximity, there is potential for a cumulative effect to occur. Specifically, there is potential for emissions from the operation of the Project dock and the Meadowbank dock to result in a cumulative effect on ambient NO_2 concentrations within the vicinity of the two dock operations (Table 6.1-20). This potential cumulative effect was assigned a value of 2.

6.2.2 Cumulative Environmental Effects to Ambient NO_2 Concentrations

6.2.2.1 Interactions for Cumulative Environmental Effects to Ambient NO_2 Concentrations

Base Case

The Meadowbank Gold Project, which commenced operations in July 2010, includes operation of a barge landing site located approximately 2 km east of the community of Baker Lake. In addition to a barge landing facility, Meadowbank's Baker Lake facilities consist of a storage compound, which includes an open storage area, a cold storage building and a fuel storage and distribution complex (AMEC 2005). The facility receives fuel and other supplies during the shipping season from late July until early October (AMEC 2005). These supplies are then shipped to the mine site using conventional tractor trailer via a 102 km all-season access road.

Base air emissions from Meadowbank's Baker Lake facilities consist mostly of NO_x from idling barges and other fuel combustion sources. Dust and exhaust emissions of NO_x are also generated by traffic activity along the access road. According to the Air Quality Assessment for the Meadowbank Gold Project (Cumberland Resources Ltd. 2005), no measurable effects on air quality were anticipated from operations within the barge landing area. Although barge traffic emissions were predicted to lead to a low frequency of pollution events, this effect was not predicted to cause a significant effect on air quality. Similarly, measureable effects from access road traffic were predicted to be not significant.

Project Case

The Kiggavik Project dock and storage areawill be located approximately 1 km southeast of the Meadowbank dock and storage facilities. Both facilities will receive fuel and other supplies via barge or tug-barge during the ice-free shipping season from late-July to early October. As a result, there is the possibility that barge traffic will be present in each dock area at the same time, releasing NO_x emissions simultaneously from the idling barge (or tug-barge) engines. Additional sources of NO_x, including cargo handling equipment such as cranes, may also operate simultaneously.

Vehicle activity in and around the dock and storage areas for each project may or may not overlap temporally depending on the transportation schedule of each project. However, due to the relative size and number of vehicles in comparison to that of the tug-barges, cranes and other on-site equipment, vehicles are expected to contribute negligible quantities of NO_2 to the overall concentrations. In addition, the air quality assessment for the Meadowbank Gold Project also showed that effects of the access road were not significant. As a result, only the barge traffic and heavy-duty equipment were carried through to the cumulative effects assessment.

Future Case

Based on the Project Inclusion List, there are no future projects or activities that could act cumulatively with the Project to cause a cumulative effect on ambient NO_2 concentrations.

Future Potential Case

Based on the Project Inclusion List, there are no far future projects or activities that could act cumulatively with the Project to cause a cumulative effect on ambient NO_2 concentrations.

6.2.2.2 Mitigation of Cumulative Environmental Effects to Ambient NO_2 Concentrations

It is recommended that AREVA and Agnico-Eagle Mines work collaboratively to implement mitigation measures to reduce potential cumulative environmental effects on ambient NO_2 concentrations in the vicinity of their dock and storage facilities. AREVA will implement the following general and activity-specific mitigation by management measures to reduce cumulative effects on air quality.

General Mitigation Measures

- Employ standard operating procedures for use of equipment and machinery;
- Perform regular maintenance of equipment and machinery in accordance with good engineering practices or as recommended by equipment suppliers such that the equipment is kept in good operating condition (e.g., effective fuel combustion):
- Develop community complaint/response procedure(s)
- Adhere to all permits, authorizations and/or approvals

Activity-Specific Mitigation Measures

- Marine Vessels and Heavy Equipment Operation

- Where available, use diesel-powered heavy equipment equipped with appropriate exhaust emissions controls such that US EPA Tier 4 emissions standards are met
- Optimize the number of heavy equipment movements and minimize travel distances, where possible
- Minimize number of barge shipments and offloading activities
- Minimize the amount of barge or tug-barge engine idling at each dock (i.e., where possible, limit idling emissions to a single tug-barge at each dock)

6.2.2.3 Characterization of Residual Cumulative Environmental Effects on Air Quality

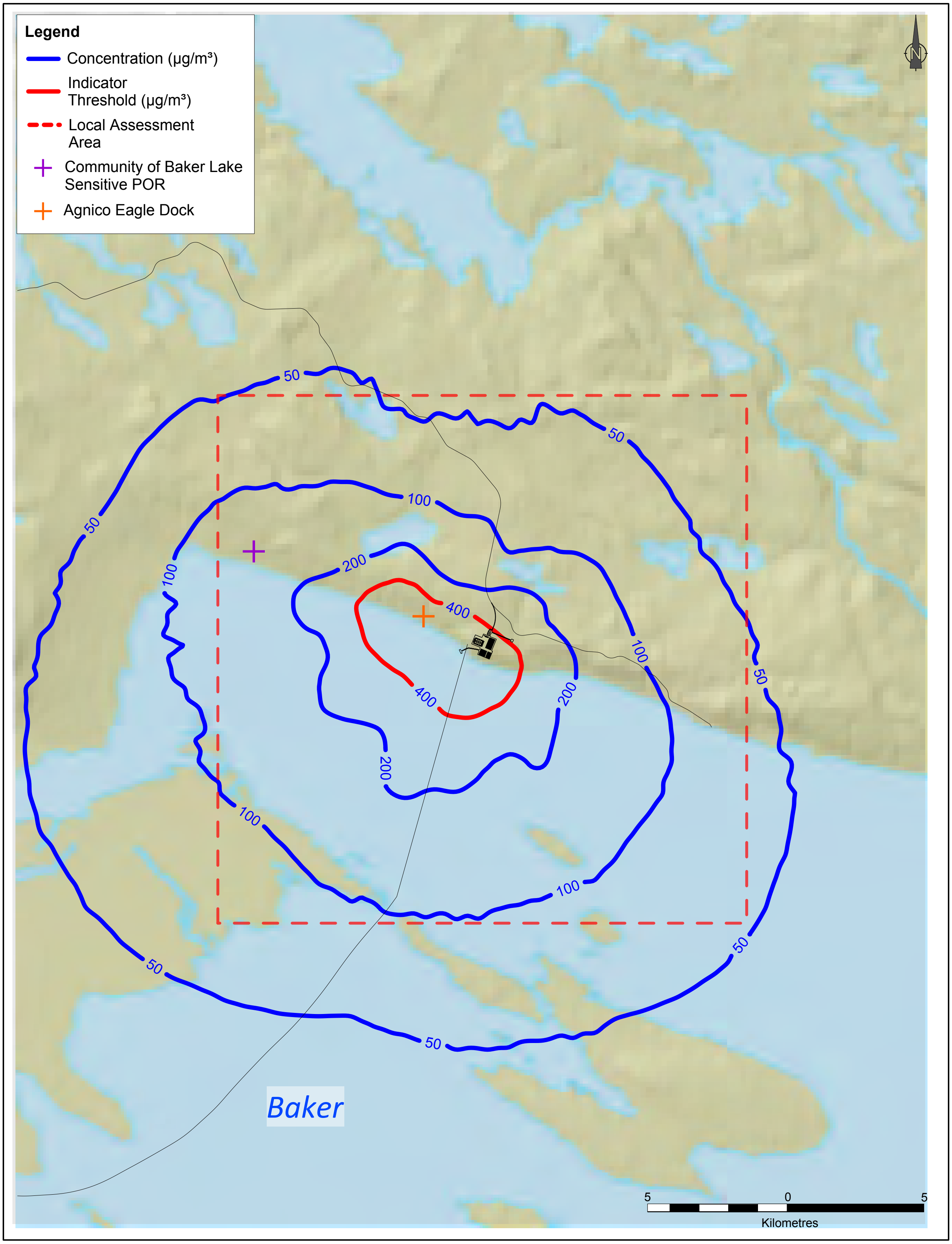
Air emission modelling was completed to assess the potential cumulative effects of operations at the Project's dock facility in combination with operations at the Meadowbank dock and storage facility. For the purposes of modelling, operations were assumed to always occur simultaneously at the Kiggavik and Meadowbank docks, even though this will not be the case. The predicted incremental concentration of NO_2 at the receptor (representing the community of Baker Lake) is provided in Table 6.2-2. At this receptor location, the incremental concentrations of NO_2 for all averaging periods are below the applicable Indicator Thresholds. Based on a comparison of the cumulative annual NO_2 concentration and the predicted annual concentration for the Project Case), the relative contribution of the Project at this sensitive POR is lower than that of the operations at the Meadowbank dock (i.e., Project contribution is 37%). This is due to the fact that the Meadowbank dock and storage facility is located closer to the community of Baker Lake.

Table 6.2-2 Predicted Incremental Concentrations of NO_2 resulting from the simultaneous operation of the Project and Meadowbank Dock and Storage Facilities

Sensitive POR	UTM Coordinates (m)		Incremental Concentration of NO_2 (µg/m^3)		
	Easting	Northing	1-hour Maximum	24-hour Maximum	Annual
Community of Baker Lake	644179	7135840	155.3	29.1	0.5
Air Quality Criteria (µg/m^3)			**400**	**200**	**100**

Contour plots of 1-hour and 24-hour incremental NO_2 concentrations are provided in Figure 6.2-1 and Figure 6.2-2, respectively. Both the 1-hour and 24-hour NO_2 Indicator Thresholds are exceeded in the area surrounding the two facilities. To determine the nature of the exceedances, a frequency analysis was completed and frequency plots are developed for 1-hour NO_2 (Figures 6.2-3) and 24-hour NO_2 (Figure 6.2-4). The results predict that there will be no more than 61 exceedances of the 1-hour Indicator Threshold (about 1% of the time each year) and no more than 4 exceedances of the 24-hour Indicator Threshold (or 1% of the time each year).

The Project's contribution to the total predicted residual cumulative environmental effect on ambient 1-hour and 24-hour NO_2 concentrations will depend on the receptor location of interest. The isopleths presented in Figures 6.2-1 and 6.2-2 represent the overall maximum concentration at each receptor location, meaning that the maximum concentration shown at each receptor does not necessarily occur during the same hour or day. Depending on the location of the receptor, the concentration may be a result of either the Project alone, the Meadowbank dock operations alone, or a combination of the two dock operations. The concentration at each receptor is determined by its location relative to the operations and the wind direction. For example, when the wind is blowing from the northwest, receptors located downwind the Project dock (i.e., to the southeast) would be influenced mostly by the Project, but there would be some contribution from the Meadowbank dock. Conversely, when the wind is blowing from the southeast, receptors located downwind the Meadowbank dock (i.e., to the northwest) would be influenced mostly by the Meadowbank operations, with some contribution from the Project dock. To demonstrate this concept, two receptors, one northwest of the Meadowbank dock and one southeast of the Project dock were selected and the contribution of the Project to the maximum predicted 1- and 24-hour concentrations were determined. This exercise was also completed for a receptor located between the two sites.



Projection: NAD 1983 UTM Zone 14N
Compiled: SENES Consultants
Date: 05/05/2014
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 6.2-1
Baker Lake Dock and Storage Facility Cumulative Assessment
1-hour NO_2 Concentration (µg/m³)

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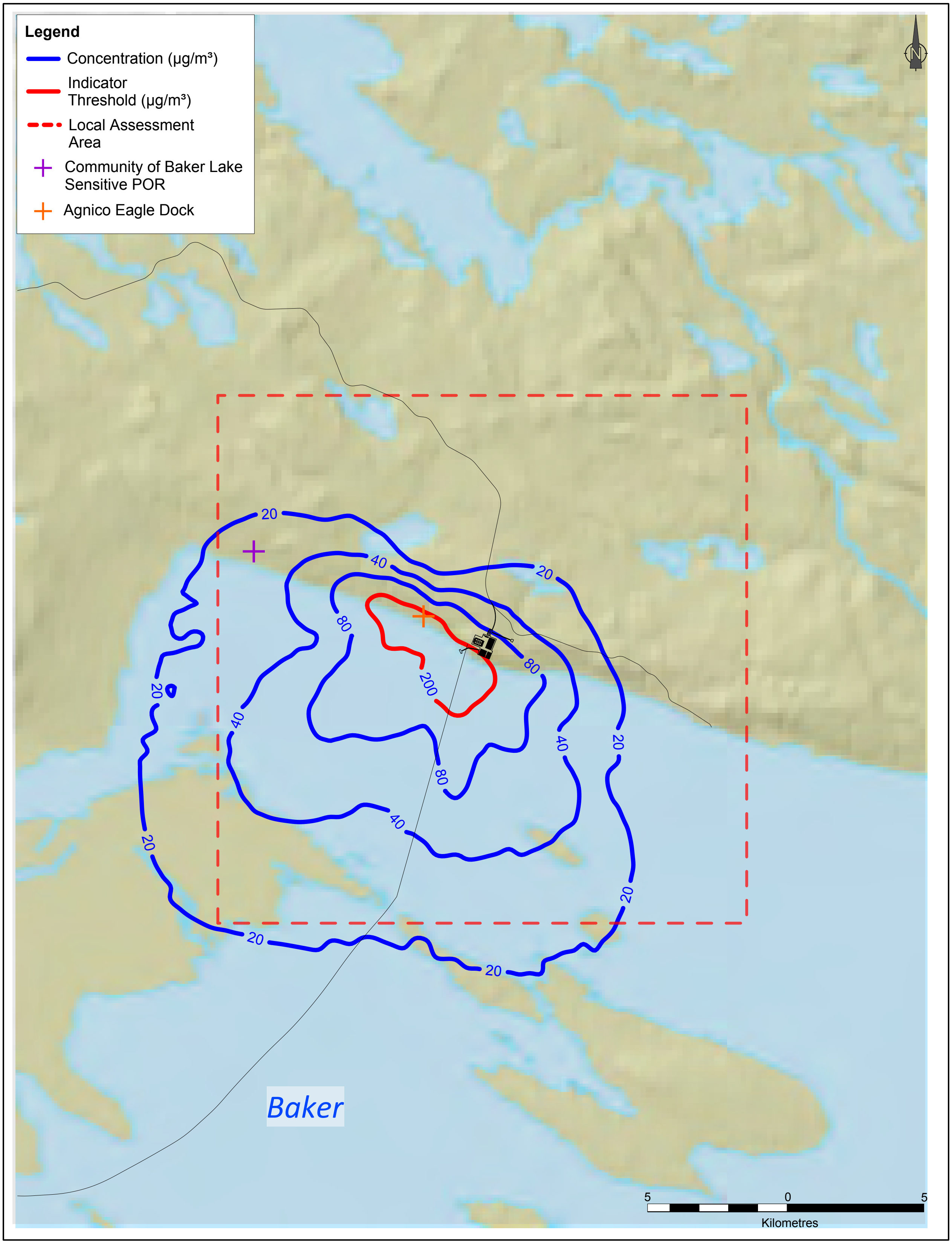

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FIGURE 6.2-2
Baker Lake Dock and Storage Facility Cumulative Assessment
24-hour NO_2 Concentration (µg/m³)

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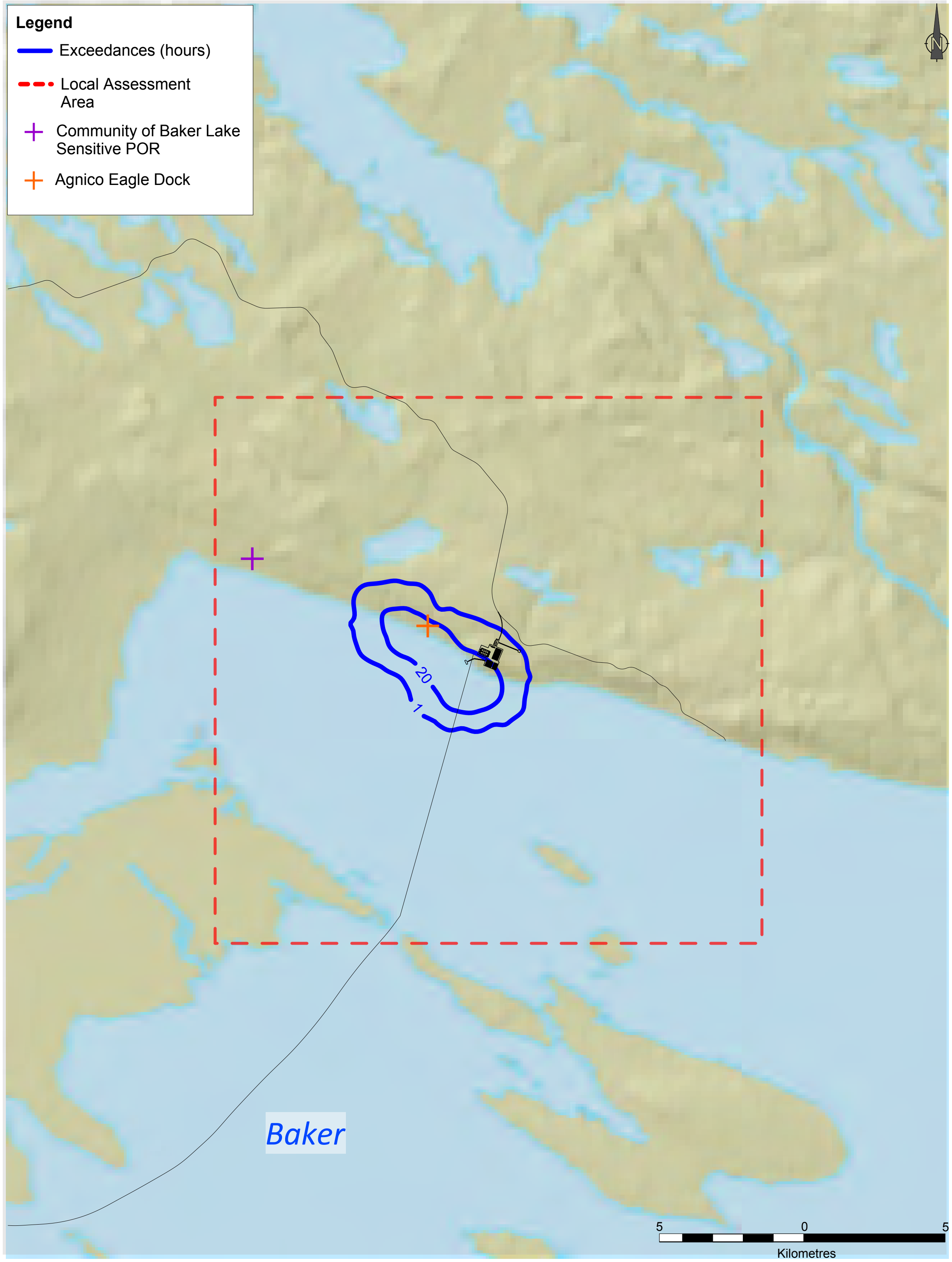

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FIGURE 6.2-3
Baker Lake Dock and Storage Facility Cumulative Assessment Exceedances of 1-hour NO_2 Indicator Threshold (hours)

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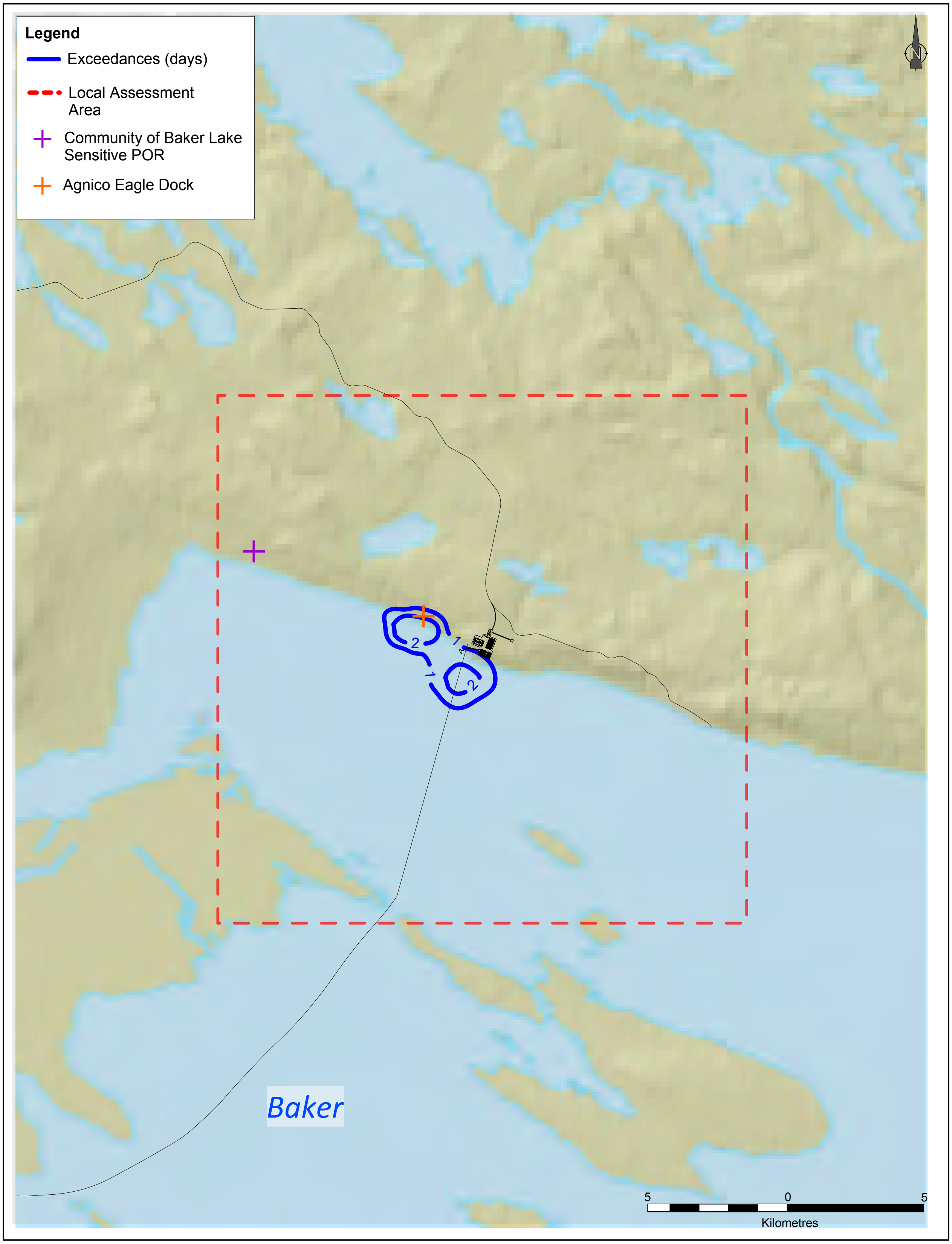

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Date: 05/05/2014
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 6.2-4
Baker Lake Dock and Storage Facility Cumulative Assessment
Exceedances of 24-hour NO_2 Indicator Threshold (days)

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Table 6.2-3 and Table 6.2-4show the relative contribution of Project dock and storage facility operations to the maximum predicted 1- and 24-hr NO_2 concentrations for three receptor locations. The results are also shown graphically in Figure 6.2-5. For a receptor located to the northwest of the Meadowbank dock (Receptor 3), the Project's contribution to the maximum 1-hour concentration is predicted to be less than 1%. At a location southeast of the Project dock (Receptor 1), the contribution of the Project is predicted to be 99%. At a receptor located between the sites (Receptor 2), the Project will be the main contributor (93%) of ambient NO_2.

Table 6.2-3 Relative Contribution of the Project to Maximum 1-hour NO_2 Concentrations at Three Receptor Locations

Receptor	UTM Coordinates (m)		Maximum 1-hour NO_2 Concentration	Year	Julian Day	Hour	Project Contribution (%)
	Easting	Northing					
1	648015	7133374	959.89	2009	266	0900	99.1%
2	647515	7133874	821.81	2009	264	1100	93.3%
3	647015	7134374	1091.6	2009	265	900	0.55%

Table 6.2-4 Relative Contribution of the Project to Maximum 24-hour NO_2 Concentrations at Three Receptor Locations

Receptor	UTM Coordinates (m)		Maximum 24-hour NO_2 Concentration	Year	Julian Day	Project Contribution (%)
	Easting	Northing				
1	648015	7133374	469.41	2009	237	99.4%
2	647515	7133874	212.01	2010	218	95.8%
3	647015	7134374	428.57	2009	264	1.29%

Projection: NAD 1983 UTM Zone 14N
Compiled: SENES Consultants
Date: 05/05/2014
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 6.2-5
Baker Lake Dock and Storage Facility Cumulative Assessment
Project Contribution to 1-hour NO_2 at 3 Receptor Locations

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6.2.3 Summary of Residual Cumulative Environmental Effects on Air Quality

Simultaneous operations of the Project and Meadowbank dock facilities are predicted to result in incidental increased ambient 1-hour and 24-hour NO_2 concentrations relative to the operation of the Project dock facility alone (Section 0). It is therefore concluded that there will be residual cumulative effects on air quality.

The residual cumulative environmental effect of operation of the Project and Meadowbank dock facilities on ambient NO_2 concentrations is predicted to be moderate to high in magnitude. However, exceedance of Indicator Thresholds will not extend beyond 2 km from the combined Project Footprints and will be infrequent.

6.2.4 Determination of Significance of Cumulative Environmental Effects

With implementation of the proposed mitigation and environmental protection measures, the residual cumulative environmental effect of increased ambient NO_2 concentrations from the Meadowbank dock and storage facility operations, in combination with the Project dock and storage facility operations, is predicted to be not significant (Table 6.2-5). Residual cumulative effects on air quality in the vicinity of the dock facilities will be localized, and occur infrequently during the period of time when both the Project and Meadowbank docks are operating simultaneously. Residual cumulative effects on air quality in the vicinity of the docks will be reversible once one or both of these projects cease operations.

Table 6.2-5 Summary of Residual Cumulative Environmental Effects on Air Quality

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Description of Residual Effects				Significance
				Magnitude	Geographic Extent	Frequency	Reversibility	
Change in Air Quality – Preferred Option								
Ambient 1-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Section 6.2.2.2	H	F*	I	R	NS
Ambient 24-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Section 6.2.2.2	M	F*	I	R	NS

Summary of Project Residual Environmental Effects: Air Quality

KEY		
Magnitude: L Low: The predicted COPC concentrations are less than 25% greater than the Indicator Threshold criterion. M Moderate: The predicted COPC concentrations are less than 100% greater than the Indicator Threshold. H High: The predicted COPC concentrations are more than 100% greater than the Indicator Threshold. ***Geographic Extent:*** F Footprint: Effect confined to the project footprint F* Footprint: Effect confined to 2km from the project footprint L Local: Effect confined to the LAA R Regional: Effect extends beyond the LAA but within the RAA	***Duration:*** ST Short term: Less than one year (growing season) MT Medium term: More than one year, but not beyond the end of project decommissioning LT Long term: Beyond the life of the project P Permanent ***Frequency:*** I Infrequent: occurs less than 1% of the time (no more than 4 days per year or 88 hours per year) S Sporadic: Occurs less than 3.5% of the time (no more than 12 days per year or 305 hours per year) R Regular: Occurs less than 15% of the time (no more than 55 days per year or 1300 hours per year) C Continuous: the effect occurs more than 15% of the time. ***Reversibility:*** R Reversible I Irreversible	***Significance:*** S Significant N Not Significant ***Likelihood:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence **N/A** Not Applicable

6.3 Summary of Residual Effects on Air Quality

6.3.1 Project Effects

An overall summary of residual Project effects to air quality related to the various Project phases are presented in Table 6.3-1 along with a summary of recommended follow-up and monitoring. All predicted residual effects to air quality resulting from Project-environment interactions are predicted to be not significant. Based on the air dispersion modelling results, all identified residual effects to air quality are expected not to extend beyond the Local Assessment Area (LAA) boundary and any exceedances of applicable Indicator Thresholds are limited to a few times per year.

6.3.2 Cumulative Effects

An overall summary of residual cumulative effects to air quality related to the various Project phases are presented in Table 6.3-2 along with a summary of recommended follow-up and monitoring. All predicted residual cumulative effects to air quality resulting from Project-environment interactions are predicted to be not significant. Based on the air dispersion modelling results, all identified residual effects to air quality are expected not to extend beyond the Local Assessment Area (LAA) boundary and any exceedances of applicable Indicator Thresholds are limited to a few times per year.

6.3.3 Effects of Climate Change on Project and Cumulative Effects to Air Quality

Changes in the local or regional climate during the lifetime of the Project could affect meteorological parameters governing air dispersion, and consequently ambient air concentrations of COPCs. Twenty three climate change ensembles, which reflect different combinations of models and emission scenarios, were explored (Technical Appendix 5K). Twenty of these twenty three ensembes predict an increase in annual precipitation for the period 2071-2099. An increase in precipitation would likely result in a decrease in total suspended particulate and associated contaminant concentrations as precipitation would “wash” the COPCs from the air and depress dust deposition. Wind speed is predicted to increase by 0.2 m/s on average and would not affect changes to air quality.

Table 6.3-1 Summary of Project Residual Environmental Effects to Air Quality

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics: Direction	Magnitude	Geographic Extent	Frequency	Reversibility	Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
Change in Ambient Air Concentrations of Constituents of Potential Concern - Preferred Option										
Construction – Quarries	General mitigation measures – Section 0	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Construction – Mine Development Area	General mitigation measures – Section 0	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Operation – Mine Development Area										
24-hr TSP	General and activity-specific measures – Section 0	A	M	L	I	R	NS	n/a	n/a	Implement dust management plan and ambient air monitoring program as required. See Appendix 4C.
			H	F*	I	R	NS	n/a	n/a	
24-hr PM_{10}	General and activity-specific measures – Section 0	A	H	L	I	R	NS	n/a	n/a	
			H	F*	S	R	NS	n/a	n/a	
24-hr $PM_{2.5}$	General and activity-specific measures – Section 0	A	H	F*	I	R	NS	n/a	n/a	
24-hr Uranium	Design, general and activity-specific measures – Section 0	A	H	F*	I	R	NS	n/a	n/a	
1-hr NO_2	Design, general and activity-specific measures – Section 0	A	H	F*	S	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
24-hr NO_2	Design, general and activity-specific measures – Section 0	A	H	F*	I	R	NS	n/a	n/a	
Other COPCs	Design, general and activity-specific measures – Section 0	No residual effects					n/a			Implement ambient air monitoring program as required. See Appendix 4C.
Operation - South Winter Road	Design, general and activity-specific measures – Section 0	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Operation - Baker Lake Dock and Storage Facility										
1-hr NO_2	Design, general and activity-specific measures – Section 0	A	H	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
24-hr NO_2	Design, general and activity-specific measures – Section 0	A	M	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
Final Closure	Design, general and activity-specific measures – Section 0	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Post-Closure	Design, general and activity-specific measures – Section 0	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.

Table 6.3-1 Summary of Project Residual Environmental Effects to Air Quality

Change in Ambient Air Concentrations of Constituents of Potential Concern - Other Options				
Operation - North Winter Road	General mitigation measures – Section 0	No residual effects	n/a	Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Operation - All-Season Road	General mitigation measures – Section 0	No residual effects	n/a	Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.

KEY

Magnitude:

L Low: The predicted COPC concentrations are less than 25% greater than the Indicator Threshold criterion.

M Moderate: The predicted COPC concentrations are less than 100% greater than the Indicator Threshold.

H High: The predicted COPC concentrations are more than 100% greater than the Indicator Threshold.

Geographic Extent:

F Footprint: Effect confined to the project footprint

F* Footprint: Effect confined to 2km from the project footprint

L Local: Effect confined to the LAA

R Regional: Effect extends beyond the LAA but within the RAA

Duration:

ST Short term: Less than one year (growing season)

MT Medium term: More than one year, but not beyond the end of project decommissioning

LT Long term: Beyond the life of the project

P Permanent

Frequency:

I Infrequent: occurs less than 1% of the time (no more than 4 days per year or 88 hours per year)

S Sporadic: Occurs less than 3.5% of the time (no more than 12 days per year or 305 hours per year)

R Regular: Occurs less than 15% of the time (no more than 55 days per year or 1300 hours per year)

C Continuous: the effect occurs more than 15% of the time.

Reversibility:

R Reversible

I Irreversible

Significance:

S Significant

N Not Significant

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

N/A Not Applicable

Table 6.3-2 Summary of Cumulative Residual Environmental Effects to Air Quality

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Description of Residual Effects				Significance	Likelihood	Prediction Confidence	Proposed Follow-up and Monitoring Programs
				Magnitude	Geographic Extent	Frequency	Reversibility				
Change in Air Quality – Preferred Option											
Ambient 1-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Section 6.2.2.2	H	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
Ambient 24-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Section 6.2.2.2	M	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.

6.4 Summary of Mitigation Measures for Air Quality

Potential effects on air quality can be mitigated through the direct reduction or prevention of emissions from the Project related emission sources. Reasonable mitigation measures have already been proposed and considered in the assessment. A complete list of mitigation measures was provided Section 6.1.3. An abbreviated list is as follows:

- Develop and implement an Air Quality Monitoring and Mitigation Plan;
- Install end of pipe (exhaust) air pollution controls for milling processes, acid production and power generation;
- Treatment and sub-aqueous discharge of tailings;
- Ensure proper equipment operation and regular maintenance;
- Develop and implement community complaints/response procedures; and
- Adhere to all permits, authorizations and approvals.

These measures are generally regarded as Best Practices for the reduction of COPCs from the Project, and represent the most commonly applied mitigation for similar operations. Administrative controls, such as limiting activities in certain conditions (i.e., high winds) could be implemented to provide additional mitigation, if necessary.

6.5 Summary of Compliance and Environmental Monitoring for Air Quality

An Air Quality Monitoring and Mitigation Plan (Tier 3, Technical Appendix 4C) will be implemented to demonstrate compliance and that the environmental effects are equivalent to or lower than those predicted herein (EN-BL EL Oct 2012[60]). The compliance and environmental monitoring plan associated with the air quality assessment incorporate IQ guiding principles (GN 2009), including Qanuqtuurnunnarniq (being resourceful to solve problems), Avatimik Kamattiarniq (environmental stewardship), Pilimmaksarniq (skills and knowledge acquisition) and Piliriqatigiingniq (collaborative relationships or working together for a common purpose). The importance of environmental monitoring was highlighted through IQ interviews and engagement feedback (EN-BL OH Nov 2013[61]).

The monitoring will include the following COPCs:

- Particulate matter

[60] EN-BL EL Oct 2012: *Could you explain air quality monitoring, since this is a concern in the community?*

[61] EN-BL OH Nov 2013: *What about the environment? How do you know what is in the air and water and lichen that caribou eat?*

- Selected Metals in particulate
- Nitrogen dioxide
- Sulphur dioxide
- Radon

For example, predicted residual effects for TSP, PM_{10} and $PM_{2.5}$ can generally be attributed to emissions from unpaved roads at the mine site, including in-pit ramps. Since reasonable mitigation measures such as watering (or equivalent control) and low vehicle speeds have already been considered in this assessment. Therefore, monitoring of particulate matter will be undertaken to verify model results. If exceedances are observed, enhanced dust controls such as the application of alternative dust suppressants should be considered at that time. Further details are provided in Appendix 4C.

7 Effects Assessment for Climate Change

7.1 Background Information

7.1.1 Relationship between Greenhouse Gases and Climate Change

Greenhouse gases (GHGs) are gases present in the atmosphere, which trap outgoing terrestrial radiation that would otherwise escape to space. This natural phenomenon causes a warming of the Earth's surface and is known as the "Greenhouse Effect". Greenhouse gases collectively include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), water vapour, ozone (O_3), and a group of chemical compounds known as chlorofluorocarbons (CFCs). Each greenhouse gas has a different radiative forcing or Global Warming Potential (GWP), which is simply a measure of its effectiveness to trap heat in the atmosphere. CO_2 has a GWP of one (1), whereas CH_4 is 25 and N_2O is 298 according to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (Solomon et al. 2007).

Currently, there is much concern that the rapid increase in anthropogenic sources of GHGs is leading to an enhanced warming of the Earth, otherwise known as "Global Warming". Northerners have been adapting to changes in climate for generations (Bolton et al. 2011). Some comments from Inuit Qaujimajatuqangit and public engagement suggests that climate change is happening (EN-BL CLC 2010[62], IQ-WCCR 2011[63]) although there are also other comments are in contrast with climate change (EN-RB OH 2012[64]). Simple theory shows that an increase in GHGs, particularly CO_2, will lead to a warming of the Earth's average temperature; however, scepticism still surrounds the link between the observed warming of the Earth and increases in GHGs. The link between GHGs and other climatic parameters like precipitation is even less certain. In fact, there are many other forcing and amplification mechanisms which drive climatic change besides GHGs such as solar variability, resulting in a complex topic that is under much scientific scrutiny (see Technical Appendix 4D for further discussions).

[62] EN-BL CLC 2010: *My concern is I notice that winters are different now. Ice is thin.*

[63] IQ-WCCR 2011: *Freeze-up is later now than in the past.*

[64] EN-RB OH 2012: *8-9 years ago in Baker Lake, I noticed that when I looked at the lake, the water levels were much lower. It was dry where so much water was before.*

7.1.2 Climate Change and the Project

As discussed previously, Project-related activities that require the combustion of fossil fuels will result in emissions greenhouse gases (EN-AR OH Nov 2012[65]). Because of the possible linkage between increased emissions of GHGs and Global Warming, there is a potential for the Project to contribute to changes in climate in the long term, although, the nature and magnitude of these changes is highly speculative. In addition, the Canadian Environmental Assessment Agency's guide to *Incorporating Climate Change Considerations in Environmental Assessment* (CEA Agency 2003) notes that climate change is a complex, global phenomenon and unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured. As a result, only a comparison to current provincial and Canada-wide GHG emissions can be made as a means to quantify the Project's possible contribution to climate change. Such comparisons are made in the following sections. Alternatively, a discussion about how future changes to the local and regional climate may impact the Project are discussed in Technical Appendix 4D.

7.2 Effects Assessment Analytical Methods

As described above as well as in Section 4.8, the effect of the Project on the VEC - Climate Change can be assessed by quantifying the increase in greenhouse gas emissions due to Project activities. This effect is assessed in the following sections.

A mass balance approach was used to estimate emissions of CO_2-equivalent from all project related activities which require the use of diesel fuel. Emission factors adapted from Environment Canada (2011) were used to estimate emissions of greenhouse gases, including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) resulting from the operation of the power plant (diesel generators), heavy equipment and vehicles.

Current estimates of diesel fuel usage for the Project were multiplied by the emission factors to estimate emissions of greenhouse gases. Further details about the methods employed are provided in Technical Appendix 4B – Air Dispersion Assessment.

7.3 Effects Mechanisms and Linkages for Increases in Greenhouse Gases

The Project-environment interactions and effects described above in Section 4.3 and listed in Tables 4.3-1 through 4.3-3 for the construction, operation and closure Project phases, form the basis for the climate change assessment effects mechanisms and linkages. The Project climate change effects

[65] EN-AR OH Nov 2012: *How much energy will be produced, and how much greenhouse gases will be offset?*

relate to emissions of greenhouse gases (GHGs) including CO_2, CH_4 and N_2O from construction activities, open pit and underground mining and supporting activities, power generation and vehicle transportation which may have to potential to cause effects to climate change within the LAA and RAA.

Project activities that could result in increased concentrations of greenhouse gases include:

- Greenhouse gas emissions from the combustion of sources/activities using diesel fuel, including:
- Heavy-duty equipment operation at both the Mine site and at the Dock and Storage Facility;
- Vehicular transport along on-site roads, haul roads and access road;
- Power generation at the Mine site; and
- Marine vessels.

7.4 Mitigation Measures and Project Design for Increases in Greenhouse Gases

Design aspects, operational measures and other mitigation measures have been incorporated into the current Project plans which will minimize project-associated emissions and/or the potential effect of project-related emissions (i.e., increased GHG emissions). Mitigation measures that will be applied to reduce emissions of GHGs are divided into two (2) categories, General and Activity-Specific Mitigation Measures; each one is outlined below.

General Mitigation Measures

- Incorporate energy efficient and emission minimization features in building design and operation of equipment and facilities
- Employ standard operating procedures for use of equipment and machinery
- Perform regular maintenance of equipment and machinery in accordance with good engineering practices or as recommended by equipment suppliers such that the equipment is kept in good operating condition (e.g., effective fuel combustion)

Activity-Specific Mitigation Measures

- Heavy Equipment Operation, Vehicles and Marine Vessels;
- Where available, use diesel-powered heavy that meet US EPA Tier 4 emissions standards;
- Optimize the number of heavy equipment movements and minimize travel distances, where possible; and

- Minimize number of barge shipments and offloading activities.

7.5 Residual Effects for Increases in Greenhouse Gases

As discussed previously, the assessment of potential residual effects to climate change is subjective as there are no specific thresholds or criteria that define whether an effect is expected to occur. Instead, as outlined in CEA guidance, predicted GHG emissions associated with an individual project are put into context by comparing the project to regional or jurisdictional emissions (CEA Agency 2003). Therefore, potential effects to climate change from the Project were assessed quantitatively through comparison of Project-related emissions of greenhouse gases to total federal and provincial/territorial GHG emission levels. Since climate change is a global issue, the Project's potential contribution to global GHG emission levels was also examined.

The analytical methods described in Section 7.2 above were applied to the Project to quantify how the Project, with mitigation, could change ambient levels of greenhouse gases. The results of the analysis are discussed in the follow paragraphs.

Table 7.5-1 shows the associated emission factors adapted from Environment Canada (Environment Canada 2011b) and estimated GHG emissions from the Project. During peak consumption, annual GHG emissions were calculated to be 181 kilotonnes (kt) of CO_2 equivalent per year.

The project related GHG emissions were compared to the baseline levels outlined in Section 5.3. This comparison is presented in Table 7.5-2 below. The Project represents a maximum annual increase in GHG emissions of 181 kt CO_2-equivalent. This would represent a 44% increase in the baseline GHG emissions for Nunavut and a 0.03% increase in the baseline GHG emissions for Canada. In general, it is expected that the Project will noticeably contribute to Nunavut's overall GHG emissions total. It is also expected that other proposed projects will be operational when the Project commences operations, therefore, the contribution to Nunavut GHG emissions will likely be a smaller fraction relative to the total emissions. Further details are discussed in Section 7.6.

Table 7.5-1 Project-Related Greenhouse Gas Emissions during the Peak Production Year

Greenhouse Gas	Emission Factor[(a)]	GWP[(b)]	Estimated GHG Emissions (kt CO_2 eq)
CO_2	2,663	1	173
CH_4	0.133	25	0.22
N_2O	0.4	298	7.7
Total	-	-	**181**

NOTES:
[(a)] Emission factors from Environment Canada's GHG Emissions Quantification Guidance available at www.ec.gc.ca/ges-ghg/
[(b)] GWP = global warming potential. As per values indicated in the IPCC's 4th Assessment Report, 2007 (Solomon et al. 2007)

Table 7.5-2 Project Contribution to National and Northwest Territories Greenhouse Gas Emissions

Region[(a)]	Baseline GHG Emissions (kt CO_2 eq)	Total GHG Emissions[(b)] (kt CO_2 eq)	% Change in GHG Emissions due to Project
Canada[(a)]	699,203	699,384	+0.03%
Nunavut	413	594	+43.8%

NOTES:
[(a)] Includes 2012 Environment Canada reported GHG emissions and Meadowbank Gold Mine GHG emissions estimate of 203 kt of CO_2-equivalent
[(b)] Baseline GHG emissions + peak annual emissions from the Project

In addition, according to the International Energy Agency (IEA), the 2009 estimate of global GHG emissions from the energy sector is 30.6 Gigatonnes (Gt) (IEA 2011). As a result, the annual contribution of the Project to global CO_2 emissions is 0.0006 %.

7.6 Cumulative Effects Analysis for Climate Change

Climate change resulting from increased emissions of greenhouse gases (GHG) is a global phenomenon driven by global emissions of GHG. Emissions of GHG from the Project will act cumulatively with GHG emissions from other local or regional projects, such as the Meadowbank project, in addition to other future projects which will be major contributions to the total territorial GHG inventory for Nunavut. As such, the potential cumulative increases in the total emissions were considered.

As discussed previously, the potential effects of emissions of GHG and other COPCs on climate change is subjective as there are no specific thresholds or criteria that define whether an effect is expected to occur. Instead, potential effects to climate change are typically assessed quantitatively through comparison of Project-related emissions of greenhouse gases to total federal and provincial/territorial GHG emission levels. Where possible, Project-related emissions of GHGs have been compared to the emissions estimated from each of the projects identified earlier in Section 3.4.3 which provides perspective on the relative contributions of each of the other projects. However, due to a lack of the necessary scientific information, these will not be compared to any specific Indicator Thresholds to assess the presence of a residual effect or the significance thereof.

7.6.1 Assessment of Cumulative Effects: Increases in Greenhouse Gases

Table 7.6-1, presents the estimated annual greenhouse gas emissions from those projects listed in the PIL where information was available. As can be seen in the table, the estimated annual GHG emissions for the High Lake and Doris North project are both approximately 78 kt of CO_2-equivalent, whereas emissions from the Mary River Project are closer to 350 kt. Collectively, emissions from the Kiggavik Project and other projects within the RAA make up 62% of the Nunavut total and 0.1% of the Canada-wide total of CO_2-equivalent emissions. As noted earlier, AREVA has committed to a number of measures to reduce their overall contribution to cumulative GHG emissions.

Table 7.6-1 Greenhouse Gas Emissions from other Projects within the Regional Assessment Area

Project Name	Estimated Annual GHG Production[1] (kt CO_2-equivalent)	Reference
High Lake Project	76.47	High Lake EIS, Volume 4, Section 2
Doris North Project	77.45	Doris North Project EIS, Chapter 10
Mary River Project	344	Mary River Project EIS, Appendix 5B
NOTES: [1]Unless otherwise indicated, GHG emissions are based on annual estimates of diesel fuel consumption during operations		

7.7 Summary of Mitigation Measures for Climate Change

In summary, mitigation measures will be employed to reduce emissions of greenhouse gases from fuel combustion sources used by the Project. Such mitigation includes incorporating practices which promote and maintain efficient fuel combustion and which minimizes fossil fuel consumption by optimizing the amount of movement of vehicles and heavy equipment.

7.8 Summary of Compliance and Environmental Monitoring for Climate Change

In general, annual records and verification of fuel use for the Project and other local and regional sources, if available, will be maintained and estimates of GHG emissions will be completed on an annual basis using appropriate emission factors. Emissions will be reported annually to the Environment Canada Greenhouse Gas Inventory if the reporting threshold (50,000 tonnes of CO_2-equivalanet) is met. If necessary, a greenhouse gas reduction strategy could be considered in the future.

8 References – Air Quality

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Attachment A Glossary and Terms

A.1 Glossary

Acid Deposition	When acid-forming compounds such as sulphur dioxide (SO_2) and nitrogen oxides (NO_x) react with water to create weak acids that are deposited on the Earth's surface.
Ambient Air	The air occurring at a particular time and place outdoors. Often used interchangeably with "outdoor air."
Anthropogenic	Produced by people or happening because of human activities.
AP-42 Emission Factors	AP-42 is the US EPA's primary compilation of emission factors and supporting information for more than 200 air pollution source categories. It is collectively known as "AP-42, Compilation of Air Pollutant Emission Factors".
Atmosphere	The gaseous mass or envelope of air surrounding the Earth. From ground-level up, the atmosphere is further subdivided into the troposphere, stratosphere, mesosphere, and the thermosphere; however, when discussing air quality, the layer of concern is the troposphere.
Baseline Air Quality	Existing concentrations of compounds within the atmosphere that can be used to measure changes to the environment as a result of a project undertaking.

CALMET	A diagnostic, 3-dimensional meteorological model used in conjunction with CALPUFF.
CALPUFF	An advanced, integrated Gaussian plume air dispersion modelling system.
Carbon Dioxide (CO_2)	A colorless, odourless gas that occurs naturally in the Earth's atmosphere. Significant quantities are emitted into the air by fossil fuel combustion.
Carbon Dioxide Equivalent (CO_2-eq)	A unit of measurement used to describe a greenhouse gas' potential to warm the atmosphere relative to carbon dioxide. The carbon dioxide equivalent is calculated by multiplying the amount of the gas (usually in tonnes) by the associated Global Warming Potential (GWP).
Climate	The usual temperature, rain or snow and wind conditions of an area over a very long number of seasons.
Climate Change	A difference in the usual and extreme global temperatures that is not just a short cycle, but lasts for decades.
Combustion	The act or instance of burning a fuel such as gasoline to produce energy. Combustion is typically the process that powers automobile engines and power plant generators.
Concentration	The amount of a given substance that exists within another substance. With respect to air quality, it refers to the amount of a particular compound within a given volume of air. Typically in units of micrograms per cubic meter ($\mu g/m^3$).

Constituent of Potential Concern	For air quality, a compound for which measurable concentrations in the atmosphere can be used to describe the condition of air quality.
(Air) Dispersion Model	Mathematical relationship between emissions and air quality which simulates on a computer the transport, dispersion, and transformation of compounds emitted into the air.
Dustfall or Dust Deposition	Solid particles in the air which fall to the ground under the influence of gravity. Typically measured in units of grams per square meter over a 30-day period (g/m^2/30-days).
Emission Factor	A relation between the quantities of a compound released to the atmosphere with an activity associated with the release of that contaminant. For example, for stationary sources, it is the relationship between the amount of a compound produced and the amount of raw material processed over a given amount of time.
Emission Rate	The weight of a compound emitted per unit of time (e.g., grams per second).
Fugitive Dust	Dust particles that are introduced into the air through open sources and not discharged through a confined air stream such as an exhaust stack. Sources of fugitive dust include unpaved roads, wind erosion of stockpiles, material handling, etc.
Generator	An engine (usually diesel) equipped with an electrical generator which is used to generate electricity. Can be used as a primary power source or for back-up power generation.

Global Warming	A term used to describe the current and continuous rise of Earth's average atmospheric and oceanic temperature. Most often linked to increases in greenhouse gases in the Earth's atmosphere.
Global Warming Potential	A measure of a greenhouse gas' radiative forcing or its effectiveness to trap heat in the atmosphere relative to carbon dioxide.
Greenhouse Effect	A term used to describe the natural process whereby greenhouse gases warm the Earth's surface by trapping terrestrial radiation that would otherwise escape to space.
Greenhouse Gas	A gas in an atmosphere that absorbs and emits radiation. Examples include carbon dioxide, methane, nitrous oxide, water vapour, sulphur hexafluoride and chlorofluorocarbons.
Hi-Volume Air Sampler	An instrument used to measure the amount of particulate (TSP or PM_{10}) in the atmosphere. A known volume of air is drawn in through a pre-weighed filter for a period of 24-hours.
Incremental Concentration	The concentration of a pollutant in the atmosphere above the baseline air concentration. Used to measure the contribution of a project to overall air quality.
Indicator Threshold	A chosen environmental effects criterion where several air quality criteria, guidelines or objectives for a Constituent of Potential Concern were identified. Are used to identify potential residual environmental effects to air quality.

Meteorology	The science of the atmosphere and its direct effects upon the earth's surface. Meteorology is especially concerned with how atmospheric conditions affect the weather.
Methane (CH_4)	A greenhouse gas that occurs naturally in the Earth's atmosphere. Is also the primary component of natural gas. Sources include decomposition of organic material, wildfire and geologic processes as well as fossil fuel combustion.
Mixing Height	The layer of the atmosphere where pollution gets mixed and dispersed. Factors controlling this phenomenon include solar radiation, wind speed, and local surface roughness.
Monitoring	The periodic or continuous sampling and analysis of air pollutants in ambient air or from individual emissions sources.
National Ambient Air Quality Objectives (NAAQOs)	Guidelines developed under the Canadian Environmental Protection Act that have been established to provide a measure of protection to people and the environment from adverse effects due to airborne pollutants.
Nitrogen Oxides (Oxides of Nitrogen, NOx)	A general term pertaining to compounds of nitric oxide (NO), nitrogen dioxide (NO_2) and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition.
Nitrogen Dioxide (NO_2)	A highly reactive gas having a characteristic reddish-brown colour and strong odour. The main anthropogenic source of NO_2 is fossil fuel combustion.

Nitrous Oxide (N_2O)	A greenhouse gas that occurs naturally in the Earth's atmosphere which is largely attributed to microbial processes.
PM – Particulate Matter	Tiny subdivisions of solid matter suspended in a gas or liquid.
PM_{10} – Particulate matter of 10 microns or less	Tiny subdivisions of solid matter suspended in a gas or liquid of 10 micrometres or less.
$PM_{2.5}$ - Particulate matter of 2.5 microns or less	Tiny subdivisions of solid matter suspended in a gas or liquid of 2.5 micrometres or less.
Radioactive	Exhibiting radioactivity; emitting or relating to the emission of ionizing radiation or particles such as alpha and beta particles, neutrons or gamma rays.
Radionuclide	A radioactive nuclide such as Radon-222, Lead-210, Polonium-210, etc.
Point of Reception	A location or receptor that may be impacted by emissions from a facility (air, noise, vibration). A receptor is generally a place where people live, or conduct educational or recreational or religious activities.
Potential Acid Input	A measure of the amount of acid deposition on the Earth`s surface.

Potential Alpha Energy Concentration	A measure of the amount of potential alpha energy in a given volume of air. A common unit is nJ/m^3.
PQ-100 Sampler	An instrument used to measure the amount of TSP or PM_{10} present in ambient air. A known volume of air is drawn in through a pre-weighed filter for a period of 24-hours.
Sulphur Dioxide (SO_2)	A strong smelling, colorless gas that is formed by the combustion of fossil fuels. Power plants, which may use fuels high in sulphur, can be major sources of SO_2. SO_2 and other sulphur oxides also contribute to the problem of acid deposition.
Total Suspended Particulate (TSP)	Tiny airborne particles or aerosols that are less than 30 micrometers as defined by the US EPA.
Volatile Organic Compounds (VOCs)	Carbon-containing compounds that evaporate into the air (with a few exceptions). VOCs contribute to the formation of smog and / or may be toxic. VOCs often have an odour, and some examples include gasoline, alcohol, and the solvents used in paints.

A.2 Units/Terms

$\mu g/m^3$	microgram per cubic meter
µm	micron
BDL	Below Detection Limit

Bq/m^3	Becquerel per cubic meter
CAAQS	Canadian Ambient Air Quality Standard
CCME	Canadian Council of Ministers of the Environment
CDOH	Colorado Department of Health
CEPA	Canadian Environmental Protection Act
CNSC	Canadian Nuclear Safety Commission
CO_2-eq	Carbon Dioxide Equivalent
COPC	Constituent of Potential Concern
CWS	Canada Wide Standards
EA	Environmental Assessment
EIS	Environmental Impact Statement
g/m^2/30-day	grams per square meter per 30 days

g/m²/year	grams per square meter per year
g/s	gram per second
Gt	Gigatonne
GHG	Greenhouse Gas
HCl	Hydrogen Chloride
IQ	Inuit Qaujimajatuqangit
keq/ha/yr	kilomoles of equivalent acidity per hectare per year
KI	Key Indicator
kt	kilotonne
LAA	Local Assessment Area
MOE	Ontario Ministry of the Environment
NAAQOS	National Ambient Air Quality Objectives

NAtChem	National Atmospheric Chemistry Precipitation Database
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claim Agreement
NU	Nunavut
NWT	Northwest Territories
PAE	Potential Alpha Energy
PAI	Potential Acid Input
PIL	Project Inclusion List
POR	Points of Reception
ppm	parts per million
RAA	Regional Assessment Area
TMF	Tailings Management Facility

US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VC	Valued Component
VEC	Valued Environmental Component
VOC	Volatile Organic Compound
VSEC	Valued Socio-Economic Component
WHO	World Health Organization