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# 17.0 SUBJECT OF NOTE: ACCIDENTS AND MALFUNCTIONS

## 17.1 Introduction

### 17.1.1 Context

This section of the Developer's Assessment Report (DAR) for the NICO Cobalt-Gold-Copper-Bismuth Project (NICO Project) consists solely of the Subject of Note (SON) for the accidents and malfunctions. In the Terms of Reference (TOR) for the NICO Project's DAR issued on 30 November 2009, the Mackenzie Valley Review Board (MVRB) identified accidents and malfunctions as one of the top priority issues requiring consideration by the developer (MVRB 2009). As identified within the TOR, the SON: Accidents and Malfunctions addresses the risks of potential accidents and malfunctions for the NICO Project.

The following Key Lines of Inquiry (KLOI) or SON in the DAR also provide information related to accidents and malfunctions:

- KLOI: Water Quality (Section 7);
- KLOI: Caribou and Caribou Habitat (Section 8);
- KLOI: Closure and Reclamation (Section 9);
- SON: Water Quantity (Section 11);
- SON: Terrain and Soils (Section 13);
- SON: Human Environment (Section 16); and
- Effects of the Environment on the Project (Section 19).

### 17.1.2 Purpose and Scope

Accidents and malfunctions are unplanned events that may be caused by industrial hazards (e.g., equipment failure) or natural hazards (e.g., earthquake). The purpose of the SON: Accidents and Malfunctions is to:

- identify the primary hazard scenarios for potential accidents and malfunctions in the NICO Project facilities that may impact the environment or public safety;
- estimate the residual risks following the implementation of risk mitigation measures and prioritize the resources for risk management based on the levels of risks identified; and
- identify the general requirements for an emergency response and spill contingency plan based on the risk assessment.

To verify that the contents of the TOR are addressed in this report, a table of concordance that cross-references the TOR to the information and location in this DAR is contained in Table 17.1-1. The entire TOR document is included in Appendix 1.I and the complete table of concordance for the DAR is in Appendix 1.II of Section 1.

This SON includes a qualitative assessment of the environmental and public safety risks posed by potential accidents and malfunctions for all Project components, including mining, processing, Co-Disposal Facility (CDF), utilities, and the transportation corridors. The risk assessment includes all NICO Project phases (i.e., construction, operation, closure, and post-closure).

To systematically assess all risks, each NICO Project component was evaluated individually and then the complete NICO Project site was evaluated. Potential accidents and malfunctions for each component were identified and assessed to estimate the associated environmental and public safety risks. Risk mitigation measures were identified and referenced in the conceptual Emergency Response and Spill Contingency Plan (Section 17.5).

Information from other components of the DAR, including air quality, water quality, water quantity, fish and aquatic resources, vegetation, wildlife, and the human environment are referenced in this SON.

**Table 17.1-1: Subject of Note: Accidents and Malfunctions Concordance with the Terms of Reference**

| Section in Terms of Reference | Requirement | Section in Developer's Assessment Report |
|---|---|---|
| **3.2.3** | **Developer's assessment boundaries**<br>The developer will describe and provide rationales for: | |
| | • An overall environmental assessment study area and the rationale for its boundaries; | 17.1.3.1 |
| | • Fortune's chosen spatial boundaries for the assessment of potential impacts for each of the valued components considered; and | 17.1.3.1 |
| | • The temporal boundaries chosen for the assessment of impacts on each valued component. | 17.1.3.2 |
| **3.5** | **Accidents and Malfunctions**<br>The developer will: | |
| | • Conduct a risk assessment using best practices for the NICO Project, including components, systems, hazards, and failure modes. | 17.2 |
| | • Assess likelihood and severity of each risk identified. | 17.3 |
| | • Provide rationale for criteria used for decisions on the various risks related to malfunctions/accidents during all project phases from construction through post-closure. | 17.2 |
| | • Describe contingency plans for accidents, malfunctions or unforeseen impacts of the environment on the development. | 17.4, Appendix 3.VI |
| | • Describe on-site containment features, such as concrete pads and dykes and detection systems used for early warning of spills. | 17.3.2.1, 17.3.3.1, 17.3.3.3, 17.3.3.4, 17.3.4.1, 17.3.4.2, Appendix 3.VI |
| | • Describe all accident and emergency response plans that will be in place during the construction phase and operations phase, including emergency communication plans. | 17.5, Appendix 3.VI |

## 17.1.3 Spatial and Temporal Boundaries

### *17.1.3.1 Spatial Boundary*

The study areas for this SON were selected by evaluating the regions around the NICO Project and the transportation corridors that are expected to be affected by potential accidents and malfunctions. The specific study areas vary based on the particular risk being assessed:

- For risks associated with a facility, the area of focus is the immediate vicinity of the facility and the area surrounding the facility that may be affected by the risk.
- For risks associated with transportation, local and regional transportation corridors define the transportation study areas.

### *17.1.3.2 Temporal Boundary*

This SON assesses the impacts for the construction, operation, closure, and post-closure phases of the NICO Project.

Pre-stripping of the Open Pit area is expected to last 3 months and the Open Pit will become operational within 3 months of Mineral Processing Plant (Plant) start-up. Construction of the Plant and CDF is proposed to commence during mobilization the year following award of a water license. Construction of the NICO Project is expected to take approximately 12 months. The NICO Project will operate for 18 years. Progressive decommissioning and reclamation of the CDF will take place during operation, and interim closure and removal of most of the site infrastructure will be completed with a 2-year closure period. The 2-year closure period will be followed by a post-closure period, which will include passive filling of the Open Pit. Facilities remaining during post-closure will be those required for water treatment (if any) and site maintenance activities. These facilities will be removed from the site 10 years after closure if the water quality is acceptable.

## 17.1.4 Content

The general organization of this SON is outlined in Table 17.1-2.

**Table 17.1-2: Subject of Note: Accidents and Malfunctions Organization**

| Section | Content |
|---|---|
| Section 17.1 | **Introduction –** Provides an introduction to the accidents and malfunctions SON by defining the context, purpose, scope, and study areas, and providing an overview of the SON organization |
| Section 17.2 | **Assessment Methods –** Provides the approach used to assess the risks associated with potential accidents and malfunctions, and developing the management plans appropriate for the Project |
| Section 17.3 | **Risk Assessment –** Describes the risk assessment for potential accidents and malfunctions |
| Section 17.4 | **Summary of Results –** Provides a summary of the risk assessment results associated with the potential accidents and malfunctions |
| Section 17.5 | **Emergency Response and Spill Contingency Plan** – Identifies guidelines for emergency response and spill contingency planning for the risks identified in this assessment |
| Section17.6 | **Conclusions** – Provides the conclusions from the risk assessment |

## 17.2 Assessment Methods

It is expected that ongoing risk assessments will be performed throughout the NICO Project phases to manage environmental and public safety risks according to good industry practice.

The assessment methods for accidents and malfunctions were based on the Systems Failure Modes and Effects Criticality Analysis approach, which is a standard risk assessment method (Canadian Standards Association 1997; International Organization for Standardization 2009 a, b). Failure modes and their associated consequences (i.e., hazard scenarios) were first identified for each component of the NICO Project facility using an assessment protocol and the knowledge base of the risk assessment team. Planned mitigation measures for the NICO Project were also identified. The residual (following implementation of risk mitigation measures) environmental and public safety risks were then estimated for each hazard scenario using a risk matrix approach. A specific NICO Project Risk Matrix was developed for the purpose of the DAR to define and rank environmental and public safety risks related to accidents and malfunctions.

### 17.2.1 Hazard Identification

The risk assessment began by identifying hazard scenarios associated with the NICO Project components that could impact the environment or public safety. The NICO Project facilities were divided into components and each was systematically reviewed to identify potential hazard scenarios.

A series of events usually need to occur before a failure (i.e., an accident or malfunction) results in an environmental or public safety impact; therefore, the complete series of such events was assessed. A “failure mode” was first identified using the knowledge base of the risk assessment team and the NICO Project reference drawings and information. Possible causes were then identified ranging from natural events (e.g., earthquakes), to equipment failures, operator errors, and management system deficiencies. Secondly, consequence effects from the failure mode that may impact the environment or public safety were identified. Lastly, planned mitigation measures were identified for each hazard scenario. These include prevention measures that will minimize the probability of causes occurring, and control measures to mitigate the consequence severity from an accident or malfunction.

### 17.2.2 Risk Measurement

Following the identification of the hazard scenarios, the risk associated with each hazard scenario was estimated as a function of likelihood (frequency) and consequences severity. Risk was estimated using a NICO Project Risk Matrix (Table 17.2-1) comprised of a *Likelihood Index* and a *Consequence Severity Index*.

The *Likelihood Index* ranges from a “Rare” event to a “Probable” event and is more formally defined through the events/year value. There is an order of magnitude of events/year values for each Likelihood level. For example, the “Possible” level ranges from 1 Event in 10 Years to 1 Event in 100 Years.

The *Consequence Severity Index* ranges from “Very Low” to “Very High” and is applied to 2 categories of consequences: environment, and public safety; therefore, there are a total of 2 risk matrices combined in the NICO Project Risk Matrix. A description of the consequence levels from “Very Low” to “Very High” for each of the 2 categories is presented in Table 17.2-1. Likelihood and consequence severity were estimated based on industry and operation experience, NICO Project specific conditions and the knowledge base of the risk assessment team.

**Table 17.2-1: NICO Project Risk Matrix**

| | | CONSEQUENCE SEVERITY | | | | |
|---|---|---|---|---|---|---|
| | **Category** | **1 Very Low** | **2 Low** | **3 Moderate** | **4 High** | **5 Very High** |
| | **Environment** | Negligible physical or biological effects | Short-term (<2 years) local effects (onsite and vicinity) | Medium-term (2 to 20 years) regional effects | Long-term (>20 years) regional effects | Long-term (>20 years) ecosystem effects |
| | **Public Safety** | Medical treatment not required | Reversible disability or injury requiring hospitalization | Irreversible moderate (<30%) disability to 1 or more people | Single fatality, single irreversible severe (>30%) disability | Multiple fatalities, multiple irreversible severe health effects |
| **Likelihood** | | | | | | |
| **Index** | **Events/Year** | | | | | |
| **A Probable** | **>1** | | | | | |
| **B Likely** | **1 - 1/10** | | | | | |
| **C Possible** | **1/10 - 1/100** | | | | | |
| **D Unlikely** | **1/100 - 1/1000** | | | | | |
| **E Rare** | **1/1000 - 1/10 000** | | | | | |

### 17.2.3 Risk Evaluation

Following the hazard identification and risk measurement, the risks were evaluated and then managed appropriately. Risk evaluation requires determining the acceptability of risk as defined through the different locations within the NICO Project Risk Matrix (Table 17.2-1).

For each of the hazard scenarios, the associated risk following the implementation of all planned risk mitigation measures was estimated by locating it within the NICO Project Risk Matrix. A risk level color ranking system and associated management actions are also shown in Table 17.2-2. The risks were ranked according to 4 priority levels, ranging from low (green) to moderate (yellow) to high (orange) to highest (red). The NICO Project Risk Matrix is a resource for communicating results, prioritizing risks, and facilitating implementation of the most effective risk mitigation options.

**Table 17.2-2: Risk Matrix Priority Levels**

| Risk Level | | Management Action |
|---|---|---|
| | Highest | Action required. More detailed risk analysis may be required. |
| | High | Assess risk mitigation options and reduce risk before closure, where practical. Prioritize resources to manage these risks before Moderate or Low ranked risks. More detailed risk analysis may be required. |
| | Moderate | Assess risk mitigation options and reduce risk before closure, where practical. |
| | Low | Accept risk (and monitor). |

### 17.2.4 Emergency Response and Spill Contingency Plan

Following the assessment of accidents and malfunctions, emergency and spill contingency measures contained in the Emergency Response and Spill Contingency Plan (Appendix 3.VI) and other relevant management plans were reviewed to verify that potential emergencies and spills identified in this assessment have been properly addressed according to good industry practice.

## 17.3 Risk Assessment

The risk assessment addresses potential accidents and malfunctions for the following NICO Project components:

- mining (including the Open Pit and Underground Mine facilities);
- processing (including the primary crushing station, crushing and screening plant, concentrator plant, and Effluent Treatment Facility [ETF]);
- co-disposed Tailings and Mine Rock (including the tailings pipeline, CDF, and associated water management ponds);
- utilities (including fuel station, freshwater supply, and power supply); and
- transportation (including truck transportation of concentrates and supply, and flights to and from the Airstrip).

The following sections summarize the risk assessment for each NICO Project component. Following a brief overview of the NICO Project facility and its operation throughout all the NICO Project phases, the following information is provided for each hazard scenario:

- The hazard scenario is first described in terms of the failure mode, causes, and consequences.
- Mitigation measures and other information used in estimating the risks are then presented.
- Likelihood and consequence severity are estimated and the risk is determined from the NICO Project Risk Matrix.
- Other additional comments are provided as applicable.

A summary of the hazard scenarios and risk estimates are provided in Section 17.4.

Potential accidents and malfunctions that may impact workers' safety but not the environment or public safety (e.g., underground head failure, on-site explosives incident, etc.) are part of the more general NICO Project risk management program but are not included in this assessment. Fuel spills from on-site equipment, which may occur anywhere within the NICO Project site, are addressed under Utilities (Section 17.3.4).

### 17.3.1 Mining

The mining component will produce 31 million tonnes (Mt) of ore over 18 years, including 2.2 Mt via the Underground Mine and 28.8 via the Open Pit. Both underground and Open Pit mining will take place in the first 2 years of operation. In the third year of operation, the mine will switch to an Open Pit operation only. The Open Pit will eventually mine through the underground stopes.

Engineering studies and investigations have been completed, and no significant hydrologic connection was identified between the mines and the surrounding lakes. Dewatering will start during underground mine development. Water quality standards must be met before water collected from dewatering can be discharged. Any dewatering discharge not meeting the water quality standard will be directed to the ETF.

During operation, water accumulation in the Underground Mine or in the Open Pit, as well as water used for drilling and excavating, will be sent to the Surge Pond from which water will be recycled for use in the Plant or treated at the and released. Seepage will flow from the environment into the mines due to an inward flow gradient.

At closure, site runoff from Seepage Collection Pond (SCP) No. 4 and from impacted land surrounding the Open Pit will drain by gravity into the Open Pit. The Open Pit will flood slowly after closure. Modelling predicts that it will take approximately 120 years after the end of operations for the water level to reach elevation 260 m. This elevation is the crest of the former haul road and the low point on the rim of the Open Pit. The base case for managing the overflow from the flooded Open Pit will be to direct it to Wetland Treatment System No. 4, which will be constructed on the western shore of Peanut Lake. There is not expected to be any discharge from the underground mine portal (elevation 258 m) because the decline ramp will be sealed at the completion of underground mining (i.e., 2 years after the start of mining).

Hazard scenarios for the Flooded Open Pit during closure and post-closure are described below. Hazards during construction and operation that may affect the environment or public safety are addressed elsewhere, including dust in Section 10.9.2, fuel spills in Section 17.3.4.1, and transportation accidents in Section 17.3.5. As discussed above, seepage from the mines to the environment is not a credible hazard scenario because seepage will flow inward even in the case of a malfunction of the dewatering pumps. Stability of the surrounding topography also prevents slope failure from causing a massive overflow of the Flooded Open Pit.

#### *17.3.1.1 Water Treatment Failure during Flooded Open Pit Overflow*

Failure of the water treatment system during Open Pit Overflow phase could be caused by inadequate design or unknown operating conditions. It could result in discharge that exceeds water quality standards, reaching Peanut Lake.

Just prior to Flooded Open Pit overflow, the water quality at the top of the Flooded Open Pit will be evaluated and a decision will be made about post-Flooded Open Pit overflow treatment. The options include no further treatment (when water quality is acceptable and Flooded Open Pit overflow may be directed through a ditch to

Peanut Lake), in-pit treatment by chemical or biological means, commissioning of an ETF based on the technology at the time, or routing of pit discharge through Wetland Treatment System No. 4.

Thus, the estimated likelihood of water treatment failure during Flooded Open Pit overflow resulting in discharge into Peanut Lake exceeding water quality standards is Rare (E). The environmental consequence is Moderate (3), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

#### *17.3.1.2 Public Entering the Flooded Open Pit*

The public could enter the Flooded Open Pit during post-closure, leading to injury. The region is very sparsely populated, although residents of the surrounding communities occasionally use the areas around the site for hunting, fishing, gathering, and recreational activities. Signage will notify public of the hazard of entering the Flooded Open Pit and there will be a boulder barrier around the edges of the Flooded Open Pit, making it difficult to access.

Thus, the estimated likelihood of public entering the Flooded Open Pit resulting in injury is Unlikely (D). There are no environmental consequences and the public safety consequence is Moderate (3). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

### 17.3.2 Processing

The processing component will take run-of-mine ore directly or from a stockpile used for blending purposes. The ore will be fed to the primary crusher, and then the crushing and screening plant for secondary crushing, screening, and tertiary crushing. From here, the resulting fine ore will be fed to the concentrator plant, which includes a ball mill and gravity concentrator. Ground ore will be first fed to the primary flotation circuit consisting of rougher, cleaner, and scavenger sections. Tailings from the cleaner-scavenger circuit will be fed to a regrind mill. The regrind product will be fed to a secondary flotation circuit also consisting of rougher, cleaner, and scavenger sections. Cleaner concentrates will be combined and filtered for shipping. Tailings streams will be combined for water recycling through the tailings thickener. Water for the grinding will be obtained from recycled water recovered from a tailings thickener and reclaimed water from the CDF. The primary rougher tailings (91% of all tailings), secondary rougher tailings (8%), and secondary cleaner scavenger tailings (1%) will be combined, thickened, and sent to the CDF. The bulk cleaner concentrate will be thickened and presented to a pressure filter for dewatering to 8% moisture. The resulting solids will be packaged into large flexible intermediate bulk containers for transport to the Saskatchewan Metals Processing Plant in Saskatoon.

A list of processing chemicals/reagents used at the Plant at the NICO Project is provided in Table 17.3-1. All site water collected near the Plant will be captured and treated in the ETF.

Hazard scenarios for the primary crushing station, crushing and screening plant, concentrator plant, and ETF during operation are described below. No environmental or public safety hazard scenarios were identified for construction, closure, and post-closure.

**Table 17.3-1: Processing Chemicals and Estimated Consumption**

| Reagent (Chemicals) | Process Use | Consumption Rate | |
|---|---|---|---|
| | | kg/t of Ore | t/y |
| **Base Consumption** | | | |
| Steel grinding balls | Grinding | 0.454 | 769 |
| Potassium Amyl Xanthate (PAX) | Bulk flotation of ground slurry | 0.320 | 542 |
| Methylisobutyl Carbinol (MIBC) | Bulk flotation of ground slurry | 0.055 | 93 |
| Colorado Sand (or equivalent) | Re-grinding of primary Cl-Scav Tailing | 0.032 | 190 |
| Flocculant polymer (Anionic) | Tailings and concentrate thickening | 0.112 | 54 |

kg/t ore = kilograms per dry tonne of ore fed to the plant; t/y = dry tonnes per year

#### *17.3.2.1 On-Site Spill of Process Materials*

An on-site spill during operation could result from operator error or failure of the containment vessels, mechanical equipment, or control system. Potential sources of an on-site spill include loading and unloading activities and leaks from storage vessels and process equipment at the Plant, as well as any ammonium nitrate spillage from blasting activities. These could lead to the local release of ore, chemicals/reagents, or concentrate into the on-site environment.

Workers will be trained in spill prevention and response. The Plant will inventory emergency response kits. Process equipment will be placed indoor within the Plant. Smaller storage tanks will be double-walled, or located within lined and bermed containment areas. Reagents will be stored in larger, double-walled containers. Secondary containment will provide at least 110% capacity of the largest vessel within each facility. In case of a spill, the spill response procedures as part of the Emergency Response and Spill Contingency Plan (Appendix 3.VI) will be implemented. Potential contaminated soil will be sent to the landfarm.

The estimated likelihood of an on-site spill leading to the release of process materials into the environment is Possible (C). The environmental consequence is Low (2), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

#### *17.3.2.2 Failure of Surface Runoff Collection*

Failure of the surface runoff collection system during operation could result from high precipitation or inadequate engineering design or maintenance. It could lead to the release of contacted surface runoff to the environment. Surface runoff from around the Plant site will be directed to the surface runoff pond and returned to process.

The surface runoff collection ditches are designed for 100-year return period precipitation. Maintenance of the collection ditches will be performed as part of the operating procedure.

The estimated likelihood of a release of contacted surface runoffs to the environment is Possible (C). The environmental consequence is Low (2), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

### 17.3.3 Co-Disposed Tailings and Mine Rock

Thickened tailings (73 to 77 wt% solids) will be delivered from the Plant to the CDF. The CDF will occupy a total footprint area of 139 hectates and rise to a maximum elevation of 310 m. The bulk of the CDF will comprise inter-mixed layers of tailings and mine rock (the co-mingling area), which will be developed by alternatively depositing layers of tailings and mine rock. The tailings layer will be created by constructing a series of bermed tailings disposal cells, typically having a p shape of 200 x 200 m.

The CDF will be contained by the natural topography and a perimeter dyke constructed of Mine Rock with no tailings. The perimeter dyke will comprise 3 zones: upstream zone, filter zone, and downstream zone. The upstream zone will provide containment for provide containment for tailings and Mine Rock. The filter zone will be constructed of Type 2 Mine Rock crushed to produce aggregate or non-woven geomembrane to keep the tailings from passing through the downstream zone.

Tailings reclaim ponds will form at various locations on the CDF throughout operation as the CDF develops. Seepage and run-off from the CDF will be intercepted by 5 SCPs. A Surge Pond will temporarily store contact water pumped back from the SCPs and the tailings reclaim pond(s) for process reuse or discharge through the ETF (Appendix 3.III, Water Management Plan).

Hazard scenarios for tailings pipeline, perimeter dyke, Co-Disposed Tailings and Mine Rock area, and the associated water management ponds during construction, operation, closure, and post-closure are described below. No environmental or public safety hazard scenarios were identified for construction.

#### *17.3.3.1 Tailings Pipeline Rupture*

Rupture of the tailings pipelines during operation could result from landslides and earth movement, erosion, inadequate construction, siltation, mechanical failure, and vehicular accident involving maintenance vehicles. It could lead to the loss of thickened tailings into the environment outside of the perimeter dykes.

The tailings pipelines include inherently safe design features that prevent any release of tailings from impacting the off-site environment, including the surrounding lakes. The pipelines will be placed within bunding and trenches, which allow for any potential spills of tailings slurry to be collected for pickup and trucking to the CDF. The high density slurry will release relatively little water if a spill should occur and any drainage should report to the Surge Pond or one of the SCPs and not to the environment. An emergency spill containment pond will be constructed at the low point on the tailings pipeline. After the tailings line reaches the top of the CDF Perimeter Dyke any spills would flow into the deposition area. The tailings pipeline system will not freeze as long as flow is maintained. The system will be equipped to allow flushing whenever necessary for shutdowns. The tailings pipelines will be equipped with telemetry to monitor integrity between the Plant and the CDF. Vehicular activities in the vicinity of the pipeline are expected to be very infrequent. Emergency response and contingency measures in case of tailings pipeline rupture are described in Appendix 3.II, CDF Management Plan, and Appendix 3.VI, Emergency Response and Spill Contingency Plan. Procedures for flushing are discussed in Appendix 3.II.

The estimated likelihood of a release of thickened tailings to the environment is Unlikely (D). The environmental consequence is Very Low (1), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Low (green) (Table 17.2-1).

#### *17.3.3.2 Co-Disposal Facility Perimeter Dyke Failure*

A CDF Perimeter Dyke failure during operation, closure, or post-closure could result from slope failure due to earthquake exceeding design criteria, localized erosion as the result of an extreme precipitation event, or inadequate design, construction, or material. It could lead to tailings being released into the off-site environment, including the surrounding lakes.

The site lies in a region of low seismicity. The CDF Perimeter Dyke will be designed for a peak ground acceleration of 0.059 g (i.e., acceleration due to gravity at, 9.81 metres per second), which corresponds to a 2475-year return period earthquake event. Construction quality control and material testing will be performed as the CDF Perimeter Dyke is progressively constructed, to meet specifications. Slope inspection and monitoring will also be performed to limit the slope to 3:1 (H:V). In the case of a failure, the volume of tailings that could be released to the environment is limited by the Co-Disposed Tailings and Mine Rock cell design, and the effects are at most medium-term and regional. In the worst-case, SCPs would be filled with tailings and Mine Rock with these seepage collection dams acting as a separate barrier. Emergency response measures will be taken, as described in Appendix 3.VI.

The estimated likelihood of a CDF Perimeter Dyke failure impacting the off-site environment is Rare (E). The environmental consequence is Moderate (3), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

### *17.3.3.3 Overflow of the Tailings Reclaim Ponds*

Overflow of the tailings reclaim ponds, which will be created upstream of, or on, active and inactive tailings disposal cells during operation could result from precipitation exceeding design criteria, slope failure in the CDF or surrounding natural topography, or inadequate design, construction, or material. It could lead to the release of contact water to the environment.

The CDF is designed to store the Inflow Design Flood in addition to the Environmental Design Flood during operations. The Inflow Design Flood is a rainfall storm of 1/3 between the 1000-year return period precipitation and the probable maximum precipitation, and the Environmental Design Flood is the 100-year return period 30-day rainfall-plus-snowmelt event. Because reclaimed water collected in deposition cells is returned to the Plant for use as process water, a high degree of saturation in the surrounding water and tailings would be required for overflow. Reclaimed water collection areas will also be constructed away from the perimeter dykes. During final years of operation and following closure, an Emergency Spillway will be constructed to safely convey the Inflow Design Flood away from the perimeter dyke (Appendix 3.III, Water Management Plan). The CDF leads to an inherently more stable slope to prevent slope failure. Furthermore, construction quality control and material testing will be performed as the CDF Perimeter Dyke is progressively constructed, to meet specifications. Slope inspection and monitoring will also be performed. In the case of a failure, the effects are at most medium-term and regional and may be the cause of a perimeter dyke failure, and likely contained within the seepage ponds. Emergency response measures will be taken, as described in Appendix 3.VI.

The estimated likelihood of a perimeter dyke failure impacting the off-site environment is Rare (E). The environmental consequence is Moderate (3), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

### *17.3.3.4 Seepage Greater than Design*

Seepage greater than design from the CDF and associated water management ponds during operation, closure, or post-closure could be caused by unknown geologic conditions, inadequate engineering design (e.g., ungrouted drill holes), material (e.g., geomembrane rupture), or construction implementation. Seepage greater than design could result in an excess infiltration of contact water into the groundwater, affecting nearby lakes.

Inherent to the CDF design is that filling the Mine Rock void space with thickened tailings will reduce infiltration, maintain saturation, and reduce the rate of oxygen ingress into the co-disposed mass, thus reducing the rates of infiltration, sulphite oxidation, acid generation, and exfiltration. To reduce seepage from the CDF, the CDF Perimeter Dykes will be constructed as a low permeability structure with a geosynthetic liner for the water retaining element. Seepage from the CDF will be intercepted by the SCPs. The SCPs will be designed to accommodate the anticipated higher seepage rate during spring thawing. During operations, water in the SCPs will be pumped to the Surge Pond. Water from the Surge Pond will be pumped for use in the Plant or pumped to the ETF for treatment prior to release into Peanut Lake. The pumping of water from the ponds back to the Plant during operations will also serve to limit the differential head across the CDF Perimeter Dykes and thus reduce the rate of seepage.

During closure, a closure cover will be placed over the entire surface of the CDF to reduce seepage from the CDF to the SCPs. The rate of seepage from the 3 SCPs into Nico Lake will be as low as can reasonably be achieved by good dam design and dam foundation treatment.

The estimated likelihood of an excess infiltration of contact water into the groundwater affecting the off-site environment is Rare (E). The environmental consequence is Moderate (3), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

#### *17.3.3.5 Dam Failure at the Water Management Ponds*

Dam failure at the Water Management Ponds (i.e., the Seepage Collection Ponds, Surge Pond, the Plant Runoff Pond, and Contingency Pond [if constructed]) during operation, closure, or post-closure could be caused by slope failure due to earthquake exceeding design criteria, localized erosion as the result of an extreme precipitation event, or inadequate design, construction, or material. It may result in the release of seepage, contact water, or unacceptable effluent directly into the environment, reaching the surrounding lakes.

Dams will be present at 6 of the water management ponds (SCPs No. 1, 2, and 3, Surge Pond, Contingency Pond, and Processing Plant Runoff Pond). The site lies in a region of low seismicity and the dams will be designed for a peak ground acceleration of 0.021 g, which corresponds to a 475-year return period earthquake event. Ponds will be designed to store the Environmental Design Flood of 100-year, 24-hour storm. The dams will include spillways to prevent dam overtopping and failure in case of a flood event of a longer return period.

The estimated likelihood of dam failure at the water management ponds is Unlikely (D). For the SCPs, the environmental consequence is Moderate (3), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow). For the Surge Pond, Contingency Pond, and the Plant Runoff Pond the environmental consequence is Low (2), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Low (green) (Table 17.2-1).

#### *17.3.3.6 Public Entering the Co-Disposal Facility*

The public could enter the CDF during operation, leading to injury. The region is very sparsely populated, although residents of the surrounding communities occasionally use the areas around the site for hunting, fishing, and gathering activities. Signage, security, and access restriction will prevent the public from entering the CDF.

The estimated likelihood of public entering the CDF during operation resulting in injury is Rare (E). There are no environmental consequences and the public safety consequence is Moderate (3). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

### 17.3.4 Utilities

The NICO Project will include a temporary (for construction) and permanent fuel storage and dispensing station located near the Plant. Following construction, the temporary diesel storage tanks will be removed and the lined area used for soil reclamation. A water intake pipeline will source make-up freshwater from Lou Lake to the Plant.

To avoid freezing, water lines on the site will be installed, wherever possible, with profiles that will allow them to drain freely. For example, this would be the case for the pipeline from the ETF to Peanut Lake. If necessary, drain points and vacuum breaks will be installed on water lines to facilitate drain down. Sections of water lines which cannot be readily drained will be insulated and heat traced if necessary. In case of a spill from a water line, the water will report to one of the water management ponds. Exceptions are the freshwater intake pipeline, which will carry freshwater, and the water line from the ETF to Peanut Lake, which will carry treated water, as loss of these materials will not impact the environment. Potential loss of freshwater will also be managed through safe shutdown procedures so that it will not result in contaminant spills.

Hazard scenarios for the fuel station during construction, operation, and closure are described below. No hazard scenarios were identified for the water intake pipeline. The facilities will be demolished during closure and there will be no environmental or public safety risk post-closure.

#### *17.3.4.1 On-Site Fuel Spill*

An on-site fuel spill during construction, operation, or closure could result from fuel line rupture, fuel truck leak, or other accident involving mobile heavy equipment, operator overfilling, or mechanical failure at the fuel dispensing station. It could lead to soil contamination on-site.

Equipment and vehicle maintenance programs will be in place to prevent malfunctions, such as a fuel line rupture. Equipment and vehicle operators will receive safety training, including accident prevention and fuel station safety. Smaller storage tanks will be double-walled, or located in lined and bermed containment areas. Fuel will be stored in larger double-walled containers. A containment dyke will be constructed around the fuel station and storage facility design will follow the CCME “Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Product (PN 1148, 1994).” Spills from these activities are expected to be small and localized. Emergency response and spill contingency measures are provided in Appendix 3.VI. Soils from petroleum spill areas will be deposited and spread in a lined landfarm cell for bioremediation.

The estimated likelihood of an on-site fuel spill is Probable (A). The environmental consequence is Very Low (1), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

#### *17.3.4.2 Catastrophic Piping or Tank Failure*

Catastrophic failure of piping or a tank at the fuel station during construction, operation, or closure could result from construction defects, corrosion, fatigue, or other factors. It could lead to a large spill or fire (if an ignition source is present).

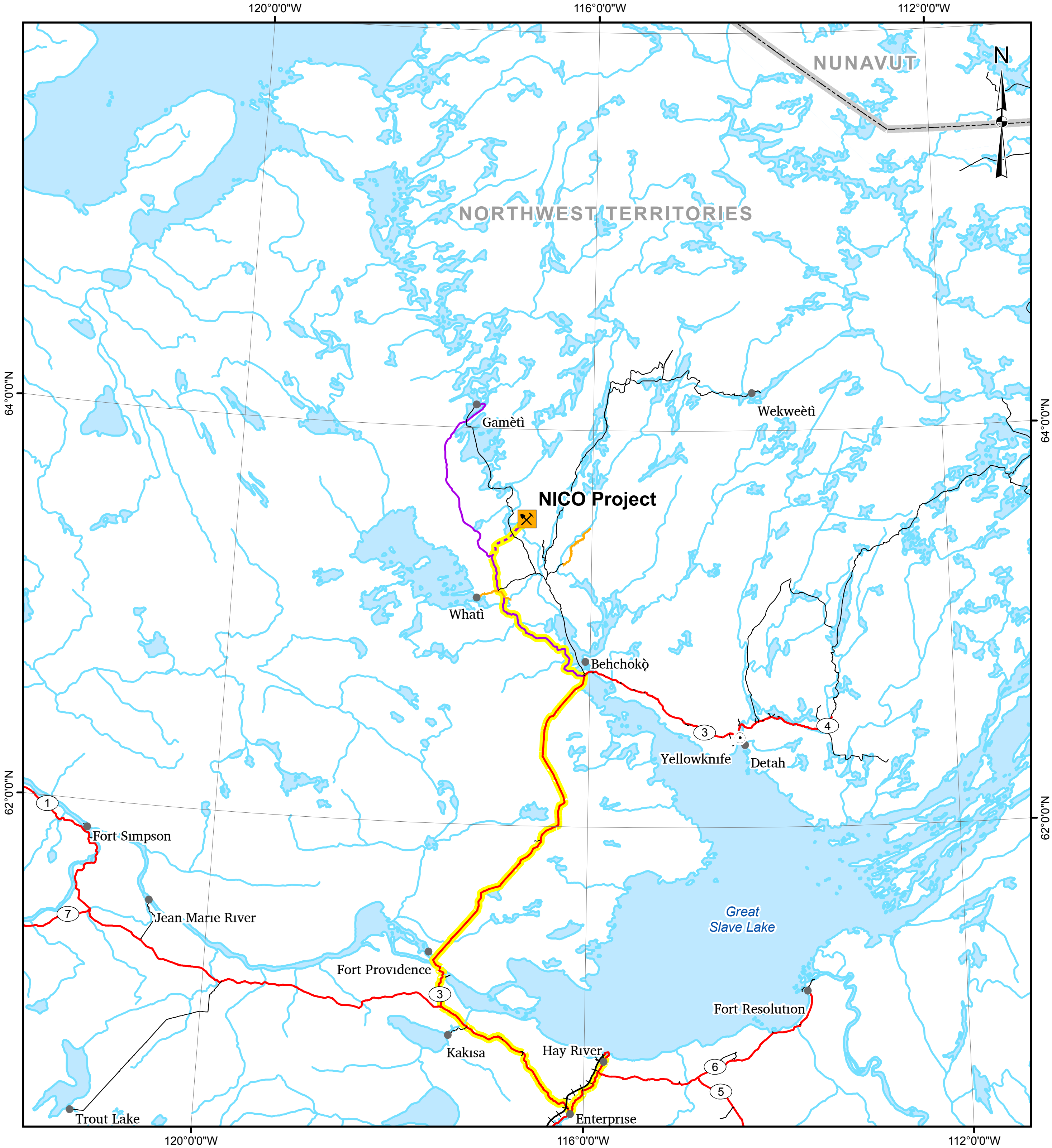
Piping and tank failures will be prevented through good engineering design and construction quality assurance. Furthermore, fuel will be stored in double-walled containers. Secondary containment of at least 110% of the largest tank will be present. A containment dyke will also be constructed around the fuel station and storage facility design will follow the CCME "Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Product (PN 1148, 1994)." Fuel station operations and maintenance procedure will include measures to prevent ignition sources. The spill and fire are not expected to reach off-site environment. Emergency response and spill contingency measures are provided in Appendix 3.VI.

The estimated likelihood of a catastrophic piping or tank failure resulting in a large spill or fire is Unlikely (D). The environmental consequence is Low (2), and there are no public safety consequences. Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Low (green) (Table 17.2-1).

### 17.3.5 Transportation

During construction, equipment and supply will be hauled to the NICO Project site locally through the proposed NICO Project Access Road (NPAR), the existing Whatì and Gamètì winter roads, the Proposed Tłı̨chǫ Road Route, and regionally through the Northwest Territories (NWT) highway system (Figure 17.3-1). A conservative estimate of 2200 truckloads of equipment and supply will be transported over 1 winter road season (approximately 85 trucks per day, see Section 17.3.5.1).

During operation, 5 trucks/day of concentrate will be hauled from the NICO Project site to Hay River, before being further transported by rail to the Saskatchewan Metals Processing Plant in Saskatoon. In addition, a conservative estimate of 4 trucks/day of supply will be transported to the NICO Project site. The Proposed Tłı̨chǫ Road Route is expected to be operational during the entire operation phase of the NICO Project. Trucks will access the NICO Project site locally through the NPAR and the Proposed Tłı̨chǫ Road Route, and regionally through the NWT highway system (Figure 17.3-1).




## LEGEND

- NICO PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- EXISTING ALL-WEATHER ROAD
- EXISTING WINTER ROAD
- PROPOSED NICO PROJECT ACCESS ROAD
- PROPOSED TŁĮCHǪ ROAD ROUTE
- RAILROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- WATERBODY
- CONCENTRATE TRANSPORTATION ROUTE

100 0 100

SCALE 1:3,000,000 KILOMETRES

## REFERENCE

Base data obtained from Atlas of Canada, DMTI, and ESRI.
Projection: Canada Lambert Conformal Conic

FORTUNE MINERALS LIMITED
FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

# NICO PROJECT CONCENTRATE TRANSPORTATION ROUTE

FILE NO. E-Risk-001-GIS

| | | | | |
|---|---|---|---|---|
| PROJECT No. 09-1373-1004 | | | SCALE AS SHOWN | REV. 0 |
| DESIGN | DT | 18 Jan. 2011 | | |
| GIS | VGV | 19 Jan. 2011 | | |
| CHECK | GRA | 03 Apr. 2011 | FIGURE: 17.3-1 | |
| REVIEW | GRA | 03 Apr. 2011 | | |

Golder Associates
Edmonton, Alberta

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The NICO Project Airstrip will be used for personnel transport during construction. Over the 12 month construction period, there will be approximately 2 flights per week during the first 6 months, and 4 flights per week during the second 6 months flying into and out of the airstrip. During operation, the Airstrip will be used only for emergency flights.

Hazard scenarios for truck and air transport during construction and operation are described below. Hazard scenarios during closure have not been assessed. However, transportation exposure during closure is expected to be similar to the construction and operation phases. Transportation during post-closure will be minimal.

#### *17.3.5.1 Truck Accident on Local Roads*

Truck accidents on the local roads could result from vehicle factors (e.g., inadequate maintenance), driver factors (e.g., fatigue), and environmental factors (e.g., road condition). They could lead to an off-site spill affecting the environment or a casualty collision (i.e., injury or fatality) affecting public users of the road. Potential collision with wildlife, along with physical hazards on the mine site, have been determined to have negligible effect on the persistence of caribou populations (Section 8.4.2.2) and other wildlife population (Section 15.3.2.2).

The likelihood of a transportation hazard scenario is estimated based on the exposure (vehicle kilometres travelled [VKT] over a time period) and accident rates (collision rates, spill rates). During construction, the trucks will travel approximately 100 km of the existing Whatì and Gamètì winter roads or the Proposed Tłįchǫ Road Route and approximately 27 km of the proposed NPAR. The transportation risk can be estimated using baseline historical data for the existing roads. NWT Department of Transportation (DOT) publishes annual reports on transportation statistics, including data on traffic volume (DOT 2009), collisions (DOT 2010), and spills (DOT 2007), for NWT highways and roads. NWT Environment and Natural Resources (ENR) also maintains a separate database on spills (ENR 2005, internet site).

Information for Whatì and Gamètì winter roads for the last 10 years of available data are provided in Tables 17.3-2 and 17.3-3. However, as can be seen in the tables, the information is often incomplete. From 2000 to 2009, the average number of days of a winter road season is 74 days for the Whatì winter road and 52 days for the Gamètì winter road.

Recent vehicle counts are only available for Gamètì winter road from 2007 to 2009, which has an average of 46 vehicles/day average daily traffic (ADT). Two injury collisions and 4 spills were recorded on the Whatì and Gamètì winter roads between 2000 and 2009. The calculated historical injury collision and spill rates are also shown in Tables 17.3-2 and 17.3-3.

**Table 17.3-2: Whatì Winter Road Transportation Statistics**

| Year | Number of Days | Average Daily Traffic | Injury Collision | Spills | Injury Collision Rate (per million VKT)[a] | Spill Rate (per million VKT) |
|---|---|---|---|---|---|---|
| 2009 | 81 | — | 0 | 2 | — | — |
| 2008 | 62 | — | 0 | 0 | — | — |
| 2007 | 68 | — | 0 | 0 | — | — |
| 2006 | 68 | — | 0 | 0 | — | — |
| 2005 | 89 | — | 0 | 0 | — | — |
| 2004 | 68 | — | 0 | 2 | — | — |
| 2003 | 80 | — | 0 | 0 | — | — |
| 2002 | 91 | — | 0 | 0 | — | — |
| 2001 | 53 | — | 0 | 0 | — | — |
| 2000 | 78 | — | — | 0 | — | — |
| Average | 74 | — | 0.0 | 0.4 | — | — |

[a] All injuries, including to the driver, passenger, and other users of the road, for all types of vehicles

— = not available; VKT = vehicle kilometres travelled

**Table 17.3-3: Gamètì Winter Road Transportation Statistics**

| Year | Number of Days | Average Daily Traffic | Injury Collision | Spills | Injury Collision Rate (per million VKT)[a] | Spill Rate (per million VKT) |
|---|---|---|---|---|---|---|
| 2009 | 52 | 40 | 0 | 0 | 0.0 | 0.0 |
| 2008 | 42 | 49 | 1 | 0 | 3.9 | 0.0 |
| 2007 | 43 | 49 | 0 | 0 | 0.0 | 0.0 |
| 2006 | 31 | — | 0 | 0 | — | — |
| 2005 | 75 | — | 0 | 0 | — | — |
| 2004 | 44 | — | 0 | 0 | — | — |
| 2003 | 66 | — | 1 | 0 | — | — |
| 2002 | 73 | — | 0 | 0 | — | — |
| 2001 | 35 | — | 0 | 0 | — | — |
| 2000 | 57 | — | — | 0 | — | — |
| Average | 52 | 46 | 0.2 | 0.0 | 0.7 | 0.0 |

[a] All injuries, including to the driver, passenger, and other users of the road, for all types of vehicles

— = not available; VKT = vehicle kilometres travelled

The NICO Project truck traffic will represent an increase compared to baseline traffic. As the construction mobilization traffic will pass over both Whatì and Gamètì winter roads, it is assumed that the 2200 truckloads of construction equipment and supply will be spread over 1 season of the Gamètì winter road (average 52 days). The winter roads are expected to be open longer during construction and a portion of the construction traffic may use the Proposed Tłįchǫ Road Route, therefore this assumption is conservative. It corresponds to an increase of approximately 85 vehicles per day ADT (including return trips), which is a 185% increase compared to baseline traffic on Gamètì winter road (Table 17.3-3). Exposure is determined from the number of truck trips and the distance traveled. The total distance traveled by all NICO Project trucks along the NPAR and the winter roads during construction is approximately 484 000 VKT.

Although the historical spill and injury collision rate data are incomplete, the available information suggests that they have been historically low. During construction, diesel, ammonium nitrate, and concrete are the highest volume of materials transported that could be involved in a spill. The transport of these products and clean-up procedures are well understood in the NWT. The NICO Project will use a transportation contractor with proven safety records and winter road experience. It will also designate a contractor to assist with clean-up between Behchokǫ̀ and the NICO Project site. The winter roads will go over a number of lakes and streams, including the Marian River; however, frozen conditions will facilitate clean-up. Contingency and emergency response procedures, including for spill clean-up and medical emergencies, will be in place to reduce the consequences of an accident.

Based on the historical record and the estimated volume of NICO Project traffic, the estimated likelihood of a truck accident on the existing winter roads leading to public injury during construction is Likely (B). The public safety consequence is Low (2). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

Similarly, the estimated likelihood of a truck accident on the existing winter roads leading to public fatality during construction is Unlikely (D). The public safety consequence is High (4). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as High (orange) (Table 17.2-1).

The estimated likelihood of a truck accident on the existing winter roads leading to spills affecting the environment is Possible (C). The environmental consequence is Low (2). Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

During operation, the trucks will travel approximately 120 km of the Proposed Tłįchǫ Road Route and approximately 30 km of the NPAR. While historical data do not apply to the Proposed Tłįchǫ Road Route and the NPAR, spill and injury collision rates are expected to be less than for the winter roads.

Transportation exposure during operation is similar to the construction phase. The NICO Project operation will increase vehicle traffic by approximately 18 vehicles/day (including 5 concentrate trucks and 4 supply trucks per day, with return trips). Expected traffic volume for other vehicles on the Proposed Tłįchǫ Road Route is unknown. The total distance travelled by all NICO Project trucks during operation is approximately 490 000 VKT/year.

Mitigation measures during construction will also apply for operation. Reagents to be transported during operations are shown in Table 17.3-1. Transport and spill clean-up procedures for these reagents are also well understood among transportation contractors in NWT. The concentrate will be transported in double-lined flexible intermediate bulk container bags thus reducing the likelihood of release to the environment.

Given the similar transportation exposure, risk estimates for public injury, public fatality, and spills affecting the environment on the local roads during operation are similar to those during construction.

#### 17.3.5.2 Truck Accident on Regional Highways

Trucks will travel to and from the NICO Project using the NWT highway network. During construction, equipment and supply will reach the NWT highways via various modes of transportation. Trucks will travel to and from key transportation hubs, such as Hay River and Yellowknife, predominantly through Highway 3. During construction, total distance travelled for the 2200 truckloads of construction equipment and supply through the NWT highways is estimated to be 1 700 000 VKT/year. During operation, total distance travelled for concentrate and supply is estimated to be 1 000 000 VKT/year.

Baseline historical traffic statistics for Highway 3 are used to characterize the transportation risk. They are provided in Table 17.3-4 for the last 10 years of available data. Traffic volume is presented as the annualized average daily traffic (AADT) at 5 DOT traffic counters along Highway 3. As shown in the table, the AADT is highest at KM 338 in Yellowknife, with an average value of 5410. Outside of Yellowknife, average AADT ranges from 221 at KM 175 between Fort Providence and Behchokǫ̀, to 663 at KM 240 near Behchokǫ̀.

The calculated injury collision, fatality collision, and spill rates for Highway 3 are also shown in Table 17.3-4. These rates are similar to the national rates for all vehicle types, which are approximately 0.5 per million VKT for injury and 0.007 per million VKT for fatality (Transport Canada 2010a), and the national rates for trucks, which are approximately 0.4 per million VKT for injury and 0.02 per million VKT for fatality (Transport Canada 2010b).

**Table 17.3-4: Highway 3 Transportation Statistics**

| Year | Annualized Average Daily Traffic at Traffic Counters Along Highway 3[a] | | | | | Injury Collision Rate[b] (per million VKT) | Fatality Collision Rate[b] (per million VKT) | Spill Rate (per million VKT-) |
|---|---|---|---|---|---|---|---|---|
| | KM 2 | KM 175 | KM 240 | KM 324 | KM 338 | | | |
| 2008 | 320 | 310 | 770 | 640 | 5600 | 0.18 | 0.02 | 0.10 |
| 2007 | 300 | 300 | 780 | 640 | 5600 | 0.17 | 0.03 | 0.05 |
| 2006 | 270 | 210 | 780 | 640 | 5680 | 0.21 | 0.00 | 0.02 |
| 2005 | 260 | 210 | 650 | 610 | 5570 | 0.39 | 0.00 | 0.02 |
| 2004 | 250 | 210 | 650 | 450 | 5570 | 0.24 | 0.00 | 0.00 |
| 2003 | 250 | 210 | 650 | 450 | 5570 | 0.35 | 0.02 | 0.09 |
| 2002 | 240 | 210 | 640 | 440 | 5460 | 0.42 | 0.02 | 0.13 |
| 2001 | 220 | 190 | 590 | 410 | 5060 | 0.46 | 0.00 | 0.12 |
| 2000 | 200 | 180 | 570 | 400 | 4980 | — | — | 0.02 |
| 1999 | 190 | 180 | 550 | 390 | 5010 | — | — | — |
| Average | 250 | 221 | 663 | 507 | 5410 | 0.30 | 0.01 | 0.06 |

[a] Traffic counters at distances measured from Highway 1 junction: KM 2 (near Highway 1 junction), KM 175 (between Fort Providence and Behchokǫ̀), KM 240 (near Behchokǫ̀), KM 324 (near Yellowknife), and KM 338 (in Yellowknife).

[b] All injuries/fatalities, including to the driver, passenger, and other users of the road, for all types of vehicles.

— = not available; km = kilometre; VKT = vehicle kilometres travelled

The NICO Project truck traffic will represent a minor increase in traffic compared to the baseline. The highest increase is anticipated at Highway 3, KM 175, because of its low baseline traffic volume. The increase due to

NICO Project truck traffic at this location is estimated to be approximately 5% during construction and 3% during operation.

The mitigation measures applied for the local roads also will be applied on the regional highways. The transportation contractors are expected to perform better than average road users given the planned mitigation measures; thus, the injury, fatality, and spill rates are expected to be lower.

The estimated likelihood of a truck accident on the regional highways leading to public injury is Likely (B). The public safety consequence is Low (2). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

The estimated likelihood of a truck accident on the regional highways leading to public fatality is Unlikely (D). The public safety consequence is High (4). Therefore, the level of risk to public safety is estimated from the NICO Project Risk Matrix as High (orange) (Table 17.2-1).

The estimated likelihood of a truck accident on the regional highways leading to spills affecting the environment is Possible (C). The environmental consequence is Low (2). Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Moderate (yellow) (Table 17.2-1).

#### *17.3.5.3 Aircraft Accident*

An aircraft accident could result from aircraft, pilot, or environmental factors and could lead to localized environmental impact or public fatality at the crash site.

Accidents could occur at the Airstrip during takeoff or landing. The Airstrip will be maintained to a safety standard required by the air charter companies, which operate under the regulations set by Transport Canada. This will include regular grading throughout the year and snow removal in the winter. During construction, the Airstrip will be installed with temporary lighting, a field electrical center, a published GPS approach procedure, and wind socks. Radio contact will be maintained between the aircraft and NICO Project personnel for flights to and from the NICO Project site. Any vehicles operating on the Airstrip will be equipped with approved flashing lights and will be equipped with radios to maintain contact with the site air traffic controller. Large ungulates, such as caribou, will be herded off the strip, if required.

Accidents could also occur anywhere along the flight path. The Emergency Response and Spill Contingency Plan will provide response actions needed for this type of accident. Aircraft operations and safety profiles are expected to be similar to other northern aircraft operations. The aircraft maximum size will be limited to Dash 7 Combi, Twin Otter, Buffalo, and Beechcraft sized aircraft.

The NICO Project's exposure to aircraft accidents is low. As stated earlier, the Airstrip will be used only for approximately 2 flights per week during the first 6 months of construction, and 4 flights per week for the second 6 months. During operation, the Airstrip will be used only for emergency flights.

The estimated likelihood of an aircraft accident is Rare (E). The environmental consequence is Low (2) and public safety consequence is High (4). Therefore, the level of risk to the environment is estimated from the NICO Project Risk Matrix as Low (green) and to public safety as High (orange) (Table 17.2-1).

## 17.4 Summary of Results

Hazard scenarios and risk estimates have been developed in Section 17.3 for potential accidents and malfunctions associated with the NICO Project. The results are summarized in Table 17.4-1. The risks were estimated according to likelihood and consequence severity indices in the NICO Project Risk Matrix (Table 17.2-1) and Risk Matrix Priority Levels (Table 17.2-2).

As shown, most of the residual risks were estimated as Low (green) or Moderate (yellow). Three hazard scenarios for transportation-related fatalities were estimated as High risks (orange). This High level of risk reflects the existing regional and national fatality rates for similar highway and air transportation activities.

**Table 17.4-1: Summary of Hazard Scenarios and Risk Estimates**

| Section Number | Hazard Scenario | Likelihood | Consequence Severity | |
|---|---|---|---|---|
| | | | Environmental | Public Safety |
| **Mining** | | | | |
| 17.3.1.1 | Water treatment failure during Open Pit Overflow | Rare (E) | Moderate (3) | — |
| 17.3.1.2 | Public entering the Flooded Open Pit | Unlikely (D) | — | Moderate (3) |
| **Processing** | | | | |
| 17.3.2.1 | On-site spill of process materials | Possible (C) | Low (2) | — |
| 17.3.2.2 | Failure of surface runoff collection | Possible (C) | Low (2) | — |
| **Co-Disposed Tailings and Mine Rock** | | | | |
| 17.3.3.1 | Tailings pipeline rupture | Unlikely (D) | Very Low (1) | — |
| 17.3.3.2 | Co-Disposal Facility Perimeter Dyke failure | Rare (E) | Moderate (3) | — |
| 17.3.3.3 | Overflow of the reclaim pond | Rare (E) | Low (2) | — |
| 17.3.3.4 | Seepage greater than design | Rare (E) | Moderate (3) | — |
| 17.3.3.5 | Dam failure | | | |
| | at a seepage collection pond | Unlikely (D) | Moderate (3) | — |
| | at the surge or contingency pond | Unlikely (D) | Low (2) | — |
| 17.3.3.6 | Public entering the CDF | Rare (E) | — | Moderate (3) |
| **Utilities** | | | | |
| 17.3.4.1 | On-site fuel spills | Probable (A) | Very Low (1) | — |
| 17.3.4.2 | Catastrophic failure of fuel tank or piping | Unlikely (D) | Low (2) | — |
| **Transportation** | | | | |
| 17.3.5.1 | Truck accident on local roads | | | |
| | leading to public injury | Likely (B) | — | Low (2) |
| | leading to public fatality | Unlikely (D) | — | High (4) |
| | leading to spills affecting the environment | Possible (C) | Low (2) | — |
| 17.3.5.2 | Truck accident on regional highways | | | |
| | leading to public injury | Likely (B) | — | Low (2) |
| | leading to public fatality | Unlikely (D) | — | High (4) |
| | leading to spills affecting the environment | Possible (C) | Low (2) | — |
| 17.3.5.3 | Aircraft accident | Rare (E) | — | High (4) |

Note: color coding refers to the risk level, refer to Table 17.2-2.
— = not applicable

## 17.5 Emergency Response and Spill Contingency Plan

The Emergency Response and Spill Contingency Plan for the NICO Project is provided in Appendix 3.VI. The plan was developed for the purposes of the environmental assessment and is intended to provide general guidance for emergency response and spill contingency planning at the NICO Project site during the construction and operational phases. This plan will be reviewed and updated to incorporate commitments made during the environmental assessment process and conditions contained within the water license, and as the NICO Project moves into the construction and operations phases, and ultimately to closure and reclamation.

Emergency response and spill contingency measures for on-site risks identified in this risk assessment have been addressed in Appendix 3.VI. In addition, Appendix 3.II, CDF Management Plan, provides the contingency plan for the CDF and emergency response and spill contingency plan for the tailings distribution system. Appendix 3.III, Water Management Plan, discusses the adaptive management plan for extreme climatic and precipitation events as well as for contingent water treatment during operation and closure.

Emergency response and spill contingency plans for transportation-related risks (both road and air transportation) will be provided by third-party transportation contractors. The third-party plans will provide the prevention, response, communication, and reporting procedures, as well as organization and responsibilities, for transportation accidents and spills. Spills exceeding any of the threshold quantities shown in Table 17.5-1 must be immediately reported to the NWT 24-Hour spill Report Line. Local Royal Canadian Mounted Police must be notified if a risk to the public exists.

**Table 17.5-1: Spill Report Threshold Quantities**

| TDGA Class | Description of Contaminant | Amount Spill |
|---|---|---|
| 1 | Explosives | Any amount |
| 2.1 | Compressed Gas (flammable) | Any amount of gas from containers with a capacity greater than 100 L |
| 2.2 | Compressed Gas (non-corrosive) | Any amount of gas from containers with a capacity greater than 100 L |
| 2.3 | Compressed Gas (toxic) | Any amount |
| 2.4 | Compressed Gas (corrosive) | Any amount |
| 3.1, 3.2, 3.3 | Flammable Liquid | 100 L |
| 4.1 | Flammable Solid | 25 kg |
| 4.2 | Spontaneously Combustible | 25 kg |
| 4.3 | Water Reactant Solids | 25 kg |
| 5.1 | Oxidizing Substances | 50 L or 50 kg |
| 5.2 | Organic Peroxides | 1 L or 1 kg |
| 6.1 | Poisonous Substances | 5 L or 5 kg |
| 6.2 | Infections Substances | Any amount |
| 7 | Radioactive | Any amount |
| 8 | Corrosive Substances | 5 L or 5 kg |
| 9.1 (in part) | Miscellaneous Products or Substances excluding PCB Mixtures | 50 L or 50 kg |
| 9.2 | Environmentally Hazardous | 1 L or 1 kg |
| 9.3 | Dangerous Wastes | 1 L or 1 kg |
| 9.1 (in part) | PCB Mixtures of 5 ppm or more | 0.5 L or 0.5 kg |
| None | Other Contaminants | 100 L or 100 kg |

Source: *Environmental Protection Act*, Consolidation of Spill Contingency Planning and Reporting Regulations R.R.N.W.T. 1990, c, Schedule B.

TDGA = *Transportation of Dangerous Goods Act*; kg = kilogram; L = litre

## 17.6 Conclusions

Hazard scenarios were identified for accidents and malfunctions that present risks to the environment or public safety. None of the risks identified were classified as Highest (red) using the NICO Project Risk Matrix. Most risks were estimated as Low (green) or Moderate (yellow). Three hazard scenarios for transportation-related fatalities were estimated as High risks (orange). This High level of risk reflects the existing regional and national fatality rates for similar highway and air transportation activities. The residual risks for all hazard scenarios are expected to be within Territorial and Federal standards.

Detailed emergency response and spill contingency plans will be developed prior to construction and operation, incorporating commitments made during the environmental assessment processes and conditions contained within the water license. Risks will continue to be identified, estimated, and managed in an ongoing risk management program throughout detailed design, construction, and operation. This continuous risk management process also will be applied to closure planning throughout the life of the operation.

## 17.7 References

Canadian Standards Association. 1997. CAN/CSA-Q850-97 – Risk Management: Guideline for Decision-Makers. Etobicoke, ON.

DOT (Department of Transportation). 2007. Minister of Transportation’s Report to the Legislative Assembly for 2006 on the *Transportation of Dangerous Goods Act* (1990). Yellowknife, NWT.

DOT. 2009. Northwest Territories highway traffic, 2008. Yellowknife, NWT.

DOT. 2010. 2009 Northwest Territories traffic collision facts. Yellowknife, NWT.

ENR (Environment and Natural Resources). 2005. Available at: http://www.enr.gov.nt.ca/_live/pages/wpPages/Hazardous_Materials_Spill_Database.aspx. Accessed on 17 January 2011.

International Organization for Standardization. 2009a. ISO 31000:2009 – Risk management – Principles and Guidelines. Geneva, Switzerland.

International Organization for Standardization. 2009b. ISO/IEC 31010:2009 – Risk management – Risk assessment techniques. Geneva, Switzerland.

MVRB (Mackenzie Valley Review Board). 2009. Terms of Reference for the environmental assessment of Fortune Minerals Ltd. NICO Cobalt-Gold-Bismuth-Copper Project EA 0809-004. Yellowknife, NWT.

Transport Canada. 2010a. Canadian motor vehicle traffic statistics 2008. Ottawa, ON.

Transport Canada. 2010b. Heavy truck casualty collisions 2001–2005. Ottawa, ON.