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B.21 – ACCIDENTS AND MALFUNCTIONS

B.21.1 INTRODUCTION

Section 21 of the Proposal for the Casino Project (the Project) presented an assessment of potential environmental or socio-economic effects that could result from accidents or malfunctions of the Project. The intent of the Proposal was to identify potential hazards associated with the Project, assess the associated risks, and identify risk reduction strategies (mitigation measures) to reduce the risks to an acceptable level on a continuous basis.

The Proposal assessed credible accidents and malfunction scenarios with the potential for moderate to major effects or consequences; the analysis of risk included the evaluation of the likelihood of occurrence of a credible incident, and the consequences should the incident occur. A qualitative risk assessment was used with descriptive terms to identify broad likelihoods and consequences of events; the accidents and malfunctions were illustrated and ranked using a risk matrix.

On January 27, 2015, the Executive Committee requested that CMC provide supplementary information to the Casino Project (YESAB Project No. 2014-0002) to enable the Executive Committee to commence Screening. The Executive Committee considered comments from various First Nations, Decision Bodies and regulators on the adequacy of the Project Proposal in the preparation of the Adequacy Review Report (ARR). CMC provided a Supplementary Information Report (SIR-A) on March 16, 2015. Subsequently, the Executive Committee issued a second Adequacy Review Report (ARR No.2) on May 15, 2015 following a second round of review.

Responses to the eight requests for supplementary information related to Section 21 and Section A.21 of the Project Proposal and SIR are provided below, as outlined in Table B.21.1-1. CMC is providing this Supplementary Information Report (SIR-B) to comply with the Executive Committee's Adequacy Review Report ARR No.2; CMC anticipates that the information in the two SIRs and in the Proposal, when considered together, is adequate to commence Screening.

Table B.21.1-1 Requests for Supplementary Information Related to Accidents and Malfunctions

Request #	Request for Supplementary Information	Response
R2-217	Details on evacuation including anticipated timelines and seasonal considerations.	Section B.21.2.1.1
R2-218	Rationale for the two hours, or 682m³, as the minimum capacity for water storage on-site for firefighting capacity.	Section B.21.2.2.1
R2-219	A risk assessment of the transportation route that considers all major water crossings in relation to the transportation of hazardous materials.	Section B.21.2.3.1
R2-220	A human health risk assessment for the Project. Details should include: a. identify hazardous materials present on-site; b. evaluation of toxicity of hazardous materials; c. identify and assess pathways, including consumption of wildlife, fish, and traditional foods; and d. characterize risk to human health.	Section B.21.2.4.1

R2-221	Rationale based on an HHRA for the exclusion of a human health monitoring plan, or, alternatively, details on a human health monitoring plan.	Section B.21.2.4.2
R2-222	Summaries of discussions that support the proposed emergency response plans with emergency service providers, communities, and governments.	Section B.21.2.5.1
R2-223	Details on emergency response for LNG accidents or emergencies in relation to the response team and their equipment including details on training, composition, availability, and location.	Section B.21.2.5.2
R2-224	Please provide a comprehensive emergency response plan that addresses accidents and malfunctions related to major mine infrastructure. This must include consideration of structural and non-structural failure of the TMF dam as informed by the risk assessment and the dam breach and inundation study.	Section B.21.3.1.1

B.21.2 EMERGENCIES AND HUMAN HEALTH

B.21.2.1 Evacuation

B.21.2.1.1 R2-217

R2-217. Details on evacuation including anticipated timelines and seasonal considerations.

A general Site Evacuation Plan will be prepared for the Casino mine site for emergency situations where the Emergency Response Coordinator and/or the Incident Commander deem that an evacuation is necessary. A site wide notification either by radio, phone, or alarm system will be established and all staff and contractors on the site will be made aware of its use. Muster station(s) will be set up at the mine site and all personnel will be made aware of the locations. The key element of the mine evacuation plan will be to ensure that all staff, contractors and visitors are accounted for and that all personnel are evacuated in a rapid and safe manner.

The design of Casino Mine offers substantial separation between major structures such as the camp and the administration building from the major mine infrastructure. This enables the camp and administration buildings to be designated “safe zone” in the event of a major event at the mine and mill area. The primary safe zone would be the permanent camp as it is the most comfortable place of refuge. The secondary safe zone would be the administration building as it is large enough to shelter workers. A safety stock of emergency rations will be stored in secure storage containers in a location such that it will not be impacted in the event of a natural disaster or major event.

If required, an orderly evacuation can be undertaken with workers being transported off site by air transport, road transport or a combination of both. Relief supplies will be delivered to the camp on empty transports heading back to the mine site. An orderly evacuation using 2 busses and one airplane as outlined in the response to R422 where the round trip for a 47 person bus is 8 hours and the round trip for air transport (operating 16 hours/day) is 3 hours. At this capacity a full evacuation of the site will be accomplished within 48 hours. In the event that an evacuation coincided with inclement weather that impedes the availability of air transport a full evacuation using 2 coaches only can be accomplished in approximately 3 days.

As the Freegold road is designed as an "all weather" road, it will be maintained and kept clear as part of normal operations, with access available 24 hours per day, 365 days per year. Air transport to Casino can be limited by visibility (snow/fog) and extreme cold (-40°C). The development of a seasonal evacuation plan will result in similar outcomes as visibility issues can occur during any season.

As part of Casino mine's normal operation, contracts with both air and ground transportation carriers will be established, provisions will be included for emergency evacuations, where minimum notice times and back up provisions will be determined.

Evacuation procedures, emergency exit routes, and muster points for each building will be posted throughout the mine buildings, including each individual room in the camp.

Further details will be provided in the Emergency Response Health and Safety Plan, as required in the application for Quartz Mining Licence, as detailed in the Plan Requirement Guidance for Quartz Mining Projects (Yukon Government, 2013), which will be reviewed for completeness by the Yukon Workers' Compensation Health and Safety Board.

B.21.2.2 Fire

B.21.2.2.1 R2-218

R2-218. Rationale for the two hours, or 682m³, as the minimum capacity for water storage on-site for firefighting capacity.

The 682 m^3 was selected as the minimum capacity for water storage on-site as follows:

- Based upon preliminary layouts of the major facilities, the area and classification of fire zones to be protected was established.
- Using the area and classification of the zones, the firewater demand was established for the highest demand zone in accordance with NFPA, and an understanding of insurance underwriter expectations for facilities of this kind.
- A conservative 2-hour firewater storage capacity, based on the maximum zone demand was established.
- The proposed system design criteria are consistent with practice in the industry for mining facilities.

B.21.2.3 Dangerous Goods, Spills and Leaks

B.21.2.3.1 R2-219

R2-219. A risk assessment of the transportation route that considers all major water crossings in relation to the transportation of hazardous materials.

As outlined in Section 21.4.3.2, the Freegold Road Extension, will be used for year-round hauling of materials into and out of the Casino mine site during operations. There will be 18 major bridge crossings located along the route, which include crossings of Bow Creek, Big Creek, Hayes Creek, and Selwyn River, and 71 major short-span bridge crossings. During the last two years of construction, LNG will be transported from Fort Nelson to the Casino Project via tanker trucks at an average frequency of two trucks per day; during operations this number will increase to eleven. The volume, form and transportation logistics of the process reagents noted in Table 21.3-1 and Table 21.3-2 will be determined during detail design engineering of the Project. A risk assessment of the

likelihood and consequence of traffic accidents was considered in Section 21.4.3.2. A spill to water at any of the watercourse crossings along the transport route is summarized below.

The likelihood of a vehicle accident resulting in a spill is a combination of the likelihood of a vehicle accident times the likelihood of loss of cargo from the vehicle and a failure of the containment method. The transportation route is approximately 200 km and the bridge and stream crossings in total represent in total length of approximately 500 m, the risk of an incident involving the waterways or any fish habitat can be characterized as relatively remote. Transportation of goods and materials will be in accordance with all applicable regulations and legislation, as well as the Explosives and Hazardous Materials Transport Permit required for the Project. The likelihood of an off-site vehicle accident resulting in the release of reagents or concentrate to the environment is rated as Possible; Consequence is rated as Moderate.

The likelihood of an off-site vehicle accident resulting in the release of LNG to the environment is rated as Unlikely; Consequence is rated as Low given the characteristics of the material. The individual LNG trailers contain less than 50 m^3 of LNG, such a small quantity, in the unlikely event of an accident resulting in a release of LNG, would not constitute a major spill nor would it have an effect lasting more than a few hours. Any damage to fish habitat or other would be very limited in scope and recoverable in a short period of time.

If spilled to water, LNG is lighter than water and boils on top until it evaporates (Drube et al 2012). As described by ABS Consulting (2004): “When spilled onto water, LNG will initially produce a negatively buoyant vapor cloud (i.e., the cold vapors are more dense than air and stay close to the water or ground). As this cloud mixes with air, it will warm up and disperse into the atmosphere.” Natural gas is also non-toxic; therefore, no impacts to water or sediment quality or fish and fish habitat are expected.

The likelihood of an off-site vehicle accident resulting in the release of diesel to the environment is rated as Unlikely; Consequence is rated as High given the characteristics of the material. Spills to water could result in a significant impact on water and sediment quality and on fish and fish habitat, depending on the location of the spill; the volume and characteristics of material spilled; and the flow within the watercourse. Chinook and chum salmon have been documented in Big Creek. Chinook have also been reported in the Selwyn River and Dip Creek. Impacts could include direct mortality to aquatic biota, sediment contamination resulting in chronic adverse effects, and loss of habitat. Effects could be localized in slower flowing, low gradient streams, or extend for several kilometres in higher gradient or larger rivers. Fish mortality affecting the species population could have an indirect effect on the Sustainable Livelihood VC, if that species was part of a traditional fishery.

Diesel spills to water could result in direct mortality of fish and invertebrates, since diesel is considered to be one of the most acutely toxic oil types (National Oceanic and Atmospheric Administration, 2013). Best practices will be followed when siting and using the mobile re-fuelers and two portable fueling stations (e.g., ensuring that they are more than 30 m from any watercourse).

In the event that a transport truck carrying reagents or concentrate is involved in a collision or accident, the effects of a reagent or concentrate spill will depend on the volume released, which will be primarily determined by the containment methods used. Environmental effects could range from negligible to moderate, depending on the location of the spill (to land or water) and the characteristics of the product. The following materials released to water could result in impacts to fish and fish habitat:

- Sodium-diisobutyl dithiophosphinate: at high concentrations acutely toxic to aquatic life
- Pebble Lime (CaO), because of the high pH, would be expected to be toxic to aquatic organisms and aquatic systems;
- Sodium Hydrosulfide (NaHS): strongly alkaline

- Potassium amyl xanthate: may persist for several days in water; highly toxic to aquatic life and may increase metal uptake in fish
- Sodium Cyanide (NaCN): highly toxic to fish, amphibians, aquatic insects and aquatic vegetation; cyanide is acutely toxic to most species of fish at concentrations greater than 200 µg/L.

Access and transportation management during the operation phase will include regular maintenance and inspections for safe operation of vehicles, snow clearing, and the application of dust suppressants as required. Ore handling and spills response is included in the Emergency and Spill Response Plan (Appendix A.22B). The Project Road Use Plan (Appendix A.22E) will outline speed limits and their enforcement; right-of-way; truck traffic communications; and the community notification and update process for the village of Carmacks.

While not assessed specifically, the risks of spills of hazardous materials to watercourses can be inferred from the risks assessed for collisions and spills, as summarized in Table 21.5-1, 21.5-2 and 21.5-3, summarized in Table B.21.2-1.

Table B.21.2-1 Risk Assessment for Hazardous Material Spills or Explosion

Scenario	Hazard	Likelihood	Consequence	Risk
6.b	Collision resulting in spill to land or water - reagent or concentrate	Possible	Moderate	Moderate
6.d	Collision resulting in fire or explosion	Unlikely	High	Low
10.c	Fire/explosion during LNG or diesel transport	Unlikely	High	Low
10.d	LNG or diesel spill during transport	Unlikely	Low	Non-actionable

Further, an LNG Management Plan was provided in Appendix A.22G and a Spill Contingency Management Plan in Appendix A.22B.

In previous assessments, the Executive Committee has determined that a hazard and risk assessment, in terms of a quantitative risk analysis (QRA) for LNG facilities and associated road route be required “during the regulatory approval process” (YOR 2013-0115-229-1). Additionally, the Executive Committee agreed with the Government of Yukon Oil and Gas Branch’s assessment that stated that through application of the Gas Plant Processing Regulation (OIC 2013/162) and the CSA standard 276-11, the “demanding regulatory requirements include comprehensive management, prevention, and contingency planning, such that adverse effects… are highly unlikely” (YOR 2013-0115-229-1). The design, manufacture, and configuration of the transportation vehicles for the Casino Project would be in accordance with the same codes & standards, as described in the approved LNG Project previously assessed by the Executive Committee.

Also, the Executive Committee found that “transportation of LNG falls under the jurisdiction of federal transport authorities. The transport company will haul the LNG under the Transportation of Dangerous Goods Regulations (Classification 2.1 - flammable gas). The transport company is responsible for all permitting and reporting of controlled or uncontrolled release while the LNG is in their custody.” (YOR 2013-0115-229-1). This conclusion applies to the Casino Project transportation of LNG as well.

B.21.2.4 Human Health Risks

B.21.2.4.1 R2-220

R2-220. A human health risk assessment for the Project. Details should include:

a. identify hazardous materials present on-site;

b. evaluation of toxicity of hazardous materials;

c. identify and assess pathways, including consumption of wildlife, fish, and traditional foods; and

d. characterize risk to human health.

a. Identify hazardous materials present on-site

b. Evaluation of toxicity of hazardous materials

The Executive Committee has requested an identification of hazardous materials present on-site and an evaluation of toxicity of hazardous materials on human health. CMC stresses that exposure to hazardous chemicals is considered under occupational health hazards (Workplace Hazardous Materials Information System (WHMIS)) and such exposure is not considered acceptable practice. CMC will comply with the *Worker's Compensation Act and Regulations*, the *Occupational Health and Safety Act*, and the *Public Health and Safety Act*. Mine operations will be conducted in a manner to minimize risk through training, awareness, and continuous improvement. Worker health and safety is the primary objective of the detailed Occupational Health and Safety Plan that will be developed by CMC and submitted to the Yukon Government for review and approval as part of the Quartz Mining License application (Yukon Water Board, 2013). The detailed Occupational Health and Safety Plan will outline potential worker exposure scenarios and procedures to minimize worker exposure. The Occupational Health and Safety Plan will also outline how worker health and safety will be monitored and what measures will be utilized in exposure situations.

c. Identify and assess pathways, including consumption of wildlife, fish, and traditional foods

A comprehensive list of potential Project – human health interactions is provided in Table B.21.2-2. Those potential environmental perturbations and potential human health influences that may not be readily amenable to avoidance through various best management practices – and which merit a more formal quantitative evaluation within a HHRA framework – are discussed below.

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Table B.21.2-2 Project Components or Activities as Candidate Sources of Contamination or Environmental Stress with Relevance to Human Health

PROJECT COMPONENT OR ACTIVITY	1) Noise Generation Potential			2) Releases to Air				3) Releases to Soil or Water
	a) Semi-continuous	b) Low Frequency	c) Intermittent/ Impulsive	a) Dust from weathered surface	b) Dust from ores and wastes	c) Combustion emissions	d) Other	
Mine Site								
Construction phase management of wastes (Section 4.3.1.5 of project proposal)								[6]
Open pit	✓	✓	✓ [1]	✓	✓	✓ [2]		Pit dewatering
Temporary ore stockpiles					✓			
Crusher and conveyor system	✓	✓			✓			
Tailings management facility					✓		cyanide loss to air [8]	Discharge from TMF; uptake into waterfowl on TMF [5]
Sulphide ore processing facility	✓				✓[3]			
Oxide ore heap leach facility	✓				✓			[4]
Smelting of Dore Bars						✓		
Copper and molybdenum concentrate storage and hauling to Skagway via road				✓	✓	✓		
Special Waste removal to appropriate disposal facilities								[6], [9]
Temporary topsoil and overburden stockpiles				[6]				[6]
Aggregate/borrow sources and stockpiles				✓				[6]
On-site power generation								

PROJECT COMPONENT OR ACTIVITY	1) Noise Generation Potential			2) Releases to Air				3) Releases to Soil or Water
	a) Semi-continuous	b) Low Frequency	c) Intermittent/ Impulsive	a) Dust from weathered surface	b) Dust from ores and wastes	c) Combustion emissions	d) Other	
Main power plant	✓					✓		
Supplementary power plant	✓					✓		
Diesel generators	✓					✓		
LNG storage, re-gasification and distribution								
Diesel storage and distribution								[9]
Casino airstrip and access road	✓			✓		✓		
Ancillary support facilities: admin. Building, change house (mine dry) and laboratories, warehouse and laydown area, light vehicle maintenance building, guard shed and scale house; explosives facility								[6]
Accommodations camp								[6]
Riverbank caisson and radial well system, distribution network								
Wastewater treatment plant	[6]							[6]
Water ponds, incl. process water pond, freshwater pond, temporary fresh water pond, TMF water management pond, HLF Events Pond								
Communications infrastructure								
Service and haul roads	✓			✓		✓		
Freegold Road Extension								
Two-lane, gravel resource road	✓			✓		✓		[6]
Aggregate/borrow sources and	✓			✓		✓		[6]

PROJECT COMPONENT OR ACTIVITY	1) Noise Generation Potential			2) Releases to Air				3) Releases to Soil or Water
	a) Semi-continuous	b) Low Frequency	c) Intermittent/ Impulsive	a) Dust from weathered surface	b) Dust from ores and wastes	c) Combustion emissions	d) Other	
stockpiles								
Temporary construction camp	✓			✓		✓		[6]
Freegold Road Upgrade								
Upgraded two-lane, gravel public road	✓			✓		✓		[6]
Carmacks by-pass	✓			✓		✓		[6]
Nordenskiold River bridge	✓			✓ [7]		✓ [7]		[6]
Aggregate/borrow sources and stockpiles	✓			✓		✓		[6]

[1] Includes blasting

[2] Haul trucks

[3] Fugitive releases

[4] Assumes that all heap leach barren solution and associated discharge will be captured and treated.

[5] During mine operations, the water management system associated with the TMF will collect any seepage, recycle it and manage against releases; therefore, it is assumed that there is no potential for environmental release beyond the TMF at adverse levels until after closure. Waterfowl and other wildlife, however, may use the TMF during the mining operational phase.

[6] Any potential effects via environmental releases can be readily avoided through application of best management practices (BMPS); therefore, the health effects potential is not considered further.

[7] Construction-phase only.

[8] Cyanide will be destroyed in HLP prior to discharge to the TMF

[9] Environmental releases associated with spills are addressed in the Accidents and Malfunctions portion of the Project Proposal, and are not included in the HHRA

Noise

Three categories of noise are considered based on the existing knowledge about noise health effects: average magnitude of continuous to semi-continuous noise, low frequency noise, and intermittent/impulsive noise types. Ground-borne vibrations are not considered as plausible sources of human health impacts, based on the limited distance that such vibrations can plausibly travel relative to the locations of humans that reside near or would expend extended periods near activities that result in ground vibration, outside of an occupational setting. Occupational exposures to ground vibration are not considered a source of potential adverse health effects, since the vibration is not expected to result in the same degree of stress and annoyance, or indirect influences associated with property destruction, as might be experienced by a member of the public with no positive interest in the mining related activities.

- Semi-continuous noise generation [e.g. assessed as daytime noise levels (L_D), night time noise levels (L_N), and day-night noise levels (L_{DN})]:
    - At/near proposed Casino minesite:
        - Open pit (excavation and hauling)
        - Crusher and conveyer systems
        - Sulphide ore processing facility (mill building)
        - Oxide ore heap leach facility (e.g. during loading)
        - Service and haul roads (noise from road transport)
    - Freegold Road Extension:
        - Construction and traffic along two lane gravel resource road
        - Aggregate borrow sources/stockpiles
        - Temporary construction camp
    - Freegold Road Upgrade:
        - Upgrades to and traffic along two lane public road
        - Construction of Nordeskiold River bridge
        - Aggregate borrow sources/stockpiles
- Low Frequency and/or Intermittent/Impulsive Noise events:
    - Open pit (especially based on blasting
    - Crushers.

Noise sources merit evaluation during both Project construction and operation. Low frequency noises and intermittent noises such as impulsive or transient higher energy noise events can increase the degree to which humans in a residential or long term setting feel stress and annoyance, and can result in sleep disturbance – especially if the peak noise energies (L_{MAX}) exceed 45 decibels (A-weighted; dBA) in the environment in which exposure is experienced (for example in an indoor setting) and if there are several impulsive or transient noise events at intervals through the sleep period. The evaluation of low frequency and intermittent noises, therefore, is important near communities and residential settings or encampments.

Air Emissions via Dust Generation and Fuel Combustion

Three categories of emissions to air merit evaluation in the context of possible human health effects (Table B.21.2-2):

1. Dust generation from land surface that generally do not contain concentrations of trace elements that are greater than average crustal abundances: i.e., areas of overburden, unconsolidated soil, road surfaces, etc. that are not unduly influenced by mineralization with sulphidic, oxidic or other metal/metalloid minerals.
2. Dust generation from areas of mine disturbance, ore extraction, stockpiling, and waste (tailings, waste rock) deposition: such dust may contain atypically high concentrations of one or more trace elements.
3. Particulate and gaseous (volatilized) emissions associated with fuel combustion, in minesite diesel equipment, power generation units run on lng or diesel, transport trucks, etc.

The following Project components and activities have the potential to generate airborne emissions of one or more of these three source types (Table B.21.2-2):

- Minimally mineralized dust:
    - Open pit
    - Copper and molybdenum concentrate hauling to Skagway
    - Aggregate/borrow sources and stockpiles near the minesite
    - Casino airstrip and access road
    - Minesite service and haul roads
    - Construction on and travel along Freegold Road Extension
    - Construction on and travel along Freegold Public Access Road, including Carmacks bypass
    - Aggregate/borrow sources and stockpiles along the access road improvements and used for routine road maintenance
    - Construction camps along the access road
- Mineralized dust:
    - Open pit
    - Temporary ore stockpiles
    - Crushers and conveyors
    - Tailings management facility
    - Sulphidic ore processing facility (as fugitive dust)
    - Oxide or heap leach facility (especially during loading)
    - Copper and molybdenum concentrate storage and hauling to Skagway via road
- Combustion-derived emissions:
    - Open pit (equipment use other than electrical shovels)
    - Copper and molybdenum concentrate storage and hauling to Skagway via road
    - Main power plant

  - Supplementary power plant
  - Diesel generators
  - Casino airstrip (air traffic) and access road (road traffic)
  - Service and haul roads (road traffic)
  - Construction on and travel along Freegold Road Extension
  - Construction on and travel along Freegold Public Access Road, including Carmacks bypass
  - Construction equipment activities to develop aggregate/borrow sources and stockpiles along the access road improvements and used for routine road maintenance
  - Construction camps along the access road
- Other activities that may generate Criterion Air Contaminants (CACs):
  - Smelting of Dore Bars (e.g. SO_2)

While a number of mine process chemicals will be used in either sulphide ore processing or the heap leach facility (HLF), these are not considered to be an issue for local air quality or human exposures, based on use of best management practices in the treatment of various solutions. For example, any cyanide remaining in spent liquor from the HLF will be destroyed prior to discharge of the spent solution to the Tailings Management Facility (TMF).

The three major categories of air emissions comprise different source types from a human health effects perspective, and should be addressed differently in the HHRA. For exposures to dust derived from mineralized areas, for example, it will be important to evaluate exposures to trace elements that are anomalously high in various portions of the overall ore deposit (and in stockpile areas) as well as waste areas.

Criteria air contaminants (CACs) such as fine particulate matter ($PM_{2.5}$, PM_{10}), NO_2, SO_2, CO, or O_3 and volatile organic contaminants or “mobile source air toxics” such as formaldehyde, naphthalene, and benzo[a]pyrene are the major substance of interest in combustion-derived air emissions.

Possible Environmental Releases to Water or Soil

Water and sediment, soil, and plant surfaces can become contaminated as a result of the secondary deposition of airborne contaminants to the extent that the airborne emissions themselves contain appreciable concentrations of limited volatility and adequately persistent substances. Such secondary exposure sources are considered above for dust and combustion-derived emissions as the primary source of environmental input.

There are a limited number of other possible exposure scenarios that could plausibly result in human exposures, including:

- During operations: uptake of trace elements from water in the TMF by waterfowl or wildlife that ingest the water, to the extent that the water contains elevated concentrations of such trace elements, followed by ingestion by humans.
- Following closure: uptake of trace elements from water or sediment in the TMF passive treatment wetland, to the extent that the water contains elevated concentrations of such trace elements, followed by ingestion by humans.

All other sources of potential exposure can be ruled out based on the use of best management practices to prevent environmental releases, or recover spilled materials and hazardous wastes following an accident or malfunction. It is assumed that the risk-based closure plan will effectively limit human exposures to all other

potential source types. Detailed risk-based closure planning will likely include a formalized quantitative HHRA that captures site conditions near the end of the mine operational life.

Potential Receptors

HHRA is based on methodical analysis of potential contaminant/stressors sources, the potential receptors for any exposures arising from such sources, and the environmental exposure pathways that connect sources to receptors. For the purpose of the Project HHRA, the following receptor groups merit formal evaluation:

- Members of Selkirk First Nation;
- Members of Little Salmon/Carmacks First Nation;
- Members of the general public; and
- Occupationally exposed mine workers, especially for air quality

The HHRA focusses on those individuals and locations where people could be exposed to noise, air emissions and the deposition of airborne contaminants, or contaminated waterfowl and wildlife, for extended durations. This is because few if any of the source types discussed above have a potential to cause acute toxicity (for example, based on a one-time exposure or exposures over hours or days). Different cohorts as listed above, therefore, are expected to have different probabilities of engaging in land uses or various other activities that could plausibly result in exposures. Noise conditions and air quality at the operating mine, therefore, is deemed to be of relevance only to minesite workers, while the conditions adjacent to the operating mine may be relevant for the health of First Nations or members of the general public.

The HHRA will examine sensitive receptors and the locations where sensitive receptors may be found. Sensitive receptors are taken to mean any individual or groups of individuals that may experience greater exposure to the contaminant or stressor, as a result of their particular life history and habits, or that may be particularly sensitive to the effects of the contaminant or stressor. Developing children, the elderly, or pregnant women, for example, may be more sensitive to various environmental exposures than the general population.

Conceptual Site Models for HHRA

The conceptual model for the evaluation of human health risks associated with Project related noise is provided in Figure B.21.2-1. Human exposures to noise occur via airborne transmission of sound energies, as modelled in the noise assessment of the Project Proposal. Especially at or near the ground surface, noise transmission can be affected by masking from objects such as terrain or trees. The types of noise metrics that are used to formally and quantitatively assess health effects such as percent of an exposed sub-population that may experience feelings of being highly annoyed or sleep disturbance are generally available from the previously complete noise assessment (response to R444).

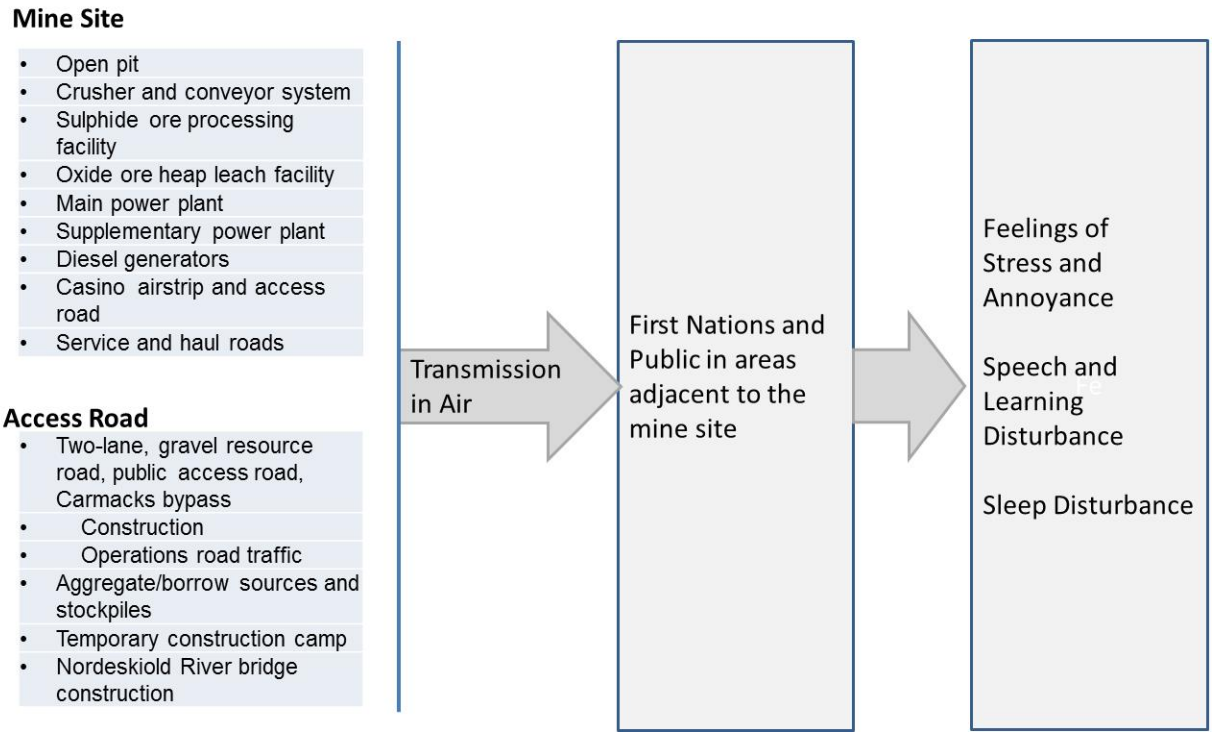

Figure B.21.2-1HHRA Conceptual Model for Noise Exposures

The HHRA conceptual model for air emissions is provided in Figure B.21.2-2**.** Note in Figure B.21.2-2 that the line connecting humans to general dust is a dashed line, which is intended to signify that this is not likely to be a significant health concern. Dust or fine particulate matter with a particle size greater than approximately 2.5 µm once breathed in by humans tends to be deposited in the upper airways and respiratory tract rather than travelling into the deeper portion of the lungs and alveoli. Such inhaled particulates are then transferred out of the respiratory tract via mucociliary action and transferred into the gastrointestinal tract. Provided that the concentrations of contaminants in the coarse dust are relatively low (as is expected in the case of dust generation from highly weathered surface materials with low sulphidic or oxidic metal complexes), there is very limited potential for contaminant uptake in the stomach or intestines, and the exposure is likely to be comparatively benign.

As illustrated in Figure B.21.2-2, the vast majority of contaminants in combustion emissions are expected to affect humans via the pulmonary (inhalation) route, while there is only a limited number of substances that could also result in human exposures, at concentrations of concern for health, based on indirect exposure pathways: i.e. based on wet or dry deposition to water surfaces, soil or plant surfaces followed by dermal contact or ingestion.

Mine Site	General Dust	Mineralized Dust	Combustion Emissions
• Open pit	✓	✓	✓
• Copper and molybdenum concentrate storage and hauling to Skagway via road	✓	✓	✓
• Casino airstrip and access road	✓		✓
• Service and haul roads	✓		✓
• Aggregate/borrow sources and stockpiles	✓		
• Temporary ore stockpiles		✓	
• Crusher and conveyor system		✓	
• Tailings management facility		✓	
• Sulphide ore processing facility		✓	
• Oxide ore heap leach facility		✓	
• Main power plant			✓
• Supplementary power plant			✓
• Diesel generators			✓
Access Road			
• Two-lane, gravel resource road, public access road, Carmacks bypass	✓		✓
• Construction	✓		✓
• Operations road traffic	✓		✓
• Aggregate/borrow sources and stockpiles	✓		✓
• Temporary construction camp	✓		✓
• Nordeskiold River bridge construction	✓		✓

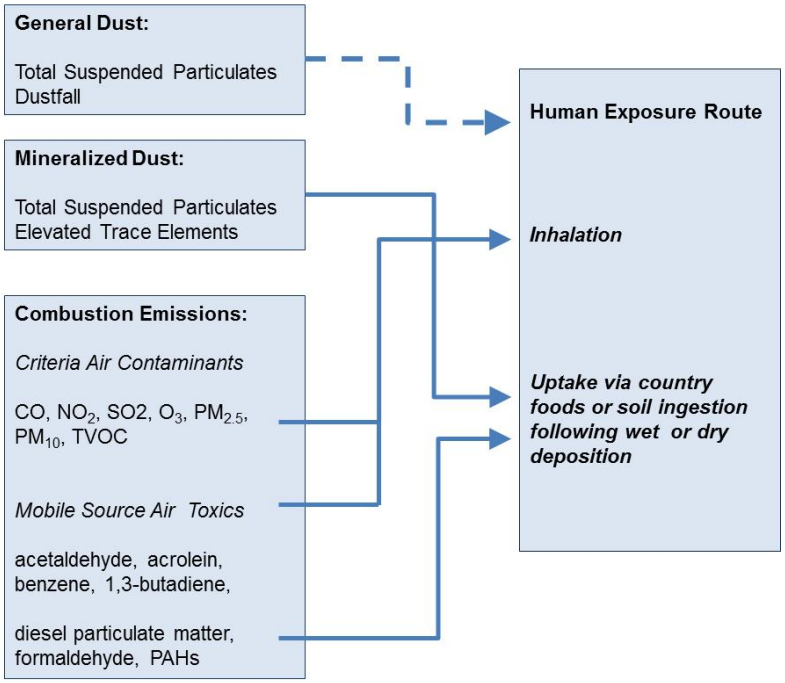

Figure B.21.2-2 HHRA Conceptual Model for Human Exposures Associated with Air Emissions

Figure B.21.2-3 provides a conceptual site model for human exposures via the ingestion of waterfowl or other wildlife that may be exposed to contaminants in water in the TMF or TMF treatment wetland. The exposure of humans via wildlife consumption is plausible only to the extent that the TMF surface water, or that of the treatment wetland following closure exhibits elevated levels of specific trace elements – detailed above. Further discussion on the impact of the TMF wetlands on waterfowl is provided in the responses to R2-183 and R2-184.

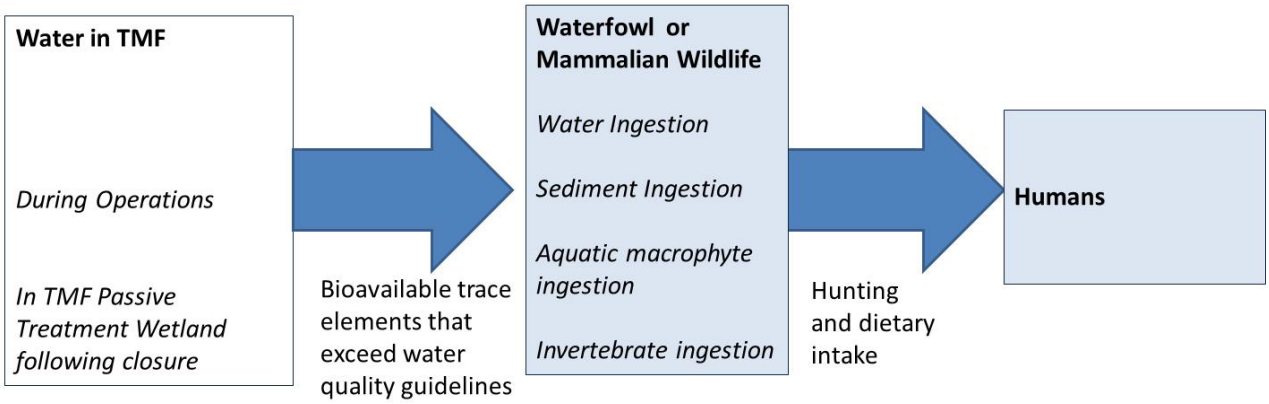

Figure B.21.2-3HHRA Conceptual Model for Human Exposures Associated with Trace Element Uptake on TMF and Treatment Wetland

CMC will conduct a more comprehensive human health risk assessment should metals in the water, soils and/or vegetation in the receiving environment exceed guidelines during any phases of the Project.

d. Characterize risk to human health

The current mitigations for the protection of water, soil and air quality, and the isolated nature of the Project indicate that there will be no significant impacts to human health from the Project. A description of potential impacts on human health from surface water quality and consumption of country foods (i.e., caribou, moose, fish, small trapped mammals, berries, etc.) is described below, as human health impacts from air quality and noise was described adequately in the response to R444.

Impacts to Surface Water Quality

Water quality forms one of the vital links between the abiotic and biotic environments, and is the foundation for supporting and maintaining healthy ecological processes for a rich and varied community of users (e.g., fish, wildlife, humans). Results of the Hydrogeology Baseline Assessment (Appendix 7C) did not identify any groundwater users or significant groundwater resources in the Project area, and concluded that all groundwater flow would ultimately discharge to surface water or to the TMF. Therefore, potential effects from changes in groundwater quality are captured in the surface water assessment.

As assessment on water quality was conducted in Section 7 of the Proposal, and supported with supplementary information in Sections A.7 and B.7 of SIR-A and SIR-B, respectively. These assessments compared predicted water quality to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life. These guidelines are used as key indicators during the assessment to determine whether or not an effect is likely to occur. Baseline values indicate that exceedances of the CCME guidelines for the protection of freshwater aquatic life were evident for ten parameters (copper, cadmium, aluminum, iron, uranium, fluoride, zinc, lead, pH and silver) throughout the project area. The number of exceedances was highest for aluminum, cadmium, copper and iron.

Water quality in the downstream receiving environment (Dip Creek) meets CCME guidelines for all modelled parameters except for copper, fluoride and selenium. Copper is naturally elevated in the watershed, and hence a 90^{th} percentile site specific water quality objective approach, and hence the background concentration procedure (BCP) was selected to calculate the SSWQO (P90) values for Casino and Dip Creeks. Predicted maximum copper concentrations do not exceed the SSWQO during any project phase. Predicted fluoride values in Dip Creek are less than the BC MOE guideline using baseline hardness (guidelines = 1.1 mg/L). Predicted selenium concentrations at W5 during discharge from the water management pond and TMF pond (April through November) exceed the CCME guideline only in May during the discharge period, and are less than the BC MOE guideline for all project phases.

Therefore, all parameter predictions fall below either site specific water quality objectives or are considered acceptable based on literature from the development of guidelines from other jurisdictions, by modelled station W5 on Dip Creek.

There is no use of the water upsteam of the W5 monitoring station, therefore, water use downstream of the Project is considered safe for use, and meets the guideline values for protection of aquatic life, and therefore there are no predicted impacts to human health due to consumption of surface water or to consumption of fish that may come into contact with this water.

Impacts to Country Foods

Country foods are animals, plants, and fungi used by humans for nutritional or medicinal purposes and that are harvested through hunting, fishing, or gathering of vegetation (Health Canada, 2010). People obtaining country

foods by hunting, trapping, and collecting berries, mushrooms, and medicinal plants from the Project area, and by fishing inside and downstream of the Project area, can be affected by the quality of the country foods they consume. There are no identified use of the Project area for collecting berries, mushrooms or medicical plants; however, there is hunting and trapping in the area (see Section B.18 for more details).

The effect of the project on terrestrial mammals and birds is provided in Section 12 of the Project Proposal. Mitigations applicable to water, air and soil quality, outlined in Sections 7, 8 and 6, respectively, will result in mitigation of potential effects to country food. Impacts to fish and aquatic resources are assessed in Section 10. Monitoring to be conducted to prevent impacts to country foods include:

- An Air Quality and Fugitive Dust Deposition Monitoring Program will form part of the Environmental Monitoring, Surveillance and Report Plan, and will connect fugitive dust and potential effects on wildlife forage.
- Vegetation monitoring will be conducted as part of the Wildlife Mitigation and Monitoring Plan (Appendix A.12A) and will include metals analysis.
- Water quality monitoring for project infrastructure (i.e., TMF pond, pit groundwater discharge) and the receiving environment will be conducted throughout construction, operations, closure and post-closure.
- Monitoring of small mammals or large terrestrial mammals (e.g., moose, caribou), may be conducted at the recommendation of the Wildlife Working Group.

B.21.2.4.2 R2-221

R2-221. Rationale based on an HHRA for the exclusion of a human health monitoring plan, or, alternatively, details on a human health monitoring plan.

Should the results of the monitoring conducted through the following monitoring programs indicate a increases above baseline concentrations, CMC will consider conducting a quantitative HHRA that identifies trigger values of contaminants in key country food items or soil for decisions about increased risk management:

- Air Quality and Fugitive Dust Deposition Monitoring Program, which will form part of the Environmental Monitoring, Surveillance and Report Plan, and will connect fugitive dust and potential effects on wildlife forage.
- Vegetation monitoring conducted as part of the Wildlife Mitigation and Monitoring Plan (Appendix A.12A) and will include metals analysis.
- Water quality monitoring for project infrastructure (i.e., TMF pond, pit groundwater discharge) and the receiving environment will be conducted throughout construction, operations, closure and post-closure.
- Monitoring of small mammals or large terrestrial mammals (e.g., moose, caribou), may be conducted at the recommendation of the Wildlife Working Group.

However, currently, as no detrimental impacts are predicted to human health through impacts on surface water quality, consumption of country foods, air quality or noise, an human health monitoring plan is not proposed, as Human Health Monitoring Plans are generally created to monitor the health of sensitive populations to potential source(s) of contamination (e.g., Alberta Health 1999, Health Canada 2014).

As the Project is located in an isolated area there are no sensitive human receptors predicted to be affected by potential contaminants generated by the Project outside of the Project area (i.e., workers). Air quality and noise were evaluated for effects along the road route and in Carmacks, (Section 8 and 9 of the Proposal), and found to

be lower than guidelines at all areas evaluated. As no impacts to human health are predicted, human health monitoring is not required, although, sources with the potential to impact human health (e.g., water, air, noise, wildlife, vegetation) will be monitored to ensure consistency with predictions.

The health of workers is protected under the *Occupational Health and Safety Act* and its supporting regulations. All Project related activities will be conducted in a manner that minimizes risk to worker health and safety through training, awareness, and continuous improvement. Worker health and safety is the primary objective of the detailed Occupational Health and Safety Plan that will be developed by CMC and submitted to the Yukon Government for review and approval as part of the Quartz Mining License application (Yukon Water Board 2013). The detailed Occupational Health and Safety Plan will outline potential worker exposure scenarios and procedures to minimize worker exposure. The Occupational Health and Safety Plan will also outline how worker health and safety will be monitored and what measures will be utilized in exposure situations.

B.21.2.5 Emergency Services

B.21.2.5.1 R2-222

R2-222. Summaries of discussions that support the proposed emergency response plans with emergency service providers, communities, and governments.

External emergency support providers outlined in the Emergency Response Plan (Appendix 22B), include health care providers in Whitehorse, Carmacks and Pelly Crossing, emergency responders, and Yukon Government. Discussions with those service providers are summarized in Table B.21.2-3. However, it should be noted that conversations will be on-going, and that this list is not intended to be all inclusive at this stage of the Proposal and will be updated prior to beginning the construction phase of the Project. An emergency response responsibility matrix will also be created for definition and quick reference.

Since the preparation of the Project Proposal, the Dawson City Community Hospital opened in December 2013. The Dawson City Community Hospital has 6 beds, and 28 staff (Yukon Hospital Corporation, 2015). It provides 24/7 emergency care, inpatient and ambulatory care (Yukon Hospital Corporation, 2015). The Dawson City Community Hospital will be an important option for emergency care from the Casino Project, as it will be the closest emergency facility, by air, to the Project. Decisions on where to take patients in an emergency will be made when the Medical Responder contacts Yukon Emergency Medical Services (EMS) Dispatch to provide history and an assessment of the situation. Medical support and/or evacuation is possible by air transport via the Casino Mine airstrip to support fixed-wing air ambulance and helicopters.

Table B.21.2-3 Summary of Communication with Emergency Services Providers

CMC ROC ‘	Event Type	Date	Participating Organization	Event Summary*
192	Meeting	October 3, 2012	Yukon Health & Social Services	Discussed emergency services planning and response relating to health and social services. Concerns: (a) distance to services during emergencies.
195	Meeting	October 3, 2012	Yukon Community Services	Discussed municipal infrastructure in Whitehorse, Pelly and Carmacks.
292	Meeting	February 20, 2013	Little Salmon-Carmacks First Nation	Discussed health services in Carmacks, including provision of services, users, service structure, the Project and potential changes if it is developed,

CMC ROC ‘	Event Type	Date	Participating Organization	Event Summary*
				government funding and health & safety concerns. Concerns: (a) lack of capacity, staff and equipment in the Carmacks health care system; (b) safety issue relating to trucks driving through the community (road safety, dust, noise).
436	Meeting	July 10, 2012	Whitehorse Hospital	Discussed hospital services. No major hurdles or issues were noted in relation to increased activity the mine may bring to the area. Discussed: health & safety, services provided and hospital use. Concerns: (a) access to injured workers at mine sites and transport to health facilities; (b) improvements in mining safety records; (c) health infrastructure needs related to increasing population.
437	Meeting	July 10, 2012	Whitehorse RCMP	Discussed crime, health and safety in the community. Concerns: (a) lack of resourcing.
440	Meeting	February 13, 2013	Village of Carmacks	Discussed infrastructure and services, recreation services, community well-being, economic development, tourism, and recreational fishing and hunting/ Concerns: (a) need for a local economic development plan to assist with procurement for industry.
442	Meeting	February 13, 2013	Carmacks Health Centre	Socio-economic data collection on services available at the health centre.
457	Phone Call	October 23, 2013	Whitehorse Fire Department	Discussed fire-fighting capacity and services.
458	Phone Call	October 23, 2013	Whitehorse Hospital	CMC requested information on hospital services, and was advised to re-contact the hospital in November to address questions with the relevant contact.
459	Phone Call	October 23, 2013	RCMP	CMC requested information on capacity, and was asked to provide questions in writing.
463	Phone Call	October 24, 2013	Whitehorse Hospital	Discussed health services capacity in Whitehorse, as well as benefits of potential new skilled workforce that could be available with the Project.
469	Meeting	May 17, 2013	Yukon Executive Council Office, Yukon Health & Social Services	CMC addressed concerns raised by the Yukon Executive Council about cyanide and its implications, traffic, wages and sourcing people, boundaries, camps, and increased service requirements.

*Full details in Appendix 2A

Whitehorse General Hospital

Whitehorse General Hospital (WGH) was contacted in 2012 and 2013, as follows, to determine the range of services available and to connect with the Hospital on the potential effects of the Project:

- Whitehorse General Hospital (July 10, 2012);
- Whitehorse General Hospital, Community Relations (October 23, 2012); and
- Whitehorse General Hospital, Patient Services (October 24, 2013).

Discussions with WGH were around the available programs at the hospital, and the capacity of the hospital, as well as private medical and dental clinics to support emergency services for the Project. A full range of health care services is available in Whitehorse, including services provided by WGH (e.g., medical daycare, visiting clinics for specialist doctors, gynaecology, medical imaging, cancer care and chemotherapy, and emergency clinic care). It was determined that WGH serves as a regional referral center for the Yukon and serves the rural nursing stations through a system of ground and air ambulance as well as other communication means such as tele-medicine. Whitehorse will be the primary community in which off-site services will be relied on.

Selkirk First Nation/Pelly Crossing

Pelly Crossing has a local community health centre with regular hours from Monday to Friday, as well as a 24-hour emergency service. An informal discussion was held in the early summer of 2012 regarding the temporary nurse who is stationed at the health centre, and additional discussions about Pelly Crossing's nursing support continued in 2013. To date, the following aspects about the community health centre have been noted:

- There has been no permanent nurse based in the community, with staffing provided by temporary staff who work under contract and who temporarily live in the community for the duration of their contract;
- The operational hours were respected by the community members and there was a positive relationship with the health staff;
- Specialist services are provided on an infrequent basis by doctors or other health providers who periodically visit the community;
- The ability exists to obtain remote, real-time medical advice by contacting staff in Whitehorse; and
- Patients in need of emergency care are transported to hospitals either by ambulance or aircraft from the local airstrip.

A representative from the Yukon Government Health and Social Services department was interviewed regarding services available in Pelly Crossing. During the 2012 and 2013 consultations, representatives noted that residents of Pelly Crossing would likely receive emergency services at the hospital in Dawson City, once it is open.

Little Salmon/Carmacks First Nation and Carmacks

.A visit to the health centre and interviews with key representatives during 2012 and 2013 reveal the following aspects about the community health centre:

- The current health centre is not large enough to service the Village of Carmacks. The centre has two exam rooms: one can be used for trauma as required and only one room is available to see patients. The centre also has an x-ray machine, a laboratory, and a pharmacy. Each room has cameras that allow conferencing with doctors in Whitehorse.

- The centre has two nurses stationed in the community and is currently lobbying to have a third nurse. It was noted that staffing for community centres in Pelly Crossing and Carmacks are lower than in other Yukon communities such as Mayo or Faro with comparable populations.
- Major health concerns in the community include diabetes, high blood pressure, and injuries from motor vehicle accidents.
- The centre offers specialized programming for women such as the Well Woman Program (provides preventative health screening services to women) and pre-natal care.
- Currently, the Minto Mine is more likely to use the Carmacks health centre to treat injuries than the centre in Pelly Crossing.

It was noted that residents of Carmacks would also receive emergency services at the new regional hospital in Dawson City.

Yukon Government

Yukon Government Department of Health and Social Services (YHSS) was contacted on 8 occasions by CMC (October 3, 2012; April 18, 2013; April 19, 2013; April 29, 2013; May 2, 2013; May 14, 2013; May 16, 2013; May 17, 2013 – Appendix 2A), over phone, email and through in-person meetings. Emergency services were discussed and emergency response planning was evaluated. YHSS raised concerns regarding the distance to services in emergencies. In the May 17, 2013 meeting with the Executive Council Office and YHSS, CMC addressed concerns around increased service requirements.

B.21.2.5.2 R2-223

R2-223. Details on emergency response for LNG accidents or emergencies in relation to the response team and their equipment including details on training, composition, availability, and location.

It should be noted that the requirement for “specialized response teams”, as noted by ARCADIS (YOR-2014-0002-402-1), are teams that would be developed within the mine site, with employees housed on-site, as expedient response would be required in all emergency situations, not, as ARCADIS implies, from outside services.

The details of the emergency response teams and their equipment will be detailed in the LNG Management Plan, and through manuals required by the Yukon Oil and Gas Act (YOGA), developed in consideration of the principles and standards of practice of the Canadian Standards Association (CSA) standards CSA-Z276, CSA-Z731 and the National Fire Protection Association (NFPA) codes NFPA 59A, as well as other principles and standards of practice. Additionally, the YOGA Gas Processing Plant Regulations, requires the submission and approval of the following manuals, with the following requirements pertaining to emergency response team, prior to the commencement of operation:

Emergency Procedures Manual

Gas Processing Plant Regulations sections:

- 27(2)(e) an organization structure and resources to manage the emergency, including trained personnel, equipment and facilities.
- 27(2)(i) a description of the safety equipment and medical equipment.

- 27(3)(c) develop and implement a continuing educational program for the police fire departments medical facilities other appropriate organizations and agencies and the public residing in proximity to the plant or facility to inform them of its location, potential emergency situations involving the plant or facility and the safety procedures to be followed in the event of an emergency.

Staffing plan and training Program

Gas Processing Plant Regulations sections:

- 28(1) A licensee's staffing plan referred to in paragraph 25(2)(d) must provide for:
  - (a) the number of persons necessary to operate its processing plant or LNG facility safely; and
  - (b) the competencies required for each position.
- 28(2) The licensee must ensure that:
  - (a) its plant or facility is at all times staffed with the full complement of personnel in accordance with the plan referred to in subsection (1);
  - (b) all personnel have, before assuming their duties, the necessary experience, training and qualifications and are able to conduct their duties safely, competently and in compliance with this Regulation; and
  - (c) records of the experience, training and qualifications of all personnel are kept and made available to the Chief Operations Officer on request.
- 28(3) A licensee's training program referred to in paragraph 25(2)(e) must contain instructions for all personnel directly involved in the operation of its plant or facility respecting:
  - (a) the safety practices and procedures operation of the plant or facility;
  - (b) responsible environmental practices and procedures in the operation of the plant or facility;
  - (c) the proper operating procedures for the equipment that they could reasonably be expected to use; and
  - (d) the emergency procedures set out in the manual referred to in section 27.

Fire, safety, emergency equipment, staffing and training are regulated under the Yukon Oil and Gas Act as well as CSA-Z276. The following principles will be included in the Emergency Response Plan provided as part of permit application for the operation of the LNG facility and transportation of LNG to the mine site to meet the CSA-Z276 code requirements:

- Identify potential LNG spill scenarios and measures necessary to eliminate, mitigate and control, and minimize worker exposure. The scenarios will include vapor dispersion/thermal radiation from potential spills, and the layers of protection associated (i.e. a spill impoundment).
- Prepare detailed emergency response plans for potential LNG spills as they may cause fires if not contained. The plans will outline the potential scenarios and specific response actions including clearing the site, personnel, and the public as necessary.
- Develop and implement emergency response plans to respond to worker exposure to LNG/natural gas.
- Involve site personnel and stakeholders in the planning process.
- Periodically evaluate response procedures and capabilities and revise them as needed.
- Train appropriate personnel to operate the LNG receiving and unloading facility according to systems and procedures that protect human health, the community, and environment.

- Train workers to understand the hazards associated with LNG/natural gas.
- Train workers and personnel to respond to LNG/natural gas exposure and environmental releases, including use of first aid measures.
- Designate personnel and commit equipment and resources for emergency response as necessary.
- Develop internal and external procedures for emergency notification and reporting.

To ensure the protection of communities and the environment during transport of LNG to the Casino Project, the general guidelines below will be followed:

- Responsibility for safety, security, release prevention, training, and emergency response will be established in written agreements with producers, distributors and transporters.
- Emergency response plans and management measures will be implemented by LNG transporters.
- Casino Mining Corporation will require contractors retained for LNG deliveries to the Project will develop and implement a LNG Transportation Plan that is consistent with the LNG standards mentioned above, and should be integrated with the overall LNG management plan as well as with related management plans (i.e. the Environmental Management Plan).

The following practices will be described and implemented:

- Training of all personnel operating LNG handling and transport equipment.
- Emergency Response plans for a potential LNG release during transportation including:
- Designate appropriate response personnel and commit necessary resources for emergency response
- Emergency response training of involved personnel
- Descriptions of the specific emergency response duties and personnel responsibilities
- A detailed list of all emergency response equipment available during transport or along the transportation route
- A detailed list of all emergency response and personal protective equipment during transportation
- Initial and periodic refresher training in emergency response procedures

B.21.3 ACCIDENTS AND MALFUNCTIONS

B.21.3.1.1 R2-224

R2-224. Please provide a comprehensive emergency response plan that addresses accidents and malfunctions related to major mine infrastructure. This must include consideration of structural and non-structural failure of the TMF dam as informed by the risk assessment and the dam breach and inundation study.

A comprehensive emergency response plan (ERP), addressing accidents and malfunctions including the TMF dam will be developed during Detailed Engineering. The ERP is part of the regulatory process and will be submitted in the application to the Yukon Water Board (YWB) for a Type A Water Licence and to EMR for Quartz Mining License as per the *Dam Guide: Design Expectations and Required* Information (YESAB and Yukon Environment, 2012) which states that proponents should "*ensure that your licence application includes:…*

l) Detailed engineering design drawings of the dam, spillway, low level outlet and other features of the dam design with supporting information: iii. An emergency response plan (this is required for all dams with a Consequence of Failure Classification of 'high' or higher). This plan can be included as a section in the operation, maintenance and surveillance plan or a stand-alone document."

Typical contents for ERPs are summarized in Section 8 of the TMF Operation, Maintenance and Surveillance Manual (Appendix B.4D). The ERP will identify the actions to be taken by the owner/ operator and responsibilities assigned to appropriate individuals at the site, as well as those of other agencies and affected parties. The ERP will define actions to identify the potential for accidents, to respond in emergency situations, and to prevent and mitigate the environmental and safety impacts, both on- and off-site, associated with emergency situations.

The ERP will list (and classify) warning signs with reference to potential tailings and water management facility failure modes or emergencies – both from a structural failure and failure due to environmental impacts. Examples include:

- equipment failure;
- slope or foundation failure;
- overtopping;
- power line failure;
- seepage or piping;
- loss of process control; and
- flooding.

Warning signs and potential emergencies are site-specific. For each one listed and classified, the ERP will identify the appropriate actions and responses.

The ERP will specify and initiate a "call-out" process as appropriate, in the event of an incident. Lines of communication within the site (involving, for example, management, operations, engineers, consultants) will be specified and will include names, positions, telephone numbers (work and home) and e-mail addresses. Relevant off-site contacts, such as contractors or equipment suppliers will be included.

The process for notifying affected external stakeholders – municipalities, government agencies, local organizations, first aid, fire department, ambulance, other individuals, etc. – will be specified and will include telephone numbers and e-mail addresses.

The ERP will establish verification and follow-up procedures to ensure that appropriate parties have been contacted, and that the call-out process is kept up to date.

The ERP will also develop and maintain contingency plans. The plans will be tested for effectiveness, reviewed regularly and updated as appropriate.

The ERP will be widely distributed to appropriate personnel within the organization, as well as to potentially affected external stakeholders.

Typical Contents of Emergency Response Plans include:

- Identification of failure modes
- Identification of roles and responsibilities
- Identification of requirements of legislation, codes of practice, notification and reporting obligations
- Identification of available resources
- Mutual aid agreements
- Public relations plans
- Telephone lists
- Establishment of communication system for notifications and for post-notification purposes
- Risk analysis for on-site and off-site effects
- Inundation study, maps and tables for both physical and environmental releases (including dam break)
- Basis for activation of emergency response plan and emergency decision making
- Training of personnel
- Investigation and evaluation of incidents and accidents
- Contingency plans
- Restoration of safe operating conditions
- Validation drills, test of the system