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A.22 – ENVIRONMENTAL MANAGEMENT PLANS

A.22.1 INTRODUCTION

All quartz mining projects in the Yukon, including the Casino Project, will require the submission of comprehensive environmental management and monitoring plans as part of an application for a *Quartz Mining Act* permit after the completion of the YESAB review and prior to development and operation of the mine. Typically, conceptual-level environmental management and monitoring plans are provided as part of the Project Proposal during the YESAB review and these preliminary plans are refined into comprehensive plans after the YESAB review, for submission for regulatory approvals including a Quartz Mining License and/or Water Use License. Moreover, during construction and operation of the mine, management and monitoring plans are continuously refined based on project particulars. Figure A.22.1-1 represents the development of preliminary plans into comprehensive plans for mining projects in the Yukon.

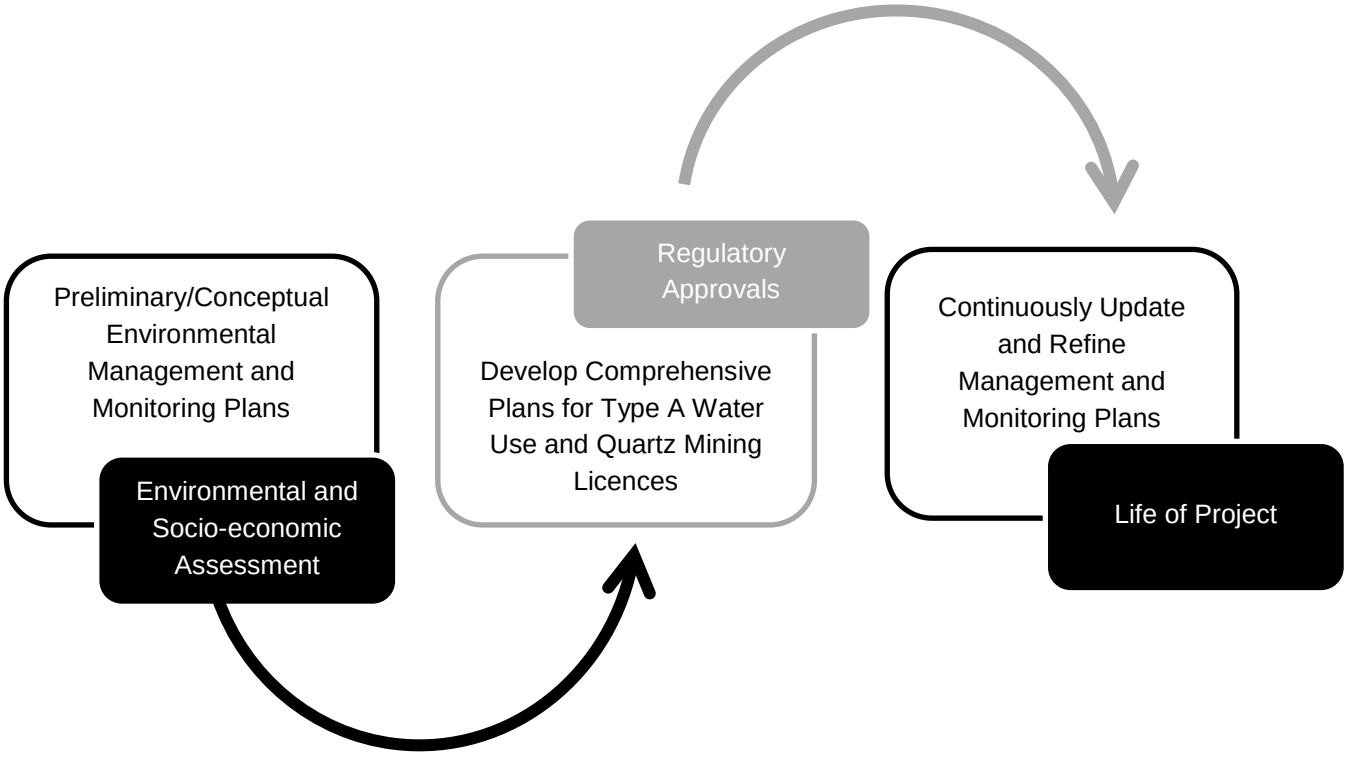


Figure A.22.1-1 Development of Management and Monitoring Plans

YESAB's review of the Project Proposal identified additional information that could be provided during the Adequacy Review phase of the YESAB review. In response, CMC has updated many of the conceptual environmental management and monitoring plans original provided in the Project Proposal, appended to this section. CMC's objective for providing preliminary plans during the YESAB review is to describe in a general manner how the Project's activities will be carried out in an environmentally and socially responsible way throughout all Project phases.

The final management and monitoring plans for the Project will be established in accordance with best management practices (BMPs) and will include commitments identified in the YESAA decision document, Quartz Mining Licence (QML), Type A Water Use Licence (Type A WUL) and other regulatory approvals that will be

required for the construction and operation of the Project. Plans required by the QML and Type A WUL as well as other plans to be prepared for the Project, and the timing of final plan development are summarized in Figure A.22.1-2. While conceptual plans have been submitted in the Project Proposal, in deference to the scope of the Project, some environmental management plans have been updated to a preliminary level in response to reviewers comments and concerns. The following preliminary plans are found in the following Appendices to support supplementary information provided throughout this report:

- Appendix A.22A Preliminary Waste and Hazardous Materials Management Plan
- Appendix A.22B Preliminary Spill Contingency Management Plan
- Appendix A.22C Preliminary Sediment and Erosion Control Management Plan
- Appendix A.22D Preliminary Invasive Species Management Plan
- Appendix A.22E Preliminary Road Use Plan
- Appendix A.22F Conceptual Socio-Economic Management Plan
- Appendix A.22G Liquefied Natural Gas Management Plan
- Appendix A.22H ML/ARD Management Plan

On January 27, 2015, the Executive Committee requested that Casino Mining Corporation (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). Casino Mining Corporation is providing this Supplementary Information Report (SIR) to comply with the Executive Committee's Adequacy Review Report; CMC anticipates that the information in the SIR and Proposal, when considered together, is adequate to commence Screening.

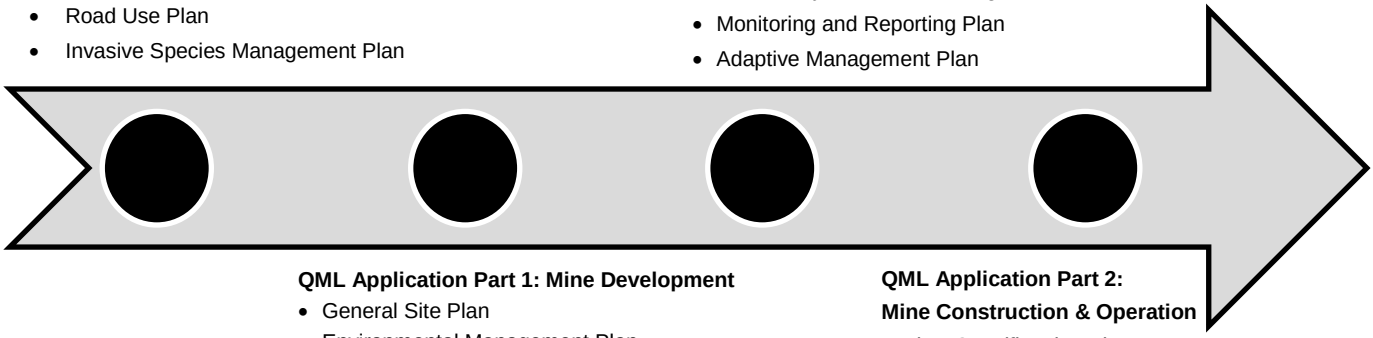
The Executive Committee has 11 requests related to information presented in Section 22 Environmental Management Plans of the Project Proposal submitted on January 3, 2014. These requests are outlined in Table A.22.1-1. Some responses require detailed technical information, data, and figures. Where necessary, this additional supporting information is provided as appendices to the SIR.

Preliminary Plans

- Waste and Hazardous Materials Management Plan
- Wildlife Protection Plan
- Spill Contingency Plan
- Sediment and Erosion Control Plan
- Emergency Response Plan
- Human Health and Safety Plan
- Heritage Resource Protection Plan
- Environmental Monitoring, Surveillance and Reporting Plan
- Air Quality Management Plan
- Road Use Plan
- Invasive Species Management Plan

Type A WUL Application

- Water and Waste Management Plans
- Hazardous Material Management Plan
- Preliminary Decommissioning and Reclamation Plan
- Monitoring and Reporting Plan
- Adaptive Management Plan



QML Application Part 1: Mine Development

- General Site Plan
- Environmental Management Plan
- Sediment and Erosion Control Plan
- Environmental Monitoring Plan
- Emergency Response Plan
- Wildlife Protection Plan
- Heritage Resource Protection Plan
- Worker Health & Safety Plan
- Reclamation and Closure Plan

QML Application Part 2:
Mine Construction & Operation

Project Specific Mine Plans

- Transportation Infrastructure Plan
- Cyanide Management Plan
- Open Pit Development and Operation Plan
- Mill Construction and Operation Plan
- Tailings and Water Infrastructure Management
- Waste Rock Management Plan

Environmental Protection Plans

- Sediment and Erosion Control Plan
- Environmental Monitoring and Surveillance Plan
- Hazardous Materials Management Plan
- Spill Contingency Plan
- Heritage Resources Protection Plan
- Wildlife Protection Plan
- Waste Management Plan
- Emergency Response Plan
- Invasive Species Management Plan

Figure A.22.1-2 Environmental Management Plan Submission Sequence

Table A.22.1-1 Requests for Supplementary Information Related to Environmental Management Plans

Request #	Request for Supplementary Information	Response
R435	Details of a Human Health Monitoring Plan.	Section A.22.2.1.1
R436	Any description of spill infrastructure along public highways or the Freegold Road upgrade and extension.	Section A.22.3.1.1 Appendix A.22B Spill Contingency Management Plan
R437	A complete list of floatation circuit and heap leach chemicals with their anticipated on-site storage capacities and rates of use.	Section A.22.3.2.1 Appendix A.4M Processing Flow Sheets Appendix A.22B Spill Contingency Management Plan
R438	A detailed Cyanide Transportation Management Plan. Details should be Yukon-focused, and in particular the Freegold Road to the Project site.	Section A.22.3.3.1 Appendix A.22B Spill Contingency Management Plan
R439	Clarification regarding handling, storage, and use of cyanide at the Project site. Details should include: a. description of unloading process and area for solid sodium cyanide (NaCN); b. details on storage of solid NaCN in bulk bags; c. the process for moving: the solid NaCN from the unloading area to the storage area in the adsorption, desorption and recovery building; the solid NaCN from the storage area to the NaCN mix tank; and the NaCN from the mix tank to the liquid NaCN storage tank; d. use of level indicators and high-level alarms for the liquid NaCN mix and storage tanks; e. ventilation requirements for the solid NaCN in the cyanide storage area within the adsorption, desorption and recovery building; and f. ambient air monitoring requirements within the solid NaCN storage area, liquid NaCN mixing area and liquid NaCN storage area to protect workers.	Section A.22.3.3.2 Appendix A.4M Processing Flow Sheets
R440	A detailed management plan for LNG.	Section A.22.3.3.3 Appendix A.22G LNG Management Plan
R441	A detailed management plan for explosives and its constituents.	Section A.22.3.3.4 Appendix A.22A Waste and Hazardous Materials Management Plan
R442	An assessment of risk for the transportation of LNG, cyanide, ammonium nitrate, and other hazardous materials with focus on sensitive areas such as major bridge and culvert crossings.	Section A.22.3.3.5 Appendix A.22C Sediment and Erosion Control Plan Appendix A.22B Spill

Request #	Request for Supplementary Information	Response
		Contingency Management Plan
R443	A more detailed description of what will be included in the Emergency Response Plan for emergencies related to cyanide. Details should include: a. potential cyanide failure scenarios appropriate for the site-specific environmental and operating circumstances; b. specific response actions such as clearing site personnel and advising potentially-affected communities; c. use of cyanide antidotes and first aid measures for cyanide exposure; and d. control of releases at their source and containment, assessment, mitigation and future prevention of releases.	Section A.22.3.3.6
R444	A comprehensive Human Health Risk Assessment for each stage of the Project.	Section A.22.4.1.1
R449	A Mine Infrastructure Failure Response Plan that includes consideration of updated site condition characterization and dam break/inundation analysis as outlined in other sections of the Adequacy Review Report.	Section A.22.5.1.1

Notes:

1. Request # refers to the assigned identification number in the YESAB Adequacy Review Report January 27, 2015 Prepared by Executive Committee Yukon Environmental and Socio-economic Assessment Board.
2. Response refers to the location of CMC's response to the YESAB request for supplementary information.

A.22.2 MEDICAL AND HEALTH

A.22.2.1.1 R435

R435. Details of a Human Health Monitoring Plan.

As discussed in Section 5, worker health and safety is protected by a legally binding government requirement that requires mandatory compliance. Existing regulations and guidelines ensure the protection of worker health and safety and have been developed based on information and knowledge regarding potential effects. By definition, monitoring plans are generally created to monitor the effects of a predicted impact on a receptor (i.e., discharge of mine effluent on the aquatic ecosystem, or mine operation on affected communities), and detail adaptive management should impacts to those receptors be detected. 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 discussed below, in R444, toxicological or physiological risks from a set of activities or environmental release are only plausible to the extent that there is a simultaneous co-occurrence in space and time of three key elements: a stressor or contaminant source, a human or other living 'receptor' organism that is of interest from an

effects assessment perspective, and an environmental transport pathway or exposure route that connects the source to the receptor (Figure A.22.2-1).

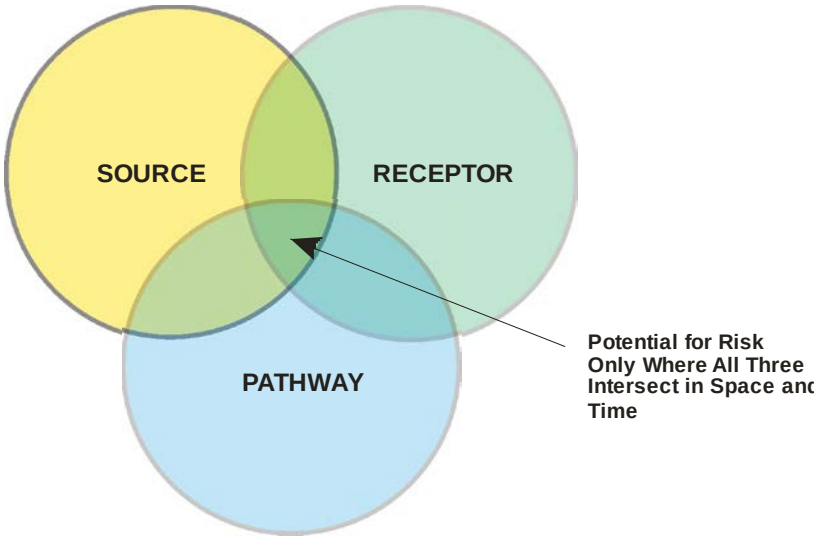


Figure A.22.2-1 Pre-conditions for Environmental Risk Potential

Within the mine site, which would be the area of greatest impact to human health, only workers employed by the Project will be exposed to potential sources of contaminants, as the mine and Freegold Road extension will be privately run, and the public will be excluded. 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. In addition to the detailed Occupational Health and Safety Plan, CMC will be required to submit other plans for the Quartz Mining License application that are related to worker health and safety, including:

- A description of all dust control measures that will be employed to ensure worker health and safety and minimize effects on the environment;
- A Spill Contingency Plan to communicate to staff, contractors, and workers the actions to be taken when responding to spills during mine construction, operation and closure; and
- An Emergency Response Plan which will be reviewed for completeness by the Yukon Workers' Compensation Health and Safety Board.

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.

A.22.3 DANGEROUS GOODS, SPILLS AND LEAKS

A.22.3.1.1 R436

R436. Any description of spill infrastructure along public highways or the Freegold Road upgrade and extension.

As described in the Spill Contingency Management Plan (Appendix A.22B), 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. All carriers and suppliers to the Casino Project will be certified under Transport Canada, and, as required, under the *Transportation of Dangerous Goods Act*. It is expected that external carriers and suppliers will have their own emergency response plans and training for their personnel, as they will be transporting supplies in their own vehicles with their own drivers.

Transportation of cyanide (as sodium cyanide) will be conducted in a manner to protect communities and the environment in accordance with the International Cyanide Management Code (International Cyanide Management Institute 2012). Additionally, preventative maintenance along the access route will include regular maintenance and inspections for safe operation of vehicles, snow clearing, and the application of dust suppressants as required.

Shipping documents travel with hazardous materials, and are kept in the cab of the motor vehicle. Shipping documents provide vital information regarding the hazardous materials/dangerous goods to initiate protective actions, as per the Emergency Response Guidebook (Transport Canada 2012). An example of information provided in the Emergency Response Guidebook is provided in Appendix B of the Spill Contingency Management Plan for sodium cyanide and LNG.

Spill response equipment will be stationed along the access road at appropriate intervals. Spill kits typically contain oil sorbents (pads, socks, and granular), shovels, and protective equipment including gloves, goggles and protective suits. Heavy equipment, such as front-end loaders and haul trucks will be available for larger spills near the mine site, and pumps, suction hoses and portable storage tanks or drums will also be located at the mine site to assist with spill recovery and cleanup.

Spills along public highways and roads in Yukon are addressed by federal, territorial and municipal governments through the Yukon Spill Report Line (867-667-7244) (Government of Yukon 2015). Spills involving dangerous goods will also be reported to CANUTEC (613-996-6666).

A.22.3.2 Flotation and Heap Leach Constituents

A.22.3.2.1 R437

R437. A complete list of floatation circuit and heap leach chemicals with their anticipated on-site storage capacities and rates of use.

Proposed reagents for use in the floatation circuit and heap leach circuit were detailed in the Feasibility Study (M3 2013), and summarized in Section 4.4.1 of the Proposal. On-site storage capacities and rates of use for each are outlined in Table A.22.3-1, and flow sheets outlining the distribution systems in the flotation and heap leach systems are show in drawings 000-FS-011, 000-FS-012 and 050-FS-010 provided in Appendix A.4M. MSDS sheets for all reagents listed below are provided in Appendix A of the Spill Contingency Management Plan provided in Appendix A.22B. Spill response for chemical spills is outlined in Section 6.2.6 of the Spill Contingency Management Plan.

Table A.22.3-1 Rates of Use of Reagents for Sulphide Ore and Oxide Ore Circuits

Reagent	Delivered form	On-site Storage	Usage Rate
Sodium-diisobutyl dithiophosphinate (Aerophine 3418A)	Liquid (totes)	Totes and as 10% water solution	1,000 kg/day
Sodium diethyl dithiophosphate (Aerofloat 208)	Liquid (totes)	Totes and as 10% water solution	2,000 kg/day
Methyl Isobutyl Carbinol (MIBC)	Liquid (totes)	Totes and in tank, undiluted	1,200 kg/day
Pebble Lime	Bulk truck	8,000 t lime silo	270 tonnes/day
Fuel Oil (#2 Diesel fuel)	Liquid (trucks)	Liquid in tank, undiluted	880 kg/day
Sodium Hydrosulfide (NaHS)	Dry powder bags or super sacks	Bags or sacks on pallets	6,700 kg/day
Flocculant	Dry powder bags or super sacks	Bags or sacks on pallets	3,200 kg/day
Potassium amyl xanthate (PAX)	Solid (drums)	Drums on pallets and as 10% water solution	4,800 kg/day
Sodium Cyanide (NaCN)	1,000 kg bag boxes	Bag boxes on pallets	12.5 tonnes/day
Caustic (sodium hydroxide, NaOH)	1,000 kg bag boxes	Bag boxes on pallets	325 kg/day
Hydrochloric Acid (HCl)	Drums	Drums on pallets	250 kg/day
Sulphuric acid (H_2SO_4)	Bulk truck	Storage tank	8,200 kg/day
Activated Carbon	Super sacks	Sacks on pallets	12.5 kg/day
Antiscalant	Bulk truck	Storage tanks	75 kg/day

A.22.3.3 Materials Management Plans

A.22.3.3.1 R438

R438. A detailed Cyanide Transportation Management Plan. Details should be Yukon-focused, and in particular the Freegold Road to the Project site.

Pending further design and operational decisions, the Cyanide Management Plan (which includes details on cyanide transportation) has not been updated from the Project Proposal. However, CMC has outlined specific requirements in the Spill Contingency Management Plan (Appendix A.22B), which includes ensuring the protection of communities and the environment during transport of cyanide to the Casino Project, through compliance with the International Cyanide Management Code (International Cyanide Management Institute 2012) standards as follows:

- Responsibility for safety, security, release prevention, training, and emergency response will be established in written agreements with producers, distributors and transporters; and
- Emergency response plans and management measures will be implemented by cyanide transporters.

Casino Mining Corporation will require that contractors retained for delivery of cyanide to the Project will develop and implement a Cyanide Transportation Plan that is consistent with the Cyanide Code, as well as the Casino Cyanide Management Plan and component plans of the Environmental Management Plan.

The following industry best management practices will be described and implemented:

- Vehicles used for transportation of the cyanide and all containers and packaging comply with all applicable prescribed safety standards and display all applicable prescribed safety marks in accordance with the Dangerous Goods Transportation Act.
- Chain of custody documentation (including Material Safety Data Sheets) to track inventory and movement of cyanide.
- Methods to minimize the potential for contact of solid cyanide with water (e.g., covered trucks, sealed containers).
- Use of escort vehicles or convoys for cyanide shipments as necessary (e.g., inclement weather, change in road conditions).
- Regular maintenance of transportation equipment including containers, vehicles, loading and unloading machinery and storage systems.
- Training of all personnel operating cyanide handling and transport equipment.
- Emergency response plans for potential cyanide releases during transportation including:
    - Designate appropriate response personnel and commit necessary resources for emergency response.
    - Emergency response training of appropriate 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 transport including self-contained breathing apparatus and oxygen gas.
    - Initial and periodic refresher training in emergency response procedures including implementation of the Emergency Response Plan and Spill Contingency Plan.
    - Develop procedures for internal and external emergency notification and reporting.
    - Periodically evaluate response procedures and capabilities and revise them as needed.

The final Cyanide Transportation Plan developed by the contractor responsible for transportation of cyanide the mine site will include a risk assessment of the transportation route that will consider water crossings, population centres, road characteristics, weather characteristics, and public infrastructure.

Information provided in the Emergency Response Guidebook for sodium cyanide is provided in Appendix B of the Spill Contingency Management Plan and a spill response procedures should a chemical spill occur is outlined in the plan in Section 6.2.6.

A.22.3.3.2 R439

R439. Clarification regarding handling, storage, and use of cyanide at the Project site. Details should include:

- **a. description of unloading process and area for solid sodium cyanide (NaCN);**
- **b. details on storage of solid NaCN in bulk bags;**
- **c. the process for moving: the solid NaCN from the unloading area to the storage area in the adsorption, desorption and recovery building; the solid NaCN from the storage area to the NaCN mix tank; and the NaCN from the mix tank to the liquid NaCN storage tank;**
- **d. use of level indicators and high-level alarms for the liquid NaCN mix and storage tanks;**
- **e. ventilation requirements for the solid NaCN in the cyanide storage area within the adsorption, desorption and recovery building; and**
- **f. ambient air monitoring requirements within the solid NaCN storage area, liquid NaCN mixing area and liquid NaCN storage area to protect workers.**

As detailed in the Feasibility Study (M3 2013), sodium cyanide solution will be mainly added to the pregnant leach solution just before it enters the carbon adsorption tanks. Lesser amounts of cyanide solution will also be added to the barren solution sump before this solution is applied to the ore pile at the heap leach facility. Sodium cyanide solution will be made up by dissolving sodium cyanide pellets or briquettes in water. Sodium cyanide will be added to the process at the barren solution tank and in the pregnant solution fed to the CIC circuit. Sodium cyanide solution will also be used in the carbon cold strip circuit and alternatively in the carbon elution circuit of the Carbon/SART area.

Sodium cyanide pellets will be delivered in 1,361-kg (3,000-lb) flow bins or 1,000-kg (2,205-lb) bag boxes. The pellets will be dissolved in the cyanide mix tank (850-TK-001) agitated by an agitator (850-AG-001), as shown in flowsheet 050-FS-008 (Appendix A.4M). The cyanide mix tank (850-TK-001) will be a covered, flat bottom tank with an opening for bag boxes or flow-bins to be dumped into the tank. The cyanide transfer pumps (850-PP-005/015) will forward the cyanide solution to the cyanide storage tank (850-TK-003). Cyanide distribution pumps (850-PP-001/002) will pump cyanide solution from tank (850-TK-003) to various destinations.

The details of the handling, storage and use of cyanide at the Project site will be determined during the detailed design phase of the project, and will be incorporated into the Cyanide Management Plan (Figure A.22.1-2).

A.22.3.3.3 R440

R440. A detailed management plan for LNG.

A preliminary LNG Management Plan is provided in Appendix A.22G. A detailed management plan for LNG will be provided in addition to the detailed management plans required for the Project as part of the QML and Type A WUL applications (Figure A.22.1-2).

A.22.3.3.4 R441

R441. A detailed management plan for explosives and its constituents.

Management of dangerous goods and hazardous materials, including explosives, is described in a preliminary level in the Waste and Hazardous Materials Management Plan (Appendix A.22A). Generally, an explosives magazine permit will be required under the *Explosives Act* for the storage of explosives. The use and storage of explosives on mineral claims in the Yukon is regulated by the *Yukon Blasting Regulations* (part of the *Yukon Occupational Health and Safety Regulations*). This includes provisions for the issuance of blasting permits and

magazine permits, limitations on the transport of blasting agents, the handling of blasting material and the control of the blasting area. This regulation does not govern the mixing or manufacturing of explosives. If manufacturing or mixing of explosives is required for blasting activities, a Factory Licence must be obtained from Natural Resources Canada.

As described in Section A.21, the explosives facility is an explosives magazine located northeast of the Open Pit. Explosives will be prepared and stored in accordance with the explosives license issued by Natural Resources Canada to a licensed explosives contractor hired by CMC; explosives and blast caps will be stored in separate facilities, away from operational areas. CMC will obtain an Explosives Act magazine license requirements with respect to storage and handling of explosives, and necessary permits including Blasting Permit, Magazine license, Factory license, ANFO Certificate, Purchase and Possession Permit, Explosives and Hazardous Materials Transport Permit.

Explosive storage areas are necessarily located away from camp and other facilities, and a qualified explosives contractor will be retained to provided blasting services and will mix and dispense explosives into the blast holes. Strict safety protocols will be observed during blasting operations.

As detailed in Section 4, CMC will engage in discussions with potential licensed explosives contractors to determine final requirements for the explosives facility. The explosives facility will be located at the north end of the Casino mine site, taking into consideration Natural Resources Canada (NRCan) requirements for siting. All materials will be stored in accordance with the applicable regulations and standards and are managed by an NRCan licensed explosives contractor.

Prior to construction of the explosives facilities, the soils in the footprint of the buildings will be salvaged and stockpiled locally in windrows adjacent to the disturbance sites or in designated soil stockpile areas. The designated areas will be graded and surrounded by a perimeter berm with a minimum height of 1.2 m, and a single gated lockable entry point, as per requirements of the explosive‘s license.

The specifications of the explosives facility will be determined by the explosives contractor to match the anticipated rate of use for the Casino Project. In general, an explosives facility consists of:

- Bulk ammonium nitrate outdoor storage area (silos);
- Bulk fuel area;
- Magazine for storage of detonators, detonating cord, boosters ;
- Emulsion manufacturing facility;
- Wash bay;
- Maintenance facility; and
- Trucks.

The licensed blasting contractor will supply all the surface facilities for the explosives magazines and for storage of blasting supplies.

Under the NRCan Guidelines for Bulk Explosives Facilities Minimum Requirements a Fire Safety Plan must be developed. The Explosive Regulatory Division provides guidelines (NRCan 2014) on what the plan must contain, including:

- Licensee information;

- Measures to be taken to minimize the likelihood of a fire at the site and to control the spread of any fire;
- Emergency procedures for responding to a fire;
- Procedures for determining if a fire should be fought; and
- Measures to be taken to train employees in the measures, procedures, and circumstances described in the plan.

CMC will develop all plans required under the *Explosives Act and Regulations (2013)*.

A.22.3.3.5 R442

R442. An assessment of risk for the transportation of LNG, cyanide, ammonium nitrate, and other hazardous materials with focus on sensitive areas such as major bridge and culvert crossings.

The Proposal details potential interactions between Project components and activities and identified valued components (VCs). Three of the potential interactions were concentrate transport and loading, hazardous materials storage, transport and disposal and LNG transport to site. Each of these three project components were evaluated for effect on each of the 14 valued components, as outlined in Table A.22.3-2. For VCs where there is a predicted effect (i.e., a 'Y' in the 'Potential Interaction' column), mitigation measures are proposed to eliminate, reduce or control the potential effect. Potential interactions during the transportation of hazardous materials were identified for VCs of water quality, air quality, noise, fish and aquatic resources, rare plants and vegetation health, wildlife and land use and tenure due to impacts from chemical spills, dust and emissions and noise. These impacts will be mitigated through implementation:

1. Traffic Management Plan, which will include details on speed limits and communications protocol to minimize the potential for spills;
2. The Sediment and Erosion Control Plan (Appendix A.22C), which will include details on prevention and control of sedimentation from transportation; and
3. The Spill Contingency Management Plan (Appendix A.22B), which details procedures to mitigate effects from spills of hazardous materials at all areas of the Project, including the road route.

Table A.22.3-2 Potential Interactions between Transportation of Hazardous Materials and Value Components

Proposal Section	Project Components and Activities	Project Phase (C, O, CD, PC)	Potential Interaction (Y/N)	Mechanism of Interaction (or Rationale for No Interaction)
Terrain Features Section 6.5.1 Table 8.5-1	Concentrate Transport and Loading	O	N	No physical disturbance to terrain features outside of clearing footprint, which is addressed in the PDA
	Hazardous Materials Storage, Transport, and Disposal	C,O	N	Disturbance occurred during construction, no additional footprint clearing required
	LNG Transport to site	C,O	N	No physical disturbance to terrain features

Proposal Section	Project Components and Activities	Project Phase (C, O, CD, PC)	Potential Interaction (Y/N)	Mechanism of Interaction (or Rationale for No Interaction)
Water Quality Section 7.4.1 Table 7.4-1	Concentrate Transport and Loading	O	Y	Concentrate or chemical spills
	Hazardous Materials Storage, Transport, and Disposal	C, O	Y	Chemical spill
	LNG Transport to site	C, O	N	An interaction is not anticipated as in the event of a spill, LNG would rapidly vaporize and therefore in its gaseous state would not affect a watercourse
Air Quality Section 8.4.1 Table 8.4-5	Concentrate Transport and Loading	O	Y	Vehicle emissions during transportation and fugitive dust from unpaved roads
	Hazardous Materials Storage, Transport, and Disposal	C, O	Y	Fuel use during transportation
	LNG Transport to site	C, O	Y	Diesel equipment use and fugitive dust on unpaved roads
Noise Section 9.4.1 Table 9.4-2	Concentrate Transport and Loading	O	Y	Vehicle noise
	Hazardous Materials Storage, Transport, and Disposal	C, O	Y	Transportation-related noise such as loading, unloading and traffic
	LNG Transport to site	C, O	Y	Transportation-related noise such as loading, unloading, and traffic
Fish and Aquatic Resources Section 10.4.1 Table 10.4-1	Concentrate Transport and Loading	O	N	≥30 m away from nearest watercourse, or, addressed in Casino Emergency Response Plan (Appendix 22B)
	Hazardous Materials Storage, Transport, and Disposal	C, O	N	≥30 m away from nearest watercourse
	LNG Transport to site	C, O	Y	Dust, emissions and road runoff
Rare Plants and Vegetation Health Section 11.5.1 Table 10.5-1	Concentrate Transport and Loading	O	Y	Generation of dust and emissions
	Hazardous Materials Storage, Transport, and Disposal	C,O	N	No additional clearing outside of footprint that is addressed in the PDA

Proposal Section	Project Components and Activities	Project Phase (C, O, CD, PC)	Potential Interaction (Y/N)	Mechanism of Interaction (or Rationale for No Interaction)
	LNG Transport to site	C,O	Y	Generation of dust and emissions
Wildlife Section 12.3.1 Table 12.3-1	Concentrate Transport and Loading	C, O	Y	Noise, traffic, clearing of Project footprint
	Hazardous materials storage, transport, and disposal	C,O	N	No ecological disturbance outside of the existing footprint.
	LNG transport to site	O	Y	Noise, traffic
Employment and Income, Employability, Economic Development and Business Sector, Community Vitality, Community Infrastructure and Services, Cultural Continuity Sections 13.4.1 – 18.4.1	Concentrate Transport and Loading	O	N	No specific interaction with this socio-economic VC
	Hazardous Materials Storage, Transport, and Disposal	C, O	N	No specific interaction with this socio-economic VC
	LNG Transport to Site	C, O	N	No specific interaction with this socio-economic VC
Land Use and Tenure Section 19.4.1 Table 19.4-1	Concentrate Transport and Loading	O,	Y	Included in Maximum Disturbance Area
	Hazardous Materials Storage, Transport, and Disposal	C, O,	Y	No interaction expected with implementation of mitigation Addressed in Accidents and Malfunctions Section
	LNG Transport to site	C, O,	Y	No interaction expected with implementation of mitigation Addressed in Accidents and Malfunctions Section

Notes:

1. C (Construction), O (Operation), CD (Closure and Decommissioning) and PC (Post-Closure) represent the Project phases when the potential interaction between the Project and valued component is anticipated to occur.

A.22.3.3.6 R443

R443. A more detailed description of what will be included in the Emergency Response Plan for emergencies related to cyanide. Details should include:

- **a. potential cyanide failure scenarios appropriate for the site-specific environmental and operating circumstances;**
- **b. specific response actions such as clearing site personnel and advising potentially-affected communities;**
- **c. use of cyanide antidotes and first aid measures for cyanide exposure; and**
- **d. control of releases at their source and containment, assessment, mitigation and future prevention of releases.**

Pending further design and operational decisions, the Cyanide Management Plan has not been updated from the Project Proposal. The details of the handling, storage and use of cyanide at the Project site will be determined during the detailed design phase of the project, and will be incorporated into the Cyanide Management Plan, required as a component of the Quartz Mining Licence (Figure A.22.1-2). As detailed in the Cyanide Management Plan (Appendix 22C), prior to the start of operation, a comprehensive Cyanide Management Plan for the Casino Project will be developed to ensure worker safety and to prevent release of cyanide to the environment and will be developed in consideration of the principles and standards of practice of the International Cyanide Management Code (International Cyanide Management Institute 2012).

A.22.4 HUMAN HEALTH RISK ASSESSMENT

A.22.4.1.1 R444

R444. A comprehensive Human Health Risk Assessment for each stage of the Project.

Human Health Risk Assessment (HHRA) is an analytical/interpretative tool that formalizes interpretations about risks to the health of humans from measured or predicted exposures associated with changes in environmental quality (for example, based on changes in the acoustic environment, air quality, soil quality, or water and sediment quality). The Proposal includes an implicit and quantitative screening evaluation of human health risks in the effects assessment for air quality (Section 8 of the Proposal) and noise (Section 9 of the Proposal).

Toxicological or physiological risks from a set of activities or environmental release are only plausible to the extent that there is a simultaneous co-occurrence in space and time of three key elements: a stressor or contaminant source, a human or other living ‘receptor’ organism that is of interest from an effects assessment perspective, and an environmental transport pathway or exposure route that connects the source to the receptor. Figure A.22.2-1 serves as an initial basis for either discounting various contaminant and stressor related effects hypotheses for Valued Components (VCs) or alternatively nominating them for further (typically more quantitative) scrutiny.

This aspect of HHRA was incorporated into the evaluation of project interactions and potential effects (Section 5.3.1 of the Proposal). While the terminology used in classical HHRA and environmental impact assessments are different, decisions about whether there is a potential interaction from a project component serves the same purpose as qualitative screening-level risk assessment, as discussed above. The scope of such screening for HHRA will almost invariably be more narrow than for environmental impact assessment, for which the interest in also on potential for ecological effects, socio-economic effects, and the broader determinants of human health. Below follows a discussion of the human health risk assessment as it fits within the Project, and the assessment outlined in the Proposal.

Once the plausibility of contaminant or stressor risk potential to humans is established, the next step in a formalized HHRA approach is to examine the probability of adverse effect potential, or significance of adverse effects for various exposure and effects hypotheses. This is achieved by the simple comparison of the quantitative estimate of the magnitude of human exposure with the best estimate from the state of scientific knowledge about the threshold of exposure beyond which various negative health effects might occur (threshold of effects, toxicity reference value, *etc.*).

The comparison of predicted exposure levels to relevant threshold of effects levels (ideally as adopted by authoritative health agencies and regulators based on extensive peer review) constitutes a quantitative "risk characterization". Based on standardized HHRA practice, the risk characterization must also explicitly consider the degree of confidence in the estimated magnitude of exposure and threshold of effects values used, as well as in the underlying conceptual models for the Project – health VC interaction (i.e. the HHRA should include a formalized uncertainty analysis, and the conclusions from the HHRA should explicitly account for important stochastic and other uncertainties in the assessment). Nonetheless, the risk quotients and incremental life time cancer risk (ILCR) estimates that are produced in a quantitative HHRA are a credible basis for assessing significance of health effects for those determinants of health that are amenable to description using valid quantitative exposure – health response models.

HHRA for Airborne Contaminants

The assessment of human health risks for airborne contaminants associated with Casino Project was carried out by comparing the concentrations of criteria air contaminants (CACs) predicted from the project related emissions (particularly NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}, dustfall) with Yukon Ambient Air Quality Standards or other relevant ambient air quality objectives (Table 8.4-1). Since such standards and objectives are *de facto* risk-based thresholds derived from the best available epidemiological and toxicological knowledge, and subjected to prior regulatory and scientific peer review, the comparison of predicted airborne exposures concentrations with ambient air quality standards and objectives comprises three of the major components of standardized HHRA approaches; i.e., exposure characterization, effects (or toxicity) characterization, and risk characterization. The CACs included in the health effects assessment, with the exception of dustfall, plausibly affect human health only through the pulmonary (inhalation) exposure route. This is the exposure scenario considered in the derivation of ambient air quality standards and objectives. For the CACs, other exposure scenarios such as wet and dry deposition to soils or plant surfaces, followed by direct (dermal, incidental soil ingestion) or dietary exposures are not plausible, and concerns about health risks via these other pathways can be discounted based on a qualitative screening level approach.

HHRA for Project Noise

The assessment of human health risks from noise exposures associated with the Casino Project was carried out by comparing the predicted project-related a-weighted noise levels (expressed as L_{EQ}, including L_{DAY}, L_{NIGHT}, but not L_{DN}) to the British Columbia Oil and Gas Commission (BC OGC) *Noise Control Best Practices Guideline* (BC OGC 2009).

The Proposal assumed an ambient sound level ≤ 35 dBA L_{EQ} during the night time and ≤ 45 dBA L_{EQ} during the day time (BC OGC 2009) in wilderness areas around the proposed minesite and along the transportation route, which is a reasonable estimate and assumptions to the contrary would not appreciably affect any determinations about the significance of adverse effects from noise.

The noise-related project effects were assessed from a significance perspective using the BC OGC permissible sound levels (PSLs), which state that "*new facilities should meet a PSL of 40 dBA L_{EQ} (nighttime) at the nearest dwelling, or at 1.5 km from the facility fence line, whichever is the lesser distance*" (BC OGC 2009). For sensitive

receptor locations (e.g residences) within a distance from a noise-generating project component that is less than 1.5 km, and for chronic noise exposure (operations phase as opposed to construction phase), the night time PSL is 40 dBA L_{EQ} in relatively unpopulated areas, and 50 dBA L_{EQ} during the day time (Proposal Section 9.3).

The assessment of health risks from noise can also be completed based on preferred approaches by Health Canada, the World Health Organization, and other international health agencies. Health Canada, in 2010, circulated a "Useful Information" document (Health Canada 2010) that provided a brief summary of noise-induced health effects along with recommended definitions of acceptable effects. In April of 2011, Health Canada released draft "Guidance for Evaluating for Evaluating Human Health Impacts in Environmental Assessments: Noise" (Health Canada 2011), which further advanced the recommended approach. This draft guidance has since been temporarily withdrawn by Health Canada pending official publication. Nonetheless, World Health Organization and United States regulatory guidance describe very similar methodologies and thresholds of effects levels beyond which the health effects may be significant.

The available scientific information on the human health effects of noise is focussed around a large number of epidemiological studies of especially transportation-related noise (aircraft, road, rail). Several clinical trials have been completed of noise effects on sleep disturbance and sleep patterns. Overall, there is compelling epidemiological evidence that human noise exposures increase self-reported feeling of stress and annoyance. Based on the meta-analysis of a large number of epidemiological studies, a quantitative relationship has been developed between the magnitude of noise exposure, as day-night noise levels (L_{DN}) and percentage of an exposed sub-population that is highly annoyed (percent highly annoyed: %HA). This quantitative relationship, and %HA, forms the primary basis for the major portion of contemporary noise health risk assessments. Important secondary assessment endpoints include sleep disturbance based especially on the frequency of occurrence and or intensity of shorter duration, higher noise events, speech interference and learning deficits arising from the effects of noise on learner attention in early childhood learning settings. Based on the current state of research internationally, these are the direct health effects endpoints for which there is compelling evidence. Both stress (captured as %HA) and sleep disturbance can result in hypertension and subsequently the possibility of cardiovascular disease; however, the epidemiological studies have been more equivocal in the evidence for a relationship between noise exposure and either hypertension or cardiovascular diseases.

The primary criteria for assessing human health effects of noise based on the current state of HHRA practice include the following:

- A change in %HA for the with-project case in comparison to the without-project case should not exceed 6.5%. Impulsive and tonal characteristics of source noise are accounted for with adjustments in the %HA calculations since their presence can increase the potential annoyance of sound;
- Sleep disturbance potential is evaluated against a threshold nighttime sound level (L_N) of 30 dBA (indoor) or 45 dBA (outdoor);
- In schools, preschools, and similar early learning centres, effects are considered to be significant for project-related noise during the day time associated with a sound level (L_D) greater the 35 dBA (indoor) or 50 dBA (outdoor) during class time.
- If any of these thresholds are predicted to be exceeded, the effects are considered to be significant and require mitigation. In the context of these criteria for significance of adverse health effects, note that the BC OGC (2009) guidelines would generally provide the same degree of health protection as these alternative indicators – which were applied in the Proposal.

Therefore, as the risk assessment outlined in the Proposal demonstrates that the air quality and noise effects generated by the Project will not exceed acceptable guidelines, CMC maintains that the risk to air quality and noise to human health provided in the Proposal is sufficient to demonstrate that no impacts to human health would result from the Project activities, and no further risk assessment is warranted.

A.22.5 ACCIDENTS AND MALFUNCTIONS

A.22.5.1.1 R449

R449. A Mine Infrastructure Failure Response Plan that includes consideration of updated site condition characterization and dam break/inundation analysis as outlined in other sections of the Adequacy Review Report.

As discussed in Section A.4, dam inundation mapping is conducted to support detailed emergency response planning. Casino Mining Corporation will conduct an inundation study during the YESAB process in order to evaluate the proposed design, and corresponding credible modes of failure, tailings outflow volume, peak discharge, maximum downstream distance for the initial water driven food wave, maximum downstream distance for tailings slumping, and the width of the zone of influence resulting from the dam break analysis. The risk assessment process enables a quantitative assessment of potential risks and their effects and provides for the development of appropriate mitigation and management plans. However, a detailed Emergency Response Plan will not be provided until the detailed design of the tailings management facility is completed, which is typical of Environmental Impact Assessments (Seabridge 2013; Avanti Mining Inc 2011).

The risk of a tailings impoundment failure is very low, provided that the design is carried out by qualified professionals and all details of construction and maintenance are followed. Details of monitoring and inspections required to maintain the integrity of the Tailings Management Facility (TMF) will be detailed in the details construction design, and may include inspections following extreme precipitation or runoff events, high level alarms on the seepage recovery pond, and containment of any spills and the water returned to the TMF.