



INFORMATION REQUEST –T(3)-09

ACCIDENTS AND MALFUNCTIONS

Source: Canadian Environmental Assessment Agency

Summary of Comment

Section 10.7 of the EIS Guidelines requires the EIS to describe the magnitude of an accident or malfunction, including the quantity, mechanism, rate, form and characteristics of the contaminants likely to be released into the environment. The discussion of a tailings dam failure scenario in section 6.6.5 of the EIS is limited to thickened tailings escaping (or slumping over) the tailings containment structure. Figure 5-9 depicts the various stages of tailings deposition, water pooling within the tailings management facility (TMF), and dam(s) construction over time. The figure suggests that the failure of any of the labeled dams may result in TMF water (contact water) entering the ecosystem and nearby waterbodies.

The potential environmental effects on receiving water bodies from a catastrophic dam failure, which results in TMF water partially to fully discharging into the receiving environment during the various stages of tailings deposition, are unclear.

The information is needed for the Agency to analyze potential effects from accidents and malfunctions.

- 1) Provide an analysis of the potential effects of the quality and volume(s) of tailings management facility (TMF) water that would escape the TMF under a worst-case dam failure scenario during the various stages of tailings deposition and dam construction outlined in Figure 5-9 (particularly Stage 1A and Stage 4). Justify that the location of the dam break selected for each example would result in a worst-case scenario release of TMF water, and include details on the significance of the effects based on the Agency's methodology for assessing significance (including the criteria of magnitude, geographic extent, duration, frequency, reversibility, ecological/social/cultural context); and likelihood of occurrence of the worst-case scenario.
- 2) Describe the drainage pathways for the tailings dam failure scenarios and include the topographic information to support the analysis of item 1. Characterize the effects of TMF water quality on nearby water bodies for each dam failure scenario.
- 3) Describe the contingency and response plans to address the effects of the TMF water that would escape the TMF during the scenarios outlined in item 1.

Reference to EIS/EA

EIS Figure 5-9; Subsection 6.6.5

Previous IR

None

Response

The response to this comment, including supporting analysis, is provided in the attached technical memorandum.

Attachments

Technical Memorandum: Assessment of Potential Impacts to Downstream Water Quality in the Event of Failure of the TMF Reclaim Pond– Hammond Reef Gold Project.



**CANADIAN MALARTIC CORPORATION
HAMMOND REEF GOLD PROJECT EIS/EA
INFORMATION REQUEST RESPONSES**

GRT Review Findings and Comments on above Responses

(Provided in letter to proponent dated October 13, 2016)

The response indicates that in the event of a dam breach, the receiving water bodies would have cyanide, cadmium, cobalt, copper, molybdenum and uranium concentrations in excess of Provincial Water Quality Objectives. It is further indicated that the immediate receiving waterbodies of Lizard Lake and Sawbill Bay would require two and six years to return to pre-breach conditions, respectively, based on the assimilative capacities of Lizard Lake and Sawbill Bay.

Given the water released in the event of a dam breach would be flushed downstream over several years, the Agency requires clarification on the potential effects of the dam breach on resources and resource uses (e.g., fisheries and wild rice areas, traditional Indigenous activities and practices, local recreational and tourism activities, hydro power production) downstream of the Project and contingency measures to be implemented.

Required Clarification

- a) Describe the potential adverse effects on downstream resources and resource uses in the event of a dam breach. Include details on magnitude, geographic extent to which adverse effects are predicted to occur and duration of the effects.
- b) Describe the contingency measures to be implemented to respond to adverse effects on downstream resources and resource uses, in the event of a dam breach. In addition to a commitment to implement the contingency measures, the proponent is expected to include a commitment to develop and implement a communication strategy to notify federal and provincial authorities, Indigenous groups and the public in the updated commitments registry (i.e., the response to T(2)-16). (This strategy should also form part of the proposed Risk Management Plan)

CMC Response

Part a)

Table 1 provides the estimated maximum concentrations of parameters that have potential concentrations above guideline values in the receiving water bodies. Under steady state (average) operational conditions, all parameters not shown in Table 1, including Cadmium, are predicted to have concentrations below Provincial Water Quality Objectives (PWQO) within the TMF reclaim pond and therefore cannot result in exceedances in the receiving water bodies. In the very unlikely event of a dam breach, only basin 7c within Marmion Reservoir and Lizard Lake will have mixed concentrations exceeding PWQO or the Site Specific Water Quality Objectives (SSWQO) for copper and cyanide that have been demonstrated to be protective of aquatic life (see Human Health and Ecological Risk Assessment TSD). Table 2 provides an estimate of the number of days that mixed concentrations exceed PWQO or SSWQO.

The additional analysis summarized in Tables 1 and 2 are based on the previously presented worst-case, upper bound dam breach assessment (see attached memo). The conservative dam breach assessment and additional water quality analysis provided herein, support the following conclusions related to water quality impacts:

- Only basin 7c, immediately downstream of the potential breach location, will have copper and cyanide concentrations slightly above the SSWQO. This condition would persist for a relatively short duration, with concentrations reaching SSWQO within 23 days and 1 day for cyanide and copper, respectively.



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- All other basins within Marmion Reservoir will maintain concentrations for all parameters below PWQO or SSWQO and therefore will not be adversely impacted.
- Lizard Lake is predicted to have concentrations of Cyanide, Cobalt, Copper, Molybdenum and Uranium that exceed PWQO and/or SSWQO immediately following the dam breach, with most returning to PWQO or SSWQO within a year.

Marmion Reservoir

In Marmion Reservoir, under worst case dam breach scenario, the maximum predicted cyanide concentration is 0.0198 mg/L and the maximum predicted copper concentration is 0.0084 mg/L. These concentrations exceed the SSWQO of 0.01 mg/L for cyanide and 0.0079 mg/L for copper.

A review of cyanide toxicity data provides chronic thresholds for warm water fish species and invertebrates (see HHERA TSD). No effect concentrations (NOECs) for fathead minnow and bluegill were reported as 0.016 mg/L and 0.009 mg/L, while lowest effect levels (LOECs) for these same species were reported as 0.02 mg/L. Invertebrates appeared to be less sensitive, with reported NOECs and LOECs for amphipods of 0.016 and 0.021 mg/L, respectively. Reported NOECs and LOECs for isopods (*Asellus* sp.) were 0.029 and 0.04 mg/L, respectively. In the event of a dam breach, the predicted short duration, maximum concentration of cyanide is below the reported NOEC for isopods, and is below the LOEC and only slightly above the NOEC for the above referenced warm water fish species and invertebrates. Based on this assessment, the predicted short duration, maximum cyanide concentration is not expected to result in adverse effects on aquatic life in Upper Marmion Reservoir.

A Biotic Ligand Model (BLM) was used to derive the SSWQO for copper in Upper Marmion Reservoir (see HHERA TSD). The fifth percentile of the BLM-derived chronic criteria for copper was calculated (HHERA TSD, Appendix 4.II, Table 2) to be 0.0079 mg/L and the fifth percentile of the BLM-derived acute criteria for copper was calculated to be 0.013 mg/L. The predicted short duration worst case concentration of copper is lower than the derived acute criteria and only slightly above the chronic criteria for 1 day, therefore, the increased copper concentrations following a dam breach are not expected to result in adverse effects on aquatic life in Upper Marmion Reservoir.

The release of 6.2 M-m³ of water into Marmion Reservoir would result in a temporary water level increase of less than 0.4 m. Water levels in Marmion reservoir have a normal operating range 3.0 m (from 312.5 masl to 315.5 masl). Outflows from the Raft Lake Dam would be increased, compared to a 'no-dam-breach scenario' until water levels return to 'no-dam-breach scenario' conditions. Temporary increases in reservoir water levels and outflows are not expected to result in significant adverse impacts to water users.

Lizard Lake

In the event of a dam breach, water quality in Lizard Lake will be impaired for up to 408 days, potentially resulting in adverse effects to the aquatic environment. This condition would be temporary and reversible.

Water levels in Lizard Lake would be expected to increase temporarily above the normal range of fluctuation and outflows would be expected to exceed normal maximum flow rates. Erosion of the shoreline and outlet channel may occur as the lake water level is drawn down and excess water discharges from the lake. These physical effects would be limited to the shoreline of Lizard Lake and the channel connection between Lizard Lake and Turtle Bay.



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Part b)

CMC will develop and implement a communication strategy to notify federal and provincial authorities, Indigenous groups and the public if a dam breach were to occur. Although there are no predicted impacts to downstream water users, a water quality monitoring program will be implemented if a dam breach were to occur to confirm the predicted magnitude of the changes in water quality. The results of this water quality monitoring program will be provided to the federal and provincial authorities, Indigenous groups and the public and part of the communication strategy. The monitoring program will sample water from different locations and depths within the receiving water bodies to determine if stratification is limiting mixing within the Reservoir. If deemed necessary by monitoring results, remedial measures such as mechanical mixing will be implemented.



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Table 1: Estimated Maximum Concentrations following TMF Reclaim Pond Dam Breach

Parameter	TMF Reclaim Concentration ^(a) (mg/L)	Marmion Baseline Concentration (mg/L)	Guideline Concentration ^(c) (mg/L)	Marmion Reservoir											Lizard Lake				
				1	2	3	4	5	6	7a	7b	7c	8	9	10	11	1	2	3
Cyanide ^(b)	0.23	0.001	0.01	0.0010	0.0010	0.0012	0.0012	0.0035	0.0040	0.0065	0.0081	0.0198	0.0033	0.0031	0.0019	0.0031	0.0940	0.2037	0.1160
Cobalt	0.002	0.00017	0.0009	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0009	0.0018	0.0011
Copper	0.09	0.0011	0.0079	0.0011	0.0011	0.0012	0.0012	0.0021	0.0023	0.0032	0.0039	0.0084	0.0020	0.0019	0.0015	0.0019	0.0372	0.0798	0.0457
Molybdenum	0.07	0.00036	0.04	0.0004	0.0004	0.0004	0.0004	0.0011	0.0013	0.0020	0.0025	0.0061	0.0011	0.0010	0.0006	0.0010	0.0286	0.0620	0.0353
Uranium	0.006	0.002	0.005	0.0020	0.0020	0.0020	0.0020	0.0020	0.0021	0.0021	0.0021	0.0023	0.0020	0.0020	0.0020	0.0020	0.0036	0.0055	0.0040

(a) TMF Water Quality based on predicted steady-state (average) conditions (see Table 4-10 of Site Water Quality TSD)

(b) TMF cyanide concentration based on maximum concentration within predicted range

(c) Guidelines are Provincial Water Quality Objectives (PWQO), with exception of Copper and Cyanide, in which Site Specific Water Quality Objectives (SSWQO) apply

Table 2: Estimated Number of Days with Concentrations above Guidelines

Parameter	TMF Reclaim Concentration ^(a) (mg/L)	Marmion Baseline Concentration (mg/L)	Guideline Concentration ^(c) (mg/L)	Marmion Reservoir											Lizard Lake				
				1	2	3	4	5	6	7a	7b	7c	8	9	10	11	1	2	3
Cyanide ^(b)	0.23	0.001	0.01	0	0	0	0	0	0	0	0	23	0	0	0	0	106	244	408
Cobalt	0.002	0.00017	0.0009	0	0	0	0	0	0	0	0	0	0	0	0	0	4	58	107
Copper	0.09	0.0011	0.0079	0	0	0	0	0	0	0	0	1	0	0	0	0	82	211	371
Molybdenum	0.07	0.00036	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0
Uranium	0.006	0.002	0.005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0

(a) TMF Water Quality based on predicted steady-state (average) conditions (see Table 4-10 of Site Water Quality TSD)

(b) TMF cyanide concentration based on maximum concentration within predicted range

(c) Guidelines are Provincial Water Quality Objectives (PWQO), with exception of Copper and Cyanide, in which Site Specific Water Quality Objectives (SSWQO) apply



CANADIAN MALARTIC CORPORATION HAMMOND REEF GOLD PROJECT EIS/EA INFORMATION REQUEST RESPONSES

GRT Review Findings and Comments on above Responses

(Provided in letter to CMC dated December 22, 2017)

The response to T(3)-09 is sufficient to close pending confirmation from CMC of the specific commitments that will enable to company to fulfill the communications plan outlined in the response to T(3)-09 and the overall Risk Management Plan for potential accidents, malfunctions and emergency situations. Kindly provide a comprehensive list for commitments for inclusion in CMC's commitments registry. For CMC's consideration, the Agency proposes commitments such as the following:

- Identify the potential accidents, malfunctions and emergency situations that would require a notification by CMC to Indigenous groups;
- Identify the manner by which Indigenous would be notified by CMC of an accident, malfunction or emergency situation, and of any opportunities for the Indigenous groups to assist in the response;
- Provide the proponent contact information that the Indigenous groups may contact, and of the representatives of the Indigenous groups to which CMC provides notifications; and,
- Seek and address input from Indigenous groups on all of the above prior to finalizing the communication plan and Risk Management Plan.

CMC Response

Prior to construction, CMC will develop and implement a Communications Plan and Risk Management Plan. These plans will be developed in consultation with the local community and Indigenous groups, and will include the following:

- Identification of the potential accidents, malfunctions and emergency situations that would require communication to the public and Indigenous groups;
- Identification of communication protocols for notifying the public and Indigenous groups, including identification of who will be notified;
- CMC contact information; and,
- Emergency response strategies, including opportunities for the public and Indigenous groups to assist in the response (where practical and with consideration of safety).

A commitment to develop and implement a Communications Plan and Risk Management Plan will be added to the commitments registry for the project.