Information Request 27

Responses to Information Request 27

IR 27 – Disturbance of Contaminated Soils

References:

EIS Guidelines, Section 2.7.2.6
EIS, Sections 2.7.2.6 and 2.7.3.3
EIS, Table 2.7.2.6-13 (Recommended Soil Quality Guidelines for Metal Concentrations)
EIS, Table 2.7.3.3-6 (Changes in Soil Quality at Worst Case Site (North Shore of Fish Lake) as a Result of Project Activities to Assess Human Health Risk)

Related Comments:

CEAR # 290 (Tsilhqot'in National Government)
CEAR # 264 (Ehrhart-English)

Rationale:

In Section 2.7.2.6 (p.50), the EIS Guidelines require the Proponent to include "details of soil sample analysis completed and the QA/QC program followed."

This element of the Guidelines is relevant to the assessment of the environmental effects of the project as it contributes to the determination of soil contamination and reclamation suitability, in addition to other potential effects on components of the environment.

In the EIS Section 2.7.2.6 (p. 940), using Table 2.7.2.6-9 the Proponent indicates that there are natural elevated metals in some of the topsoil and elevated metals and sodicity in overburden which may result in soil contamination.

The EIS provides data in Table 2.7.2.6-13 (p. 946) illustrating the recommended soil quality guidelines for metal concentrations using the standards prescribed in the Canadian Council of Ministers of the Environment (CCME) Guidelines and the British Columbia, Contaminated Sites Regulation (BC CSR) soil quality guidelines. Based on the results of the topsoil and soil samples taken in the mine footprint, Section 2.7.2.6 (p. 959) of the EIS states that arsenic, copper, nickel, selenium and zinc were found to exceed the recommended CCME guidelines.

Table 2.7.3.3-6 (p. 1198) of the EIS compares the baseline conditions and the predicted maximum increases in the concentrations of these metals over baseline around Fish Lake with the CCME Soil Quality Guidelines.

Table 2.7.3.3-6 illustrates that the predicted maximum increase in the concentrations of all metals due to project activities are minimal and are not expected to increase above baseline concentrations in the soils surrounding Fish Lake.

The table also demonstrates that arsenic concentrations at baseline (99.9 mg/kg) and the maximum predicted increase after 20 years (99.903 mg/kg) are respectively well above the recommended CCME Soil Quality Guidelines (12 mg/kg). The EIS states that a metal for which the baseline or background concentration exceeds its respective CCME guideline is not considered to be an environmental concern because the local

environment (human and ecological) is considered to have adapted to the elevated presence of the metal.

The Tsilhqot'in National Government expressed concerns and raised questions specific to the baseline presence of certain metals and contaminants of concern in soil concentrations which exceed the CCME Guidelines.

Despite the natural exceedances, the Panel would like to better understand the risks of exposure to arsenic.

Information Requested:

The Panel requests that Taseko:

a. Assess the potential effects and outcomes associated with disturbing the arsenic contaminated soils.

b. Determine whether the disturbance of the contaminated soils (arsenic) has a potential effect on the following environmental components:
   i. Air quality
   ii. Water quality
   iii. Fish and fish habitat
   iv. Soils
   v. Vegetation
   vi. Wildlife
   vii. Human health

c. Determine the significance of these effects and the mitigation measures to be implemented to reduce or minimize these effects.

d. Consider the recent studies referenced by the Tsilhqot'in National Government that suggest higher soil ingestion by Aboriginal people in the area and discuss how the inclusion of these studies would change the predictions of effects on human health.

Information Request #27a

Assess the potential effects and outcomes associated with disturbing the arsenic contaminated soils.

Response Summary

Arsenic (As) increases in availability and toxicity in reducing conditions, therefore disturbances that would reduce the oxidation state of soils could increase As availability. The only soils in the New Prosperity Project with naturally elevated As at baseline are organic soils of the O1 map unit. Organic soils are formed under reducing conditions, so it is not likely that project disturbances could cause further reducing conditions and mobilization of As in these soils beyond what currently exists at baseline. There are no predicted effects on environmental or human receptors due to disturbance of soils with natural concentrations of As.

Discussion

Arsenic Availability and Toxicity

The oxidation state and, therefore, availability of As to be leached from the soil by water or taken up by plants depends strongly on the pH and oxidation state of the soil, and secondarily on the organic matter content, aluminum and iron content, clay content and calcium content of the soil (Kabata-Pendias 2010). In the New Prosperity study area, most As in mineral soils is likely to be adsorbed by iron (Fe) and aluminum (Al) hydroxides, as the base content and clay content of the soils is relatively low. In organic soils, As will be mostly sorbed to the organic matter. As sorbed (held at the surface of reactive sites) to organic matter and Fe/Al hydroxides is typically strongly held, and will not be desorbed without large changes in the chemistry of the soil, such as a large reduction in the oxidation state of the soil (e.g., by flooding).

Baseline Arsenic Concentrations

None of the mineral soils sampled in the New Prosperity study area have elevated As concentrations. The only soils with elevated As concentrations were organic soils of the O1 soil map unit (with 99.9 mg/kg As, above the Canadian Council of Ministers of Environment [CCME 1999] guideline of 12 mg/kg). The location of the O1 map unit soils are shown on Figure 2.6.1.6-4 from the 2012 EIS (attached). O1 soils represent 10.6 percent of the soils by area in the New Prosperity LSA (Section 2.6.1.6.1 of the 2012 EIS Application).

Project Disturbance Effects on Arsenic Mobility in Naturally Elevated Soils

O1 map unit soils will be disturbed due to the New Prosperity Project during soil salvage for reclamation and construction of facilities and roads within the Project footprint. This disturbance will consist of:

- excavating soils and moving them to other locations;
- driving machinery on top of soils;
- flooding and burying soils under the Tailings Storage Facility (TSF); and,
- changing soil moisture regimes due to stream diversions and construction of new drainages for the mine.

Most soil disturbance for New Prosperity will be due to excavation or flooding and burial. Excavating the soil and moving it to new locations in stockpiles or directly to reclaimed areas, compacting soils, or drying soils, is not expected to create the strong reducing conditions necessary to desorb arsenic retained by organic matter (or from the Al and Fe hydroxides and hydrosilicates in mineral soils). Drying soils is typically associated with lowering the availability of As (Xie and Huang 1994).

Creating reducing conditions in soils due to flooding and burial for the TSF, or wetting soils with changing hydrological regimes, could increase the concentration of more mobile As^{3+} compounds; however, organic soils like the O1 map unit are typically formed in depressions and other wet sites, so they are already wet most of the year. Therefore, it is unlikely that their oxidation state can be reduced further from what already exists at baseline.

Information Request #27b

Determine whether the disturbance of the contaminated soils (arsenic) has a potential effect on the following environmental components:

i. Air quality

ii. Water quality

iii. Fish and fish habitat

iv. Soils

v. Vegetation

vi. Wildlife

vii. Human health

Response Summary

There is no potential effect on air quality, water quality, fish and fish habitat, soils, vegetation, wildlife or human health due to disturbance of soils with natural concentrations of arsenic.

Discussion

The effect of disturbance of O1 map unit soils with natural concentrations of arsenic on each ecological component listed in Information Request IR 27 is presented below. Answers are based on the information provided in part a) above.

i. Air quality: There is no potential mechanism for a change in As availability in the O1 map unit soils to affect air quality, as effects to air quality would be due to creation of dust with high arsenic concentrations, and wetted or buried soils do not create more dust.

ii. Water quality: There is no potential effect on water quality due to change in As availability in the O1 map unit soils. It is not likely that project disturbance from wetting or flooding of already wet O1 soils would result in mobility of As in the soils above baseline.

iii. Fish and fish habitat: There is no potential effect on fish and fish habitat due to change in As availability in the O1 map unit soils. It is not likely that project disturbance from wetting or flooding of already wet O1 soils would result in mobility of As in the soils above baseline.

iv. Soils: There is no potential effect on soils due to change in As availability in the O1 map unit soils. It is not likely that project disturbance from wetting or flooding of already wet O1 soils would result in mobility of As in the soils above baseline.

v. Vegetation: There is no potential effect on vegetation due to change in As availability in the O1 map unit soils. It is not likely that project disturbance from wetting or flooding of already wet O1 soils would result in increased mobility of As in the soils and greater uptake of As in plants. The baseline vegetation data collected to date (Appendix 5.5-D of the 2009 EIS Application) suggests that average As concentration in plants is below 0.2 mg/kg, with the highest concentration recorded at 0.28 mg/kg in a clover sample. Vegetation samples collected from species growing on organic soils (willows, scrub birch) had an average concentration of 0.051 mg/kg As in leaves, with a maximum in a willow sample of 0.21 mg/kg. As uptake in plants shows a linear relationship to total and available as in soils (Kabata-Pendias 2010), the low arsenic concentrations in the vegetation relative to the concentration in the soils suggests that the baseline uptake of arsenic in the vegetation is low.

vi. Wildlife: There is no potential effect on wildlife due to change in As availability in the O1 map unit soils. As described in the discussion on effect on vegetation, above, it is not likely that project disturbance from wetting or flooding of already wet O1 soils would result in an increase in mobility of As in the soils causing greater uptake of As in plants or greater As concentration in surface waters (see point ii) consumed by wildlife.

vii. Human health: There is no potential effect on human health due to changes in As availability in the O1 map unit soils, since, as described in points ii, iv, v and vi, it is not likely that project disturbance will result in greater bioavailability of As in soils, plants, surface waters, or wildlife tissues consumed by humans.

Information Request #27c

Determine the significance of these effects and the mitigation measures to be implemented to reduce or minimize these effects.

Response Summary

There are no mitigations required to prevent effects to environmental and human receptors due to disturbance of soil with natural arsenic concentrations, as there are no potential effects predicted.

Information Request #27d

Consider the recent studies referenced by the Tsilhqot'in National Government that suggest higher soil ingestion by Aboriginal people in the area and discuss how the inclusion of these studies would change the predictions of effects on human health.

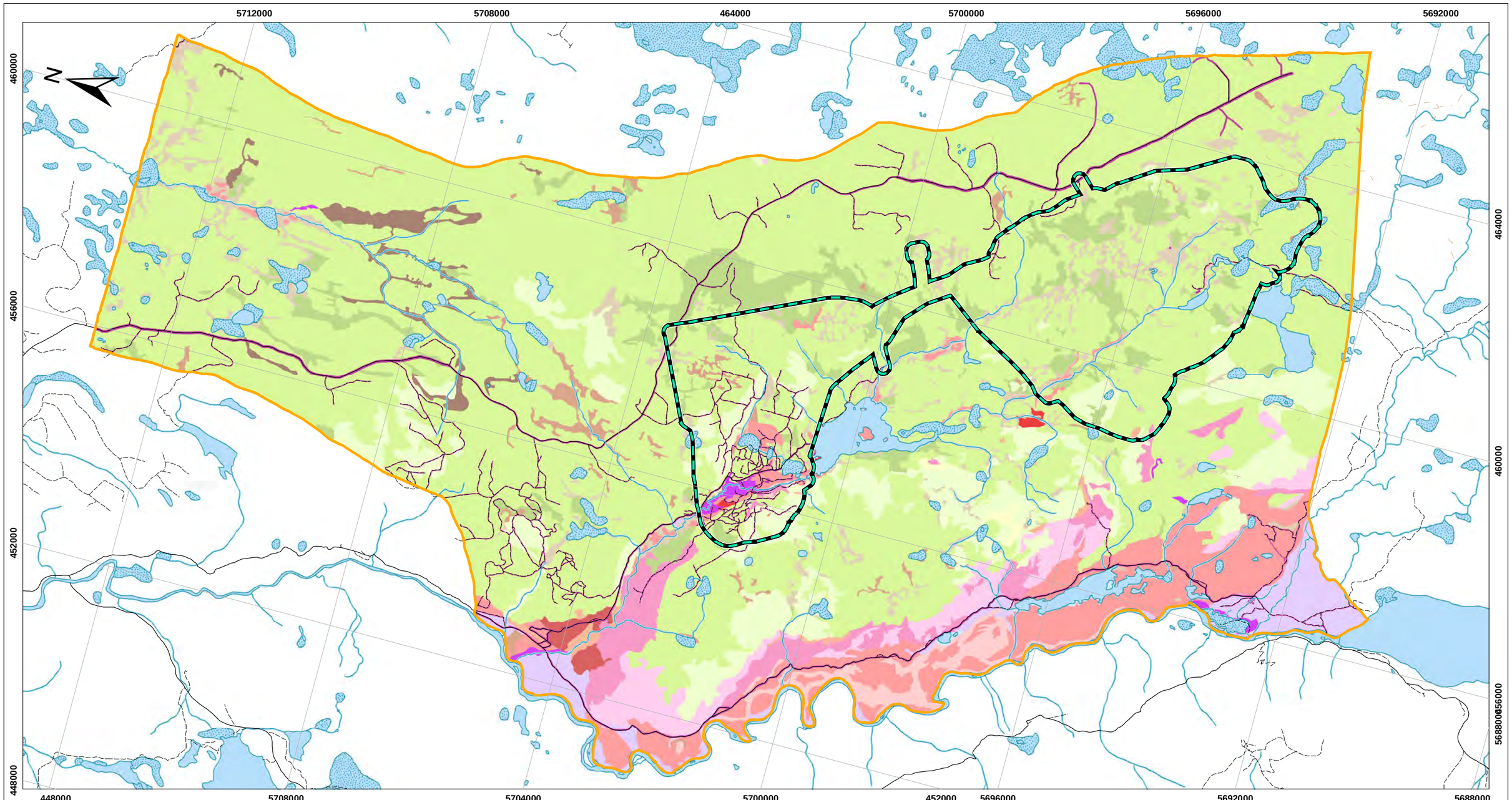
Response Summary

There is no change in arsenic availability predicted for the O1 map unit soils, which are naturally elevated in arsenic, due to Project disturbance. Since there is no change in arsenic availability predicted, there is no potential effect on Aboriginal people in the area due to soil ingestion that does not already exist at baseline. Increasing the ingestion rate of soil would increase the estimated exposures and risks for both baseline and post-closure conditions compared to what would be predicted using recommended soil ingestion rates; however, the ratio between baseline and post-closure exposures and risks would remain the same. As a result, since there is no change in arsenic availability predicted from Project activities, the conclusions regarding potential effects would not be altered if a higher (or lower) soil ingestion rate were to be used to assess exposures for baseline and post-closure conditions.

References

Kabata-Pendias, A. 2010. Trace Elements in Soils and Plants, 4th Edition. CRC Press, Boca Raton, FL.

Xie Z.M. and C.Y. Huang. 1994. Relationship between lead, zinc and arsenic contents and rice



LEGEND:

Soil Map Unit					
C1	FG2	O1	2012 Soils LSA	Gravel Road	River
C2	FG3	O2	Terrestrial Ecosystem Mapping Extent	Paved Road	Lake
D1	FG4	O3		Rough Road	Wetland
F1	L1	R1		Trail	
F2	M1	WA			
FG1	M3	DL			
	M4				

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Kilometers

Datum: NAD 83 Zone 10 Drawn By: K. Poll Verified By: T. Dinneen Data Sources: Taseko Mines Limited, Stantec, Province of British Columbia
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TASEKO MINES LIMITED

NEW PROSPERITY GOLD-COPPER PROJECT

Soils Regional Study Area and Local Study Area

Stantec | Taseko New Prosperity

25th July 2012

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