DRILLING CUTTINGS MANAGEMENT AND MONITORING

HACKETT RIVER EXPLORATION PROJECT

Water License No. 2BE-HAK0915
AANDC Land Use Permits N2013C0017 , N2013F0022
KIA Land Use Licenses KTL313C005, KTL313F006

GLENCORE CANADA CORPORATION

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Drilling Cuttings Management and Monitoring

Waste from drilling activities primarily consists of slurry, made up of one or more of the following: (rock) cuttings, muds, flocculants, salt and water (collectively referred to henceforth as cuttings). Cuttings need to be managed to prevent any impacts to the surrounding lands and water. Cuttings associated with permafrost drilling are typically saline in nature (to prevent freezing of drilling rods in ground) and can be harmful to vegetation, impact soil quality and degrade permafrost locally. Pooling of cuttings around the drill, or an uncontrolled deposition of cuttings to the surrounding lands, is not permitted. Cuttings management systems are inspected as a component of the daily drill inspection conducted by the Geologist.

Implementing drilling best practices, including water recirculation and cuttings collection through either a filter box set-up or a series of settling tanks, increases the amount of water reused and decreases the amount of waste produced by each drill. The lower volume of cuttings produced in this manner are a very thick and viscous mud either deposited directly into a natural dry depression area, or deposited in a *megabag*, which is then relocated to a sump or dry depression area and deposited. The setup is most efficient if the water recirculation system is located as close as possible to the sump to reduce sludge handling distances.

During winter drilling on ice, all cuttings are disposed of on land in an appropriate sump or dry depression area. Any accidental release of cuttings to the ice surface will be reported to the authorities. All sumps or deposition areas will be located at least 31m away from the high water mark of any body of water. All winter drilling on ice utilize a water recirculation system to avoid release of cuttings to the aquatic environment. Once deposited in a suitable sump or dry depression area, cuttings will solidify. In case of unsuitable conditions at sump sites, drilling will be stopped and appropriate corrections will be implemented. Cuttings can be deposited either into a properly constructed sump or in a dry depression area (collectively referred to as sumps henceforth). A properly constructed sump or dry depression area can consist of:

- A mega bag (temporary);
- A mud tank (temporary);
- An area surrounded by geotextile (temporary);
- A boulder field with no surface water outflow (preferred);
- Rock outcrop areas with deep voids (and no observed flow) between rocks (preferred), and
- Localized depression areas with no surface water outflow (preferred).

Figure 1 Sludge management set-up, winter.

Figure 2 Sludge management set-up, summer.

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Prior to commencing drilling and depositing cuttings, a survey will be conducted under snow-free conditions to identify suitable locations to receive cuttings during both summer and winter drilling. The survey should include identification of suitable locations, an estimation of capacity, a survey proximal to freshet early June (to verify the presence of any surface water flow) and a field visit to clearly delineate the sump area in the field.

Currently, sludge pits are marked with a pink flagged post with SLUDGE written on it. Record of established sludge pits locations should be maintained into database. All locations where cuttings are deposited, need to be documented and reported to the NWB in the Annual Report.

Monitoring

The following monitoring steps are to be implemented when surface diamond drilling activities are taking place.

As stated in Condition 10 Part D of water license 2BE-HAK-0915, all effluent discharged from sumps where drill cuttings have been deposited shall have a pH between 6.0 and 9.5. If the pH limits are exceeded, the Licensee shall either treat the effluent to the above levels, backhaul for proper disposal or as otherwise approved by the Board.

Following deposition of cuttings, all active (current year) sumps will be monitored to determine the integrity of the cuttings deposition area (i.e. area covered by cuttings have not increased) and the presence of water at the deposition area; Then pH of the water will be measured at the deposition area and in the water upstream from the sump and/or in nearby small streams of the same sub-watershed. During the freshet period (approximately mid-May to mid-June) and also following important precipitation events (when possible), the active sumps will be inspected to ensure of the physical (size) and chemical (normal pH range of effluent) stability of cuttings. All the active deposition areas will also be inspected prior to the end of the drilling campaign or freezing conditions. Sumps that are consistently dry or show normal pH ranges of the overlying water for two snow-free seasons can be considered closed.

When pH values of sumps effluent exceed the 6 to 9.5 pH range, the effluent will be either treated (eg. lime solution addition) or cuttings will be backhauled for proper disposal. Other remediation techniques may be investigated to ensure effluent pH normal range. For example, the spreading bentonite chips (and hydrating with water) over the surface of the sump's cuttings would isolate sulfide materials from air and water and could prevent oxidation responsible for pH reduction. However, before such techniques can be implemented, they will be need to be detailed and approved by authorities.