TANBREEZ

mining for greener technologies

8th September 2021

Attention : Jørgen T. Hammeken-Holm

Via Email - mlsa@nanoq.gl

Dear Mr Hammeken-Holm

On behalf of Tanbreez Mining Greenland A/S, who has considerable experience, especially on the Ilimaussaq intrusion we feel the company must comment on some of the proposals in the Greenland Minerals & Energy (GGG) EIA which in this company's opinion may severely impede the Tanbreez operation in Greenland. The problem is that in sufficient data is available in the published EIA to be able to determine how and if the problems could affect Tanbreez have been examined in sufficient detail. Most lead back to what, in this company's opinion, is a poor quality bulk sample taken from samples left in the rain for over half a century. From this the soluble minerals of fluorine and phosphates appear to have been dissolved.

Below are some examples.

1. Fluorine Poisoning

Tanbreez is not convinced that soluble fluorine in the form of villiaumite (NaF) will not be a major problem (NaF is a class one poison essentially as it can form hydro fluoric acid in the lungs or stomach) and may affect the Tanbreez mine in the form of an aerosol (although NaF in dust from the mine and mullock dump probably will not impede due to the distance separating, it may well have major effect on any of the company's work force that attempts to live and work in and around Narsaq).

Tanbreez's major concern is the soluble fluorine in Lake Tarsaq that could be distributed in suspension via foam (so called aerosol foam). This lake is to be the residue from the physical separation plant where not only will the NaF end up, but also so will some of the soaps/ detergents used in the floatation process.

Our experience when logging of the Kvanefjeld cores was the ore examined assayed 2-5% NaF, with some zones well above 10%. Secondly in some cases this mineral was seen within 7 metres of the surface (although recrystallised the sodium fluoride can be white in colour rather than the normal purple) and is often forming secondary minerals, possibly with phosphates (a published report quoting no NaF within 50m of the surface was clearly an assumption made by someone who had not logged the cores).

TANBREEZ MINING GREENLAND A/S
A/H: +61 411 426 829
Office: +61 8 9367 6855
Fax: +61 8 9367 3038
Web: www.tanbreez.com
Email: admin@gbbarnes.com.au
47 Labouchere Rd, South Perth, W.A, 6151

The EIA is extremely brief on this class one poison with the rock averaging 2-5% NaF, the apparent recovery is however only approximately 0.3%. This implies that the fluorine content will build up in lake Tarsaq to a maximum possible that we believe around 40,000 ppm. Anything over 100 ppm in water could be deadly. It appears this error in estimating fluorine grades was caused by the taking the sample from the old mine dump, which had been left in the rain for 50 years, dissolving the fluorine (meaning the 0.3% fluorine may be the fluorine left in stable minerals such as fluorite or arfvedsonite.

The presence of small amounts of soap (in the floatation process the ore in this case the phosphates are floated off by using detergents of various properties) will greatly increase the ability to form froth . Froth can form (aerosol) at winds as low as 10 km/hr, even without soap being present. As winds in the area can exceed 100 km/hr, our advice is that any strong wind from the north may endanger the Tanbreez workforce from fluorine poisoning and mining would have to be suspended. The sodium fluoride would be carried as an aerosol in the air.

It has been shown that windblown froth from say the ocean containing salt can blow many hundreds of kilometres inland and especially over the first 10 or so kilometres, so that the Tanbreez project is well within the range of such an event, while our fluorine expert stated that in his opinion Narsaq will be unliveable because of this problem.

The Laki Fissure volcano eruption in Iceland in1783 killed most of the islands animals and thousands of people, essentially from sodium fluorine poisoning, although here the poisoning was from a volcanic eruption.

The question (that is not examined in the EIA) is "**what is the effect and distribution of fluorine carried in froth form from Lake Tarsaq" and how will the workers at Tanbreez and those workers that live in Narsaq be effected.**

2. Phosphate poisoning

In an equivalent deposit on the Kola Peninsula in Russia (they drilled often using kerosene), there are over 40 soluble minerals known, most of which are phosphates. At Kvanefjeld as water was used for drilling and cutting the core, these soluble minerals have largely not been recorded although the mineral dorfmanite (Na_3PO_4) was finally found and recorded in the literature while this company when it logged the cores at Kvanefjeld found several unrecorded sodium phosphate minerals and even a crystal believed to be of sodium hydroxide. Our preliminary examination of the core suggest that soluble phosphates are present at up to 1%. Again we see no mention of assays of fresh rock for soluble phosphate (as distinct from insoluble phosphate or total phosphate in minerals such as steenstrupine).

Tanbreez is concerned about the potential for such excessive phosphate to create an algae bloom in the fjord. Such an occurrence would not only look bad for the Greenland Minerals company, but all mining companies. Thus, the question is **"how much work has been done petrologically and chemically to test for the presence of these highly soluble phosphate minerals, and why is this aspect not covered in the EIA and how much of a fertilizer is sodium phosphate in this environment"** .

3. Chemical tailings dam

The EIA is extremely unclear on this dam which faces the fjord to which the Tanbreez group of licenses also face. From the map produced it is quite impossible to determine the volume from within the dam that can take waste, also it is understood that the top 6 meters will have to be water to stop the radon escaping.

It is of extreme concern to Tanbreez that this dam is not large enough for the waste to be produced. One looks at the waste created in Bayan Obo , China at Baotou Lake (refer to photo below) only heightens our concern.

Figure 1 – Bayan Obo tailings dam - note the plant in the rear

One of the main reasons for this is the great increase in volume of the associated metal, sulphate salts. Going from an S.G. of 3 to perhaps 1.5 means the waste there is naturally doubled in volume.

However, the potential major possible reasons for an increase in volume as seen by the Chinese example above is the volume increase due to water crystallisation often associated with sulphate salts.

If Aluminium is in waste from a sulphuric acid attack for example can form the following solid:

$2Al \rightarrow Al_2(SO_4)_3 \cdot 18H_2O$
54g *666g*

Or the original 54g goes to 666g of sulphate salt which taking into account the increase in volume due to the change of S.G. could be a 2400% increase in volume.

Sodium, which could be a major constituent of the waste, can have a 7 or 10 water molecules crystallisation i.e.:

$2Na \rightarrow Na_2SO_4 \cdot 10\,H_2O$
46g *322g or 268g*

Which could be a 1400% increase in volume.

Which sulphate salt will be formed for each of the waste metals? There also is no chemical description of what is the exact make up of the waste and in what amount of each waste metal is present in the waste. From such a calculation could be made as to the potential final volume of the dump. Preliminary estimates show in a worse case the waste may exceed the capacity of the dam by a factor of 3 or 4 (clearly the facts that have allowed for this potential mis-conception need to be far better explained).

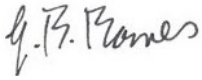
Thus, the questions are **"is this process likely to create solid sulphates with water crystallisation and if it does is the chemical dam large enough to cope with this great increase in volume from water crystallisation as it does appear to be at the moment on the information supplied"?**

4. **Sodium Sulphate**
   Sodium sulphate has a unique property in that its solubility varies greatly with temperature by a factor of 3-4 from 0°, to about 20°c. Thus the company would like to know **"if this change in solubility does occur will it cause any instability in the chemical dump and perhaps weaking the dump or dump walls".**

5. **Thorium**
   On examination of the handbook of chemistry and physics, it is suggested that thorium sulphate can be soluble. In what form is this radioactive element to be stored in this lake. Will it be in a soluble or partially soluble state or not as this likewise doe not appear to be explained in the EIA. Similarly thorium's daughter product, the radioactive metal actinium, no records could be found as to the solubility of its sulphate salts or whether this metal exported off with the rare earths, notably lanthanum with whom it has an infinity.

Tanbreez is justifiably worried about the above problems and as approaches to that company by Tanbreez have been totally unsuccessful, Tanbreez has taken the rather unpleasant step of asking these questions to the company, publicly, and awaits their formal reply.

Kind regards



Greg Barnes
Managing Director