RIO TINTO/QMM MINE ANOSY – RADIOACTIVITY MONITORING

Introduction to the Swanson Memo 2022

The Andrew Lees Trust (ALT UK) has been inquiring into and advocating for answers to questions about the water quality around the Rio Tinto/QMM mine since 2017. ALT UK has commissioned and published a number of studies including a radioactivity review by expert Dr Stella Swanson.

In her study, entitled "Review of the Release of Radioactive Material from the Rio Tinto/QMM mine Madagascar", 2019, Dr Swanson identified elevated levels of uranium in waters around QMM, 50 times the WHO safe drinking water guidelines. She also determined that there was no apparent radioactivity monitoring plan for QMM's impact on the wider environment in the Anosy region where the mine operates, especially for ingestion pathways that could affect local peoples' health.

One outcome of our advocacy work on this issue is that Rio Tinto/QMM commissioned a new radioactivity study in 2019 by an external provider, JBS&G. The JBS&G study was set as a one-year exercise but the Covid 19 pandemic delayed, and continues to delay, having any formal results.

When the new study was first mooted by Rio Tinto, ALT UK requested an opportunity to review the scoping and methodology proposed, in order to ascertain if it measured up to the recommendations made by Dr Swanson in her 2019 review. Sadly, Rio Tinto did not take up that offer. However, the company has shared two interim reports from JBS&G, and one "incidental" report on water quality.

We have shared all three of the interim JBS&G reports with Dr Stella Swanson. We are now sharing the recommendations she has made about this study, based on what has been made available to date.
Please see attached.

We draw your attention to her key recommendation on page 4 which states:

"It is unclear whether the current monitoring design will generate data that can confidently be used by QMM as well as by Malagasy regulatory authorities to meet the following goals:

1) *determine all incremental increases relative to background of radionuclides and other chemicals of concern (e.g., lead)*
2) *identify QMM-related exceedances of air and water quality standards, objectives or guidelines;*
3) *identify QMM-related exceedances of applicable radiation dose limits for the protection of the general public; and*
4) *identify QMM-related sources of exceedances in order to guide management action"*

We are sharing this document with Rio Tinto/QMM, releasing it also publicly and disseminating it as widely as possible to assist external monitoring bodies in Madagascar including the ONE, ANDEA, the Ministries of Water, the Environment, and Mines, the external advisory panels to QMM, other national and international concerned bodies, CSOs and NGOs, and local stakeholders, in order to contribute to robust interpretation of the results that will be presented by QMM once the JBS&G results are finally shared, probably this year.

Please be in touch if you have any questions: info@andrewleestrust.org

Note: Dr Swanson's 2019 review together with multiple other water quality studies are available from our website at http://www.andrewleestrust.org/studies_and_reports.html

Swanson Environmental Strategies

MEMORANDUM

To: **Yvonne Orengo, The Andrew Lees Trust**

From: **Stella Swanson**

Date: **January 11, 2022**

Re: **Recommendations for the QMM Water Quality Monitoring and the Community Radiation Study**

This memorandum presents recommendations arising from my review of two reports by Rio Tinto regarding water quality monitoring: (1) Mandena Mine Interim Summary – Radiation Study April 2020; and (2) QMM Incidental Water Quality Sampling Report. I also include recommendations based on my review of the JBS&G Interim Report #2, dated August 20, 2021 regarding the Community Radiation Study.

Recommendations for the QMM Water Quality Monitoring Program

1. Additional sampling stations representing natural background conditions are needed in order to more confidently distinguish between natural background and mine-related concentrations
2. Replicate samples (minimum of 3) from within each sample location are needed in order to provide greater confidence in the ability to distinguish upstream (background) from downstream samples as well as whether the WHO drinking water quality guidelines are met. The Figure on the *next page* provides an example comparison between taking just one sample and three samples at each site.
3. The monitoring program and data interpretation should include a focus on before and after the cessation of mine-affected discharges to the Mandromondromotra River[1].
4. The total number of upstream and downstream stations should be evaluated to ensure that there are a sufficient number of sample stations to produce results with a known degree of statistical confidence and, thus, can be relied upon by decision-makers.
5. The role of pH in affecting risk to human health should be investigated.
6. The ecological risk of the acidic pH downstream of QMM should be investigated. Acidic pH may affect fish and other aquatic life, including their ability to reproduce. This, in turn may affect the supply of fish used for food by the local population.

[1] Note from ALT UK: - QMM announced in 2021 that they had stopped releasing process mine wastewater since August 2020, as they had reported exceedances of cadmium and aluminum above the legal limit. JBS&G collected most of the water samples for its study after this period.

Clarifications Needed

- It is unclear how many rounds of sampling fit within the JBS&G scope of work.
- It is also unclear whether there is a planned complementarity between the QMM water monitoring program and the Community Radiation Study. For example, water samples deliberately taken close to areas used for drinking or fishing within the same time period would provide valuable data for later interpretation.

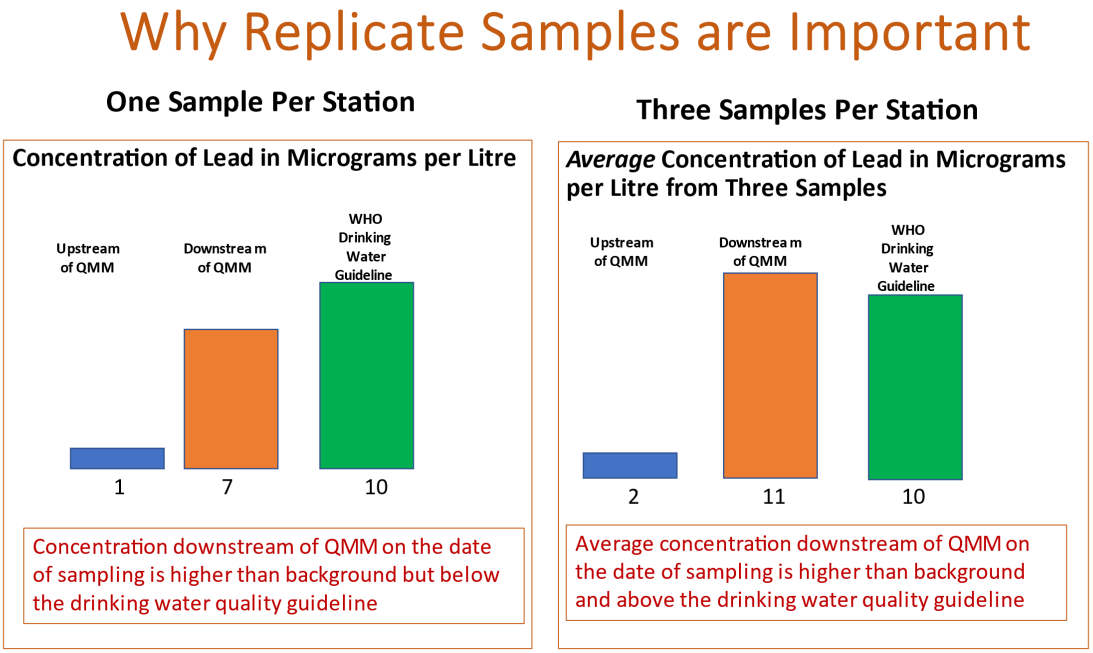

Figure 1. The example is derived from results reported by JBS&G from the Mandromondromotra River at two sampling sites - one upstream of QMM and one adjacent to QMM. The results were for lead concentrations determined from analysis of one sample per site. Theoretical results were then produced using the author's experience of typical variability in measured metal concentrations among replicates. As illustrated in the Figure, the average lead concentration from 3 replicates exceeds the WHO drinking water quality guideline. People drinking water from the river would be exposed to average conditions – replicate samples help ensure that we understand what those average conditions are.

Recommendations for the Community Radiation Study

7. The number of sampling locations and the frequency of sampling of upwind/downwind air, upstream/downstream surface water, and upgradient/downgradient groundwater should be evaluated to ensure that the sampling effort produces sufficiently reliable results. Reliable results will produce confident interpretations of natural background versus mine-related radiation exposures with season and location[2].
8. Larger sample sizes are recommended, particularly for specific food items such as fish and shrimp.
9. Replicate samples should be taken at all locations. This is of particular importance given the apparently wide range of natural background in the study area.
10. Continued involvement of community members, including those who have expressed concerns about radiation exposure, is essential. It will be important to confirm that the consultation with local people is sufficiently representative.
11. JBS&G's plans to perform gamma monitoring using two methods to record exposure rates of local people at specific road intersections should be implemented once this is possible, given COVID19 restrictions. These data will contribute further information with which to assess the risk associated with the transport of rare earths as well as the overall risk associated with dust inhalation at various locations.

Overall Recommendation

Monitoring programs should be adjusted in response to lessons learned and past results. QMM should provide their plan for how they intend to use existing data to improve the program further. The plan should include results of engagement with communities, in order that monitoring program adjustments reflect community input and concerns.

[2] Methods for determining the sample size and frequency needed are based on statistical analysis. Guidance for this analysis is provided in references cited by JBS&G in the Incidental Water Quality Sampling Report (i.e., US EPA 2006). The analysis should be based upon data for radionuclides which are usually greater than detection limits in the medium in question (e.g., Ra-226 in surface water). The QA/QC reporting should include the derivation of sample size required to detect a specified difference from background.

Key Recommendation: JBS&G Study

It is unclear whether the current monitoring design will generate data that can confidently be used by QMM as well as by Malagasy regulatory authorities to meet the following goals:

(1) determine all incremental increases relative to background of radionuclides and other chemicals of concern (e.g., lead);
(2) identify QMM-related exceedances of air and water quality standards, objectives or guidelines;
(3) identify QMM-related exceedances of applicable radiation dose limits for the protection of the general public; and
(4) identify QMM-related sources of exceedances in order to guide management action

The Data Quality Objective guidance provided by the US EPA (2006) includes steps for determination of the quantity of data needed to meet monitoring goals.

Data quality objectives (DQOs) can be determined according to "tolerable decision error"; i.e., the probability (or chance) of drawing erroneous conclusions (e.g., concluding that a concentration is within the range of background when it is not or vice versa). Alternatively, DQOs can be expressed as a level of acceptable uncertainty associated with a point estimate (e.g., average metal concentration) at a desired level of statistical confidence (e.g., arriving at an average metal concentration which can be compared with regulatory limits). In either case, data are required before DQOs can be derived. There are now data with which to determine DQOs for surface water; however, since so many results are less than detection limits, DQOs for metals will be possible only for those metals which were above detection limits a sufficient number of times. DQOs for radionuclides, on the other hand, should be derived since the Interim Summary report indicates that for some radionuclides at least, there will be sufficient data above detection limits.

Transparent derivation and communication of the "tolerable decision error" associated with the monitoring data will help mitigate the risk of multiple rounds of disagreements among experts and decision-makers regarding the interpretation of results. Error can never be completely be eliminated. However, tolerable decision error defines the acceptable risk of being wrong (in this case, the consequences of being wrong about exposure of the general public to radiation and other chemicals of concern).