Before the Hearing Commissioners
Appointed by the Grey District Council
And West Coast Regional Council

Resource Consent applications by TiGa Minerals and Metals Ltd to establish and operate a mineral sands mine on State Highway 6, Barrytown (RC-2023-0046; LUN3154/23)

Summary statement:

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Summary of evidence

1. My name is Cris Michael Ardouin.
   I am the Technical Lead Radiation Safety for the National Centre for Radiation Science (NCRS), Institute of Environmental Science and Research (ESR).
   I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court.

2. I have been a Health Physicist for over 30 years. This included 10 years as an Accredited Health Physicist in the British nuclear power industry. For the last 23 years I have worked for the National Radiation Laboratory (NRL) and now ESR, which took over NRL in 2011. My duties include provision of expert advice on radiological safety and security to core government, radiation users and other key stakeholders. I conduct regulatory inspections under the Radiation Safety Act on behalf of MoH, including the highest radiological risk category facilities. I am a National Duty Radiation Emergency Officer under the national radiation emergency response arrangements. I am the NZ representative on two International Atomic Energy Agency Safety Standards Committees (Emergency Preparedness and Response and Transport Safety). I have been engaged as an IAEA expert on multiple missions in Asia Pacific, Europe, Africa and the Caribbean including delivery of radiological protection training, technical reviews and assistance in those regions.

3. At the request of the West Coast Regional Council, ESR reviewed a radiological assessment conducted by IHC Mining titled, "Radioactivity of BJV Material Tested Project 2019". This review was carried out by myself and my colleague Dr Michael Lechermann, who is the Technical Lead for the Environmental Radioactivity Laboratory at NCRS ESR. We issued a report of our review on 4th December 2023 titled, "Peer Review of Radiological Assessment conducted by IHC Mining, "radioactivity of BJV Material Tested Project 2019" (Lechermann and Ardouin), (ESR client report no WCRC122023).

4. As stated in our report, we stated two perceived or actual conflicts of interest. Firstly, ESR provides technical advice and services (including regulatory inspections) for the Director for Radiation Safety (Ministry of Health). Secondly ESR provides radiological monitoring services including radionuclide assessment.

Summary of ESR Peer Review of IHC Mining Radiological Assessment

Background

5. Exposure to Naturally occurring radioactive materials (NORMs) is part of everyday life for all of us. NORMs are ubiquitous in the environment, including soil, rocks, building materials and water.
6. Processing operations, especially those involving chemical separation, may lead to a build-up of certain elements either in the product, by-product or waste, which may in turn increase concentrations of NORMs to a level that warrant controls to protect people and the environment from radiological hazards.

Review of IHC Mining Assessment

7. The radioactivity monitoring test results that were quoted in the IHC Mining Assessment made reference to test results from x-ray fluorescence (XRF). This determines the elemental

composition of a sample, but not its isotopic composition, so assumptions need to be made to calculate the isotopic activity values.

8. The quoted test results did not state the uncertainties and their coverage factors. Also, the limit of detection is not stated.

9. We concluded that there are shortcomings with limiting the analytical method to XRF elemental analysis and recommended that other analytical tests that are isotope specific, such as gamma spectrometry, are also used.

10. For the stated activity concentrations for the high-grade product (0.66 Bq/g natural uranium and thorium), average grade (< 0.45 Bq/g) and tailings (<0.14 Bq/g); we agree that the radiological risks associated with such materials are very low and that the Radiation Safety Act 2016 and the IAEA Transport Regulations (IAEA SSR-6) do not apply.

11. Schedule 2 of the Radiation Safety Act 2016 (the Act) lists and defines "acceptable levels" for individual radionuclides. The provisions of the Act do not apply to material that contains radionuclides below the "acceptable levels". As the "acceptable levels" for the relevant uranium and thorium radionuclides are 10 Bq/g, the stated activity concentrations are well below the threshold of what is considered as radioactive material in the Act and therefore the provisions of the Act do not apply.

12. Transport of radioactive materials must be in accordance with the IAEA Regulations for the Safe Transport of Radioactive Material (IAEA SSR-6). These regulations are implemented in New Zealand through the Ministry of Health Code ORS C6, Code of Practice for the Safe Transport of Radioactive Material and the modal regulations, including the Land Transport Dangerous Goods Rule (2005). Paragraph 107 of the IAEA regulations states, "these Regulations do not apply to any of the following: (f) Natural material and ores containing naturally occurring radionuclides, which may have been processed, provided the activity concentration of the material does not exceed 10 times the values specified in Table 2..". The values quoted in Table 2 for uranium and thorium are1 Bq/g and therefore the exempt activity concentrations for these products can be interpreted as 10 Bq/g applying paragraph 107 (f) and therefore the stated activity concentrations are well below the threshold for application of the IAEA Transport Regulations.

13. The Australian Code of Practice and Safety Guide, "Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing", references IAEA Standards Series No. RS-G-1.7 (IAEA 2004), "Application of the Concepts of Exclusion, Exemption and Clearance", which sets exclusion levels for naturally occurring radioactivity in bulk materials at 1 Bq/g head-of-chain activity for the uranium and thorium decay chain radionuclides. The activity concentration of 1 Bq/g is a generally-accepted level for naturally occurring materials containing uranium or thorium, below which a potential source of radiation exposure, such as an ore or mineral concentrate, could be considered inherently safe.

14. IAEA have recently issued a new guidance document, IAEA "Application of the Concept of Exemption, GSG17 (2023)". This guidance states that for bulk amounts of radionuclides of natural origin, exemption should be considered on a case by case basis applying a graded approach and apply regulatory controls commensurate with the radiological risk using a "dose criterion of the order of 1 mSv/y".

Conclusions and Recommendations

15. Screening tests, such as X-ray fluorescence spectroscopy or in-situ dose rate monitoring may guide decision making processes but should not be used to quantify isotopic activities. It is recommended that analytical tests that are isotope specific are carried out, to quantify and evaluate activity concentrations for comparison against regulatory requirements and international guidelines.

16. For the stated activity concentrations in the test report, the radiological risks associated with these levels are minimal and not of regulatory concern. However, there is not enough information in the report to be satisfied that the results of these samples are accurate enough or that enough sampling and assessment has been done to draw this conclusion. It is recommended that following additional sampling and testing using radionuclide analytical techniques the radiological risks are re-evaluated with a more comprehensive assessment.

17. Once the site is commissioned, it is recommended that an ongoing radiological monitoring and reporting programme is put in place to ensure the basis for any regulatory decisions (such as, whether controls and mitigations are warranted or not) remains valid.

Comments on draft applicant consent conditions dealing with radiation

18. West Coast Regional Council have drafted some consent conditions and I have the following comments on the draft (dated 8 February 2024). Note these are only draft conditions and additional work is needed with the wording and so my comments only relate to the principals and intent of the draft

19. I am in agreement that a pre-development radiological survey should be carried out prior to land disturbance. This will provide a baseline for comparison once operations commence. The baseline survey should include an assessment of gamma radiation levels at specified monitoring locations, sampling and radionuclide analysis of representative surface soils/sands, water and airborne activity. Measurements inside processing buildings should also be carried out prior to operations to determine background gamma radiation, particulate airborne activity and radon.

20. For the conditions relating to routine monitoring, I agree that regular screening by XRF analysis of representative HMC samples from the stockpile area should be carried out as described in the draft condition.

21. I agree that systematic HMC testing of representative samples from the mining area should be conducted as described. I also recommend that intercomparison tests are done from time to time comparing results from XRF analysis and direct radionuclide measurement (gamma spectrometry).

22. I agree that routine radiological surveys are carried out at agreed monitoring locations for comparison with the baseline survey (to include gamma radiation levels and airborne radioactivity).

23. I agree that the setting of an action level of 1 Bq/g from the HMC screening tests, to subject the sample to a radionuclide analysis by an independent accredited laboratory.

24. I agree with the notification requirements to WCRC and GDC and to the Director for Radiation Safety (Ministry of Health) if HMC test results exceed 1 Bq/g.

25. I agree with the notification requirements if HMC test results exceed 10 Bq/g. Note that if this occurs, the acceptable activity concentrations defined in the Radiation Safety Act would be exceeded and would be subject to licensing and all other relevant provisions of the Radiation Safety Act 2016 and supporting legislation.

26. I agree with the requirement to make assessments that confirm that public doses of 1 mSv/y are mot not exceeded. The assessment needs to consider who may be most exposed and how. As it is not anticipated that the operation will need licensing under the Radiation Safety Act, the operators will be considered as members of the public in relation to the dose limits. It is likely the operators would be considered as the "critical group" in terms of assessing maximum public doses. The dose to this group can be assessed from the data from the routine radiological monitoring programme and assessing occupancy in these monitored locations. Note that the public dose limit does not include our normal everyday background radiation exposures, so comparison with the baseline survey will also be a part of this assessment.

27. Note that if the Radiation Safety Act applies, if the public dose limit was exceeded it would be reportable to the Director for Radiation Safety (MoH) as it would be a breach of the Radiation Safety Act.

28. I agree with the requirements for radon monitoring and the proposed action levels. However, to demonstrate that operators are not exceeding 1 mSv/y (excluding normal background doses), an ongoing radon monitoring programme may be required.

29. However, it needs to be clarified that the dose limits in the Radiation Safety Act only apply when dealing with a radiation source (as defined in the Act) for a planned operation or activity. If the material is < 10 Bq/g it is not a radiation source under the Act. (Sections 4 and 9 of the Act).

30. Nevertheless, I agree with the proposed consent condition that requires the operator to assess potential doses to the public and to notify the consenting authority and the Director for Radiation Safety (MoH) if public dose estimates resulting from the operations exceed 1 mSv per year. This is consistent with IAEA GSG 17 that for planned exposure situations arising from bulk quantities of materials with radionuclides of natural origin (above 1 Bq/g U, Th) the safety assessment should be subjected to case by case consideration for compliance with a dose criterion of the order of 1 mSv/y being subject to regulatory control.

31. I also recommend that the Director for Radiation Safety is consulted on the proposed consent conditions and given the opportunity to comment, as he clearly has a role as the head of the national radiation safety authority

32. Finally on a separate issue I note that the operator intends to use a hand held XRF analyser. This will be subjected to the provisions of the Radiation Safety Act. It will need to be registered with the MoH and will be subject to licensing to authorise possession, management, control and use,

References

Peer Review of Radiological Assessment conducted by IHC Mining titled, “Radioactivity of BJV Material Tested Project 2019” (ESR December 2023)

IAEA Basic Safety Standards: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (GSR Part 3) (2014)

IAEA Regulations for the Safe Transport of Radioactive Material (IAEA SSR6) (2018)

New Zealand Radiation Safety Act 2016

Australian Government (ARPANSA) Code of Practice and Safety Guide, Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005)

IAEA Safety Standards Series GSG-17, Application of the Concept of Exemption (2013)

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13 February 2024