

In the matter of an application for approvals under the Fast Track Approvals Act 2024 for the Barrytown Minerals Project – Southern Block [FTAA-2605-1238]

By **Tāiko Critical Minerals Limited**

Applicant

Reply Statement of Evidence of David Bougourd in relation to radiation

5 October 2026

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Introduction

- 1 My name is David Bougourd.
- 2 I provided a statement of evidence dated 11 April, which outlines my experience at paragraph 3.
- 3 I reconfirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing this evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
- 4 This reply evidence responds to the following matters:
 - (a) Expert Report of John Phillip Bradley, PhD for the Coast Road Resilience Group Barrytown Radiation Geophysical Assessment
 - (b) Parliamentary Commissioner for the Environment, Simon Upton Comment of Barrytown Minerals Project – South Block [FTAA-2605-1238]

RESPONSE TO ITEM 4 (a) - John Phillip Bradley

HMC sample Analysis -paragraphs 16 - 18.

- 5 Analysis of HMC quoted in the expert report cites radioactivity levels in the HMC and the magnetic separation products. It is not clear how the analysis results quoted in Table 1 were obtained. The quoted figures for solids Bq/g are high and indicate high concentrations of radionuclides. The Barrytown project will not produce and transport products of more than 10 Bq/g, so this sample is unrelated to the Barrytown project. Further it is highly unusual to measure Radon in Bq/m³ in solid samples. How this analysis was completed has not been explained, and in my opinion is questionable.
- 6 From paragraph 18 in the response the sample noted cites the radioactivity as coming from minerals Thorite, Urano thorite, Uraninite and Monazite. These mineral suite is different to the Barrytown project where the main radioactivity source is Monazite, which is found in low concentrations. Hence this sample and its analysis is not comparable to the discussion around the Barrytown project.
- 7 In my opinion this section of the expert report presents data indicating high levels of radioactivity could be expected at the Barrytown project, where all the evidence to date indicates that the radioactivity levels are much lower.

In my opinion Barrytown testwork to date indicates ore and HMC as being lower radioactivity levels than the average mineral sand deposit and mining operation.

Radon Risk from Mineral Sands – paragraphs 26-33

- 8 Radon gas is a known risk as correctly noted by the report (at paragraph 26). However it is not clear how the results noted in Figure 5 were obtained, what equipment was used and how the result was calculated. The results appear high for residences without further explanation.
- 9 TCM acknowledges the risk of Radon and has committed to measurement of Radon and assessment of exposure to company staff and environmental emissions from the Barrytown Project. Measurement will be undertaken with correctly calibrated and approved techniques. The expected airborne concentrations are much lower than those quoted in item 25 table 5 with worse case scenario maximum concentrations of 100 Bq/m³ even in enclosed HMC storage spaces. Consequently this table and following assessment gives a somewhat misleading guide to the expected risk of Radon to TCM staff and surrounding environment.
- 10 Mineral sands are generally considered a low radon risk as the concentration of Uranium and Thorium, which generate the radon gas, are generally low. Further the short half life of Radon gas, 3.8 days, means it decays relatively quickly back to a solid, often before it has a chance to escape the immediate crystal lattice of the mineral.

NORM Solubility – paragraph 36 - 38

- 11 Solubility of NORMS from mineral sand deposits is an important consideration that TCM acknowledges. TCM will periodically measure groundwater for NORM and assess if there are any NORM solubility issues but this is not expected.
- 12 The comments in paragraph 38 electron microscope images are leached is irrelevant as the samples from the Barrytown project as it contains other minerals not found at the TCM Barrytown project.
- 13 The geological process of mineral sand deposition explains why the risk of soluble radionuclides is low. The sand originates from erosional processes in the high lands of South Island New Zealand. The minerals are eroded from the host rock form, wash down rivers into the sea and then worked by weather and sea onto beaches. Over time the sea water then retreats to leave a stranded beach. In the Barrytown case the minerals remain underwater, groundwater, to this day. This process takes thousands of

years and occurred several thousand years ago. Consequently if any elements were to leach from the mineral grains, they would have done so long ago. The mineral sand processing, including at the Rapahoe mineral separation plant (MSP), does not damage the minerals and uses groundwater for processing. Consequently the risk in any mineral sand process of solubilising radionuclides is low.

Radiation in Processing – paragraph 41

- 14 The opinion noted in paragraph 41 (that once mineral sands processing is undertaken and they are concentrated that they will be more (not less) radioactive) is not accurate. The main radioactive minerals in the Barrytown project ore body are Monazite, Zircon and to a lesser degree Ilmenite and Rutile. The remainder of the ore is lower or much lower. The process is designed to recover the Zircon, and titanium products, (Ilmenite, Rutile etc). Consequently the tails from the process has to be lower in overall radioactivity than before it started, as most of the main radioactive sources are in the saleable products. The tails from the MSP will contain some low level activity, but would be mixed with the barren WCP tails to reduce overall activity back to low level.
- 15 Further to this TCM will be monitoring the various streams generated by the process and periodically analysing them to assess radioactivity. This is normal mineral sand processing practice to understand and optimise processing recoveries.

Secular Equilibrium and Solubility – paragraph 54 - 56

- 16 As noted above the geological process of erosion and deposition leads to the stable mineral chemistry which leads to stable radioactive decay and secular equilibrium. The only way to upset the secular equilibrium is for chemical and or thermal treatment of the minerals neither of which TCM are proposing for the Barrytown project, at any stage of the project (dredging, processing at the WCP or subsequent processing at the MSP).
- 17 The practice of assuming secular equilibrium is usual for mineral sand projects, unless there is process where chemical or thermal treatment takes place.
- 18 Consequently the comment in paragraph 56 indicating that secular equilibrium is disturbed by the mining and processing route proposed by TCM is inaccurate.

NORM Management – paragraph 64

- 19 TCM has committed to managing radioactivity in the workplace and environmentally for the Southern Resources Block, and the Barrytown project as a whole. The project will comply with the NZ Office of Radiation NORM Compliance Guidelines, the NZ Radiation Safety Act and the practices will align with the Western Australian LGIRS NORM management guidelines. It is noted Western Australia has a significant mineral sand mining and processing industry and long history of safe management of radiation issues.
- 20 TCM has engaged with the regulator, the New Zealand Office of Radiation, in preparing for the project. There has been constructive discussion between the Office and TCM. At this stage the Office of Radiation has indicated that the radiation management practices proposed by TCM are adequate and compliant with the NZ Radiation Act and recent NORM compliance guideline.

Palaris Report – paragraph 23 - 26

- 21 TCM previously completed a detailed study in 2023 of the Barrytown project through an external consulting company Palaris. This report was available for public scrutiny. The report was based on a body of metallurgical data from a limited part of the ore body.
- 22 The Palaris report quoted the non magnetic concentrate of 12.9 Bq/g, which was the highest concentration of NMC produced in the testwork. The MSP at Rapahoe is a processing facility will be monitored and adjusted continuously to produce various products. The intent of the facility is to produce materials less than 10 Bq/g, so as to comply with the IAEA transport limit.

RESPONSE TO ITEM 4 (b) - Parliamentary Commissioner for the Environment

Mine Tailings NORM and radioactivity levels.

- 23 This comment raises concerns there may be an increase in ionising radiation as a result of heavy metals in the mined sand being concentrated at the Rapahoe mineral separation plant (MSP) and then being returned in the tailings (waste materials) to the mining site after processing.
- 24 As shown in an illustrative example in the table below the radioactivity of the ore generally follows with the heavy mineral content, with all the minerals being of a higher radioactivity than the sand, oversize and silt

components. The WCP tailings is planned to be returned to the mine void by pump. Hence all the products are mixed in the pump hopper and homogenised. The tails product will be mixed together, at a lower specific activity to the ore previously. As the ore body exists at surface in most places it is likely the radioactivity levels on the surface post mining will be similar, or slightly lower than pre mining levels.

- 25 Metallurgical testwork has been completed for the MSP on samples obtained from surface areas of the ore body. This testwork demonstrated that a range of non magnetic concentrates could be produced depending on the operating parameters of the separation equipment. The samples used for this previous test work however are not considered to be representative of the ore body. This testwork was used to support the Palaris Barrytown study.
- 26 The most recent test work completed September 2026, after the application lodgement, indicates the following radioactivity levels. This testwork was conducted on samples obtained from the drilling of the Canoe Creek section of the ore body. The samples are considered to be representative of the ore that would be mined on this section of the ore body, and much more representative than previous metallurgical testing.

Testwork Sept 2026	Bq/g
Ore	0.29
HMC	1.3
MSP Tails *	5.0
WCP Tails	0.25

* Note MSP tails are an estimated grade dependent on plant operating conditions. These results are somewhat lower than previous results, however are considered to be more representative of the total ore body than previous results.

- 27 As shown in the table above the radioactivity of the ore generally follows with the heavy mineral content, with all the minerals being of a higher radioactivity than the sand, oversize and silt components. The WCP tailings is planned to be returned to the mine void by pump. Hence all the products are mixed in the pump hopper and homogenised. The tails product will be mixed together, at a lower specific activity to the ore previously. As the ore body exists at surface in most places it is likely the radioactivity levels on the surface post mining will be similar, or slightly lower than pre mining levels.
- 28 As part of the normal and ongoing radiation management TCM has committed to the pre mining and post mining radioactivity levels will be

measured to ensure that the radioactivity levels post mining are the same or less than as at pre mining levels.

David Bougourd
5 October 2026