

Memo

To: White & Case

From: Darren Billingsley

CC:

1st June 2021

RE: Fingerboards Project, Consumption of livestock product and expected radiation doses (PRELIMINARY ASSESSMENT).

Please find herein some explanatory notes for the assessment of doses arising from the consumption of livestock products that was conducted as a 'preliminary' assessment for the purposes of the IAC hearings. When I was giving my evidence on 12 May 2021, the IAC asked if I could provide the RESRAD text file associated with the preliminary calculations I referred to in my evidence and at the conclave, so that this could be provided to the IAC's Technical Expert, Dr Joyner.

A few assumptions were made in the 'preliminary' Livestock assessment.

RESRAD OFF-SITE Ver 4.0 was used. The 'Simulate the RESRAD on-site model' option was chosen as a worst case. The assumption was that a beef or dairy cow resides on site, rather than relying on transportation of radionuclides off site by air or via water systems. Please refer to the two output files, titled 'Fingerboards Livestock BASELINE Preliminary' and 'Fingerboards Livestock OPERATIONS Preliminary' for the specific parameters and resultant doses calculated. The assessment was considered preliminary as largely default values provided by the software package were not altered.

Two models were run, one (BASELINE) assumes an original soil activity based on approximate values of activity concentrations from the Farming district. (Concentrations chosen are irrelevant as we are only interested in the increment as a result of operations). The second model (for year 20) (OPERATIONS) assumes an increased soil activity concentration. This is based on conservative dust deposition for 20 years, homogeneously mixed with existing soil.

The BASELINE model assumes:

- U-238 chain progeny soil concentrations of **50 Bq/kg** (including U-238, U-234, Th-230, Ra-226, Po-210 and Pb-210 – radionuclides with $T_{1/2} > 30$ days)
- Th-232 chain progeny soil concentrations of **80 Bq/kg** (including Th-232, Th-228, and Ra-228 – radionuclides with $T_{1/2} > 30$ days)
- Livestock water consumption: 70L/day

The OPERATIONS model assumes:

- U-238 chain progeny soil concentrations of **50.04 Bq/kg*** (including U-238, U-234, Th-230, Ra-226, Po-210 and Pb-210 – radionuclides with $T_{1/2} > 30$ days)
- Th-232 chain progeny soil concentrations of **80.06 Bq/kg*** (including Th-232, Th-228, and Ra-228 – radionuclides with $T_{1/2} > 30$ days)
- Livestock water consumption: 70L/day

** The increased soil concentrations are calculated assuming 0.2 g/m².month deposition of ore (U-238 - 0.31 Bq/g, Th-232 - 0.48 Bq/g) deposited 12 months a year for 20 years and mixed in the top 2 cm of soils. The final concentrations however are assumed to also be at root depth of 20 cm as a worst case. A soil density of 2 g/cm³ has been assumed.*

For both models, human exposure pathways for external gamma, inhalation, plant ingestion, aquatic foods, drinking water, soil ingestion and radon have been suppressed (refer page 17). Only meat and milk ingestion are 'active'.

Other than soil concentrations, the only parameter modified in both modelling is the livestock water consumption, assumed to be 70 L/day based - as this local data was provided to me.

All other parameters have not been modified. Importantly with the exception of soil concentrations, parameters for both the BASELINE and OPERATIONS modelling are identical. An argument could be made that varying these values based on regional data may have an impact at significant concentrations/doses, but probably not for the soil concentrations being considered. It is the increment in dose that is of importance – not the BASELINE and OPERATIONS doses themselves.

The output files also show results for t=1 year and t=20 years. These should be disregarded for this preliminary assessment. The OPERATIONS model already assumes the 20 year scenario.

The results for both models are represented on Page 19, Table 2 under Meat and Milk.