An In-Field Evaluation of a Geotextile Filter to Capture Radioactively Contaminated **Corrosion Scale Removed from Disused Mining Equipment by High-Pressure Water-Cleaning (HPWC)**



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WA's lithology is replete with the naturally occurring radionuclides (NORs) thorium-232 and uranium-238 and their radioactive decay products.

Mineral processing release the NORs. As steel plant and equipment corrodes, scale is formed on the inner surfaces. The volatile radioactive decay products of the NORs, particularly isotopes of radium, polonium and lead concentrate in the corrosion scale....resulting in significant volumes of radioactively contaminated disused plant & equipment.



A worker/community hazard with a significant environmental footprint which presents long term management challenges.







HPWC can remove corrosion scales.

However, HPWC may generate large volumes of contaminated "slurry" presenting potential for radiation exposure.

The "slurry" is a mixture of water, sludge and scale, including NORs.

Geotextile*



Stormwater Filtration Device

Scale captured in geotextile.

Filtrate passed through the geotextile and captured in the bund.

Activity concentration in scale and filtrate



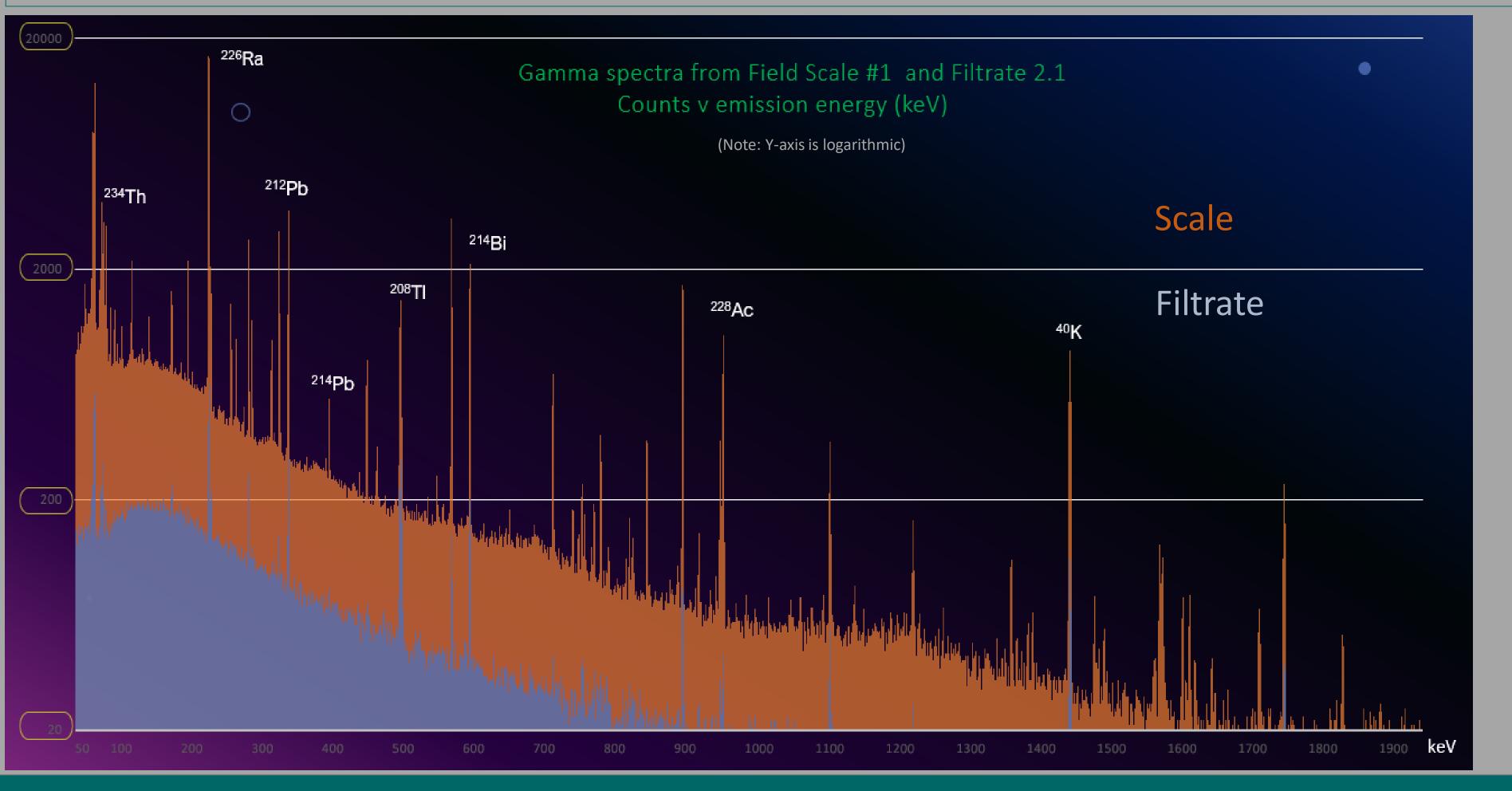


Filtrate collection bund

assessed via gamma (γ) spectrometry.

* Details of the geotextile can be found at <u>www.ariwater.com.au</u>

This research evaluated the capacity of a geotextile to capture NOR-contaminated corrosion scale. The capacity of the geotextile to capture NORs is a ratio of the activity concentration in the scale to that in the filtrate



| Total Activity | Bq per kg | Removal Effectiveness (%) |
|--------------------------------|-----------|------------------------------|
| in Scale | 25,459 | |
| in Filtrate (mean) | 1,666 | 93.9 |
| in Filtrate Top 80% | 214 | 99.2 |
| in Filtrate Bottom 20% | 3117 | 89.1 |
| Environmental Release Criteria | 1,000 | |

Capture in a settling tank will allow 80% of the filtrate to be discharged to the environment – without conditions.

Filtration efficiency of the radioactive contamination by the geotextile as evaluated via activity concentration, demonstrated efficiencies for the radionuclides ²²⁸Ac, ²²⁸Tl, ²³⁴Th and ²¹⁴Pb exceeding 98%; and 92.7 % for ²¹⁰Pb.

The overall efficiency of removal of activity concentration by the geotextile filter was 93.9%.

Scale residue is <2% of the original mass of contaminated steel - significant cost savings and potential for recycling.

PhD Thesis: Towards establishing a fit-for-purpose regulatory framework for radiation protection in Western Australia's mining industry: Evaluating mine worker exposures to naturally occurring radionuclides" is available at https://ro.ecu.edu.au/theses/264