# Comprehensive baseline environmental monitoring of an interim legacy waste store in arid zone Australia

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Radionuclide containing soil and rubble from the clean-up of a former uranium, thorium and rare earth minerals processing research facility is currently stored at the Woomera Test Range in South Australia awaiting final disposal. Prior to developing a final disposal pathway, a comprehensive baseline environmental monitoring has been carried out to establish the background radiation levels.

## How did the waste get there?

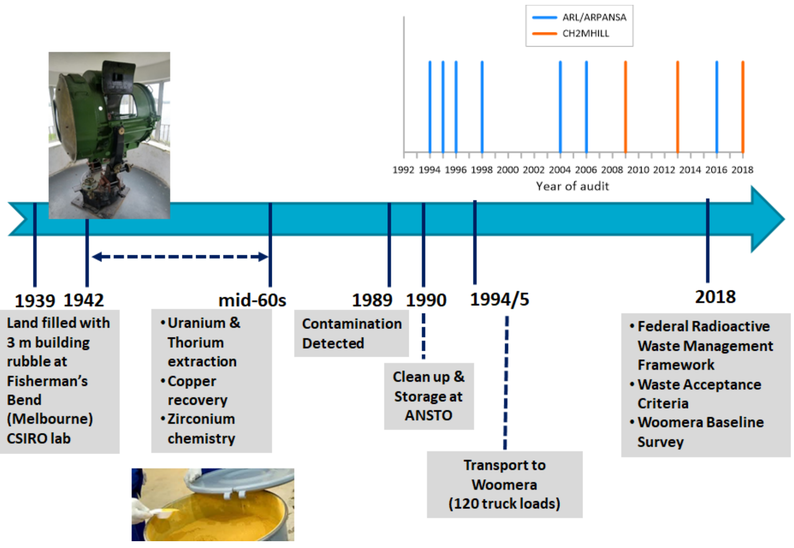



Figure 1: Timeline of activities leading up to the generation of the Woomera radioactive waste, temporarily stored at the Woomera Test Range, South Australia.

Figure 2: Removal of material from car park at Fisherman's Bend (Victoria) in 1990. Approximately 10,000 drums each 200 L were filled with soil and rubble, then temporarily stored at ANSTO until being transferred to Woomera in 1994/5.

## Level of radioactivity

### Measured at ANSTO (Nov. 1991)

- 9646 drums (99.2%) had surface dose rates <5 µSv/hr
- 68 drums (<1%) had surface dose rates between 5-17 µSv/hr
- By comparison: dose limit for workers = 20 mSv/y or 10 µSv/hr

Figure 3: Surface dose measurements (example).

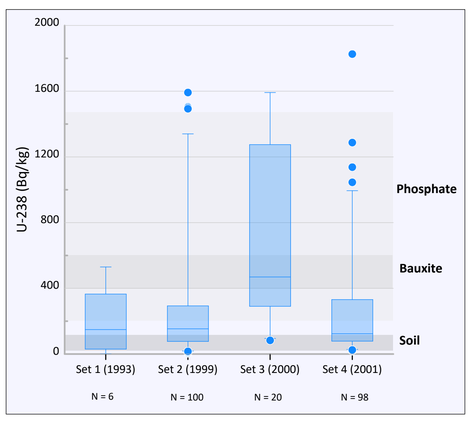



Figure 4: U-238 concentration in drum samples.

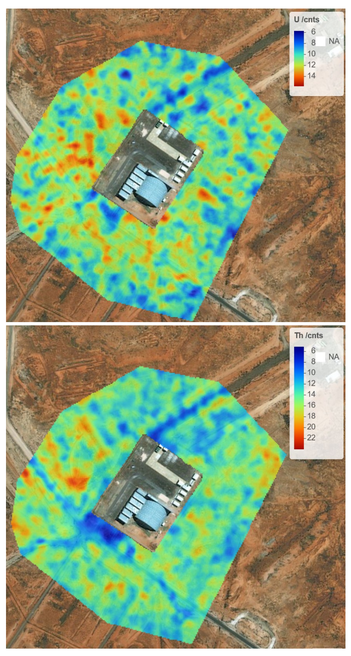
### Measured at Woomera (1993-2001)

- Sampling, in-situ analysis (U-238, Th-232, Ra-226,…)
- U-238 similar to natural radioactivity in soil and minerals (Bauxite, Phosphate)

## Environmental baseline survey

### Gamma scanning of surrounding soil

Figure 5: Detection of U-238, Th-232 and K-40 using a gamma ray radiometer (Radiation Solutions Inc., Mississauga, Ontario, Canada) with a 4.2 L thallium-activated sodium iodide detector crystal coupled with a real-time kinematic global positioning system.



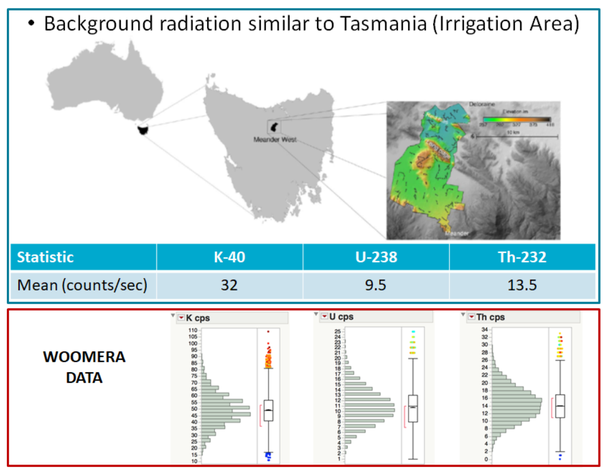




Figure 6: (Left) Natural uranium and thorium counts at the Woomera storage facility. (Top) Comparison between mean natural radionuclide counts at Woomera and a field site in Tasmania.

### Spectroscopic analysis of soil samples

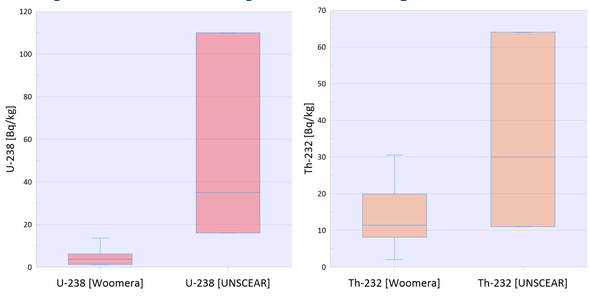
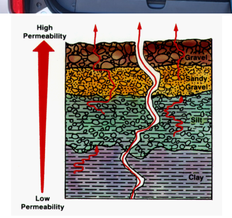
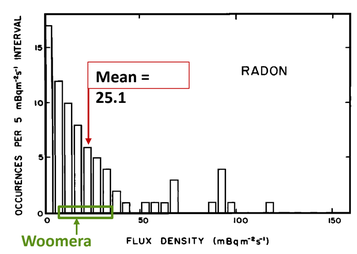



Figure 7: Alpha spectroscopy on 155 soil samples. Global background values added for comparison (UNSCEAR, 2000).

### Radon soil flux monitoring

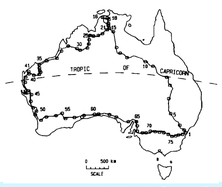




Figure 8: Soil radon (Rn-222) and thoron (Rn-220) flux measurements at 18 locations using ANSTO's radon accumulation chamber. Mean radon flux (25.1 mBq/m²/s) compared with nationwide survey data from Schery et al. (1986).

## Conclusion

The 2018 comprehensive baseline survey demonstrated radiation levels in the immediate vicinity of the Woomera waste store are typical background values of soil and rock. No contamination was detected.

FOR FURTHER INFORMATION
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REFERENCES

Schery SD, Whittlestone S, Hart KP, Hill SE. 1986. The flux of radon and thoron from Australian soils. Geophysical Research Letters 94: 8567-8576

UNSCEAR 2000. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), Sources and Effects of Ionizing Radiation, UNSCEAR 2000, Report to the General Assembly, United Nations.

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