

Radiological Characterization of High Dose-Rate Contaminated Soil Boxes by ISOCS™ Gamma Spectroscopy

Scope:

- Tank W-1A at Oak Ridge National Laboratory (ORNL) collected wastes from three high-radiation-level analytical facilities between 1951 and 1986. A groundwater contamination plume containing Cs-137, transuranics, uranium, and other isotopes emanated from contaminated soil surrounding the tank. URSiCH2M Hill Oak Ridge (UCOR) was the DOE environmental management contractor responsible for the removal action for the tank and surrounding contaminated soils under CERCLA.
- Approximately 1000 cubic yards of contaminated soils and associated wastes were placed in lead-shielded B-25 boxes for disposition as low level waste to the Nevada National Security Site (NNSS). Each box needed to be radiologically characterized to meet NNSS waste acceptance criteria.

Key Drivers:

- Transuranic radionuclides must be certified <100 nCi/g to meet NNSS waste acceptance criteria.
- Report all nuclides with activity concentrations >1% of Table E-1 Action Levels.
- Report all nuclides that contribute to 99% of the total activity.
- Dose rate measurements required for quantification of Cs-137.
- Quantify Am-241 and maintain MDC <16 nCi/g in the presence of high Cs-137.
- Sampling not practical due to high dose rates and time/budget constraints.
- Real-time analysis required to guide tank excavation.



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Case Study

Instruments & Techniques Used:

- 1 LEGe Detector
- 2 ISOCS Software
- 3 NDA-2000 Software
- 4 STTC Probe
- 5 Lynx[®] Amplifier



CANBERRA™ Solution:

- ISOCS in situ gamma spectroscopy was chosen in order to achieve direct quantification of the radioactivity in each B-25 box, accelerate completion of the project, minimize the safety risks of direct personnel contact with the contaminated soil, and cut project costs by eliminating sample preparation and off-site shipping charges.
- Two Low Energy Germanium (LEGe) detectors were mounted in a fixed geometry for high-resolution spectroscopy measurements above each box. Gamma spectra were collected from the LEGe's using Lynx high-throughput digital multichannel analyzers.
- Four CANBERRA STTC gamma dose rate probes were mounted at 1 m from the face of each box. The outputs from all six detectors were streamed wirelessly to a remote laptop PC to minimize radiation exposures to project staff.
- A low-Z box lid was designed, constructed, and temporarily installed on the boxes to allow for direct gamma measurement of Am-241.

ACHIEVEMENTS

- 316 B25 boxes were measured over six months. The measurement throughput was up to eight boxes per day.
- 309 B25 boxes were shipped to NNSS for disposal. Based on NDA measurements, a total of 8 Ci of ²⁴¹Am and 286 Ci of ¹³⁷Cs were removed from the site.
- Nondestructive analysis turnaround times were typically 1 hour.
- The 4,000 gallon tank was excavated, cut up, packed into boxes, and measured with NDA.
- Other wastes generated by the project, including Dry Active Waste, concrete, and metals, were also characterized.
- Measurements were performed over a wide range of environmental conditions, including high heat, rain, and snow.
- Cumulative dose rates to project personnel were kept very low.

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