

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. URS|CH2M 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 NNSF 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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