

## **EFCOG Best Practice #236**

**Best Practice No. :** LANL-01

**Facility:** Los Alamos National Laboratory

**Best Practice Title:** Use of Surrogate Containers to Model Isotope Activity Error

**Point of Contact:** Kathleen Gruetzmacher, (505) 665-4356,  
[kgruetzmacher@lanl.gov](mailto:kgruetzmacher@lanl.gov)

### **Brief Description of Best Practice:**

At Los Alamos National Laboratory (LANL), Triad uses surrogate containers to model the potential error in estimation of the isotope activity caused by waste distribution and geometries. These models provide a reasonable determination of potential impacts of variations in source distribution and self-shielding within standard waste matrices.

The isotopic activity of waste packages destined for disposal is normally measured by gamma spectroscopy as part of waste package certification. The computer software used for gamma spectroscopy energy line analysis appropriately tracks all gamma energy lines to a complete library of nuclides. However, there are minor exceptions, specifically in relation to used radioactive sources – these are generally disposed based on decay calculations of original source strength. Bulk liquids can be characterized using sample results extrapolated to the entire load. Some items are characterized using dose or contamination measurements at numerous sample points (e.g., Surface Contaminated Objects)

Waste management coordinators (WMC), assigned to all waste generators, engage with waste generators at the point of waste generation by reinforcing waste management requirements and providing guidance. Interviewed waste generators emphasized the importance of WMC involvement in their activities.

### **Why the best practice was used?**

The gamma spectroscopy process at LANL includes an uncertainty for low-level waste (LLW) items. The uncertainty associated with geometry and attenuation can be significant for bulk waste items. For some LLW waste items that include transuranic (TRU) radionuclides, if the uncertainty is included in the calculation of the waste item activity, that item may exceed the activity level to qualify as LLW.

The Nevada National Security Site (NNSS) is one of the primary disposal sites used by LANL for LLW. NNSS issued a position paper (DOE/NV—1121, May 10, 2006) on certifying waste for NNSS disposal. This paper indicates that systems that are not certified by the U.S. Department of Energy (DOE) Carlsbad Field Office (CBFO) for

Waste Isolation Pilot Plant (WIPP) disposal of (TRU) waste must demonstrate equivalent practices to the CBFO-certified systems in order for activity concentration values to be assigned to assayed items without adding in the total measurement uncertainty (TMU) i.e., using only the system's reported assay value. The LLW spectroscopy systems at LANL are not certified for TRU waste disposal.

The LANL gamma spectroscopy teams have determined that while most of the practices established for CBFO-certified systems are currently being executed within existing processes and procedures, some supplementary non-destructive assay (NDA) performance measurements are required in order to demonstrate full equivalence. Therefore, a process has been set up where gamma spectroscopy detector systems are put through a measurement verification process that mimic the WIPP system certification process.

### **What are the benefits of the best practice?**

NNSS accepts LLW waste from LANL characterized without adding in the TMU. This measurement validation process also provides assurance to other disposal sites of measurement accuracy.

### **What problems/issues were associated with the best practice:**

Initial efforts involved developing a process that would mimic the WIPP certified systems measurements. This included determining the requirements for the measurements and obtaining the use of Performance Demonstration Project (PDP) sources and obtaining the use of or fabricating waste matrices inside standard containers. 55-gallon drums were borrowed or fabricated that were the same as or similar to surrogate waste drums used for CBFO certified system verification measurements. Two new ST90 boxes (43"x78"x46") were obtained and waste matrices (combustible and metal) constructed inside using clean fill material surrounding a set of carefully placed and supported plastic tubes that would house Performance Demonstration Project (PDP) plutonium sources.

Problems/issues experienced in the initial setup included obtaining the use of PDP drums and sources. For the boxes, clean fill material had to be found and the optimum composition, placement, and support of the source tubes had to be determined. Obtaining the use of the PDP sources in particular required:

- Setting up a material balance area with appropriate security measures in place and approved.
- Obtaining required training to use and be responsible for the accountable sources.
- Coordinating with the owners of the PDP sources for their use.

### **How the success of the Best Practice was measured:**

Each set of measurements that have been done (2009 to present) result in the issuance of a comprehensive report detailing the results. These reports are

forwarded to the LANL NNSS Waste Disposition Team, who in turn send the results to NNSS. Audits/surveillances by NNSS of the process have been positive. In addition, when surveilled/audited by other organizations, the characterization team can point to these measurement results in conjunction with standard operating procedures to show best practices for gamma spectroscopy of waste items.

**Description of process experience using the Best Practice:**

Overall, this process has been very successful and it has resulted in validating the LANL gamma spectroscopy waste measurements procedures not only for the NNSS, but for other disposal sites. However, with respect to operating experience, it has not always been possible to perform the measurements on a strictly annual basis. Most recently, issues associated with obtaining the PDP sources and issues encountered after moving the measurement process between sites at LANL delayed the performance of the measurements. Present management has resolved these issues. During the lag time required to set up in a new location, consideration was given to using surrogate radioactive sources for the measurement campaign in place of the PDP sources, but that proved to be unnecessary.

With respect to Integrated Safety Management (ISM) and Integrated Safeguards and Security Management (ISSM), the measurement campaign requires the use and movement of drums and ST-90 boxes containing waste matrices. These can be awkward and heavy. ISM guidelines are followed to keep personnel and equipment safe. Since the measurement campaign requires the use of accountable, radioactive sources, the team performing the measurements must strictly adhere to safeguards and security requirements. Both ISM and ISSM protocols in place are subject to surveillance by appropriate organizations at LANL.