

## **PNNL-2: On-Site Inspection Capabilities – Examination of Laboratory Detector Response**

Choosing detection sensitivities or data quality objectives (DQO) for on-site inspections (OSI) requires selecting a threshold that must be met or exceeded during in-field analysis. However, this threshold may be difficult to meet in every scenario. A modeling utility built using the GEANT4 C++ framework has been developed to simulate acquired gamma spectra from any user-defined source. Using this resource, the detector response to a sample containing a mixture representative of a fast fissioned sample of  $^{239}\text{Pu}$  one month after irradiation of only the OSI relevant radionuclides from several detectors was modeled. The detectors modeled include the six HPGe detectors deployed during the Integrated Field Exercise 2014 held in Jordan, one International Monitoring System detector from Radionuclide Laboratory 16, and one detector from the advanced portal monitoring systems developed in the United States. The performance of the detectors was compared, using a non-isotope-specific minimum detectable activity (MDA). Based on these simulations, HPGe detectors with a moderate thickness (~30 mm or greater) and a wide diameter (>80 mm) provide the best MDAs in the 0-750 keV range at the expense of increased cascade summing at close counting geometries.

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