Contribution ID : **143** Type : **Oral Presentation**

Low-Background Gamma Spectrometry for the International Monitoring System

Thursday, 29 September 2016 15:00 (0:20)

Content

The International Monitoring System of the Comprehensive Test Ban Treaty Organization includes a network of 80 field stations and 16 laboratories dedicated to the detection and analysis of airborne particulates to detect possible nuclear events that could indicate a violation of the treaty. PNNL has operated a certified laboratory, USL16, since December 2007. In the last few years, PNNL has developed two very low-background gamma detectors housed in a new shallow underground laboratory. This new capability significantly improves our ability to detect trace amounts of airborne particulate that may be present in samples from the IMS field stations. The new underground laboratory at PNNL is at about 50 feet below ground with an overburden resulting in about 30 meters water equivalent. The detectors are located in a lab that operates as a class 10,000 clean room. The gamma detectors have a relative efficiency of about 100% and they were built by Canberra to PNNL specifications. All the detector components of the detector are fabricated from very low background materials. The shield consists of 20 cm of low background lead lined with 5 cm of oxygen-free high thermal conductivity (OFHC) copper. Five large cosmic veto panels surround the detectors and shields to suppress cosmic ray induced events. The entire assemblies are enclosed in a glove box that has a high flow of dry nitrogen gas from the boil off of a large liquid nitrogen tank outside the building. Samples are introduced and removed from the detector using a pass through that is flushed with nitrogen prior to opening to the detector enclosure. The cosmic veto nearly eliminates the 511 keV peak; the dry nitrogen flow greatly reduces the radon peaks; and the low background detector materials eliminate naturally occurring peaks such as the 1460 keV peak from 40K. The holders for the IMS samples were designed and fabricated with a 3D printer using ABS plastic. Overall, the background count rates for the new detectors are reduced by about a factor of 100 compared to an off the shelf commercial gamma detector operating above ground at our laboratory. The typical background count rate is about 0.05 counts per second over the range of 40 to 2500 keV. Since the minimum detectable activity (MDA) depends on the square root of the background count rate, this reduces the MDA for the 537 keV peak from 140Ba to about 3 mBq for a 7 day count, following the IMS prescribed method.

About the Presenter

Dr. Greenwood is a Laboratory Fellow at Pacific Northwest National Laboratory. He operates a certified laboratory for the International Monitoring System of the Comprehensive Test Ban Treaty Organization. He has a Ph.D. in Nuclear Physics. Research interests include radiation detection, nuclear data, reactor dosimetry, nuclear forensics, production of medical isotopes, and radiation damage in materials.

Primary author(s) : Dr. GREENWOOD, Larry (Pacific Northwest National Laboratory)

Co-author(s) : Mr. CANTALOUB, Michael (PNNL); Dr. BURNETT, Jonathan (PNNL); Mr. MYERS, Allan (PNNL); Mr. OVERMAN, Cory (PNNL); Mr. FORRESTER, Joel (PNNL); Mr. GLASGOW, Brian (PNNL); Dr. MILEY, Harry (PNNL)

Presenter(s) : Dr. GREENWOOD, Larry (Pacific Northwest National Laboratory)

Session Classification : Special Session: Monitoring Networks

Track Classification : Special Topic: Monitoring Networks