A NOVEL INTEGRATED CONTINUOUS QUALITY CONTROL METHOD FOR GAMMA SPECTROSCOPY SYSTEMS

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ABSTRACT

A well-run gamma spectroscopy system will have a documented Quality Assurance program. One element of this program is to periodically document that the system has been stable in its performance since the last calibration. This would include tests for stability of the gain [monitoring peak centroid], stability of the detector performance [monitoring peak width or FWHM], and stability of the detector efficiency [monitoring nuclide activity for a constant source geometry]. The normal method is to interrupt the sample measurement process, insert and count a Quality Control sample.

Where this works OK in the laboratory, albeit with a loss of sample assay time, it does not work very well for remote continuous measurements systems [e.g. effluent monitoring systems] that would have to be removed from their primary monitoring task to do the QC tests. The method presented here is one we have used on several deployed applications which does not require the interruption of the primary measurement tasks. It is equally applicable to laboratory sample assay measurements.

Previous systems have embedded a radioactive source near the detector and used the gamma spectral analysis to continuously monitor the QC activity parameters and sometimes the gain parameter. But any such source of sufficient activity to measure these QC parameters also interferes with the sample measurement, and increases the Minimum Detectable Activity.

In our systems we have embedded a very weak natural Thorium source inside the shield near the detector in a location where the presence or absence of a sample does not affect it. Thorium has many gamma energies, going up to 2615 keV. We shield out the low energy lines with approximately 2cm of Tungsten, and monitor the performance of the high energy peak. The activity of the thorium is low enough that when combined with the spectral analysis the performance for the normal sample is not reduced. For QC measurements with this weak source, the count time can be very long to get adequate statistics.

What makes this system work is the Mirion Data Analyst. It can perform short sample count times with the appropriate libraries to analyze those samples and to remove any weak thorium activity. And it can perform very long counts using the modified thorium library to determine the thorium QC parameters on the peak of interest. **And** it can do both of those at the same time. **And** it can do the QC measurements repeatedly and continuously for a 100% continuous uninterrupted record of the detector performance – not just periodic checks. Examples of several such systems using this method will be presented.