THE WELL-TYPE SEMICONDUCTOR DETECTOR HARNESSED

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The well-type semiconductor detector has been around almost as long as the coaxial semiconductor detector. Even though it has important advantages over the coaxial detector, the drawbacks have been severe enough to very much limit the use of these detectors.

The high sensitivity (e.g. 50 % at 100 keV, 10 % at 1000 keV) of a well-type could be achieved with a modern, large coaxial crystal with the sample on the end cap, but in that set-up the geometry becomes a crucial source of error for the coaxial detector, whereas the well-type's efficiency hardly depends on the counting geometry at all.

The severity of the coincidence summing effects has rendered it impossible in the past to calibrate a well-type detector with a standard calibration source and use the efficiency curves obtained for other radionuclides. The popular approach to this problem, where the detector is characterised with a measurement in a "reference position" and efficiencies for other geometries are obtained through computation is invalid for the well-type case.

Since 1992, a method has been under development at IRI to characterise a well-type detector using a peak efficiency and a peak-to-total efficiency curve, and compute radionuclide specific counting efficiencies from those curves for "real" peaks as well as for "sum" peaks. Recent improvements to this method have demonstrated that now, a well-type can be as easy to calibrate and operate as a coaxial detector, once the software is in place.

In this paper, the calibration method will be described and examples of results given. It will also be shown just how severe the errors are that can be made when coincidence summing is neglected, for a few typical INAA and environmentally relevant radionuclides.