

Series 2200 - Passive neutron/Gamma Multiplicity Drum Monitor

Benefits

- Instrument supplied with multiple gate neutron coincidence Pu analysis software with wide range calibration function
- For a number of Pu bearing waste streams and sample types the instrument can perform absolute multiplicity assay independent of sample matrix and without calibration
- Automated measuring procedure employing user friendly Windows NT based software
- Suitable for PCM waste with high alpha ratio ($\alpha=10$).
- Semi-automatic drum loading / unloading.



Features

- Designed for the measurement of Plutonium bearing intermediate and low level waste in 220 litre (55 gallon) drums
- Optimised for use with ANTECH 1000 Series TCA (multiplicity counter) electronics using 3 trigger methods and 16 simultaneous observation intervals (gate widths)
- Comprehensive neutron Coincidence and Multiplicity counting data analysis software incorporating analytical dead-time correction
- Individual totals count and statistical analysis for each of 16 counting chains, (each chain has a separate head amplifier)
- Detector efficiency of 20% with 64 He-3 detector tubes close coupled to the drum forming a decagon

Description

ANTECH Series 2200 Passive neutron Multiplicity Drum Monitor (nMDM) is a comprehensive measurement system for the determination of plutonium mass in intermediate/low level waste in 220 litre drums. The operation of the instrument is based on passive neutron coincidence/multiplicity counting. User friendly Windows NT software controls the semi-automatic drum loading, the neutron data acquisition and the analysis algorithms. The system can be integrated with a germanium gamma-ray drum scanner for Pu isotopic ratio determination using PC/FRAM or other isotopic analysis code.

The neutron detection system employs 64 He-3 tubes grouped in 16 rectangular polyethylene modules each with 4 tubes connected to a high voltage junction box containing an Amptek charge sensitive amplifier/discriminator circuit and connections for high voltage, low voltage and signal cables. The detector modules are fixed inside an outer shield of polyethylene which is 210 mm thick and covered in stainless steel. The internal and external module surfaces are covered in cadmium to absorb re-entrant thermal neutrons. The cadmium can be removed to increase the detection probability for coincidence and total counting for very low level detection.

The basic design is flexible and can be modified to increase the number of tubes (increase counting efficiency), to adjust the moderator thickness (vary shielding and die-away time) or for gamma-ray active waste, lead shielding may be added. The nMDM is optimised for use with the ANTECH 1000 Series neutron Time Correlation Analyser (TCA) multiplicity counter.

For pair correlation counting in neutron coincidence mode the frequency histogram is used to generate the 'Reals' rates for each of the 16 gates. Each 'Reals' rate can be used with a multi-gate calibration function to determine the Pu-240eff mass and hence the total Pu mass. For a wide range of Pu containing materials (PCM) such as PuO₂ and PCM with unitary neutron multiplication ($M=1$), triple neutron correlation may be used in absolute multiplicity counting mode. In these cases Pu-240eff mass and total Pu mass are determined without the use of a calibration function and the matrix characteristics are determined from the measured detection efficiency.

Specification

- 64 He-3 detector tubes, 25.4mm x 1.0m at 4 Atm.
- Detector efficiency: 20% (64 tubes).
- Die-away time: 68ms.
- Dimensions: (L x W x H) 3.3m x 1.8m x 2.1m
- Operating Voltage: 1600V (4 Atm. He-3)
- Estimated Sensitivity at sea level:
 - Multiplicity Counting (n triple correlation) - 50 - 100mg Pu-240eff (Cd fitted)
 - Coincidence Counting (n pair correlation) - 10 - 50mg Pu-240eff (Cd fitted)