Previous model number: 3610

G3810

Tomographic Gamma Scanner for cans and small objects

Introduction

The ANTECH G3810 Tomographic Gamma Scanner for cans and small objects combines the functions of plutonium isotopic ratio analysis and tomographic gamma scanning in a single automated instrument. The instrument can be used for combined or separate measurement and is intended for use in Safeguards and for waste assay.

Plutonium isotopic ratio analysis is performed using the PC/FRAM code developed at the Los Alamos National Laboratory (LANL) in the United States. An 8k channel spectrum is obtained during the UGS scans and this data is used to obtain the isotopic ratios, including, if required, the ratio of uranium, americium and other radionuclides to plutonium. The isotopic ratio result data can be used for safeguards or accountancy purposes, or combined with either $^{240}Pu_{effective}$ data (from neutron measurements) or specific power data (from calorimetry measurements) to determine total plutonium mass.

The second measurement component of the instrument is the transportable Tomographic Gamma Scanner (TGS), which was developed by LANL in the early 1990s for the United States' Department of Energy. The TGS uses transmission corrected, single photon emission computerised axial tomography to determine the spatial distribution quantity of radionuclides using High Resolution Gamma-ray Spectroscopy (HRGS). The technique represents a considerable advance over the Segmented Gamma Scanner (SGS) technique through the implementation of a sample translation axis in addition to vertical scanning and rotation axes. With appropriate software and modified collimator, the unit can also perform SGS measurements on cans.

A ^{75}Se transmission source allows the determination of a 3-D spatial map of the attenuation coefficient at any energy by interpolating between the gamma-ray peaks of ^{75}Se at several energies. Once the attenuation coefficient maps have been established for the sample, emission tomography is used to determine the distribution of selected radioisotopes within the sample. Two pass (transmission followed by emission) measurements are performed.

The attenuation and source distribution matrix is determined more accurately in the Tomographic Gamma Scanner for cans and small objects than in an SGS so biases due to matrix and source distributions are significantly reduced. This means that a single calibration constant can be used for the determination of isotope mass for a wide range of material and matrix types.

Features

- Automated gamma-ray energy calibration
- Mobile operator control console that is compatible with Drum TGS and Tomographic Gamma Scanner for cans and small objects and that can be local or remote from the instrument
- Trolley mounted mobile unit for measuring cans
- Automation of 3 axes of motion
- Measurement time is typically less than one hour; increased accuracy and precision can be achieved by extending the measurement time

Benefits

- Incorporates Plutonium Isotopic Ratio Measurement, Tomographic Gamma Scanner (TGS) and Segmented Gamma Scanner (SGS) in one instrument
- Plutonium Isotopic Ratio and TGS technique meets both safeguards and WIPP measurement and QA requirements
- Determines the inventory of uranium, plutonium, and other radionuclides in non-homogeneous samples including pyrochemical salt residues
- Provides tomographic maps of absorber and source distributions in heterogeneous matrices
- Measures samples with ^{241}Am content that cannot be measured by neutron techniques
- Extends the range of the SGS technique to heterogeneous samples
- Suitable for measuring plutonium oxide in cans
- Accuracy and precision sufficient to meet safeguards, shipping and disposal requirements
- Transmission corrections are achieved using a ^{75}Se transmission source to develop a 3-D spatial map of the attenuation coefficient of the sample

Specification

Overall instrument envelope (H x W x D)	1070 mm x 1520 mm x 710 mm (42.13 in x 59.84 in x 27.95 in)
Sample can size	Variable to a maximum of 200 mm diameter x 350 mm (7.87 in x 13.78 in x 44.09 in)
Sample can weight	Variable to a maximum of 20 kg
Germanium coax detector efficiency	25%
Accuracy	Typically better than 10% for measurement of cans and 20% for matrices with an average density up to 2 g/cm^3
Digital MCA	Based on the ORTEC DSPec Plus
Ethernet	Ethernet communication from operator computer console
Transmission source	30-200 mCi ^{75}Se
Dead time source	^{109}Cd
TGS analysis	Typically 4800 4k channel spectra for each measurement
Isotopic analysis	One 8k channel emission spectrum
Software	User friendly software runs under Windows NT4 and meets nuclear software QA requirements of NQA-1 (required by WIPP certification)