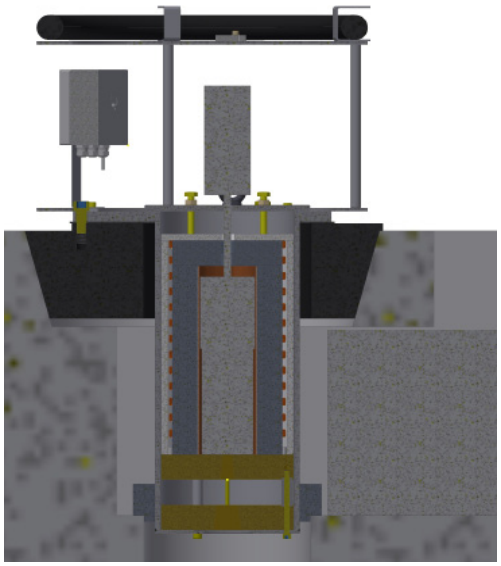
Tray Assay System for ILW and FED Waste

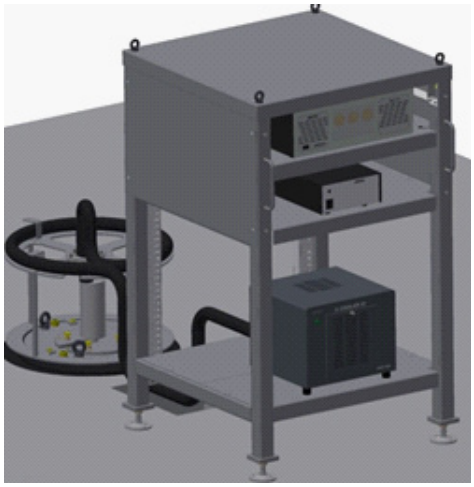
G3652

Introduction

The Model G3652 Tray Assay System is a High-resolution Gamma Assay System specially developed for Magnox Berkeley Licensed Site for the measurement of fissile material to be stored both in product packages and waste containers such as Yellow Box®, MOSAIK and TRU-Shields.



The system consists of an HPGe detector with ultra-high count rate capability (TRP amplifier), closed cycle electro-mechanical cooler and DSPEC 50 high count rate digital signal processor and analyser. The system is designed to view and measure the Co-60 and Cs-137 content of trays of ILW waste from above, through an aperture in the roof of a highly shielded process area cave. The detector extends down into the aperture and is shielded from the effects of stray radiation by a lead shield designed using MCNP modelling techniques to optimise the performance of the system. The shield is lined with a graded copper and tin liner which absorbs low energy gamma rays generated by the lead due to scattering before they can reach the detector crystal. The detector views the entire tray of waste through a tungsten collimator which has been optimised by MCNP modelling.



The electronics are mounted in a thermostatically controlled heated enclosure next to the detector. The system computer, monitor and printer can be either mounted local to or remote from the electronics. The system interfaces with the waste tray weigh scale and in-cell tray video camera.

Software Overview

Key to the performance and flexibility of the system is the software which consists of two dedicated packages which run on a Microsoft Windows operating platform.

a) ANTECH TrayScan™
b) ORTEC GammaVision®

TrayScan has been developed by ANTECH to meet specific requirements for the measurement of ILW Waste and FED, in accordance with Magnox Measurement Quality Requirements.

As well as measuring the Cs-137 and Co-60 activity on a tray of waste, the system keeps a running total as waste is added to a container. TrayScan software provides the functions and algorithms to enter information, (both manually and automatically) and facilitates the data acquisition and analysis required for assay. It also reports information both on-screen and in hard copy format, of results for a wide range of storage containers. The TrayScan software also:

- Records radionuclide activities in order to produce cumulative and final package inventories
- Provides a visual message to the operator to indicate the detection of a potential fuel piece (above a certain mass) in the waste. It estimates the activity and allows the facility to ‘accept/reject a measurement’ and add the tray to the container based upon the outcome.
- Records cumulative and final package content for a range of parameters and visually indicates when the package limit is being approached as it is filled.
- Provides a means to automatically read the mass of tray waste being assayed.
- Provides the capability to deal with different waste streams
- Supports regular functionality (control) testing of the equipment through quality control measurements in order to confirm correct operation prior to the assay of waste items.

AMETEK/ORTEC GammaVision™8.0 Spectrum Analyser and MCA Emulator is supplied to analyse the spectra and extract the counts in peak for the gamma lines analysed.

Features

- High count rate detector with TRP amplifier
- Closed cycle detector cooler for LN2 free operation
- Local or remote operation
- “TrayScan™” complies with stringent Software Quality and Security Requirements.
- Flexible software user interface to enable set up for filing multiple container types; Yellow Box®, MOSAIK™, TRU-shield, 3m^3 NIREX flasks plus others.
- Dose, heat, weight, fissile limit & A2 declaration.
- Option to interface to in-cell video cameras and load cell arrays.

Benefits

- Measurement of ILW and FED Waste.
- MCNP modelling capability to optimise system performance.
- High count rate capability.
- Robust design for use in industrial environments.
- Operator workstation can be positioned local to or remote from detector and electronics.
- Visual image of waste recorded with assay result.
- Real-time indication of container fill-levels aiding estimation of when key limits will be reached. Separate fill levels for each container type.
- Configurable validity times for background and verification measurements, automated check of performance, automated trending data recorded.
- Single software package for measurement of a wide range of container and waste types.

Specification

Attribute	Value
System	
Detector Shield Assembly (H x Φ)	838mm X 500mm (at widest point)
Instrument Enclosure (H x W x D)	720 x 720 x 125mm
Weight Detector/Shield Assembly (kg)	150kg
Power supply	220-240Vac (110Vac operation via a step-up transformer) Frequency: 50/60Hz), 1200W (max)
Gamma Spectrometer	
HPGE detector system	ORTEC GEM-F7040P4-PL with TRP amplifier and X Cooler III
Signal processing	ORTEC DSPEC-50® High Count-rate Digital Spectrometer with GammaVision®.
Environment	
Operating temperature	0^0C - 32^0C
Humidity	5 to 80% (non-condensing)
Trace Heater (detector shield)	220-240Vac 60W (max)
Compliance	
Safety	Low Voltage Directive 2014/35/EU
Security	Magnox S-374-1 Computer Security
EMC	EMC 2014/30/EU Electromagnetic Compatibility
‘TrayScan™’ Software	Magnox MCP 99/02 Quality Requirements for Development of Plant Software
Performance (matrix and waste depth dependent)	
Tray size	Up to 1000 x 400mm (configurable by design)
Waste Depth	50-100mm (typical)
Max. Co-60 activity in sample (Bq)	2.5 x 10^{11}
Max. Cs-137 activity in sample (Bq)	2.5 x 10^{11}
Cs-137 LOD Co-60 present at max. Level (Bq)	3.5 x 10^8