Case Study:Hinkley Point A Drum FED assay system

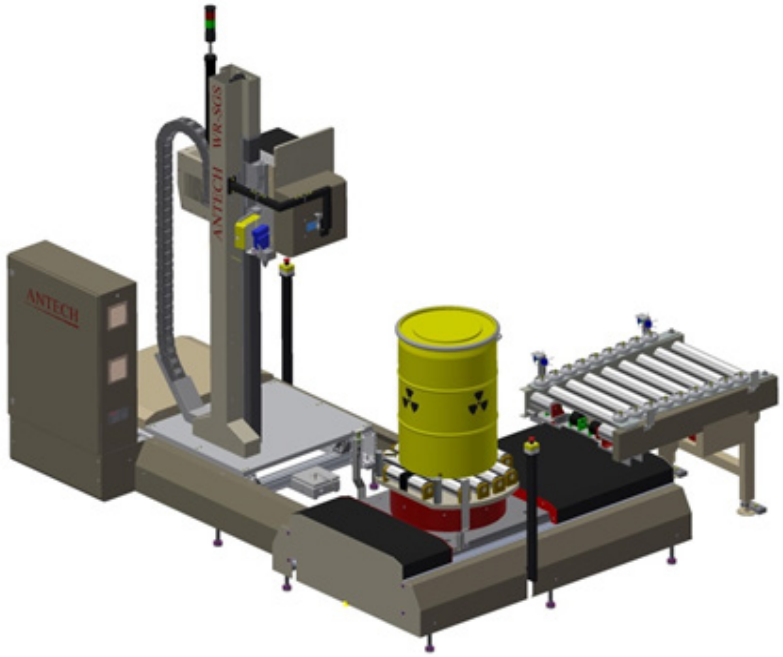
A.N. Technology Ltd has supplied a High Resolution Gamma Spectrometry (HRGS) Drum Assay System to Magnox Hinkley Point A Site for the measurement of 200 L drums of Intermediate Level Waste (ILW) containing magnox metal and Nimonic springs (which contain high levels of Co60) prior to compaction of each drum. The system will be integrated with the Concrete Box (CB) Loading Facility.

Scope

- Drum Assay system comprising 40% HPGe detector and integrated cooling system, ANTECH Variable Aperture Collimator, detector check sources, detector pillar with linear ball screw, drum turntable with integrated weigh scale, bar code reader and EMC electrical enclosure for power distribution, PLC, safety circuitry and servo drive electronics that control the system.
- Conveyor sections to integrate with the Concrete Box Loading Facility conveyor
- Operator workstation with 21.5” panel PC, ANTECH GammaScan+ assay software, status indicators, emergency stop button.
- Stand-alone CCTV system with 27” LCD display and two PTZ cameras.

Performance Objectives

- An accurate assay of Fuel Element Debris (FED) in drums to ensure it meets the limits for IP-2 transport and both LSA-II and Geological Disposal Facility (GDF) disposal.
- To be fully integrated into the Concrete Box Loading Facility (CBLF) plant conveyor. Automated drum loading into the assay system and unloading after measurement.
- LoD of lower than 2 GBq Cs-137 (assumed uniformly distributed throughout the drum) in the presence of 50 GBq Co-60 uniformly distributed in the drum.
- The capability to measure lower activity drums of magnox (older and with fewer springs) with Co-60 activity of 0.0125 GBq to a sufficiently high accuracy for Co-60.



ANTECH Solution

Drum assay system is a customised Wide Range Segmented Gamma System (WR-SGS). This is a high accuracy, precision system for the accurate measurement of 200 L drums. The ANTECH Variable Aperture Collimator provides an adaptable field of view of the drum for the detector, varying the collimator height based on activity and gives the WR-SGS an unparalleled activity range. For this project, the Variable Aperture Collimator was fitted with a secondary LASER position indicator. Both the elevated activity of activated Magnox metal and Nimonic springs which are the major components of typical Magnox Fuel Element Debris (FED) and low specific activity material defined as LSA-II. are within the range of the ANTECH WR-SGS,

Specification

Sample Sizes	200 litre drum
Sample Weight	0-500kg
Detector Type	40% HPGe Detector with integrated cooling system
Detectable activity range	Up to 10^{12} Bq per drum
Analysis software	Windows operating platform, ANTECH GammaScan+ user interface and analysis

The measurement station is in a shielded cell, so all aspects of drum handling and measurement have to be carried out safely, reliably and remotely. To achieve this, the mechanical design, position sensors, safety circuit and control system to ensure safe stand-alone operation of the WR-SGS are supplemented by additional guides and sensors on the connecting conveyor which is also integrated into the control system. The stand-alone CCTV system allows the operator to monitor the progress of the drum loading, the measurement cycle and unloading and to intervene if required. The waste drum barcode reader automatically identifies the drum and feeds the drum number into the analysis software to eliminate transcription errors.

The system uses ANTECH GammaScan+ software for all operations, measurement set-up and data analysis. The GammaScan+ software also stores all measurement parameters and results along with records of radiation backgrounds, measurement performance checks, system status and alerts and ensures that if any of these checks are outside preset limits, the measurement is stopped and the operator

Results

- A comprehensive Factory Acceptance Test was completed to inspect and demonstrate that the system met the specification and functional performance requirements, including mechanical and electrical components and peripherals, drum handling, safety system, control and analysis software and radiometric performance
- Limits of detection determined for

Co-60	3.8 kBq
Cs-137	11 kBq
Eu-152	15 kBq
Am-241	76 kBq

- Measured 0.3GBq Cs-137 in the (simulated) presence of 84GBq Co-60

Benefits

- ANTECH's knowledge, experience and track record in delivering instruments for FED ILW assay translated into system refinements which deliver the performance required.
- One system is capable of meeting the wide activity range anticipated.
- The Variable Aperture Collimator protects the detector for high activity drums, ensuring a longer lifetime.
- The modular design of the WR-SGS facilitated customisation and saved both time and cost in the delivery of the system.