

Mobile Packet Monitor

B2340-20

Introduction

The Model 2340-20 Passive Neutron Coincidence Counter (PNCC) Assay System makes quantitative measurements of the plutonium-240 effective ($^{240}\text{Pu}_{\text{eff}}$) content of Pu/MOX fuel samples. It can detect and measure from a few grams up to kilogram quantities of plutonium in Pu/MOX fuel items. The system is capable of assaying fissile materials such as plutonium and americium within various matrices. The results obtained can be used as the definitive nuclear material declaration value of packages for safety, criticality control and nuclear materials safeguards purposes. This information can be combined with the isotopic information from the Gamma Spectrometer to provide a complete isotopic inventory of plutonium present in each package.

Two pieces of equipment make up the integrated system:

- A Packet Monitor, consisting of a Passive Neutron Coincidence Counter (PNCC) Assay System for the measurement of fissile material present in fuel packages combined with a Gamma Spectrometer, which provides the isotopic ratios for Plutonium and Americium present in fuel packages, with both systems mounted on a single portable compact chassis.
- A Workstation connects to both pieces of equipment and houses the neutron counting electronics and power sources, the main computer and provides a User Interface for operation of the equipment and combining of data from these two measurements to provide a complete inventory of the Pu fissile material present in the packages.

The PNCC consists of an array of 30 x He-3 detectors arranged in two annular rings around the outside of the chamber in a polyethylene moderator. The detectors are grouped into six (6) channels, with each channel connected to an Amptek A111 high count rate amplifier. The output from each amplifier connects to an ANTECH A2000 TTL-LVDS convertor to provide a single output train to the neutron counting electronics for true lossless counting, which is particularly important for high count-rate applications. The system is designed for flexibility and can easily be converted into an Active Well Coincidence Counter by exchanging the removable chamber liners and inserting of a pair of interrogation sources in the plug units.

The High Purity Germanium (HPGe) Gamma Spectrometer consists of a high resolution gamma spectrometry data acquisition and analysis system and is designed primarily for isotopic analysis of Pu/MOX fuel. However, it can easily be configured to assay other isotopic materials.

The Workstation consists of an enclosure which houses the system main computer and the neutron counting electronics, which operates the neutron system and acquires raw measurement data. It is fitted with a worktop onto which an LCD monitor and keyboard/mouse can be mounted. A gland plate at the rear of the cabinet provides connection points for power to the Workstation, power and signal to the Neutron Assay System and signal from the Gamma Spectrometer. Both instruments can be fitted with additional data take-off points for independent safeguards monitoring and surveillance.

The sample measurement time for each instrument is typically between 10 to 20 minutes. The analysis software terminates a measurement at a pre-set time configured by the user, but should the accuracy not be reached within this period extends the count time for an additional pre-set time.

Benefits

- Compact and portable system with two instruments mounted on one chassis.
- Adaptable neutron assay system design configurable for either Passive or Active measurements.
- Automatically adjustable collimator reduces dead-time effects and gamma measurement time.
- Am-241 background can be eliminated by use of Cd absorber filters.
- User software enables both the neutron and gamma instruments to function as an integrated system, or to be used independently.



Features

- High neutron detection efficiency for coincidence counting.
- ANTECH A2000 TTL-LVDS convertor.
- Instrument compatible with ANTECH Universal Neutron Counter (N2000) and with multiple gate neutron coincidence plutonium analysis software.
- Removable neutron chamber inserts and plug units with or without cadmium liners for Active or Passive measurements.
- Flexible plug unit design into which an interrogation source can be installed for Active measurements.
- Gamma system compatible with ORTEC PCFRAM analysis software.
- Highly shielded gamma measurement chamber to minimise background effects.
- Automatically adjustable detector collimator.
- Range of cadmium filters to reduce Am-241 background.
- Standalone Workstation can be located remote from the system.
- System supplied with neutron assay and gamma measurement and analysis software.



Specification

Attribute	Value
System	
External dimensions (H x W x D) (mm)	1210 x 570 x 1474
Weight (kg)	950
Passive Neutron Coincidence Counter	
He-3 detectors	30 x Model RS-P4-0820-121
Sample Chamber dimensions (mm)	430 x 160 (height x diameter)
Detection efficiency (with Cadmium liner)	>35% typical
Measurement range Pu	
<u>Pu-Only Packages</u>	Approx 2g - 70g (Pu240 Effective Mass)
<u>MOX Packages (with U:Pu ratios up to aprox 300:1)</u>	Approx 5 - 100g (Pu240 Effective Mass)
Die-away time (µs)	47 typical
Humidity	5 to 80% (non- condensing)
Equipment Operating Temperature	5-31°C (optimum), 40°C (max)
Compliance	LVD-2014/35/EU, EMC-2014/30/EU
Gamma Spectrometer	
HPGE detector system	ORTEC 25%SGD-GEM-5050P4 HPGe, ICS, DSpec Jnr-2.0
Sample Chamber dimensions (mm)	300 x 180 (height x diameter)
Performance	
<u>Pu Only Isotopic Analysis</u>	2- 25% Pu-240 in Pu packages up to around 700g total Pu using 120-460keV range
<u>MOX Isotopic Analysis</u>	1- 25% Pu-240 in Pu packages up to around 700g total Pu. Performance dependent on U:Pu ratio. Improved performance using 180-101 keV range for high U:Pu ratio
Humidity	<95% (non-condensing)
Equipment Operating Temperature	5-32% (max)
Compliance	Machinery 2006/42/EC, EMC-2014/30/EU, CE, UKCA

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