



*Waste drum loaded onto the TRU-D® Drum monitor turntable prior to loading into the measurement chamber*

# TRU-D® Drum Plutonium Waste Monitor

Cavendish Nuclear's TRU-D® Drum high performance plutonium in waste drum monitor provides a rapid, accurate and reliable assay of the plutonium content of waste drums prior to movement, processing or disposal.

## Operational Features

- Quickly and accurately determines the TRU content of up to 200 litre (55 gallon) waste drums.
- Passive neutron drum monitor with  $^3\text{He}$  detectors arranged on all sides of the waste drum.
- Provides data to support accountancy, safeguards, criticality control, waste management and disposal operations.
- Effective over a wide range of matrix, chemical and isotopic compositions.
- Designed for safe and easy use with minimum of operator training.

## Standard Features

- High performance passive neutron multiplicity counting.
- Advanced waste matrix correction technique using ring ratio methodology.
- Use of Cavendish Nuclear's patented

"Neutron Electronics" signal collection and processing technology that provides timestamping of neutron events minimising dead time and improving measurement performance.

- Software based on latest Cavendish Nuclear developed algorithms for improved accuracy and precision.
- The turntable automatically withdraws from the measurement chamber to permit easy loading and unloading of drums.
- Chamber design permits easy access for maintenance and decontamination.
- Detectors are in close proximity to the waste drum using a close fitting hexagonal design with additional graphite neutron reflectors included to increase detection efficiency.
- Standard industrial PC based

electromechanical control system

- Maximum drums size of 700mm diameter x 980mm height can be accommodated within the measurement chamber.
- ## Optional Features
- Alternative drum sizes may be accommodated
  - HRGS measurement capability can be added to determine the plutonium isotopic composition
  - Where HRGS has been added, a single scanning or multiple fixed detectors may be selected to produce a segmented image of the plutonium distribution within the drum. The HRGS detector(s) is fully integrated with the neutron counter into a single combined assay station.
  - Flexible software allows either conventional neutron coincidence

counting (NCC) or advanced neutron multiplicity counting (ANMC) analysis.

- System can be networked using standard Ethernet protocols.
- Automatic drum identification and weighing using an auxiliary conveyor.
- Optional transmission source to provide alternative matrix attenuation correction parameters.
- Optional full radionuclide inventory using additional gamma ray analysis software to identify and quantify other gamma ray emitters within the drum.
- Optional incorporation of safeguards tamper proofing and authentication, verification and validation requirements.

### Applications

The TRU-D Drum monitor is designed to assay the transuranic (TRU) radionuclide content of waste drums prior to movement, processing or disposal. The assay provides an accurate measurement of the drum contents so that the operator can demonstrate compliance with criticality control and waste disposal requirements.

The advanced capabilities of the system allow its application to the assay of waste streams containing many different types of matrices, particularly high density materials and with widely varying isotopic and chemical compositions

### Set-up and Operation

System boot up is automatic upon

powering on.

Prior to measurements, and at routine intervals, the system will require the operator to perform a background measurement. Once conditions are suitable (i.e. no waste drums in or near to the monitor) the operator is able to select to perform a background measurement. This data is compared against background limits to ensure that the system is able to meet the required precision.

Once the background has been successfully completed the operator may select to perform a verification measurement using a standard drum containing known sources. The system will then check the verification assay results against predetermined levels to confirm the system operation.

Additionally, statistical checks are carried out automatically on all input data to identify erroneous data streams or changes in the system environment. These checks will eliminate spurious measurements due to radio-frequency interference or cosmic ray activity.

In normal operation, the operator selects to perform a drum measurement and the measurement sequence is initiated.

During the measurement the drum is rotated to allow the optional HRGS detector to gain a better view of the drum, thereby minimising the errors resulting from possible variations in



*The TRU-D® Drum monitor being tested and set up at Cavendish Nuclear's facility prior to shipping to the client*

the plutonium isotopic composition throughout the drum. With the standard monitor, which does not include HRGS, the system will use the operator declared radionuclide inventory to interpret the neutron data.

Upon completion, the operator is able to withdraw the drum/turntable from the monitor to allow the drum to be unloaded.

### Operator Interface

The system is controlled via a standard industrial PC running Microsoft Windows™ operating system. The PC may be located locally or remotely from the measurement system. All operator displays have been designed for clarity and ease of use.

All key information is provided in a concise format to the operator via the control PC. Detailed information, including raw count rates, measurement control results, etc. are automatically archived to disk and can be retrieved by the operator.

Optionally the system can provide hard copies of all radionuclide inventories to an external printer, or via file transfer to a remote database over an Ethernet link.

## Performance and Capabilities

- Neutron detection efficiency: > 30%
- Dynamic Range: 5mg to >250g <sup>240</sup>Pu
- Detection limit: 5mg <sup>240</sup>Pu
- Total Measurement Uncertainty: ± 5% (1σ for <sup>240</sup>Pu masses > 10g)

*Performance figures are quoted for standard system counting for 1000 seconds under ideal (low background, homogenous source distribution, etc.) conditions*

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