

# NCSP – AWE Collaboration

Passive Neutron Spectrometer

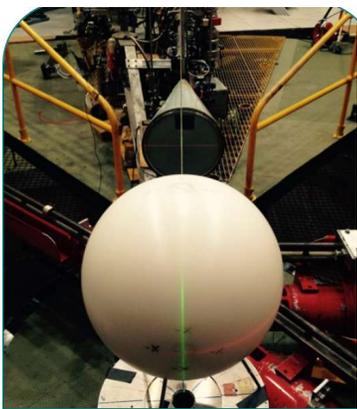


Image 1: PNS spectrometer (first generation) seen in a facility with neutron source (above the sphere) to expose the sphere and its detectors to neutron bombardment.

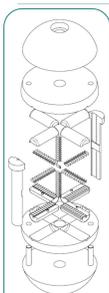


Image 2: Exploded view of all components of the second generation sphere showing inner structure and wiring. Assembling the sphere will reveal the inner structure in full for safety assessments.



Image 3: Completed sphere with all components shown in place.



CIDAAS IS589

Large Epithermal Multiplicity Counter



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# U.S. Nuclear Criticality Safety Program (NCSP) Technical Program Review (TPR) February 2022

**Appendix F      International Collaborations      AWE (U.K.)**

**Matt Harker**

Non-Destructive Assay (NDA)  
Radiation Detection Group (RDG)  
Physics/Engineering & Science

## Appendix F International Collaborations AWE UK



- **Criticality Incident Detection and Alarm System** Trevor Birkett
- **Neutron Time Correlation Measurement and Analysis Bulk Nuclear Material** Nigel Kelsall
- **Criticality Incident Dosimetry; inter-comparison trials** Phil Angus
- **Hands-on Criticality Safety Training** Richard Jones, Mark Roydhouse

# CIDAAS IS589 Installation Plan

- **Trevor Birkett attending Factory Acceptance Tests (FATs) of AWE designed IS589 at commercial manufacturers**
- **Imminent installation at Plutonium and Uranium Tech Centre's Production Facilities**
- **Follow-on installation at soon-to-commission Assembly Facility**
  - Trevor will inform Dave Heinrichs of visit dates when known
- **IS589 roll-out extends to forthcoming new builds in Nuclear Storage & Processing Area**



# CIDAAS Testing with NCSP; IS589 Mini Rack



**Similar format to May 2018 testing; 4-days - 3 prompt GODIVA IV bursts at 1 burst per day - 1<sup>st</sup> day equipment setup**

***IS859 Mini Rack Set up – IS821 DHA in similar configuration to May 2018 test***

**Two IS821 DHAs at 2 metres from GODIVA IV**

**One IS821 DHA at 4 metres + One unit “hot spare” in alcove area**



**Main differences:**

- logging unit, IS861 Data Recorder connected directly to the output of the IS821 DHA provides increased sampling rate to monitor the output frequency.
- minimum of one IS821 DHA contains additional logging equipment (designed by RIDD) to monitor current draw from ion chamber, voltage supply on EHT and (if feasible) monitor local voltage rails.

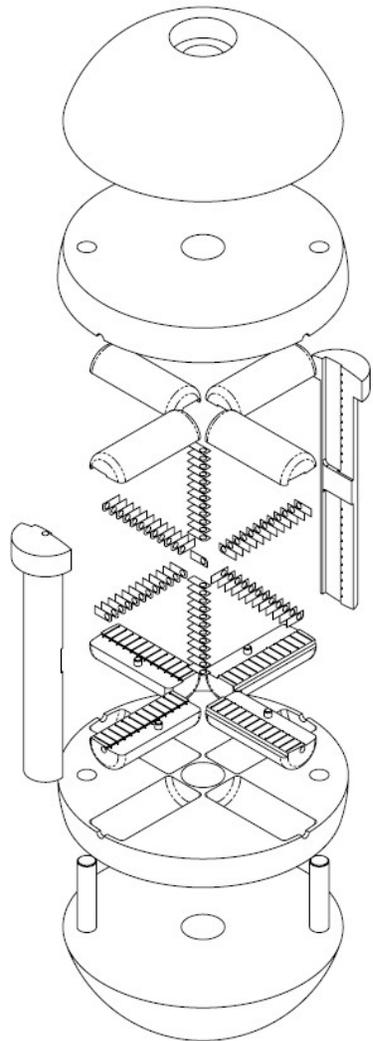


# CIDAAS Testing; Additional Instruments

## *Additional equipment to test in conjunction with the IS859 mini CIDS -*

- **Noisy Area Warning Lights (NAWL)** - these COTS units will benefit from exposure to bursts from GODIVA IV as some proposed locations in the vicinity of potential criticality event.
- **Simple visual functional test;** can unit withstand burst and continue providing visual warning for prolonged period after. Likely 2 metres from GODIVA IV.
- **Electronic Personal Dosimeter (EPD's)** – 2 COTS EPDs, Thermo and Tracerco, exposed to GODIVA IV bursts, improve understanding of behaviours and accuracy of the EPD (worn by facility staff) post-criticality event. Subject to dose data abstracted, these likely to be located  $\geq 4$  metres from GODIVA IV.
- **IS595 Wide Range Gamma Monitor (Detector Testing)** – AWE designed IS595 easily developed into trial configuration. If scintillation detectors successfully alarm when exposed to GODIVA IV burst, could provide cheaper alternative to the current IG32 ion chamber. Valued in areas such as decommissioning requiring temporary CIDAAS. Subject to availability, these are likely to be placed in a similar configuration as the IS821 DHA's detailed the IS859 mini CIDS set up.

## Passive Neutron Spectrometer (PNS)



- Continued development work on our 2<sup>nd</sup> generation PNS, with beam time at the National Physical Laboratory planned this quarter to validate our 4<sup>th</sup> and 5<sup>th</sup> system and obtain directional data
- Completed AWE workplace survey with unfolding of neutron spectra informing new dose correction factors. We now have a particular focus on AP/ROT data for both routine and critical dose measurement
- Hope to incorporate into the Spectra-UF unfolding code this financial year and increase collaborators to include international labs

# Nuclear Verification & Detector Physics



- **It is becoming increasingly difficult to find neutron sources which can provide high enough fluence to give low uncertainty gold activation; would be keen to discuss with international partners if suitable facilities are available**
- **Intending to publish a report into our workplace monitoring programme which may have some applicability to US labs**
- **Expanded our use of the passive neutron sphere for environmental monitoring external to facilities of interest**
- **Ongoing preparations for Godiva Dosimetry Intercomparison, would be particularly interested in deploying spheres for secondary measurement of neutron field**
  - **Initial contact on IER153 – Prompt Fission Uranium Spectrum**

# Nuclear Material Control & Nuclear Security

## Neutron Time Correlation applied to bulk nuclear material

- **LEMC (Large Epithermal Multiplicity Counter) data from ZPPR and TACS configurations acquired at the DAF**
- **Artificially-Reduced statistical quality of data**
- **Simulates data from lower efficiency, e.g. portable, detector**
  - Determine accuracy and precision of analytical techniques applied to low-efficiency detector counting bulk nuclear material
  - Technical report underway and likely complete late-March '22 (end U.K. FY)
- **Funding agreed for collaborative DAF visits next FY, likely late 2022-early-2023**



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# Hands-on Criticality Safety Training



- **Richard Jones and Mark Roydhouse have secured funding for development activity, including hands-on training at DAF**
- **Once international travel for large parties becomes viable Criticality Safety will explore arrangements for participation**