An Overview of Materials and Analytical Science at AWE

40th Tritium Focus Group Meeting, October 2018

Dr Dario C. Castiglione
Team Leader, Tritium Technology
Dario.Castiglione@awe.co.uk

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Materials & Analytical Science – Sub-function

- Energetic Materials
- Metals and Tritium
- Conventional Materials
- Systems & Computational Modelling
- Radiation Protection & Dosimetry
- Radiochemistry
- Analytical Chemistry
- Radiological Instrumentation

- ~480 staff
- 8 groups
- ~40 lab / workshop / office areas
MAS provides AWE with technical expertise in the fields of Materials and Nuclear Analytical Science.

**MAS MISSION**

We will deliver the material, analytical and radiological science capabilities that underpin the UK’s nuclear deterrent and national security mission.
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**MAS VISION**
To create a culture where our people, operating in a modern working environment, are empowered to provide innovative solutions, high quality science and reliable, efficient services, to support AWE’s core mission.
CMS provides expertise to underwrite the through life management of non-energetic materials and components. We actively manage risks relating to material supply, component production and through life performance by understanding and developing materials and processes.
ExMIS provides expertise to underwrite the through life management of energetic / explosive materials, devices & trains. This includes design & development, characterisation & life assessment of materials / devices / trains as well as process safety assessment.

- New Material Development
- Explosive Trains & Devices
- HE Hazards & Safety
- Explosive Characterisation & Compatibility
- Life & Mechanical Assessment
- Explosive Device Assessment
Metals and Tritium provide operational and scientific expertise & support by underwriting manufacturing process improvements, providing materials for re-processing, manufacture test pieces for multiple trials, underpin the service life of key components and provide continuing in-service support to our current system.

**Manufacturing Improvements**
- Underwrite improvements and efficiencies to manufacturing
- Provide materials and services
- Re-process strategic materials

**Test Piece Manufacture**
- Manufacture test pieces for trials, from full size casting to micro-targets
- Hydrodynamic trials component manufacture
- Micro-targets for plasma physics

**Stockpile Support**
- Underwrite materials performance and provide life prediction
- Understand SNM behaviour for in-service performance and life prediction

**Future Technologies**
- Invest in techniques which will redefine our ability to underwrite future processes and components
- Develop new techniques for material properties acquisition
- Neutron imaging: complete through life imaging of in-service assemblies
The Systems Group provides the capabilities required to deliver system-level materials assessments that underpin the UK’s nuclear deterrent.

### Compatibility Assessments
- System-level materials compatibility assessments to support:
  - Service Life Assessment (SLA) of the stockpile
  - qualification & approvals for modifications
  - new systems
- Materials compatibility assessments to support production, assembly and disassembly processes

### Predictive Modelling
- Development and validation of system-level predictive ageing and lifetime models
- Improved understanding of materials and system chemistry
- Iterations of system model reduce uncertainties associated with predictions, enabling risk to be effectively managed
- System models need to take into account different build configurations, materials selections
The role of the Analytical Chemistry group is to undertake the analysis and characterisation of bulk-to-trace levels of conventional, explosive and fissile materials.

**Actinide Certification**
- Analysis of U & Pu materials (gram quantities) for trace, minor & major elemental quantification and isotopic characterisation
- Supports Production, Nuclear Threat Reduction applications and waste processing / recycling activities

**Chemical Analysis**
- Organic material assessment, including explosives
- Elemental analysis including heavy metals for legacy material disposal
- Capsule gas analysis providing manufacturing and In-Service Support

**Isotopic Evaluation**
- Isotopic certification of nuclear materials, at the trace to ultra-trace levels
- Delivers the UK Nuclear Safeguards analysis capability
- Key Nuclear Forensic capability underpinning material provenance determination

**Material Characterisation**
- Non-nuclear material analysis and certification covering paints, resins, adhesives and polymers
- Continuous analysis of waste aqueous discharges ensuring site status remains green
- Supports Production and AWE’s regulatory obligations
The Radiochemistry Group (RCG) provides the Radiochemical Analysis expertise to deliver Regulatory, Warhead, and Nuclear Threat Reduction requirements and enable AWE Site Operations.

**Regulatory & Site Operations**
- **Deliver AWE’s Environmental Regulator requirements:**
  Through management of the Environmental Monitoring and Collections, Bulk Waste Characterisation and Dosimetry Services
- **Enable site operations:**
  By providing radiological and asbestos expertise, surveying and analysis. Also through management of AWE’s On Call Response for Dosimetry and Environmental.

**Customers**

**Nuclear Security and Treaties**
- Operation of laboratories to support the Comprehensive Test-Ban and Non-Proliferation Treaties
- Providing a full radiochemical and data analysis capability to underpin the warhead programme and to develop a Nuclear Forensics capability
- Develop DNA separation techniques to support conventional forensics
The Radiation Protection & Dosimetry Group ensure radiological safety and regulatory compliance at AWE by providing:

- Corporate policy and guidance on radiation protection, and manage training and procedures for Health Physics.
- Advice to the Police, MDP, Fire & Rescue services and other Government departments throughout the UK.
- On-call arrangements 24/7 for RPA advice to an incident, on and off-site.
- The AWE Radioactive Item Registry (ARIR) to record and track all radioactive items on site.
- Technical and legal advice on all aspects of Radiation protection through our HSE recognised RPA Body.
- An approved Dosimetry Service (ADS) that includes:
  - Internal Dose Assessment Capability
  - External Dose Assessment Capability
  - Criticality Accident Dose Assessment Capability
  - Record Keeping Service
  - Support to relevant FOI requests
The RI&C Group provide radiological instruments and systems to ensure work carried out by AWE involving radiation is legally compliant.

Service & Calibration
- 12,000 assets,
- 9,000 annual calibrations,
- 1,500 instrument repairs,
- for internal and external customers including MOD & commercial customers
- UKAS accredited calibration capability for gamma & neutron fields

In Service Support & Design
- In-service support to existing systems & instruments
- testing and evaluation of new instrumentation
- design of instrumentation where nothing suitable is available commercially,
- TA for all Radiological Protection Instrumentation at AWE