

# NPL Report to the CCRI(II) meeting 2007

P de Lavison, L Johansson

Radioactivity and Neutrons, Quality of Life Division, National Physical Laboratory,  
Teddington, Middlesex TW11 0LW, United Kingdom

## Introduction

The National Physical Laboratory (NPL) is the United Kingdom's national measurement institute. The laboratory underpins the technical and administrative infrastructure needed to ensure that measurements of physical quantities in the UK are accurate, consistent and linked to the international measurement system.

The projects in the field of radioactivity metrology are carried out under contract to the National Measurement System Policy Unit, a division of the Department of Trade and Industry. The projects are subject to peer-review by a committee of scientific experts representing all users of radioactivity, including medical physicists, radiochemists and health physicists.

The work therefore covers a wide range of different projects, from fundamental work on primary standards to organising workshops to encourage the adoption of best measurement practice. A brief summary is given below, after describing the facilities.

## Facilities

The NPL facilities include:

- Radiochemistry suite
  - ◆ Fume cupboards and glove boxes for handling a wide range of activities
  - ◆ A separate facility for low activity solutions
  - ◆ Source preparation laboratory with high accuracy electronic balances
- Primary standardisation laboratories
  - ◆  $4\pi$   $\beta$ - $\gamma$  coincidence systems (equipped with atmospheric pressure and high pressure proportional counters or liquid scintillation counters), with analogue and digital pulse processing systems
  - ◆ Gas counting systems and gas handling rig
  - ◆ TDCR
- Secondary measurement laboratories
  - ◆ High resolution  $\gamma$ -spectrometers (including low background, high efficiency detectors)
  - ◆  $\alpha$ -spectrometers
  - ◆ Ionisation chambers
  - ◆ NaI spectrometer
  - ◆ Multi-wire proportional counter for source emission measurements
  - ◆ Liquid scintillation counters

## Quality Assurance

NPL operates a quality management system that has been independently audited and approved to ISO17025 and ISO9001. NPL are receiving initial accreditation to ISO Guide 43 Part 1 (Comparisons) end of July 2007 and will thereafter apply for accreditation for Guide 34 (Reference Materials).

## Staff

The Radioactivity group currently has 16 staff in total, including physicists, radiochemists and technicians. In addition, the group is supporting a PhD student at the University of Surrey and visiting scientist from Bulgaria. The group also draws on expertise from other sections at NPL, including expert staff in the Radiation Dosimetry Team and the Mathematics Group, and from retired members of staff.

## Work performed in the last two years

- Participation in Key Comparisons
  - ◆ The group participated in and helped to organise the  $^{55}\text{Fe}$  comparison.
- Other standardisations
  - ◆ Samples of  $^{99\text{m}}\text{Tc}$ ,  $^{201}\text{Tl}$  and  $^{54}\text{Mn}$  were submitted to the BIPM SIR system. The  $^{99\text{m}}\text{Tc}$  sample was submitted in order to support a national NPL-organised comparison exercise with UK hospitals.
  - ◆ A system was developed to standardise the short-lived PET radionuclide  $^{64}\text{Cu}$  for research hospital. The use of this PET nuclide is just beginning clinical trials.
  - ◆  $^{210}\text{Pb}$  (using Cerenkov counting) and  $^{232}\text{U}$  for environmental monitoring.
- Support for the international measurement system
  - ◆ Joint project with BIPM and the Mathematics Group at NPL to develop a rigorous mathematical model of the response of the BIPM-SIR Ionisation Chamber (C. Michotte *et al.* ARI **64**, 2006). This model has also been applied to the NPL ionisation chambers.
- Other activities
  - ◆ Organising ICRM2005 in Oxford
  - ◆ Evaluation of nuclear decay data for inclusion in DDEP and IAEA databases
  - ◆ Development of a primary standard for positron-emitting radionuclides in gas (to support the measurement of stack discharges by Cyclotron Units for positron emission tomography (collaboration with the University of Surrey))
  - ◆ Provision of reference solutions, workshops, laboratory proficiency testing exercises and measurement Good Practice Guides. *GPG 93 - Protocol for Establishing and Maintaining the Calibration of Medical Radionuclide Calibrators and their Quality Control* and *GPG 82 - The examination and testing of equipment for monitoring airborne radioactive particulate in the workplace* have been released and made freely downloadable on the NPL web site.

- ◆ Environmental proficiency test 2007 has 64 participants worldwide, in total 242 samples distributed. A new feature is solid samples. Results from 2005 exercise presented in workshop March 2006.
- ◆ Up-dating of the measurement system for the NPL ionisation chambers – replacement of hardware and software and the use of new IT systems including internet-enabled metrology
- ◆ Completion of the new radionuclide calibrator “Fidelis” (ionisation chamber) marketed by Southern Scientific Ltd. The design of the ion chamber remains the same but a new electrometer and user interface has been added to the detector system. The electrometer was developed in collaboration with the Electronics Group at NPL
- ◆ Development of new amplifier for coincidence counting system completed – results will be presented at ICRM2007 in Cape Town.
- ◆ First measurement of Fe-55 and H-3 with the new TDCR system.
- ◆ Development of Road maps for the field of Ionising Radiation on a European scale (iMERA and EURAMET)
- ◆ Organisation of a workshop on reference materials for nuclear decommissioning
- ◆ Development of a new reference material to mimic a typical radioactive waste drum. The specification for this reference material was decided at a consultation meeting with the nuclear industry in 2005
- ◆ Metrologia special issue; managing of publication and NPL contribution to chapters
- ◆ First time a session on “Radioactivity” at MCNEG2007 Monte Carlo workshop organised by NPL

## Future work

- Standardisation and determination of nuclear data of  $^{124}\text{Sb}$  for EURAMET project.
- Standardisation of other radionuclides for CCRI(II) key comparisons ( $^{85}\text{Kr}$  and  $^3\text{H}$ ) and radionuclides needed by the user communities (eg  $^{209}\text{Po}$ ).
- Development of a primary standard for positron-emitting radionuclides in gas (to support the measurement of stack discharges by Cyclotron Units for positron emission tomography (collaboration with the University of Surrey).
- Continued provision of reference solutions, workshops, laboratory proficiency testing exercises and measurement Good Practice Guides.
- The waste drum reference material to be circulated to nuclear site operators and contractors to test the accuracy of the measurements.
- Evaluation of the decay data of  $^{232}\text{Th}$ ,  $^{228}\text{Ac}$ ,  $^{231}\text{Pa}$  and  $^{232}\text{U}$  is under way for the International Atomic Energy Authority's Coordinated Research Program F42006: Updated Decay Data for Actinides, with a planned submission date of end of 2008 and  $^{223}\text{Ra}$  for inclusion in the DDEP.