Minutes of the 6th Radionuclide Calibrator Users’ Forum (RCUF)

Held at the National Physical Laboratory, Teddington, 8 May 2009

Attendees:

Shona Anderson Mount Vernon Hospital
Mark Aplin Brighton and Sussex University Hospital
Dave Ashworth The Christie NHS Trust
Duncan Aston High Technology Sources Ltd
Speaker Michaela Baker NPL
Mike Dubbon Southern Scientific
Speaker Alan DuSautoy NPL
Andrew Fenwick NPL
Claire Fletcher University Hospital Coventry
Richard Gadd University Hospital of North Staffordshire
Brian Gilmore Belvoir Park Hospital, Belfast
Christopher Green Northwick Park Hospital
Paul Hinton Surrey County Hospital
Speaker Sue Hooper Velindre NHS Trust
Ian Hufton Royal Liverpool University Hospital
Marty Johnson USAFSAM
Speaker John Keightley NPL
Gary McDermott Churchill Hospital
Amy McDowell Barts and The London
Speaker Chris Nottage Essex Rivers Healthcare
Anton Paramithas St George's Hospital
Sweta Parker Royal Free Hampstead NHS Trust
David Parry-Jones Addenbrooke's Hospital
Speaker Andy Pearce NPL
Lucy Pike Addenbrookes Hospital
Brenda Pratt Downs Road
Jonathan Price St James University Hospital
Janelle Reyes-Goddard Gloucester Royal Hospital
Beverley Savini Addenbrookes Hospital
Rhodri Smith Cumberland Infirmary
Jonathan Taylor Sheffield Teaching Hospitals NHS Foundation Trust
Klaus Thieme Nuclitec
William Thomson City Hospital NHS Trust, Birmingham
Farnoosh Zananiri Bristol General Hospital

Chairman’s Welcome, Introduction and Previous Minutes

The Chairman, John Keightley, NPL, welcomed the delegates to the sixth meeting and gave a brief summary of the Terms of Reference for the RCUF. The Agenda was introduced.

The minutes from the fifth RCUF meeting were presented by Michaela Baker, NPL and were approved without changes.
Presentations:

Problems with manufacturer’s reported activities, Sue Hooper, Velindre NHS Trust

Presentation.

Following a recent change in supplier of $^{32}$P and reports of inaccuracies in their certificated activities, Sue Hooper presented her findings on this. Several samples of $^{32}$P solution from different batches were assayed in typical Capintec CRC and Capintec Beta calibrators, in the supplied P5 vial, as well as in other containers such as P6 vial and syringes. One sample was also sent to NPL for calibration and was found to be in good agreement with the hospital-measured activity. Her results showed the supplier’s certificated activity concentration to be consistently 1.4% to 27% high (similar to those noticed recently by other Nuclear Medicine centres), raising concerns of overdose to the patient. It also pointed out significant variations in the volumes supplied, ranging between 0.5 ml and 2.7 ml.

Since the meeting, Sue pointed out that the last couple of samples received were ~10% high – i.e. within the uncertainty quoted on the certificate, suggesting improved quality control being implemented by the supplier.

**Action 1:**
- The UK user community needs to further monitor the inaccuracy of the $^{32}$P certified activity and to raise this issue with the supplier and the UK distributor.
- NPL to check the level of pure beta emitting impurities present in the $^{32}$P samples and to quantify their effect on the measured activity.
- Possible future UK Comparison exercise for $^{32}$P and between National Laboratories was also suggested.

Proposed protocol for the transfer of calibration factors to syringes, Chris Nottage, Essex County Hospital

Presentation.

A typical calibration transfer from a pre-calibrated container to a new container using accurate weighing was proposed. Sets of calibration factors were determined at different volume of samples for a particular radionuclide instead of volume correction factors.

During discussions, a problem with availability of balances in some Nuclear Medicine Departments was raised. Also the effect of the sample density on weighing was pointed out, but it was decided that for most of the solutions administered to patients a density of one could be assumed.

**Action 2:**
A working group comprising Chris Nottage, Sue Hooper, John Keightley and Michaela Baker was established to continue this work.

Filter system to improve measurement accuracy of $^{90}$Y for various containers, William Thompson, City Hospital NHS Trust, Birmingham

Presentation.
Bill Thomson presented his recent investigation into extending the use of the Copper insert (already used for activity assay of $^{123}\text{I}$ and $^{111}\text{In}$) to improve the accuracy of $^{90}\text{Y}$ measurements (by eliminating the contribution of the Bremsstrahlung in the $\sim 30$ KeV region). The syringe-to-vial activity ratio suggested that a “Glass and Copper insert” filter type might be suitable for $^{90}\text{Y}$ measurements. Variable thickness of glass were examined and the filter comprising “Copper and thick glass” provided similar readings for various containers. However, this filter configuration was found to be dependant on the sample volume and a future investigation using Aluminium instead of glass was proposed.

**NPL rolling programme formulation, Alan DuSautoy, NPL**

*Presentation.*

As the emphasis of the NMO and Working Group activity is changing on an Annual cycle, the present 3-year NPL programme is due for review and discussions for new projects will be starting soon. The participants were asked to outline future proposals for projects of interest and submit those to NPL via the Measurement Network currently being launched at NPL, see [http://www.npl.co.uk/ measurement-network/ionising-radiation](http://www.npl.co.uk/measurement-network/ionising-radiation)

For any immediate suggestions, please contact [radioactivity@npl.co.uk](mailto:radioactivity@npl.co.uk)

**Proposed projects for submission to NMO/MAC working group:**

1. *NPL-conducted UK comparison exercises for individual radioisotope*
   An overwhelming majority expressed interest in NPL-conducted UK hospital comparison exercises and outlined the benefits of providing direct calibration with NPL for radionuclides of interest and highlighting measurement problems. Radionuclides of interest identified for future comparisons: still $^{90}\text{Y}$ then $^{125}\text{I}$, $^{123}\text{I}$ and $^{111}\text{In}$.

   **Action 3:**
   - The RCUF members need to actively and continuously request the need for these comparison exercises from the DTI.
   - Since the last meeting, a UK comparison for activity measurements of $^{90}\text{Y}$ was successfully completed and the findings will be presented at the next RCUF meeting.

2. **Comparison by proxy**

   It was proposed that, for each source sent to NPL for activity calibration, the hospital should provide details of their own measured activities, calibrator type used and supplier’s details, prior to an NPL calibration – the submission of information will be optional and the participants will be kept anonymous. Subsequently NPL will compare the reported activities to the NPL certificated value and collate all the data to identify measurement problems, present these to the medical community and provide support and advice. All present at the meeting agreed to take part.

   **Action 4:**
   NPL to look into the feasibility of such an extensive project and to provide a reporting form.

3. **Proposal for an NPL training course/workshop for trainee Medical Physicists**
The initial suggestion of a possible training course held and conducted by NPL for Nuclear Medicine Trainees was very positive – the aim will be to promote good measurement practice in line with the existing GPG 93, to cover general theoretical and practical aspects of activity assay using radionuclide calibrators (“simple, to the point and relevant”) and to establish good, long-term and mutual connections with new Medical Physicists. A suggestion for possible IPEM/BNMS accreditation for this course was made.

**Action 5:**
NPL to liaise with senior Medical Physicists to establish the need for a NPL training course and to identify relevant topics.

4. **Calibration Factors for the Fidelis calibrator with shielding**

Some requests have been made for provision of calibration factors for the Fidelis calibrator with its dedicated shielding, for the most commonly used radionuclide calibrators in Nuclear Medicine.

**Action 6:** NPL

5. **The realisation of Becquerel**

John Keightley pointed out general measurement problems associated to this, such as radionuclide dependency and the high level of activity required for ionisation chamber measurements versus very low levels needed for absolute standardisation (and thus the uncertainty contribution due to dilution/weighing arising from it).

Recently standardised radionuclides (used in Nuclear Medicine) by NPL and submitted to SIR for international comparison were: \(^{99m}\)Tc, \(^{56}\)Mn, \(^{64}\)Cu and \(^{177}\)Lu.

6. **Possible future collaboration between NPL and medical physicists for Monte Carlo Modelling of the NPL ionisation chamber/Fidelis calibrator**

Various Monte Carlo modelling research projects have been already done independently in the medical field and Lena Johansson at NPL had produced models for the NPL ionisation chambers, for various measurement geometries and configurations.

**Action 7:**
RCUF members to submit their requests to DTI for any of the above proposals.

**Discussions session:**

1. **Response of the NPL Calibrator to \(^{131}\)I capsule as a function of positioning/capsule orientation – Michaela Baker, NPL**

*Presentation.*

**Action 8:** NPL

Discussions following the presented NPL results indicated the need:

- For further measurements using the plastic applicator provided with \(^{131}\)I capsule
- To quantify the difference in response (calibration factor) between P6 vial and plastic applicator measurements

2. **NPL Radionuclide Calibrator Response as a function of distance from a wall – Andrew Fenwick, NPL**

*Presentation.*

This investigation was in response to measurements concerns raised at the fifth RCUF meeting. The variation in response of the NPL calibrator due to wall proximity was found to be negligible in the hospital environment.

3. **Extend /implement NPL Data logging software for other radionuclide calibrators routinely used in Nuclear Medicine to collect data**
   - Identify main radionuclide calibrator types and their suppliers
   - Test their communications routines

**Action 9:**

NPL and a small working group of Medical Physicists.

3. **Fidelis Secondary Standard radionuclide calibrator**

Southern scientific stated that “all of the new and upgraded Fidelis units have passed the linearity tests with linearity better than 2% at all points down to 10pA”. Brian Gilmore, who recently upgraded his Fidelis calibrator, further confirmed this. He also mentioned that his newly upgraded system appeared to be 1% different from his previous \(^{99m}\text{Tc}\) 2006 calibration via NPL comparison exercise (which was in perfect agreement with the NPL value). It was pointed out that the 1% variation was still within the uncertainty quoted for the Fidelis electrometer and close to the uncertainty of the \(^{99m}\text{Tc}\) calibration factor for this system – sending a sample for calibration at NPL was also suggested.

4. **NPL-conducted UK comparison exercises for individual radioisotope**

Radionuclides of interest identified for future comparisons: still \(^{90}\text{Y}\) then \(^{125}\text{I},^{123}\text{I},^{111}\text{In},^{32}\text{P}\). Regarding the proposal for a \(^{90}\text{Y}\) UK comparison exercise, John Keithley asked the audience if this radionuclide was still relevant – all present were interested in taking part.

Klaus Thieme from Nuclitec (German company, accredited by PTB – the equivalent of NPL in Germany), who already organised a similar comparison in 2004 with NIST (equivalent of NPL in the United States) in America, has outlined his proposal for producing and distributing the \(^{90}\text{Y}\) sources to all the participants and to NPL for activity concentration certification.

**Action 10:**

NPL to send out a questionnaire to establish:
- Convenient date to hold the comparison
- Required level of activity per sample
- Type of vial and volume of sample – choose the most commonly used by hospital for \(^{90}\text{Y}\) measurement

NPL to derive \(^{90}\text{Y}\) calibration factor for Fidelis with shielding.

Medical community to flag up the need for these exercises.
5. **Problems with supply of various radioisotopes**

The user community raised their concern about the availability of some radioisotopes widely used in Nuclear medicine, following GE Healthcare’s recent decision to discontinue the production of $^{67}$Ga, $^{201}$Tl, $^{90}$Y and $^{57}$Co. The main implication of this is the accuracy of the activities quoted and dispensed by new suppliers (see the case of $^{32}$P discussed above) and therefore potential under or over dose to the patient. Recalibration via comparison exercises or customer-supplied NPL calibrations are recommended when switching to a new product/supplier.

6. **Suppliers of 10R Schott vials**

**Action 11:**
NPL and Medical Physicists to identify suppliers of 10R Schott Type 1+ (silica coated) vials.

Supplier: Adelphi Tubes, Product Code: VCDIN10R
Website: [www.adelphi-hp.com](http://www.adelphi-hp.com)

7. **Possible impurities in liquid radioactive samples**

Sweta Parker from Royal Free hospital noticed that an $^{123}$I waste bag was still radioactive after several weeks. John Keightley pointed out that this was due to the presence of impurities in the original liquid sample, of significantly longer half-life. The type of impurities present depends on the production route of the particular isotope – this information can be requested from the supplier or from [http://www-pub.iaea.org](http://www-pub.iaea.org)

**Action 12:**
NPL to provide the above link and to check the impurities present in a particular sample that Chris Nottage will send to NPL for calibration soon.

8. **The primary standardisation of Radionuclides used in medicine by $4\pi\beta-\gamma$ coincidence counting, John Keightley, NPL**

*Presentation.*

9. **Calibrating pure beta emitting solution, Andy Pearce, NPL**

*Presentation.*

10. **Next RCUF meetings**

The chairman requested suggestions for alternative future meetings locations, but it was agreed that NPL was the preferred venue.

**Action 13:**
It was requested that a further presentation should be made by NPL on the activity calculations involved in the NPL secondary standard ionisation chamber measurements