

Minutes of the 8th Nuclear Spectrometry Users' Forum

Park Royal Hotel, Warrington – 18 May 2010

Participants:	Simon Jerome (Chairperson)	NPL
	Sean Collins (Secretary)	NPL
	David Baker	AMEC
	Roger Benzing	Scientifics
	Jane Caborn	NNL
	Lyn Cormack	DSRL
	Lorraine Currivan	RPII
	Matthew Curtis	VLA
	Mark Denton	Sellafield Ltd
	Leon Ewers	HPA
	Robert Hackett	Scientifics
	Chris Hardy	Babcock Marine
	Mike Healy (Speaker)	Environment Agency
	Prof. Elis Holm (Speaker)	NRPA
	Ken Inn (Speaker)	NIST
	Dr. John Keightley (Speaker)	NPL
	David Lambert	VLA
	Tony Lansdell (Speaker)	UKAEA
	John McQuirk	Sellafield Ltd
	Andy Pearce (Speaker)	NPL
	Martin Rushby	Canberra
	Sarah Shepherd	Urenco UK Ltd
	Jenny Swan	Canberra
	Keith Underwood	Sellafield Ltd
	Bill Westall	Magnox North

1. Chairman's Welcome, Previous Minutes and Actions Arising

- Simon Jerome introduced himself and the secretary (Sean Collins) to the 8th meeting.
- Opened the meeting by briefly describing the structure of NPL and the NMS system, and explained the aims and activities of the NSUF.
- Simon Jerome notified participants of changes to the agenda.
- The minutes of the 7th meeting were accepted as a true record.
- Actions:
 - There were two actions from the 7th meeting both of which are still on going:
 - To determine how the programme would be co-ordinated and how the UK sub contracts to other organisations.
 - To get a more coherent view of the UK's emergency response network and how it works.

2. NPL Talk: 'Evaluation of Decay Data for Actinides' – Andy Pearce, NPL

- Andy Pearce started the talk by reviewing the need for Nuclear Data and its requirements.
- He proceeded to give an overview of the IAEA Co-ordinated Programme and the two main aims:

- To be a knowledge exchange between the old out-going generation of evaluators and the new generation of evaluators before the expertise is lost.
- Provide improved decay data for actinides.
- To produce outputs for the DDEP evaluation project and to replace the TECREP-261.
- Andy Pearce followed this by showing the list of active participants in the evaluation programme and the radionuclides that are currently being evaluated.
- He continued by describing the required data outputs from each evaluation and the procedure for producing an evaluation.
- Andy described recent evaluations at NPL and the issues arising with each evaluation.
- Andy discussed the issues with lack of data being published for radionuclides; for instance there has been only one ^{209}Po half-life measurement which may be wrong by 25%.
- This was followed by a pie chart showing a breakdown of what kind of nuclear data measurements are required, with just over 50% of radionuclides having sufficient measurements to evaluate adequately, with more half-life and gamma emission probability measurements being the main data that is needed more of.
- Andy completed his talk by giving a list Internet databases of decay data that are recommended by NPL and useful compilations for decay data searches.

Comments/questions

- A delegate asked about using JEFF 2.1.1. as he was being pushed towards using JANIS. Andy responded by saying that JEFF 3.1.1 is the best selection of data, while JANIS is used to access the JEFF data though it isn't particularly user friendly.
- A delegate enquired about the update frequency of NUDAT. Andy informed the delegate that it is updated regularly but it is mainly done by scientists who use it for nuclear structure and so the evaluations of the nuclear data are not as rigorous but generally a good data set.
- A query was brought up to the traceability of changes in values of the decay data in an evaluation.

3. Invited Talk: 'Implementation of MCERTS' - Mike Healy, Environment Agency

- Mike Healy started his presentation by introducing himself and the Environment Agency mission statement.
- Mike continued by giving an introduction of MCERTS and that its aim was to promote the production of quality monitoring data. This would help to ensure the public confidence in the measurements being carried out and that MCERTS would help to:
 - make sure the market was driven by quality and not price
 - provide certification of monitoring equipment and services to the EA standards.
- He explained the structure of the scheme, with each element of MCERTS having two components.
- Mike discussed the scope of MCERTS which currently covers (see presentation for full list):
 - Continuous Emissions Monitoring Systems (CEMs)
 - Manual Stack Emission Monitoring
 - Continuous Water Monitoring Equipment
 - Effluent Flow Scheme

- He outlined the plan for the future scope of MCERTS which would be extended to radioanalytical testing of environmental and waste water, with a possible extension to new matrices.
- Mike explained that for water sampling and analysis schemes based on ISO17025, which only gives guidance that an extension of scope would allow for an MCERTS being awarded. He then listed the additional requirements to the ISO17025.
- Mike followed on by explaining the selection and validation of methods (the power of three) and the performance targets and how the selected methods were tested to see if they perform adequately.
- Mike explained that a requirement of the participants in MCERTS would be that they have to show ongoing quality assurance. Also that there were AQC and PT schemes to show that the participants were using the methods correctly to maintain MCERTS status.
- Mike gave a list of the benefits of the MCERTS system:
 - Formal accreditation
 - Reliability
 - level playing field
 - indicates importance of test
- Mike finished off his presentation with contact details and a web address that would give further information.

Comments/questions

- A delegate enquired as to whether MCERTS would be mandatory if the laboratory already had accreditation to ISO17025. Mike responded that it would be if the laboratory wished to carry out tests for the Environmental Agency.
- A delegate asked about the DQO process. Mike answered that it is not being employed by MCERTS.
- A question was raised about the need for CRMS. Mike replied that these were very important for monitoring though due to their expense a balance needs to be found between the different monitoring systems.
- A delegate inquired about whether there would be a threshold where MCERTS will not apply. Mike replied that he had no idea at this time.
- The use of total α/β counting and its traceability was raised. Simon Jerome explained that while it is a useful technique for screening it was very difficult to use for calibrations as there was lots of variation between radionuclides in there response.
- The timescale for the introduction of other matrices was inquired about. Mike was unsure of the current timescale.

4. NPL Talk: 'Production of ^{236}Pu of suitable purity as a chemical yield tracer for environmental analysis' – Simon Jerome, NPL

- Simon Jerome gave a brief overview of why ^{236}Pu is needed as a tracer and the techniques of analysis of ^{236}Pu .
- Simon then explained what makes a good tracer (see presentation). He included a reference to a paper that he referred to.
- Simon showed a list of Plutonium tracers and gave details of each tracer and their advantages and disadvantages, with ^{236}Pu being the most suitable of the radionuclides.
- He went on to discuss the methods of production and gave a list of the methods, with low energy charged particle irradiation with deuterons selected as the most suitable option, though with the proviso that the starting material needed to be

very pure to minimize the level of contaminants. Simon gave a paper reference that outlined the approach used by Efurud et al and their results.

- Simon continued by giving NPLs' results of test irradiation, stating that NPL had better starting material for the irradiation than the previous work and gave details of the chemistry used to purify the irradiated material. Though NPL had a lower ratio of Plutonium contaminants there was a large amount of ^{65}Zn due to activation of the target material.
- Simon discussed the conclusions:
 - A better yield, possibly due to a thinner target.
 - A need for a better impurity assay, more activity required.
 - The experiment is to be repeated, this time with more material and the details of the expected outcome.
- Simon finished by discussing the possibility of irradiating ^{237}Np with photons to produce ^{236}Pu .

Comments/questions

- A delegate inquired as to the effective shelf life of a ^{236}Pu standard. Simon replied that due to the ingrowth time of the ^{232}U that it will have a shelf life of 5 years.
- There were some queries as to the cost of a standard. Simon informed the delegates that the cost of a standard would be no more than any of the current NPL standards.
- One of the delegates asked if there are any gamma emissions that interfere with the ^{236}Pu gamma emissions. Simon brought up ^{224}Ra and ^{244}Cm as possible interferences but these would be removed during the purification stage.

5. Invited Talk: 'Marine transport of ^{129}I ; - Prof. Elis Holm, NRPA

- Elis began his presentation with an introduction of himself and the work being carried out at his lab.
- Elis pointed out that due to anthropogenic processes the amount of ^{129}I globally has increased by several orders of magnitude.
- He then went on to give examples of the benefits of using ^{129}I including:
 - it can be used as an excellent tracer, especially for the deep ocean currents.
 - It can be used for the reconstruction of doses from ^{131}I .
 - It has importance for the long term storage of nuclear waste.
- Elis informed the delegates that they had a sample bank of 93 samples representing the periods of 1982, 1983, 1986-88, 1991-95 and 2007. Each set of samples had been analysed by accelerator mass spectrometer.
- Elis that showed a table of levels of ^{129}I over the last 65 years from the corresponding sources:
 - Nuclear Weapons Testing
 - Nuclear Food Processing
 - Chernobyl Accident
- A diagram (from the internet) that showed the natural cycle of Iodine in the environment was put up by Elis.
- a map detailing the pathways of marine discharges from Sellafield and la Hague to the Scandinavian coastline was displayed.
- Elis showed a bar graph of ^{129}I releases from Sellafield and la Hague, which showed the amount of ^{129}I reaching the Scandinavian coastline is dominated by la Hague.
- Sampling was done at 40 stations along the Swedish coastline using *Fucus Vesiculosus*.
- Elis showed a map detailing that there is an inflow of ^{129}I from the North Sea into the Baltic Sea, though it would only reach a certain area in the Baltic Sea.

- A map showing the distribution of ^{137}Cs in 1986 and 2007 was shown, which showed a very high level of ^{137}Cs in the Baltic Sea in 1986 and was losing approximately 40 TBq/year to the North Sea.
- From the sampling station data it was found that at one particular sampling station there was always a high ^{137}Cs concentration. This was found to be coming from a Wood Pulping Factory nearby.
- Elis told the delegates of the transit time of the discharge from the processing plants to the Swedish coast:
 - la Hague: 1-2 years
 - Sellafield: 3-4 years
- Elis finished with a brief conclusion and a summary of the problems in using an AMS.

Comments/questions

- A delegate enquired about the type of levels of activity that they would be measuring, as he didn't use mass spectrometry as a method. Elis informed the delegate that he was counting the number of atoms, which maybe in the thousands of atoms and due to the long half life that the levels would be very, very low.
- One delegate asked as to how they prevent the loss of iodine during the microwave digestion stage. Elis explained that it was done in a sealed chamber with a stable isotope of iodine as a tracer.

6. Invited Talk: 'Graphite Characterisation' – Tony Lansdell, UKAEA

- Tony started his presentation by explaining that the project of determining the activity in graphite through modelling was supported by NPL.
- He went on to inform the delegates that reactor graphite makes up 30 % of the UK ILW.
- Tony explained that the primary objective of the project was to characterize the UK graphite waste stream.
- Tony discussed the decision to use the Wylfa and Sizewell A reactors to model, explaining that they are typical of the reactors in the UK.
- He informed the delegates that they initially looked at reactor graphite taken from the reactors before they went online. These samples were analyzed by NPL for 29 precursor elements using a variety of methods.
- Tony used MCNP and FISPACT to model the stochastic radiation transport. He went on to explain the modelling process used.
- Tony presented a graph that showed the modelling results for Tritium, ^{14}C and ^{36}Cl , which detailed a drop off point as the model went further from the reactor centre.
- Tony showed a table showing the modelled results versus the NPL measured results, which showed very good agreement for ^{60}Co , ^{133}Ba and $^{154/155}\text{Eu}$.
- His conclusions from the results between reactors indicated that they were potentially scalable, also that they had identified several activation routes not accounted for in the current RWI e.g. Tritium regeneration.
- Tony informed the delegates that more samples were being analysed and for more radionuclides.
- Tony completed his presentation by giving acknowledgements to:
 - NDA
 - NPL
 - Magnox Electric
 - Wylfa
 - Sizewell A

Comments/questions

- Prof Elis Holm enquired as to the ratio between ^{14}C and ^{12}C . Tony responded that this hadn't been analysed yet.
- A delegate made the observation that Wylfa operates differently from other reactors of type and this could affect the results.

7. Invited Talk: 'Requirements for Matrix Radiochemistry Reference Materials' – Ken Inn, NIST

- Ken started his presentation by expressing to the delegates that they need to take an active role in putting forward what they required to help guide NMS laboratories in supporting the user community.
- He then went on to discuss the importance of reference materials for supporting confidence in measurements and techniques.
- Ken explained that developing reference materials takes a lot of time and effort to produce with a rough production time of 3 years.
- Ken displayed a list of reference materials that are currently needed (see presentation).
- He then showed a list of needs for:
 - Consequence management
 - Post-IND Nuclear forensics
 - Detecting nuclear technology
- Ken finished off with a list of done and required Food PT reference materials.

Comments/questions

- A delegate asked Ken about the use of irradiated glass as a reference material. Ken explained that close to the ground zero site of a nuclear detonation blast a lot of glass could be found, further that approximately only 10 % of the weapon fuel would be used in the blast and the rest would be scattered over the area with some of it being impregnated into the glass that was formed.
- The delegate went on to discuss whether we should really be looking at ground zero and that maybe a concrete reference material would be more appropriate. Ken replied that there was a glass/concrete simulation matrix already produced that could be placed in a reactor to mimic the effects of a blast. He went on to say that he'd heard that as you get closer to the ground zero that the fractionation signature of the material changes and that you want to get as close as possible to the fuel to determine the ratios and thus the origin of the fuel.

8. NPL Talk: 'Monte Carlo Simulation for Solid Angle Calculations in Alpha Particle Spectrometry' – Dr John Keightley, NPL

- John began his presentation by indicating that he believed that this was an exact and 'pretty' method for primary measurements of radioactive isotopes.
- He explained that the work began when he noticed mathematically incorrect formulae for simple disc-to-disc solid angle calculations employed by some measurement laboratories.
- John informed the delegates that the work was not completed and that he was comparing his work against new published formulae.
- John defined the definition of a solid angle and discussed the geometric considerations affecting the precision of the solid angle.
- He then explained that the deposition of a source was a problem, as the activity will not be evenly deposited across the face of the source.
- He went on to explain the mathematics behind the simulations.
- John informed the delegates of the random number generator that he had used, that was produced by NPL and passed the 'big crush test'.

- John discussed the problems of relying on the manufacturers measurements of a PIPS window and that by using a well-defined diaphragm that the counting efficiency for α particles and low-energy photons would be the solid angle.
- John finished his presentation by offering the simulation code to the user community.

Comments/questions

- A delegate made the observation that this would have no real world application. John responded that he was putting this out into the public domain as some people may find it useful and find real world applications.

9. NPL Talk: ‘Acoustics and Ionising Radiation Programme Formulation’ – Simon Jerome, NPL

- Simon informed the delegates that he was giving the presentation on behalf of Helen Anthony at that she is the main NPL contact for any ideas/needs from the user community.
- Simon explained to the delegates how the way NPL form their programme has changed from a three-year cycle to a one-year cycle to be able to be more active in responding to user needs.
- He went on to show a diagram of the rolling formulation cycle, showing each of the stages of formulation.
- Simon put across the need for the user community to take an active role and inform NPL of:
 - The difference NPL makes to the users’ business
 - Future and changing needs
 - Project ideas
 - Potential collaborations

Comments/questions

- A delegate made the comment that it sounds like there is no way for groups of people to ‘gang up’ to put forward needs and ideas and only individual ideas get put forward. Simon responded that that is more what NPL are looking for and that there are already a small number of working groups already active and also running NPL led workshops are a possibility and have been done before.
- A delegate from Sellafield enquired about novel ideas for characterising the materials in B30 on the Sellafield site and where he could go to get these ideas. Simon suggested that he could speak to NPL staff directly or that a working group could be set up to discuss the problem.