

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

1.1 The chairman welcomed delegates to the 2008 meeting and summarised the day's agenda. The day's presentations would focus on the sampling and measurement of airborne radioactive particles, reflecting the increased level of interest in this area among ARMUG members.

1.2 One of the functions of the ARMUG is to produce guidance in measurement of radioactivity in air, usually in the form of Good Practice Guides (GPGs). Usually, NPL provides the chair and/or secretary, hosts Working Group meetings and publishes the final guide. The chairman pointed out that NPL has limited funding for supporting new GPGs in ionising radiation at present, but that this need not prevent a new GPG from being progressed; NPL would be willing in principle to restrict its role to reviewing drafts of a new guide, and publishing it. The chairman asked delegates to bear this option in mind during today's discussions.

1.3 There were no corrections to be made to the previous minutes and they were agreed to be an accurate record of the 2007 meeting.

### **Previous Actions**

Action A7.1: Secretary to arrange meeting of working group to produce guidance on adsorption factors and to ensure that guidance is published on the ARMUG webpage.

An e-mail debate between members of the working group (David Ryden, John Simpson, Pete Burgess and Julian Dean) as to what generic advice should be included on the web page had occurred and David Ryden has kindly agreed to present on this subject this afternoon so that members could decide what further is required. See (6) below.

Action A7.2: Members are invited to complete the ARMUG questionnaire, which is available on the ARMUG webpage ([www.npl.co.uk/armug](http://www.npl.co.uk/armug)) and to return to the secretary.

No returns to this questionnaire have been received. NPL will review this area and change to a more effective method of information gathering for 2009 (see **Action A8.1**).

Action A7.3: Members wishing to discuss uncertainties, or any other topic at a future meeting should contact the secretary.

Several e-mails received with suggestions for future topics had been condensed to a table in delegate packs. Subjects for future meetings were discussed under Any Other Business at the end of the meeting. **Action completed**

Action A7.4: Members to send the Secretary any comments on the draft list of Frequently Asked Questions on the ARMUG webpage by 28<sup>th</sup> February 2008 and secretary to finalise the list by 31<sup>st</sup> March 2008.

List finalised and added to webpage. **Action completed**

Action A7.5: Members with available supplies of low-activity air filters possibly suitable for a comparison to contact the secretary.

Filters have been received and measurement and analysis of these is scheduled for the next 6 months. Chairman to report results at next meeting (see **Action A8.2**).

Action A7.6: NPL to decide whether to include a Measurement Good Practice Guide on Workplace Air Monitoring in its current NMS programme and to begin work accordingly.

Action stands; NPL will arrange Working Group meeting to enable progress towards Good Practice Guide. See (5) below.

The chairman reminded the group that the GPG on calibration and testing of tritium-in-air monitors was still outstanding. There had been little recent progress on this due to illness of main author and heavy work commitments all round.

## **2. Invited talk: DSRL engineering review of stack sampling - John Keeton, Dounreay Site Restoration Ltd**

2.1 John described how Dounreay Site Restoration Ltd had carried out an engineering survey in 2006 to quantify issues surrounding the operation of airborne radioactivity monitoring systems on the site. These highlighted pump failures / trips, incorrect sampling resulting from poor equipment set up, failure to recognise trends in a timely fashion and tritium system water transfer as areas requiring improvement. A programme was initiated which has led to an improved site management system for equipment maintenance. This in conjunction with better training of management and systems operatives, the appointment of 'Stack Man' as a single point of contact for advice and the introduction of control charts with alarm and action levels has helped improve awareness of operating system conditions and reduced process downtime by enabling timely scheduling of maintenance.

2.2 Questions were asked regarding whether the accuracy of the system had been checked by injection of a known activity of tritium gas and whether the gas tightness of the system had been evaluated. John replied that the system had not been truly characterised using tritium gas as DSRL had been unable to find anyone who could perform this for them. The particulate system however had regular flow surveys performed with evaluation of capture efficiencies after injection of known activity. The gas tightness of the system had not been checked but an inspection had been carried out and from the quality of the fittings used this is not felt to be a problem.

2.3 Bernhard Warr (GE Healthcare) reported having seen similar problems and would be interested in the holding of a forum for operators of plant to discuss similar problems on different sites. John, who is chairman of the Nuclear Ventilation Forum, was able to offer the membership copies of the engineering review performed at

DSRL, but this was prepared in 2006 and the site operation has now moved significantly beyond the findings in this report.

2.4 Further questions included an enquiry as to whether more pump failures occurred in the tritium systems than in the aerosol systems. John replied that most of the failures had occurred in the aerosol systems. The maintenance policy is that on pump failure the stand-by pump will take over and the faulty pump will then be replaced. The carbon vane pumps used wear down and ultimately the system trips to the stand-by pump. It has been found that there is some water carry-over from the system to the pumps, which may be positioned at the bottom of the system. The pumps are not water tolerant. After consultation with their supplier they are in the process of changing the pumps to a type that are water tolerant.

2.5 The final question was on the reliability of tritium pumps compared to that of aerosol pumps. John replied that DSRL see more failures with the particulate pumps but are still able to maintain 24h sampling using the stand-by pump system.

### **3. Invited talk: Airborne activity sampling and monitoring at Hinkley Point A - David Williams, Magnox Electric Ltd.**

3.1 David gave a description of the ventilation controls, air sampling and monitoring programme at Hinkley Point 'A'. He explained that ventilation control can be effected using depression of workplace pressure to prevent activity release, by changing the air within a building at a given frequency and filtering the exhaust or by using flow to minimise exposure by preventing activity levels from building up. Engineered solutions may involve building ventilation systems, point source ventilation or portable filtration units. The evaluation of airflow within an area is an essential component of any ventilation control system. The monitoring programme at Hinkley Point 'A' enables the recording of the radiological conditions at various locations and permits a continuous review of workforce exposure levels for ALARP purposes. It confirms area designations according to current hazard conditions and permits the monitoring of engineering controls used for the protection of personnel and the environment. These controls are used to give warning of the elevation or release of airborne activity.

3.2 Sampling at Hinkley Point 'A' is carried out using a combination of fixed location monitors or samplers, personal samplers or portable engineering controls. Positioning of these is very important and should only be made with prior knowledge of workplace airflow patterns. Point-of-work air samplers are used to confirm area designation, whilst area monitors are used to warn of elevation or release of activity and are positioned between the worker and the potential release. These monitors may be used to estimate internal dose to operators and also the performance of engineering controls installed for protection of personnel and the environment.

3.3 David was asked whether Hinkley Point 'A' is 'an alpha site' and had there been problems convincing people of this. David responded that it had always been an alpha site although the majority of Magnox sites are not. There is a legacy of loose contamination and not much historical airborne monitoring. Now air monitoring has been introduced and alarms are most often found to be from alpha contamination.

3.4 A further question related to which US standard was being used and David replied that NUREG 1400, which is available on the web and gives useful guidance on the characteristics of air flow testing was the one he had referred to.

#### **4. Invited talk: Latest news on ISO 2889 - Jeff Rivers, Laboratory Impex Systems Ltd.**

4.1 Jeff had attended the Working Group meeting of TC85 SC2 in the USA, where the new standard (ISO2889) for Sampling of Airborne Radioactive Materials from Stacks and Ducts of Nuclear Facilities had been discussed. This standard sets out the principles for the collection of representative samples from airborne discharges and describes acceptable methods for effluent gas and particle sampling. The scope of the standard is limited to installations handling radioactivity and a major concern is with the protection of radiation workers. At a previous meeting of the working group representatives from the UK and Canada had objected to proposals that the standard include the annual cleaning of sampling lines with water vapour and the use of additional releases of radioactivity to demonstrate the efficiency of the system. Jeff warned of the potential adoption of impracticable requirements by standard bodies remote from the realities of everyday plant operation unless those working within the field were alert. He recommended that interested parties should maintain communication with the BSI representatives and work with them to ensure relevant workable standards would be developed.

4.2 A lively discussion followed. Jeff re-iterated that the standard (ISO2889) is still in draft form at the committee stage. Final comments have been made and the final rewrite has taken place. It is waiting for the adoption vote so until it is published no copies are available. ARMUG members expressed concerns on how information about the selection of topics for new standards and the decision on which standards to review could be obtained

4.3 Further questions included an enquiry on how this standard relates to the IEC standards on stack monitoring, and whether it covers monitoring as IEC 64172 does. Jeff replied that the ISO committee has decided to re-issue a number of standards and add to existing standards, and asked the meeting if there were ideas for future standards to review. He thought that the next standard to be reviewed might be workplace monitoring. Another question related to the mechanism for becoming involved in the consultation procedure for amending standards, and Jeff replied that he had heard about the update of ISO2889 via an American colleague and had been fortunate enough to attend the meeting.

4.4 The chairman asked the group if they had information on appropriate standards, as NPL would be happy to add this information to the web page. NPL will look into what standards are relevant and could flag this up to the membership (see **Action A8.3**).

## **5. Good Practice Guide working group**

Closing the morning session, the chairman returned to the setting up of a working group to write a Good Practice Guide on positioning of workplace air monitors and asked for volunteers from the group. Prospective members for the working group were requested to contact Julian by the end of the year. It is hoped to have a start up meeting early in the New Year to start up the project.

## **6. Invited talk: A review of alpha energy adsorption in filters and its potential to degrade air-monitoring accuracy - David Ryden, Canberra**

6.1 David outlined the effects requiring consideration in the measurement of particulate activity collected on filters used in air monitoring. The performance of filters changes as their time in service increases, which may lead to greater particle collection efficiencies. However should alpha emitters be covered by subsequent dust particle deposition, the covering layer will cause absorption and reduction of detection efficiency. The capture mechanism is dependent on the size of the particle. Small particles are trapped by diffusion whilst larger particles become trapped by impaction and interception.

6.2 David reported on work conducted at CEA Saclay using Whatman and Flouropore filters exposed to aerosols of  $^{239}\text{Pu}$  and  $^{137}\text{Cs}$ . He reported that spectral shape is affected by dust loading on the filter and caution should be exercised when Radon progeny are detected as short half life daughters on surface layers may exhibit better resolution compared to peaks from underlying longer lived nuclides. He then went on to describe the results from some tests using active water added to filters exposed to radon and thoron progeny at HPA Chilton, which indicated that the activity contained in the water could still be detected after the peaks from radon and thoron had been stripped from the spectra.

6.3 David cited a number of papers and reports containing information relevant to this subject. These included:

- Pickering (1984) discusses self-absorption of alpha energy in escaping from their individual aerosol particles
- Pickering and Fourcaudot (1987) describe how alpha-recoil affects the distribution of aerosols in filters
- Seiler, Newton and Guilmett (1988) give detailed theoretical models for continuous monitoring in a dusty environment
- Moore, McFarland and Rodgers (1993) describe the factors that affect alpha particle detection by continuous air monitors
- Huang, Schery, Alcantara and Rodgers (2002) discuss the influence of dust loading on the alpha-particle energy resolution of continuous air monitors

- Huang, Schery, Alcantara, Dale and Rodgers (2002) provide information in a paper on test aerosols
- “Investigation of techniques to improve Continuous Air Monitors under conditions of high dust loading in environmental settings” US DoE Report 60163. This is a particularly useful report by Huang et al.
- Luetzelschwab, Storey, Zraly and Dussinger (2000) describes measurements of self absorption of alpha energy in filters but only with sources rather than active aerosols
- Grivaud (1992) discusses alpha spectrum resolution obtained with different filters
- Grivaud and Pagliardini (2001) give a detailed assessment of Fluoropore FSLW (version 2)
- Current work includes that being done by Tony Geryes, who is two years into a doctoral thesis (Paris University) entitled “Etude de la degradation de l’energy des particules Alpha dans les filtres de surveillance de la radioactivity atmospheric”. He is supervised by Dr Celine Monsanglant –Louvet at IRSN.

6.4 Questions were asked on the recoil of gas atoms, and whether these have an effect on the particle on the filter. David replied that these will cause the aerosol particle to recoil away from the direction of emission of the alpha particle and there was the potential for the remaining aerosol particle to become further embedded in the filter.

6.5 The chairman asked what would be the best way forward, what guidance documents are most useful and what is needed. A general discussion followed with the consensus being that a guidance document on how to best interpret results from filter analysis was required. It was suggested that there are two problems, one of sample measurement and one of the effect of real time monitoring. Discussions ensued on the use of radon compensation and the effect of alpha detection efficiency changing as the spectral shape changes. The chairman asked for information as to what is required at a practical level and it was agreed to set up a working group to produce suitable guidance. This should also cover continuous filter monitoring measurements. A group of potential members for this working group was assembled from the membership and a meeting will be arranged to discuss the guidance required will be held (see **Action A8.4**).

## **7. Discussion session: Issues with radon compensation - Eliot Williams, UKAEA and Julian Dean**

7.1 Eliot introduced the topic of radon compensation by mentioning the problems with measuring radon present in areas alongside other nuclides of interest, which could lead to false alarms. He stressed the need to be able to quantify the radon level cheaply and quickly using reliable instrumentation. Problems have been encountered when a monitor has been set up in a workshop prior to use on plant and found to give erroneous radon alarms when used in earnest and the need to have a good understanding of the area to be monitored, the likely changes in radon levels, the radon equilibrium level in the area and the usual area flow rate.

7.2 Julian started a discussion on radon compensation by outlining topics raised from previous meetings, i.e.:

- Users sometimes uncertain what compensation method is in place
- No UK facility for alpha particulates for testing monitors
- Standard test verification methods would be useful for the manufacturers
- Measurement problems arising from low alpha DACs
- Calculation of uncertainties
- Difficult to monitor some areas (e.g. Radon waste stores)

7.3 A lively discussion followed with requests for the sourcing of a room where instruments could be exposed to a known radon atmosphere and their performance compared under a standard set of conditions. The use of candle-wax for generating aerosols was thought to be unsuitable.

7.4 NPL is to prepare a report on the need for a UK radioactive aerosol facility as part of its current programme. This will be presented to the group at a future meeting (see below).

7.5 The problem of an operator incorrectly setting the instrument's radon compensation level and the need to avoid building specific algorithms in radon compensation were discussed. The requirement for a guidance document on radon measurements was again expressed.

## **8. NPL talk: A new NPL project to report on needs for standard radioactive aerosols - Julian Dean**

8.1 Julian informed the meeting that NPL, as part of its current programme, is to write a report on industry and user group needs for a UK facility for the exposure of radioactivity in air monitors to labelled aerosols. The report would outline possible options to enable monitor exposure, how these could be realised and the likely costs of setting up such a facility. This will involve consultation of the ARMUG or a Working Group from it, literature searches and theoretical calculations. This is to be available by September 2010. Julian then asked the group for their reaction to this and for their thoughts on how to proceed.

8.2 Questions were posed on the funding for the report (the answer being that it would be within the NMS programme) and for the facility once it is set up (as yet to be decided). Another question was on whether the facility would be solely for radon or would other nuclides be included – other nuclide were expected to be available in conjunction with radon. The chairman was actioned to arrange a meeting with ARMUG members to take the project forward (see **Action A8.5**).

## **9. NPL talk: NMS AIR programme strategy and formulation - Alan DuSautoy**

9.1 Alan introduced the change to NPL programme formulation, which is now based on a 'rolling' annual cycle and gave an overview of the current programme. He outlined the timetable for the review of existing projects' progress and announced the September 2009 deadline for the proposal of new projects to begin in October 2010. An overview of the current ionising radiation programme was available as a 'roadmap' for the group to view and Alan was available after the meeting to enable individuals to comment on the proposed strategy, which is at the public consultation stage until the end of 2008.

9.2 Questions from the group included one on how the group could get ideas incorporated into project formulation. Alan outlined the process that suggestions ideally would need incorporation into the strategy or to be in line with it and from there would be considered for inclusion within the project framework and hence funding would follow. He is involved with taking a UK perspective for the NPL programme, which is based on the economic benefit, improving the quality of life and the scientific benefit of the proposal.

9.3 Another question related to the granting of short term funding and queried the planning for the longer term. Alan responded that the time scales were over 6-10 years for the complete planning process, with funding from DIUS spread over 5 years.

## **10. Any other business and date of next meeting**

10.1 The chairman confirmed that the presentations given at the meeting would be freely available and placed in pdf format on the ARMUG web page.

10.2 A request for topics for the next meeting was re-iterated and interest was expressed for future presentations on general radon issues, the effects of radon on measurements made with tritium in air monitors, further information on filter monitoring and measurements and also on sample line losses. The progress of the working group writing the Good Practice Guide on positioning of monitors in the workplace will also be reported at the next meeting.

10.3 ARMUG members were actioned to join Pete Burgess and David Kirkland and give presentations at the next meeting! Julian Dean will present the results of the radiochemical analysis of 'real' contaminated air filters received by NPL (see **Action A8.2**).

10.4 Proposed dates for the next meeting were 12, 13, or 14 November 2009.

## **11. Actions arising from this meeting**

Action A8.1: Chairman and Secretary to review information-gathering method to replace ARMUG questionnaire.

Action A8.2: Chairman to report results of analyses of users' air filters at next ARMUG meeting

Action A8.3: Chairman to identify standards relevant to air sampling and monitoring

Action A8.4: Chairman to arrange meeting of a working group to produce guidance on interpretation of air-filter data

Action A8.5: Chairman to arrange meeting with ARMUG members to progress report on needs for a UK aerosol facility

Hilary Phillips  
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