

BEACH MONITORING STEERING GROUP (BMSG)

Meeting no. 9.

Date Thursday 26th January 2006

Location Apex International Hotel, Grassmarket, Edinburgh.

Present	Dr Joe Toole (Chair)	UKAEA Dounreay
	Mr Peter Burgess (PB)	UKAEA Harwell
	Dr Andrew Tyler (AT)	University of Stirling
	Dr Mike Youngman (MY)	Radiological Protection Division, HPA, Chilton
	Mr Mike Woods (MW)	Ionising Radiation Metrology Consultants Ltd

Mr Stephen Innes Secretary UKAEA Dounreay

Apologies were received from Dr Philip Day.

MINUTES

1. Review of Minutes and Actions from previous meeting.

The minutes from the 6th and 8th meetings were reviewed prior to their publication on the UKAEA website. It was agreed to remove Item 3, 'Assessment of six tenders for systems testing' from the web version of the 6th meeting's minutes. Similarly, Item 3, 'Results of the tests and discussion', is excluded from the web version of the minutes from the 8th meeting.

Action 9.1 Make the agreed amendments to the minutes of the 6th and 8th meeting and post them on the UKAEA website. (SI)

Action 8.1 Make the necessary changes to the minutes from the 7th meeting and post them on the UKAEA website. (SI)
Action complete.

Action 8.2 Insert the 'Sandside cores' results from 2004 alongside those from the test-bed builders sand for comparison in the previous meeting's minutes. (SI)
These tables are attached as Appendix A in the minutes from the 7th meeting.
Action complete.

Action 8.3 Contact those organisations which participated in the Harwell detector trials but have yet to submit a report with their conclusions. (SI)
All six participants' reports have been submitted and were discussed at the present meeting.
Action complete.

Action 8.4 Provide participant 2 with further information on their test-bed trials. (SI)
Participant 2 had some problems reconciling the results from the tests with the data in their files. Further information was provided and a report was subsequently submitted.
Action complete.

Action 8.5 Compile the scores from meeting 8 into Tables in the meeting Minutes. (SI)
Action complete.

- Action 8.6 Provide the members with the results from Participant 2's detectors during objective 1. (SI)*
Action complete.
- Action 8.7 Provide the members with Participant 2's correspondence about their plastic scintillators. (SI)*
Action complete.
- Action 8.8 Correct the errors that were identified in the test-bed spreadsheet results. (SI & all)*
Action complete.
- Action 8.9 Agree on the relative weightings for each objective. (all)*
This was discussed further at the present meeting.
- Action 8.10 Obtain calibrated activities for the sources used in the test-bed trials. (PB)*
The report is attached as an appendix in these minutes.
Action complete.
- Action 8.11 Find out if the beach monitoring contract will be required to go through a OJEU, EoI and tendering process. If so, this will provide important cost information. (JT)*
The UKAEA 'contracts' department have issued guidance stating that a further OJEU is not required.
Action complete.
- Action 8.12 Find out what actions are required for the members to select monitoring systems that are better than those currently available and thus fulfil the BMSG Terms of Reference. (JT)*
Action complete.
- Action 8.13 Using the results from the test-bed trials, compose (for possible publication in an OJEU notice) the selection criteria for a beach detection system. (JT & all)*
Action closed.

2. Participants reports – significant points

The aim of reviewing the participants' reports is to establish whether they disclose any information that adds value to the corresponding (Harwell test-bed) results.

The remaining minutes from this section are confidential.

3. Results Scoring and Weighting

Tables 1 & 2 (see below) from the Harwell test-bed trials together with their weightings were drawn up and compared. The weightings reflect the view of the group that sensitivity directly underneath the detector (Objective 1 scores) is fundamental. Conversely, adverse off-axis (Objective 2) results can be engineered out or mitigated in the field.

These tables will allow the members to take a quantitative as well as a qualitative decision on which of the six participants' offer a significant overall improvement over the present system and should be recommended for participation in any forthcoming tender process. They show that despite weightings being assigned independently and in two different ways, the overall rankings (in parenthesis) are similar.

The remaining minutes from this section are confidential.

4. Recommendations to report to UKAEA

The BMSG's recommendations to UKAEA management will be made in a report due at the end of March. It will state and justify which companies should be included in any forthcoming tender process for the beach monitoring contract which, under present circumstances, expires in mid 2007.

The deliberations of the Group had to take into account the likelihood of the regulator setting more demanding monitoring and detection criteria in the near future. It is known that SEPA are considering draft recommendations from their technical advisors on monitoring targets. In addition, the BMSG must demonstrate that progress is being made in moving towards SEPA's stated target of detecting 750Bq particles at a depth of 5cm. All of the systems tested demonstrated different degrees of improvement, although they never came close to such a desirable target.

Several other of the requirements, e.g. coverage rates, vehicle type, costs etc. will be evaluated during the tender phase.

Action 9.3 Write a draft report of the BMSG's recommendations and circulate by the 14th February 2006. (MW)

Action 9.4 Comments (in 'Track Changes' format) to the draft report to be sent to MW and copied to JT by the 3rd March 2006. (All)

Action 9.5 Agree a final version by the 24th March 2006. (All)

5. Review of Confidential Items

It was agreed that Items 2 and 3 should remain confidential.

6. A.O.B.

The BMSG are hopeful that a scientific paper could be prepared for publication if the participants give their approval for their results to be presented anonymously. Potential journals include Health Physics and The Journal of Environmental Radioactivity (JER).

JT asked that the members submit invoices before the end of the current financial year.

Appendix A

1 ACTIVITY OF THE SANDPIT TEST SOURCES

1.1 Introduction

Three Cs-137 and one Co-60 test sources were used in the process of evaluating beach monitoring detectors. Their nominal activities were (Cs-137) 30 kBq, 100 kBq and 300 kBq and (Co-60) 100 kBq. The uncertainty associated with these values is probably not significant, given the other uncertainties associated with the detector assessment process. However, a short set of measurements was performed to confirm that the true activities are close to the nominal values.

1.2 Method

The method adopted was to mount the sources with the source centre 200 mm from the front face of a Ludlum 44-10 sodium iodide scintillation detector connected to an Electra ratemeter. The sources and the Electra were supported on a large, empty, cardboard box to minimise scatter. The Electra was used in gross gamma mode, with an energy threshold of about 25 keV. This means that the vast majority of the gamma events occurring in the detector will be counted, as will the K X-ray emissions. The crystal is a 2 inch diameter, 2 inch deep, unit. The detection probability for such a crystal for a parallel beam is 74 % for 662 keV photons and 62 % for 1.25 MeV photons (Reference 1, figure 10.24). For the Cs-137 K X-rays, the detection efficiency will be high, but there will be a slight loss due to attenuation in the can and some attenuation in the source itself. I have introduced a factor of 0.5 to allow for this.

At the separation used, the beam is slightly divergent. To allow for the divergence of the beam, the centre of the detector is used as the reference for the energetic emissions. This will allow for the fraction of energetic photons which has a very short path length within the crystal.

The front of the crystal subtends 4.13×10^{-3} of the solid angle viewed from the source. The centre of the crystal subtends 3.24×10^{-3} of the solid angle viewed from the source. The emission probability for the K X-rays is 7% and for the gamma line is 85 %.

Net count rate per Bq (Cs-137)

$$\begin{aligned} &= 0.07 \times (4.13 \times 10^{-3}) \times 0.5 + 0.85 \times (3.24 \times 10^{-3}) \times 0.74 \\ &= 2.18 \times 10^{-3} \text{ s}^{-1} \end{aligned}$$

The X-ray contribution is 6 %.

Hence the activity for Cs-137 (Bq) = 458 x net count rate.

$$\begin{aligned} \text{For Co-60, the net count rate per Bq} &= 2 \times (3.24 \times 10^{-3}) \times 0.62 \\ &= 4.02 \times 10^{-3} \text{ s}^{-1} \end{aligned}$$

Hence the activity for Co-60 (Bq) = 249 x net count rate

Inevitably, there will be some scatter which will be enhancing the count rate, including back-scatter from the PM tube and other components of the detector. I have allowed 5 % for this in the final calculation, reducing the Cs-137 value to 436 and the Co-60 value to 237.

1.3 Results

Nuclide	Nominal activity (kBq)	Gross count rate (s ⁻¹)	Net count rate (s ⁻¹)	Measured activity (kBq)
BG	--	91	0	--
Cs-137	30	164	73	32
	100	357	266	116
	300	855	764	333
Co-60	100	522	431	107

The uncertainty in the calculations above will be about 10 %, dominated by the estimation of effective solid angle subtended. The manufacturer's production tolerance for this type of source is -10 % to +30 %.

These sources are well within tolerance.

1.4 Reference

Knoll, Glenn F, Radiation Detection and Measurement (third edition), John Wiley and Sons, Inc, 1999

Peter H Burgess

20/12/05