Prior Risk Assessments (Ionising Radiations Regulations 1999, Reg.7)

At Sheffield we have always had a work certificate system which requires prior evaluation and approval of research work involving the use of ionising radiations. We have therefore always been carrying out 'prior risk assessments'. It has been decided that we could further enhance our system by the introduction of two innovations.

1) The first is a requirement for a 'justification' statement in the work certificate application. 'Justification' was going to be a requirement of IRR99 but was dropped from the legislation. It is of course one of the main principles of radiation protection. The requirement for justification for the use of radioactive materials is being taken up by the Environment Agency. All small users, including universities, are now expected to follow 'best practicable means' (bpm) in their use of radioactive materials. This places new emphasis on justifying the use of radionuclides and minimising the quantities used and the waste generated. One way in which we will be demonstrating this is by introducing the following section into the work certificate application form:-

Justification statement

Use of radionuclides must be justified and quantities used kept to a minimum. Alternative techniques should be investigated. Cost can be a justification provided the risk from radiation exposure is low.

We need to use the above radionuclides because:

This should not be an onerous requirement because in the majority of cases the main reason for using radionuclides is that they offer the best technique and there is no viable alternative, or the alternative is very expensive. You will see that we state that cost can be a justification provided the risk from radiation exposure is low. How do we quantify that risk? It is easy to measure the external hazard and guard against it by working behind screens. All our monitoring shows minimal exposure, but what about the potential for internal exposure? That brings me to our second innovation.

2) In the work certificate itself there will be a statement as to the potential internal dose per annum from the proposed work assuming normal work practices. To put this into perspective people will be reminded of our annual dose from natural sources. To enable DRPSs and work supervisors to assess current work and assist with the justification statement required for new work, the table below has been produced giving potential internal doses from work with the common radionuclides and typical working quantities.

The NRPB model M443[1], that we have used in relation to designation of areas and in the assessment of foetal doses, can be used to estimate potential doses from working with a given amount of material. For example, for work in a Grade C laboratory 0.2mSv/y internal dose equates to working with up to 120 ALIs (annual limit of intake) for non-volatile radionuclides. So for P-32, somebody routinely working with 37 MBq (half maximum permitted in use in the area), this would equate to:-

[1] NRPB-M443 Categorisation and Designation of Working Areas in which Unsealed Radioactive Materials are used. Hudson AP, Shaw J, Dec 1993

0.2 x 74/740 = 20uSv/y (740MBq = 120ALIs)

The model assumes that half the maximum amount in use in the area is in one single pot and could be used in a single experiment and that the following exposure pathways may occur:-

- Intakes during routine work - up to 3 days/week
- Minor releases during routine work - 25 times/year
- Minor releases during transfer from storage - 2 times/year
- Major releases during routine work - once/year
- Major releases during transfer from storage - once/year

(In the event of a major release it would be prudent to undertake biological monitoring to validate the model.)

Assessment of potential internal dose for work in a Grade C lab				
Radionuclide	**Bench or FC (ALIs for 0.2mSv/y)**	**Max activity permitted**	**Typical usage**	**Potential internal dose**
H-3 (OBT)	Bench (120 ALI)	56 GBq	37 MBq	0.3 uSv/y
C-14	Bench (120 ALI)	4 GBq	37 MBq	3.7 uSv/y
C-14 (volatile)	FC (30 ALI)	1 GBq	185 MBq	74 uSv/y
S-35	Bench (120 ALI)	1.8 GBq	37 MBq	8.2 uSv/y
P-32	Bench (120 ALI)	740 MBq *	37 MBq	20 uSv/y
P-33	Bench (120 ALI)	1.7 GBq	37 MBq	8.7 uSv/y
I-125 (fixed)	Bench (120 ALI)	156 MBq	5 MBq	12.8 uSv/y
Cr-51	Bench (120 ALI)	64 GBq	37 MBq	0.2 uSv/y
Assessment of potential internal dose for work in a Grade B lab (NB 10 times permitted quantities for same 0.2mSv/y dose constraint because of higher standards of containment)				
H-3 (water)	FC (300 ALI)	330 GBq	1 GBq	0.6 uSv/y
C-14 (volatile)	FC (300 ALI)	10 GBq	740 MBq	29.6 uSv/y
P-32	Enclosure (1200 ALI)	7.4 GBq*	740 MBq	40 uSv/y
I-125 (volatile)	FC (300 ALI)	390 MBq	74 MBq	76 uSv/y

*NB - These P-32 figures relate just to the internal hazard, because of the external hazard permitted quantities in a supervised area are restricted to 1/10 of the above levels.

The comparator for the above potential internal doses is the dose from the natural background (approximately 2200 uSv/y). It can clearly be seen from the above table that, given our typical small scale usage, potential internal doses are very low and equate to a very low level of risk. The theoretical risk factor associated with work with ionising radiations is 1:25 000 risk of developing a fatal cancer from 1mSv exposure. 10uSv exposure therefore equates to a risk factor of 1:2 500 000 which is insignificant.

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