CLASSIFICATION OF WORKERS USING OPEN/SEALED SOURCES OF RADIOACTIVE MATERIALS

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The finalisation of the European Directive on basic safety standards now means that member states of the EC must introduce legislation to implement the Directive. In the nuclear industry criteria for classification of areas could be related to the Annual Dose receive by workers in the industry.

In research laboratories, and hospital and higher education research laboratories the doses measured by workers are of the order of 2mSv per year. Therefore criteria (based on a different parameter) than dose received, needs to be considered.

The International Commission Radiological Protection[1] uses two designation of areas, controlled and supervised. Supervised areas require less administrative control but some control is necessary to ensure the doses outside the boundary are suitable for members of the general public. The ICRP in publication 68[2] recommends the use of dose coefficients e(50) which corresponds to the committed effective does E(50) resulting from an intake of 1Bq of the radionuclide.

For internal exposure it is recommended that the Annual Limit on intake should be based on a committed effective dose of 20mSv

so $$ALI = \frac{0.02}{e(50)}$$

Designation of Workers Using Open Sources

Most of the establishments above tend to designated the area and then classify the worker accordingly. Contamination is rarely present and some indication of the activity which could be handled in a supervised area would help the administrative requirements and help also to remove anomalies different establishments.

Previous papers[3] have indicated that of the total activity handled, allowing for some difference in volatilities, that of the total activity handled the fraction inhaled.

Hence allowing a factor of 3/10 for non classified workers.

Activity handled $= 10^4 \times 3/10 \text{ ALI} = 3 \times 10^3 \text{ ALI}$

$$= 3 \times 10^3 \frac{0.02}{e(50)}$$

$$= \frac{60}{e(50)}$$

where e(50) = dose coefficient

Using the dose coefficients given in ICRP8 to derive the ALI for inhalation. The table indicates the activity which may be handled, before the need for imposing greater administrative controls.

	Activity Handled Bq	e(50)	ALI Bq
$^{3}H_20$	3.3×10^{12}	1.8E-11	1.1×10^{9}
$^{3}H(OBT)$†	1.4×10^{12}	4.IE-11	4.8×10^{8}
$^{14}C_{dioxide}$	9.3×10^{12}	6.5E-12	3.1×10^{9}
^{32}P	7.5×10^{10}	8.0E-10	2.5×10^{7}
^{33}P	6.3×10^{11}	9.6E-11	2.1×10^{8}
^{35}S(vapour)	5.0×10^{11}	1.2E-10	1.7×10^{8}
^{125}I(vapour)	1.1×10^{10}	5.3E-09	3.8×10^{6}

* Dose due to the activity not absorbed through the skin is not included
† gaseous form

The administrative controls which can be relaxed include the use of Approved Dosimetry Services (UK)[4] for dosimetry purposes, rigid laboratory procedures and regulations relating to movement of radiation workers between member states[5,6].

Use of one or more radionuclide.

The activity handled would need to be reduced if more than one radionuclide is used. This is frequently the case in the type of laboratory referred to above.

The activity handled of each radionuclide can be derived quite simply by estimating the fraction of the ALI to be used.

		activity handled
^{32}P	1/10 ALI	7.5×10^{9}
^{35}S	1/5 ALI	1.0×10^{11}
^{3}H	7.10 ALI	1.0×10^{12}

Figure 2 Activities Handled in Multiple Use

The sum of the ALI's must not be greater than 1.

In the case of radionuclides with a high beta, or gamma dose rate it may be necessary to use additional shielding to reduce the workers occupational exposure. This may be a limiting factor in the activity handled.

External Exposure

The revised European Directive[7] will probably set a level of 6mSv above which workers should be designated as Category A or classified workers under UK legislation. Existing UK legislation[8] sets a dose rate of $7.5 mSvh^{-1}$ as the level above which a worker should normally be classified. The use of a time average dose rate over an 8 hour period, so as not to exceed $7.5 \mu Svh^{-1}$, allows some flexibility.

If the new European Legislation requires the designation level to be set at $6mSvy^{-1}$ corresponding to $3\mu Svh^{-1}$ the time average dose rate could be changed to $100\mu Sv$ over a 40 hour period. This would then give an average dose rate of $2.5\mu Svh^{-1}$ which would satisfy a 6mSV designation level.

This would also help reduce the potential for over classification using open sources as discussed earlier.

Conclusion

The classification of workers using open sources need to be considered in the implementation of the Directive the above could use.

References

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