

Radiation Guideline 1: Monitoring devices



Department of
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For further information on the matters discussed in this document contact the Department's Radiation Control Section on (02) 9995 5959 or email radiation@environment.nsw.gov.au.

Published by:

Department of Environment and Conservation (NSW)
59–61 Goulburn St
Sydney NSW 2000
PO Box A290
Sydney South 1232
Phone: (02)9995 5000 (switchboard)
Phone: 131 555 (information and publications requests)
Fax: (02) 9995 5999 (publications requests)
Email: info@environment.nsw.gov.au (publications requests)
Website: www.environment.nsw.gov.au

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1. Introduction

Clause 20 of the Radiation Control Regulation (2003) requires that an employer must ensure that all monitoring devices, that are issued or installed in accordance with the requirements of Division 2 of the Radiation Control Regulation, are checked, maintained and calibrated in accordance with the conditions outlined in this Guideline. The purpose of this Guideline is to prescribe those requirements.

The monitoring devices covered in this Guideline are:

- personal monitoring devices
- portable area monitoring devices
- fixed area monitoring devices

2. Personal monitoring devices

2.1 A personal monitoring device is designed to measure, over a specified period of time, the radiation dose received by a person who is occupationally exposed to radiation.

2.2 Common personal monitoring devices include:

- photographic film badges
- thermoluminescent dosimeters (TLD)
- direct reading pocket dosimeters
- Optically stimulated devices (OSD).

Other specialised personal monitoring devices are available for monitoring the radiation dose received by a person if there is a possibility of exposure to neutron radiation.

2.3 Photographic film badge, TLD and OSD personal monitoring devices can be obtained from an organisation that is approved by the Regulatory Authority to offer a personal monitoring service.

2.4 A personal monitoring device is issued to an individual who is occupationally exposed to radiation. It is for their use only and must not be used by any other individual or for any other purpose. It must be subject to the following conditions:

- (a) a photographic film badge must be used once only for the duration of its issue period. At the end of that period it must be returned promptly to the issuing organisation for assessment of the radiation dose that it has recorded. A new photographic film badge dosimeter is issued for the next issue period.
- (b) a TLD or an OSD must be used for the duration of its issue period. At the end of that period it must be returned promptly to the issuing organisation for assessment of the radiation dose that it has recorded. After assessment, a replacement dosimeter may be issued for the next issue period.

(c) a direct reading pocket dosimeter must be read at the end of the issue period. It can only be re-issued to the original wearer, or another wearer, after its reading has been noted and recorded. Preferably the reading on the direct reading pocket dosimeter must be reset to zero before it is re-issued.

- 2.5 Records of the dose received by each occupationally exposed person who is issued with a personal monitoring device must be kept by the employer as required by clause 18 of the Radiation Control Regulation 2003.
- 2.6 Care must be taken with each personal monitoring device to ensure that it is not subjected to environmental conditions or mishandling which may affect its reading or damage the device. Factors that may cause adverse effects include mechanical impact and exposure to heat, chemicals or water.

3. Portable area monitoring devices

- 3.1 Portable area monitors, often known as survey meters or portable monitors, are used to measure ionising radiation dose rates or levels of radioactive contamination on surfaces in premises in which radioactive materials and/or irradiating apparatus are used. In some cases, a portable monitor designed to measure radiation dose rates may also be capable of measuring integrated doses.
- 3.2 When using an area monitor the following requirements must be observed:
- 3.2.1 The employer must ensure that the monitor is suitable for the type of measurement for which it is to be used and that it is always fully operational and properly calibrated. If a monitor is used to measure ionising radiation dose rates, it must be capable of measuring the type of radiation being assessed over the range of energy and dose rate required. If a monitor is used to measure radioactive contamination, it must be capable of measuring the type of radiation emitted by the contamination over a sufficient range of contamination levels.
- 3.2.2 The person using the monitor must be familiar with the instrument and its capabilities and must be able to interpret its readings correctly.
- 3.2.3 The batteries of a portable monitor must be checked each time before use and must be replaced when the monitor battery indicator shows that this is necessary.
- 3.2.4 Each portable monitor must be checked with a known radioactive check source each time before it is used to ensure that it is functioning correctly.
- 3.2.5 Each portable monitor must be calibrated at least once every twelve months and each time after it has been serviced or repaired. The calibration must be traceable to a:
- (a) national primary standard, or
 - (b) a secondary or tertiary standard that is traceable to the national primary standard.

The term 'traceable to the national standard' may be interpreted as traceable to an international standard or the primary national standard of any country.

4. Fixed area monitors

- 4.1 A fixed area monitor is used in a specific location to indicate variations in the radiation field at that location and to provide an alarm if the dose rate, or integrated dose, at that location exceeds a specified level. A fixed area monitor may be mains-operated or battery-operated; the former is preferred.
- 4.2 Each fixed area monitor must be:
 - 4.2.1 Designed to detect the type of radiation likely to be encountered at its location.
 - 4.2.2 Provided with an indication of the condition of its batteries, if battery operated.
 - 4.2.3 Provided with a clearly audible, and/or visual alarm capable of being set to any required level.
- 4.3 Each fixed area monitor must be:
 - 4.3.1 Checked, at least once every week, with a known radioactive check source, to ensure that it is operating correctly.
 - 4.3.2 Calibrated at least once every twelve months and each time after it has been serviced or repaired. The calibration must be traceable to:
 - (a) a national primary standard, or
 - (b) a secondary or tertiary standard that is traceable to the national primary standard.

The term 'traceable to the national standard' may be interpreted as traceable to an international standard or the primary national standard of any country.

Calibration certificates/reports for radiation survey meters

The information in this Appendix is provided for accredited Consulting Radiation Experts (CRE) and the organisations that calibrate radiation survey meters for CREs.

Certain Environment Protection Authority (EPA)* guidelines, such as 'Recommendations for Minimum Standards and Safety Requirements for Fixed Radiation Gauges (Sealed Radioactive Sources)' have a requirement that the only acceptable calibration certificates for radiation survey meters are those issued by a laboratory having a national primary standard or a secondary or tertiary standard that is traceable to the national primary standard.

The term 'traceable to the national standard' may be interpreted as traceable to an international standard or the primary national standard of any country. In Australia the responsibilities for such standards are as follows:

- Exposure – Australian Radiation Protection and Nuclear Safety Agency
- Activity – Australian Nuclear Science and Technology Organisation
- Absorbed Dose – Australian Nuclear Science and Technology Organisation.

To register or re-register a fixed radiation gauge, an inspection must be carried out by a CRE. The registration inspection report provided by the CRE to the owner after an inspection must include a copy of the calibration certificate for each radiation survey meter used.

The EPA requires that the following information must be included in a calibration certificate/report.

1. The calibrating organisation used by a CRE must provide a background document, to be made available to the EPA on request, which establishes how that organisation achieves traceability. This must provide details of:
 - (a) how each radiation source used in the calibration process was calibrated in accordance with the national standard
 - (b) any 'secondary standard' instrument used to calibrate the organisation's radiation sources/fields and its calibration traceability.
2. The calibration factor (CF) is defined as the numerical factor by which the values indicated by the radiation survey meter under calibration must be multiplied to obtain the corresponding known values obtained from the calibration, i.e. $CF = IT/II$ (where II is the indicated reading and IT is the true reading).
3. The calibration certificate/report for each radiation survey meter must:
 - 3.1 clearly explain and define all terms used on the certificate/report such as response, stability, accuracy, error etc
 - 3.2 provide information on all conversion factors used in the calibration process

* In September 2003, the EPA became part of the Department of Environment and Conservation (NSW).

3.3 state the confidence level of the calibration

3.4 include the following information, as a minimum:

- (a) The name and address of the calibration organisation, the date of the calibration and a unique identification number which identifies the calibration certificate/report. This identification number must appear on each page of the calibration certificate/report.
- (b) Identification data for the radiation survey meter (manufacturer, model type/number, serial number), the name and address of the owner of the radiation survey meter, the date it was received for calibration and the date of calibration.
- (c) A description of the calibration conditions, calibration method and calibration standards used including:
 - a description of the radiation source(s) used for the calibration including its beam quality or energy, the distance from the source to the calibration position, the size of the field at the calibration position and the exposure rate, kerma rate or absorbed dose rate during calibration
 - a description of reference conditions of the radiation survey meter i.e. method of use during calibration, switch positions and scale points at which the calibration was carried out and angle of the detection device relative to the radiation beam axis
 - a detailed description of the calibration procedure i.e. direct substitution technique
 - details of the secondary standard instrument used by the calibration organisation and the date of its most recent calibration traceable to a national primary standard.
- (d) The calibration factor(s) to be used with the radiation survey meter under calibration, specifying how it is to be applied to the responses of that meter:
 - the temperature, pressure and humidity at which the calibration factor has been normalised must be stated, where appropriate;
 - the uncertainty, or accuracy, associated with the calibration factor must be stated together with an explanation of its derivation.
- (e) Where there is an applicable legal requirement for the period within which the radiation survey meter must be recalibrated, the date of recalibration must be specified, otherwise a recommended recalibration date must be specified.
- (f) The signature and position of the person responsible for calibration at the calibration organisation must be provided. The signature(s) or initials of the person(s) who carried out the calibration must be provided on every page containing any calibration data in the calibration certificate/report.

Traceability of wipe-test measurements

Measurement of a wipe-test medium used to check the leakage of radioactive contamination from a fixed radiation gauge (FRG) must be carried out by a laboratory which has a calibrated contamination reference source traceable to a national primary standard.

Ideally the calibrated contamination reference source should be the same as the radionuclide contained in the FRG. If this is not possible the calibrated contamination reference source radionuclide must be selected with energies close to those expected.

The results of the wipe-test measurement report must contain:

- (a) information which establishes how the traceability is achieved
- (b) the activity measured on the wipe medium and the date measured
- (c) full details of the calibrated contamination reference source (radionuclide, serial number, activity and assay date)
- (d) details of the laboratory measuring equipment used (type, serial number, and manufacturer).