



Australian Government

Department of Education, Employment and Workplace Relations

PSPRAD709A Select, commission and maintain radiation measuring instruments

Revision Number: 2

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Modification History

PSPRAD709A Release 2: Layout adjusted. No changes to content.

PSPRAD709A Release 1: Primary release.

Unit Descriptor

This unit covers the ability to provide sufficient, fully functioning radiation measuring instruments to implement an organisation's radiation management plan and monitoring programs. This involves identifying the need for specific kinds of instruments, determining the suitability of available instruments, procuring and commissioning instruments, checking their serviceability and calibration, performing routine maintenance, training staff to operate instruments correctly, and maintaining relevant records.

These tasks would be performed under the authority of a responsible person and in accordance with radiation protection safety standards, codes and guidelines.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

Application of the Unit

This unit of competency applies to personnel with a radiation safety coordination role. They may work as, or assist, a radiation safety officer working:

- at a mine or plant that processes radioactive ore and minerals
- with instruments that emit ionising radiation at geotechnical, construction, mining and manufacturing sites, or analytical and research facilities
- in a laboratory or licensed facility that handles radioactive materials or has radiation-emitting apparatus
- in a nuclear facility.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where ***bold italicised*** text is used, further information is detailed in the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Procure suitable instruments	1.1. Determine types of ionising radiation measuring instruments required by the organisation to monitor hazards associated with current or future radiation-related work activities and refer to radiation protection safety standards, codes and guidelines, if necessary. 1.2. Research information about specifications and features of instruments that may be suitable and their suppliers. 1.3. Liaise with suppliers and/or conduct tests to compare the stated performance of available instruments against the organisation's specifications. 1.4. Seek advice and assistance with evaluating instruments if beyond own technical competence. 1.5. Select the most suitable instruments and arrange for their procurement.
2. Commission new instruments	2.1. Use manufacturer's documentation to develop a thorough understanding of instrument operation, functional test procedures, routine instrument checks and maintenance requirements. 2.2. Ensure that the instrument has been calibrated appropriately for its intended use(s). 2.3. Conduct component checks and test measurements to confirm instrument performance for intended use(s). 2.4. Enter required information about the new instrument into the organisation's information management system. 2.5. Develop and document clear procedures for operating, caring for and maintaining the instrument.
3. Train instrument operators	3.1. Identify the skills and knowledge required to operate the instrument safely and reliably in the workplace and interpret the radiation quantities measured. 3.2. Develop appropriate training program for instrument operators using established adult learning principles. 3.3. Ensure that each operator can use the instrument competently for the required measurement applications. 3.4. Record training outcomes in accordance with regulator requirements and organisational procedures. 3.5. Audit operators' use of instruments at regular intervals to ensure their ongoing competence.
4. Maintain instruments fit for	4.1. Conduct regular instrument checks and minor maintenance in accordance with organisation's

purpose***radiation management plan.***

- 4.2. Check instrument calibration using specified standards and procedures, and record relevant information.
- 4.3. Troubleshoot basic faults and determine whether local repair or maintenance is technically possible and economic.
- 4.4. Arrange for repair or servicing from an accredited agent or other appropriate personnel in accordance with organisation's procedures.
- 4.5. Check instrument's performance after repair or service before approving it for use.
- 4.6. Maintain ***required records*** that are complete, accurate, legible and secure.

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

- recognising:
 - types of measuring instruments, such as air proportional, gas proportional, gas ionisation, Geiger-Muller (GM), compensated GM, scintillation, neutron monitors, solid state, and personal dosimeters (badge and electronic)
 - advantages and limitations of their use
- locating, interpreting and comparing information about measuring instruments used by organisation
- selecting suitable instruments by analysing factors, such as intended use (fixed/portable, laboratory/field), range of radiation types, intensities and energies, accuracy, sensitivity, response time, robustness, serviceability and limitations
- conducting pre-use and calibration checks, troubleshooting common faults, conducting basic repairs of and maintaining radiation measuring instruments used in job role
- safely operating radiation measuring instruments used in job role to obtain reliable data
- processing and analysing radiation measurement data and applying established corrections
- interpreting manuals and writing operating instructions for radiation measuring instruments used in organisation
- seeking advice and further directions when faced with unforeseen circumstances or situations that may require decisions or response actions beyond technical competence

Required knowledge

- terms and concepts, such as:
 - ionising radiation, radioactivity, radioactive material, activity, dose, contamination, contamination controls, shielding, half-life, and radionuclide
 - operating voltage, accuracy, response time, sensitivity, detection limit, linearity, source-detector geometry and distance corrections, compensation
- types, energies and properties of ionising radiation (e.g. alpha, beta, gamma, neutron, x-ray, electron), sources and shielding methods
- definitions of radiation quantities, such as exposure, dose, tissue weighting factor, effective dose, dose rate, radiation weighting factor, dose equivalent, and dose limits
- international system (SI) of units for radiation quantities, multiples and sub-multiples
- techniques for conducting measurements and monitoring surveys used in organisation
- characteristics, capabilities, limitations, function of key components and operating principles of radiation measuring instruments used in organisation

- role and importance of regular calibration and pre-use checks and maintenance
- common instrument faults, troubleshooting, and recommended remedial actions and repairs
- common instrument operator errors
- techniques for assessing radiation hazards likely to be encountered in job role
- guidelines and safety procedures for working with radiation sources, based on principles of:
 - reducing exposure time
 - maintaining greatest distance
 - using as much shielding as possible
- health, safety and workplace emergency response procedures relevant to job role

Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessment must confirm the ability to:

- select radiation measuring instruments that will enable the organisation to successfully implement its radiation management plan
- maintain sufficient numbers of fully functioning instruments to satisfy the organisation's predictable requirements
- train instrument operators to use radiation measuring instruments safely and reliably
- keep accurate and complete records relevant to job role.

Consistency in performance

Competency should be demonstrated by the candidate selecting, commissioning and maintaining the radiation measuring instruments relevant to his or her job role.

Pathway

Determining competency for this unit may require checking the candidate's skills against PSPRAD703A Perform basic radiation measurements.

Context of and specific resources for assessment

Competency should be assessed in the workplace or a simulated workplace environment.

Assessment must comply with:

- local regulations regarding the registration of operators, premises and sources at workplaces where radioactive materials and/or ionising radiation equipment are present
- organisation's radiation management plan
- manufacturer's instructions for operating radiation measuring instruments.

Access may be required to:

- registered premises and sources
- supervision by a radiation safety professional
- radiation measuring instruments and monitoring equipment
- appropriate personal protective equipment
- radiation management plan or procedures.

Method of assessment

The following assessment methods are suggested:

- oral and written tests and calculations involving:
 - radiation quantities
 - set-up, calibration and basic maintenance of radiation

measuring instruments

- review of records of instrument selection, use and maintenance generated by the candidate
- review of instrument training materials and records generated by the candidate
- feedback from peers and supervisor that working instruments are available when required
- observation of the candidate checking, using and maintaining radiation measuring instruments.

In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency that are difficult to assess directly.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Ionising radiation may include:

- x-rays, electrons, neutrons, gamma rays, beta particles and alpha particles emitted from radioactive materials, including sealed and unsealed sources
- neutrons emitted from generator tubes
- x-rays generated by industrial radiography equipment, XRF and XRD instruments.

Radiation measuring instruments may involve:

- detectors, such as:
 - air proportional (alpha)
 - gas proportional (alpha, beta)
 - gas ionisation (gamma)
 - Geiger-Muller (beta, gamma)
 - ionisation (beta)
 - scintillation (alpha, beta, gamma)
 - solid state (alpha, gamma)
- signal conditioning, such as:
 - analogue and digital ratemeters
 - pulse height, scalers, single/multi channel analysers, and integrators
- displays, such as:
 - dose and dose rate
 - dose equivalent and dose equivalent rate
 - exposure and exposure rate.

Programs to ***monitor hazards*** may include: surveys and measurements for:

- establishing background levels
- identifying and quantifying radiation near equipment that emits ionising radiation
- identifying areas of elevated activity and possible contamination
- identifying and quantifying radiation contamination at specified locations
- locating discrete radiation sources
- assessing integrity of packaging or shielding
- determining the effectiveness of decontamination
- locating contamination on personnel and equipment
- verifying contamination control boundaries.

Radiation-related work

- extracting, milling, processing and packing radioactive ores
- operating, installing, servicing and calibrating fixed radiation

activities may include:

- gauges, bore hole logging or industrial radiography equipment, moisture/density gauges
- decontaminating and servicing equipment that has been in contact with radioactive material
- XRF and XRD analysis
- collecting, preparing and testing samples containing radioactive materials
- using radionuclides in a laboratory.

Radiation protection safety standards, codes and guidelines may include:

- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) radiation protection series publications, such as:
 - RPS No.1 Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002)
 - RPS No.7 Recommendations for Intervention in Emergency Situations Involving Radiation Exposure (2004)
 - RPS No.6 National Directory for Radiation Protection (2004)
 - RPS No.9 Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005)
 - RPS No.15 Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) (2008)
- requirements of commonwealth, state and territory radiation protection and safety legislation
- definition of a responsible person
- Australian standards.

Specifications and features of instruments may include:

- types of measurements to be performed, such as direct, scanning and sampling
- radionuclides and radiation energies (KeV, MeV) of interest
- detector type, window thickness and density, and probe area
- detector sensitivity and detection limits
- response time
- estimated uncertainty for each range
- single or multi-channel analyser
- interfacing with data loggers and computers
- power and battery requirements
- size and weight
- use under environmental conditions, including:
 - thermal and mechanical stress
 - magnetic and electrostatic fields.

Adult learning principles may include:

- explaining aims and objectives of training program
- linking learning with everyday work tasks
- using a logical sequence of learning activities
- presenting new information in manageable chunks
- providing opportunities to practise new skills and solve common problems
- reinforcing important points
- using a range of questions to check understanding
- providing regular and constructive feedback.

Regular instrument checks

- cleaning

and minor maintenance may include:

- checking and replacing batteries
- checking zero, span and range
- using one or more sources of specific radiation type and energy to check calibration and response in each range
- assessing need for corrections for differences:
 - in source-detector geometry and/or distance
 - between calibration and intended field/laboratory use
- adjusting calibration if authorised to do so
- repairing pinholes in fragile windows
- simple fault finding using instrument manual, error codes and recommended remedial actions.

Radiation management plan should include details of:

- work practices, such as safe working rules and emergency response procedures
- roles and responsibilities of personnel
- radiation monitoring requirements
- control of an incident involving a source
- storage of a source
- accountability and records
- other requirements that may have a bearing on safety.

Required records may include details of:

- purchase records, warranties, and service agreements for instruments
- instrument calibration status
- instrument inspection, faults, servicing and repairs
- instrument use, including operator, time and date, and location
- instrument maintenance schedule and records.

Unit Sector(s)

Not applicable.

Competency field

Radiation Safety.