Australian Government

Department of Education, Employment and Workplace Relations

PSPRAD301 Perform basic radiation measurements

Release: 1

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Modification History

Release	TP Version	Comments
1	PSP12V1	Primary release. Supersedes and is equivalent to PSPRAD703A. AQF indicator updated to reflect usage.

Unit Descriptor

This unit covers the ability to directly measure radiation by following the organisation's procedures and using instruments calibrated by others. Basic radiation measurements will be straightforward involving one or two steps, take a short time and produce results that can be easily compared with specified limits.
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 undertaking radiation-related work activities, including:

- extracting, milling, processing and packing radioactive ores
- operating, installing, servicing and calibrating fixed radiation gauges, bore hole logging or industrial radiography equipment, and 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.

Measurements that are part of this unit would be performed under the authorisation and supervision, or delegated supervision, of a responsible person and in accordance with radiation protection safety standards, codes and guidelines.
The activities may take place:

- 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

ELEMENTS	PERFORMANCE CRITERIA
1. Prepare for radiation measurements	1.1. Confirm purpose, priority and nature of required ***ionising radiation measurements*** and any site access arrangements with supervisor. 1.2. Use organisation's ***radiation management plan*** to obtain information about the ***hazards*** associated with performing the measurements, ***measuring instruments*** and ***safe working rules*** to be used and refer to ***radiation protection safety standards***, ***codes and guidelines*** as necessary. 1.3. Perform and record pre-use checks of measuring instruments and tag or replace faulty items as necessary. 1.4. Check that ***personal protective equipment*** (PPE) and other task-related equipment is fit for purpose. 1.5. Stow measuring instruments and task-related equipment to ensure safe transport to the site and within the boundaries of the site if required.
2. Obtain reliable radiation data	2.1. Operate measuring instruments in accordance with radiation management plan and manufacturer specifications and applying safe working rules to minimise personal radiation exposure. 2.2. Perform measurements at specified locations and times and in accordance with organisational procedures. 2.3. Seek advice if required measurements cannot be made or if specified procedures require modification. 2.4. Conduct regular instrument checks and minor maintenance (e.g. battery changes) if required. 2.5. Take sufficient measurements to ensure reliable data. 2.6. Recognise obvious errors and atypical data, and take ***appropriate corrective actions***. 2.7. Record data with the required precision, accuracy and units. 2.8. Record environmental/site conditions or observations that may impact on data quality.
3. Finalise radiation measurements	3.1. Check for contamination and, if necessary, perform personal decontamination in accordance with radiation management plan. 3.2. Re-stow measuring instruments and task-related equipment to ensure safe transport from the site and within the boundaries of the site if required. 3.3. Record use of PPE and measuring instruments according to radiation management plan. 3.4. Check condition of measuring instruments, PPE and task-related equipment before storing them in

	accordance with manufacturer's recommendations and radiation management plan.
4. Report results	4.1. Record results according to organisational procedures. 4.2. Compare results with relevant radiation limits and identify/record significant differences or atypical results. 4.3. Maintain ***required records*** that are complete, accurate, legible and secure.
5. Respond to potential or actual radiation incidents	5.1. Recognise unusual situations, unexpected hazards, and potential or actual emergency ***radiation incidents***. 5.2. Inform relevant personnel about the situation, hazard or incident and seek their advice. 5.3. Initiate appropriate workplace emergency first response in accordance with instructions, radiation management plans and organisation's ***response procedures***.

Required Skills and Knowledge

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

Required skills

- applying manufacturer's recommended procedures for using and caring for radiation measuring instruments
- applying safe working rules and those parts of the organisation's radiation management plan relevant to job role
- conducting pre-use checks and simple maintenance for radiation measuring instruments and task-related equipment used in job role
- reading scales and displays accurately for a wide range of values
- recording radiation results legibly and with the specified accuracy, precision and units
- regularly assessing and reassessing hazards and taking appropriate protective measures
- seeking advice and further directions when faced with unforeseen circumstances or situations that may require decisions or response actions beyond technical competence
- using and caring for PPE used in job role

Required knowledge

- terms and concepts, such as ionising radiation, radioactivity, radioactive material, activity, dose, contamination, contamination controls, shielding, half-life, radionuclide, and safe distance
- types and properties of ionising radiation (e.g. alpha, beta, gamma, neutron, x-ray, electron), sources and shielding methods
- types of radiation measuring instruments used in job role, such as air proportional, gas proportional, gas ionisation, Geiger-Muller (GM), compensated GM, scintillation, neutron monitors, solid state, and personal dosimeters (badge and electronic)
- definitions of radiation quantities, such as exposure, dose, and relevant dose limits
- international system (SI) of units for radiation quantities, multiples and sub-multiples, and significant figures
- function of key components and operating principles of radiation measuring instruments used in job role
- effects on results of modifying instrument settings and variables
- basic instrument troubleshooting and maintenance procedures
- guidelines and safety procedures for working with radiation sources, based on principles:
  - reducing exposure time
  - maintaining greatest distance
  - using as much shielding as possible
- techniques for assessing radiation hazards likely to be encountered in job role

- 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:

- work safely in a radiation environment
- use measuring instruments to obtain reliable radiation data
- care for radiation measuring instruments and PPE
- record radiation data accurately and report results
- keep accurate and complete records relevant to job role or assigned tasks

Consistency in performance
Competency should be demonstrated by safely undertaking a variety of radiation measurement tasks using appropriate instruments.

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
- appropriate PPE
- organisation's radiation management plan and operating procedures

Method of assessment

The following assessment methods are suggested:

- oral or written tests and calculations involving:
  - radiation terms, principles and quantities
  - pre-use checks, operation and basic maintenance of radiation measuring instruments
  - care and use of specified PPE
- review of radiation data, results and records generated by the candidate
- feedback from peers and supervisor that the candidate consistently applies relevant radiation protection and safety

requirements

- observation of the candidate using and caring for radiation measuring instruments and PPE in a simulated radiation environment

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 measurements may include:	• recording background levels • recording radiation levels during the operation of sealed source equipment • confirming that a sealed source has been returned to the fully shielded position in its container • assessing integrity of packaging or shielding • locating contamination on personnel and equipment • determining the effectiveness of decontamination
Radiation management plan should include details of:	• safe working rules and workplace 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
Hazards may include:	• inhalation of radioactive dust or gas • ingestion of radioactive dust or contaminated food or water • unexpected exposure to sealed or unsealed radiation sources or partially enclosed equipment that emits ionising radiation
Measuring instruments may include:	• air proportional (alpha) • gas proportional (alpha, beta) • gas ionisation (gamma) • Geiger-Muller (beta, gamma) • ionisation (beta) • scintillation (alpha, beta, gamma) • solid state (alpha, gamma)

Safe working rules relevant to performing basic radiation measurements may include:	• safe methods for conducting specific radiation measurements and wipe tests • procedures for recording and reporting results • types and occasions for use of personal monitoring devices • personal decontamination procedures

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)
	• requirements of commonwealth, state and territory radiation protection and safety legislation
	• definition of a responsible person

Personal protective equipment may include:	• gloves, over-boots, safety hats, goggles, face masks, overalls and gowns • respirators or HEPA filter masks
Appropriate corrective actions may include:	• accuracy check of data entry and transcription • logical check of instrument set-up • check of calibration, zero error and drift for measuring instrument • check of source-detector geometry/distance • careful re-reading of procedures and checklists • repeat radiation measurements • seeking advice
Required records may include details of:	• calibration, inspection, and use and maintenance of radiation instruments and equipment • incidents and accidents involving exposure to radiation

Radiation incidents may include:	• exposure of unauthorised personnel entering a controlled area
	• personal exposure above statutory exposure limits and a monitoring result in excess of statutory derived levels of exposure
	• exposure from an uncontrolled, high hazard radioactive sealed source that:
	  • has loss or destruction of shielding
	  • is involved in a transport accident
	  • is lost, missing or stolen

	• has malfunction of its shutter or interlocks • has been dropped during removal from its container • has jammed in an unsafe position • exposure from equipment that emits ionising radiation and has: • loss or destruction of shielding • malfunction of its shutter or interlocks • exposure from dispersed radioactive material caused by: • leakage or radioactive contamination • industrial or laboratory accident • uncontrolled releases of radioactive materials from a mine site, such as dust or contaminated water • dispersion of contaminants following destruction of a high activity sealed source
Response procedures will include:	• instructions for keeping exposures to a minimum, consistent with essential operations through evacuation or otherwise • instructions for notifying relevant competent authority if required

Unit Sector(s)

Not applicable.

Competency field

Radiation Safety.