

MEM13013B Work safely with ionizing radiation

Unit descriptor	This unit covers working safely with ionizing radiation when performing radiographic testing in a range of industrial applications.
Prerequisites	Nil
Competency field	Occupational health & safety
Application of the competency	<p>This unit applies to safely working with ionizing radiation in open or closed sites: on fabrications, structures and components across a wide range of industries. It is a prerequisite to undertaking any other radiographic competency standards unit. The work can relate to scheduled and unscheduled maintenance activities, using general tools, specific radiographic testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>All testing must be completed with particular attention to personal and OH&S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations – for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products – must be subject to safe work habits must be stored and used in accordance with safe work practices.</p>
Related units	None
Band	A
Unit weight	4
Notes	There are no notes for this unit.

Elements	Performance criteria
Elements are the essential outcomes of the unit of competency.	Together, performance criteria specify the requirements for competent performance. Text in italics is explained in the range statement following.
1 Identify the hazards and effects of ionizing radiation in the workplace	1.1 The source of ionizing radiation is identified in accordance with <i>relevant organisational policy and procedures</i> . 1.2 <i>Production of X-rays and gamma rays</i> is explained in relation to radiographic testing activities. 1.3 Attenuation factors of ionizing radiation and the biological effects on living tissue are outlined. 1.4 The biological effects of radiation are identified.

2 Apply radiation safety procedures/plans	<p>2.1 Appropriate ionizing radiation <i>protective measures</i> are employed in accordance with relevant organisational policy and procedures.</p> <p>2.2 SI units of radiation are explained as per the National Health and Medical Research Council/ statutory requirements.</p> <p>2.3 Exposure limits for personnel as laid down by the radiation authorities in Australia are stated and adhered to.</p> <p>2.4 <i>Minimum exposure</i> rates/distances are determined from calculations and charts.</p> <p>2.5 Ionizing radiation sources are operated in accordance with legislation, standards and/or organisational policy, procedures or guidelines.</p>
3 Select and use radiation monitoring equipment	<p>3.1 The tools and equipment necessary to monitor radiation are selected and used as required.</p> <p>3.2 Techniques and system verification checks necessary to monitor radiation are selected and applied.</p> <p>3.2 Safety breaches are documented and/or reported in accordance with organisational policy and procedures.</p>
4 Respond to emergency situations	4.1 Procedures for dealing with both X-ray and gamma ray emergency situations are demonstrated.

Range statement

The range statement provides information about the context in which the unit of competency is carried out. The variables and scope cater for different work requirements, work practices and knowledge between States, Territories and the Commonwealth, and between organisations and workplaces. The range statement relates to the unit as a whole and provides a focus for assessment. Text in italics in the performance criteria is explained here.

The following variables may be present and may include, but are not limited to, the examples listed under the scope. All work is undertaken to relevant legislative requirements, where applicable.

Variable	Scope
<i>Relevant organisational policy and procedures</i>	Legislation Standard operating procedures (SOPs) Australian or international standards Risk assessments Previous testing reports Manufacturer specifications
<i>Production of X-rays and gamma rays</i>	Atomic structure, protons, neutrons, electrons, atomic number, mass number, isotopes Electromagnetic radiation wavelength, frequency, energy relationships, intensity Construction and operation of X-ray tube anode, cathode, target Gas and coolidge tubes Glass and ceramic tubes

	<p>X-ray spectrum</p> <p>Characteristic and continuous spectra effect of voltage and current on continuous spectra</p> <p>Efficiency</p> <p>Natural and artificial radioisotopes</p> <p>Production of radioisotopes</p> <p>Decay mechanisms, alpha, beta-, beta+, and gamma</p> <p>Concept of half life, decay constants</p> <p>Selection of gamma ray sources</p> <p>Units definition of curie, becquerel, conversion of units, multiple units (e.g. GBq), nuclide chart</p>
<i>Biological effects of radiation</i>	<p>Ionisation, absorption, scatter (Compton, Rayleigh, photoelectric, pair production)</p> <p>Attenuation coefficient, absorption edges</p> <p>Units roentgen, rad, coulomb/kg, gray conversions</p> <p>Effects of varying doses on living tissue</p> <p>Somatic effects, genetic effects, cell biology nucleus, cytoplasm</p> <p>DNA, chromosome, mitosis; symptoms, effect of time, ICRP recommendations</p> <p>Dose, dose equivalent, RBE, rem, seivert, conversions</p> <p>Occupancy factor</p>
<i>Protective measures</i>	<p>Personal protective equipment (PPE) including for risks other than ionizing radiation</p> <p>Safety protocols of workplace (e.g. flame limitations in refineries)</p> <p>Signage, barriers/guards</p> <p>Limitations on operation of specific equipment/machines</p>
<i>Minimum exposure</i>	<p>Time, distance, shielding effect of distance, inverse square law</p> <p>Half and tenth value layers</p> <p>Emergency procedures, company procedure codes</p>

Evidence guide

The evidence guide specifies the evidence required to demonstrate achievement in the unit of competency as a whole. It must be read in conjunction with the unit descriptor, performance criteria, range statement and the assessment guidelines for the Metal and Engineering Training Package.

Overview of assessment requirements

A person who demonstrates competency in this unit must be able to safely work with ionizing radiation when performing radiographic testing.

Context of assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where

the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

Interdependent assessment This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with radiographic testing or other units requiring the exercise of the skills and knowledge covered by this unit.

Method of assessment Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Consistency of performance Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

Required skills

Look for evidence that confirms skills in:

- calculating and numerical operations within the scope of this unit
- reading and interpreting charts, written job instructions, specifications, standard operating procedures, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related operations
- checking for conformance to specifications
- using monitoring equipment
- calculating and monitoring radiation
- handling emergencies
- following safety requirements
- assessing risk

Required knowledge

Look for evidence that confirms knowledge of:

- properties of X-rays and gamma rays and principal radioactive sources used in industrial radiography
- attenuation factors
- known biological effects of radiation
- general principles of gas ionisation, photographic effect, luminescence
- use of film, film badges, ionisation chamber devices, quartz fibre, fluorescent, electronic devices accuracy limits (energy/range)
- different SI units of radiation including becquerel, sievert and gray
- exposure limits for personnel as laid down by the radiation authorities in Australia
- the three exposure reduction factors including: time, distance and shielding
- procedures for establishing safe working barriers
- relevant techniques and checks
- emergency procedures
- safety procedures including for:
 - types of X-ray equipment
 - types of isotope cameras
 - shielding materials
 - design and requirements for exposure areas
 - requirements for storage of radioisotopes
- emergency situations, causes and appropriate responses
- hazards and control measures associated with ionizing radiation, including housekeeping
- storage requirements of equipment and materials
- use and application of personal protective equipment
- safe workplace practices and procedures
- legal requirements including;
 - Australian/NSW regulations, code of practice (detail)
 - ICRP recommended limits for various persons and various parts of the body for short-term, long-term and accumulated exposure
 - background radiation
 - duties of RSO
 - requirements for transport
 - IATA regulations
 - obligations of the licensee