



AFP National Guideline on safe working with radiation

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1. Disclosure and compliance

This document is classified **UNCLASSIFIED** and is intended for internal AFP use.

Disclosing any content must comply with Commonwealth law and the [AFP National Guideline on disclosure of information](#).

Compliance

This instrument is part of the AFP's professional standards framework. The [AFP Commissioner's Order on Professional Standards \(CO2\)](#) outlines the expectations for appointees to adhere to the requirements of the framework. Inappropriate departures from the provisions of this instrument may constitute a breach of AFP professional standards and be dealt with under Part V of the [Australian Federal Police Act 1979](#) (Cth).

2. Acronyms

AFP	Australian Federal Police
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
OHS	Occupational Health and Safety
RSO	Radiation Safety Officer

3. Definitions

In this guideline, the following terms have the following meanings -

Control badges - a dosimeter for checking and verifying the radiation dose level of other badges of the same batch.

Effective dose - a measure of dose which takes into account both the type of radiation involved and the radiological sensitivities of the tissues irradiated.

Employee(s) - means a person engaged under s. 24 of the [Australian Federal Police Act 1979](#) (Cth)

Radiation exposure - means, in context, either the circumstance of being exposed to radiation, or a defined dosimetric quantity no longer used for radiation protection purposes.

Industrial radiography equipment - portable x-ray units (eg Inspector 200, XR200, XR150) used by Bomb Appraisal Officers and ACT Policing Bomb Technicians.

Ionising radiation - radiation capable of ionising matter it passes through. Ionising radiation may damage living tissue.

Personal dosimeter/personal monitoring device - a device worn by an individual which measures progressive exposure to radiation over a period of time.

Sealed source - a source of radioactive material permanently contained in a capsule or closely bound in a solid form that is strong enough to be leak-tight for intended use and foreseeable abnormal events.

Shots - a term used by bomb technicians to indicate number of times that a portable x-ray unit has been activated. One shot means the x-ray unit has been activated once.

Thermo-luminescent dosimeter (TLD) monitor - a personal dosimeter which uses the

thermo-luminescent properties of a material to measure the dose received.

X-ray - ionizing electromagnetic radiation emitted during the transition of an atomic electron to a lower energy state or during the rapid deceleration of a charged particle.

Microsievert (μSv) - one millionth of a sievert. A unit used to express radiation dose levels.

4. Authority to create the guideline

This guideline was issued by National Manager Human Resources using power under [s. 37\(1\) of the Australian Federal Police Act 1979](#) (Cth) as delegated by the Commissioner under s. 69C of the Act.

5. Introduction

This guideline outlines the responsibilities of AFP employees involved in the use and handling of x-ray units and sealed radioactive sources, and provides information on the safe handling and precautions required to eliminate or minimise the risks involved. It includes procedures for:

- emergencies
- packing and transporting radioactive material
- disposal of unwanted sealed sources and x-ray equipment.

6. Application

This guideline applies to all AFP employees who are responsible for the use and handling of x-ray units and sealed radioactive sources.

It should be read and applied in conjunction with the:

- [Occupational Health and Safety Act 1991](#) (Cth) (in particular s. 21)
- [Australian Radiation Protection and Nuclear Safety Act 1998](#) (Cth)
- [National Guideline to AFP health and safety management arrangements 2007- 2012](#).

Operators of the Z Backscatter Van should **also** read and apply this guideline in conjunction with the:

- AFP Standard Operating Procedure for American Science and Engineering (AS&E) Z Backscatter Van X-ray Inspection System
- AFP Radiation Safety Plan for American Science and Engineering (AS&E) Z Backscatter Van X-ray Inspection System.

7. AFP management responsibilities

The Chief Police Officer for the ACT and each Functional manager and Office manager must ensure that:

- local procedures are established to implement this guideline
- resources necessary to implement this guideline and meet the requirements of the AFP licence are provided

- implementation is achieved through established workplace consultative mechanisms.

8. National Manager Forensic and Data Centres responsibilities

The National Manager Forensic and Data Centres (NMFDC) is the AFP nominee of the licence issued under s. 33 of the [Australian Radiation Protection and Nuclear Safety Act 1998](#) which enables the AFP to possess, use and dispose of x-ray units and sealed radioactive sources.

As nominee of the licence the NMFDC must:

- exercise overall control in relation to the management of x-ray units and sealed radioactive sources
- appoint a suitably qualified Radiation Safety Officer to ensure compliance with licence requirements.

9. Radiation Safety Officer responsibilities

The Radiation Safety Officer (RSO) provides advice on safe work practices that comply with regulations and codes of practice. RSOs liaise and advise as required with managers, team leaders, coordinators and employees on radiation safety issues such as:

- planning the purchase and use of additional equipment for an area
- safe storage and disposal of radioactive sources and irradiating apparatus, according to Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) requirements
- receiving requests from business areas to ensure all necessary licensing and registration matters are processed

RSOs must:

- inspect areas and installations where ionizing radiation is/will be used, and make recommendations to the NMFDC and relevant Functional manager or Office manager on radiation safety
- monitor radiation dose levels in designated radiation areas to minimise any personal exposure dose
- conduct investigations in the event of a dose level above 400 μSv , for the prescribed timeframe (i.e. 3 months) and submit reports to ARPANSA accordingly
- consult and liaise with ARPANSA and other relevant regulatory authorities on radiation safety issues
- report any suspicious behaviour to the local police and ARPANSA
- ensure that current records of all stocks and the location of radioactive substances and irradiating apparatus are maintained and kept for two years after the date of disposal
- notify the NMFDC, local police and ARPANSA and supply the latter with a written report within 7 days of notification (refer to Attachment 1 for contact details) if any radioactive source is:
 - stolen
 - lost without explanation
 - damaged, accessed or transferred without authorisation.

10. Manager and team leader responsibilities

The manager, coordinator, team leader or station manager involved in an area which uses radioactive materials must:

- ensure all relevant employees under their supervision:
 - comply with the requirements of the [Australian Radiation Protection and Nuclear Safety Act 1998](#) (Cth) and [Australian Radiation Protection and Nuclear Safety Regulations 1999](#)
 - receive sufficient training and advice on radiation safety before commencing work
 - are retrained at appropriate intervals
 - are provided with suitable monitoring devices which are kept in good working order and calibrated annually
 - are advised of their dose levels upon receipt of dose reports
- control the access of unauthorised persons to areas where exposure to radiation is possible by means of appropriate doors, bars, locks and warning or cautionary notices, signs or lights
- account for the whereabouts of any radioactive sources under their control
- notify the Radiation Safety Officer (RSO), or if unable to reach the RSO notify the National Manager Forensic and Data Centres (NMFDC) immediately upon becoming aware of any:
 - plans to purchase any new x-ray equipment or radioactive materials
 - damage, loss, theft, unauthorised access or transfer or involvement in an accident or fire of any radioactive material or x-ray unit under their control
 - unsafe practice
 - unplanned (actual or suspected) exposure to a radiation source or an intense primary beam.
- follow the instructions of the RSO (or NMFDC) to rectify any of the above situations and take steps to prevent a recurrence (refer to Attachment 1 for contact numbers)
- report to Comcare, within the legislative timeframe (24 hours), any damage, loss, accident, fire or unsafe practice in accordance with AFP on-line Workplace Incident Reporting procedures
- ensure safety checks and maintenance are conducted on all licensed equipment at least annually for portable industrial x-ray units and XRF and biennially for mail screening x-ray units and provide a copy of the maintenance report to the RSO
- keep appropriate records associated with approval, maintenance, control, monitoring, assessment and training, and make them available for inspection by Comcare and ARPANSA
- keep records of effective doses for the period required by ARPANSA (i.e. for the working life of the employee plus at least 30 years after the last dose assessment and until the employee reaches, or would have reached, the age of 75 years.)
- send the original records to the area's Corporate Support Services (to place on the employee's personal file) and a copy to the RSO
- inform the RSO when an employee's personal exposure level exceeds 400 μSv in a 3 month period and help investigate the cause of the abnormal level
- ensure all control badges are:
 - stored safely
 - shielded from radiation sources
 - returned to the ARPANSA Personal Radiation Monitoring Service together with any thermo-luminescent dosimeter monitors within the 3 month prescribed period.

11. User and operator responsibilities

Under s. 21 of the [Occupational Health and Safety Act 1991](#) (Cth) all x-ray unit operators must be aware of hazards associated with handling x-ray units and sealed radioactive sources, and must not knowingly risk their safety or that of others.

Each user and operator must:

- provide to the team leader/station manager details of prior radiation exposure upon employment
- wear a personal monitoring device or thermo-luminescent dosimeter (TLD) monitor whilst inside the x-ray equipment room if indicated in the requirements for individual design, relevant Australian Standards or manufacturer's manual
- return all TLD monitors to Australian Radiation Protection and Nuclear Safety Agency Personal Radiation Monitoring Service within the 3 month prescribed period
- be familiar with this guideline, relevant codes of practice and adhere to the safety procedures listed in s. 12 of this guideline
- report any actual or suspected exposure to a radiation source or an intense primary beam to the team leader
- be alert to suspicious behaviour relating to any radioactive sources in their control, the asset housing it and the immediate environs and report it to the Radiation Safety Officer.

12. Safety operating procedures

X-ray equipment

If used correctly, x-ray mail screening units and x-ray fluorescence units are unlikely to expose a person to intense x-ray beams. However, industrial radiography equipment used by the Bomb Response Team and Bomb Appraisal Officers can pose significant risks to health including potentially lethal radiation exposures.

Appropriate safe operating procedures must be followed at all times. All operators and users of portable x-ray units (including Golden Inspector and any other brand) must be familiar with the AFP Safety Operating Procedures for the Golden Engineering X-ray unit (Attachment 2)

For details of specific safety precautions that must be adopted, users and operators must also read the following publications:

- Code of practice for protection against ionizing radiation emitted from x-ray analysis equipment ([RHS no. 9](#))
- Code of Practice for the safe use of industrial radiography equipment ([RHS no. 31](#))
- Statement on cabinet x-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes ([RHS no. 21](#)).

As a minimum, the following practical procedures must be adhered to:

X-ray equipment must:

- be operated by an experienced operator or under the direct supervision of an experienced operator
- not be operated following inactivation of an interlock, or with part of its enclosure removed
- be monitored on a regular basis for radiation leaks, including:
 - at the time of installation
 - after any modifications

- after replacement of x-ray tubes
- after any kind of reassembly.

Written approval is required from ARPANSA before modifying an x-ray unit.

Operators of x-ray units must

- create, maintain and monitor a cordon of 6 metres around the x-ray unit while it is pulsing and ensure the control position is outside the cordon
- inspect the area inside the delineated boundary of an open site prior to exposure to ensure that no person is within it and ensure that no person enters it, using mirrors or a video camera if visibility is an issue
- record exposure details such as the number of shots/pulses used during bomb appraisal/disposal operations
- after operating the equipment in confined spaces, send personal dosimeters and/or thermo-luminescent dosimeter monitors to the Personal Monitoring Service of ARPANSA for dose evaluation.

Sealed sources

The AFP uses sealed sources containing a radioactive source of Ni-63 at 15 millicuries. Removal of the sealed source must only be undertaken by the maintenance contractor or other qualified personnel.

13. Emergency procedures

In case of an emergency the following procedures must be carried out.

X-ray unit

1. Turn off the power to the x-ray unit.
2. Display a sign on the unit indicating that the unit must not be used or altered until a full investigation and post assessment of any suspected absorbed dose of each operator has been completed.
3. Notify the team leader or station manager and the Radiation Safety Officer (RSO) so they can undertake a full investigation and assessment of any absorbed dose and, following confirmation, take action to rectify the particular fault on the x-ray unit.
4. Report the incident in accordance with AFP workplace incident reporting procedures (including notification to Comcare and the Australian Radiation Protection and Nuclear Safety Agency by the RSO).

If a fire occurs in an area containing operating x-ray units, the operator or assistant must immediately switch off or disconnect the power to the x-ray unit and convey this fact to the fire officers.

In the event of an emergency, the team leader or manager must notify fire station officers and their local fire brigade of the location of any radioactive substances or radiation apparatus.

Sealed sources

In the AFP, Ni-63 sealed sources are used in some enclosed analytical devices. Removing these sealed sources must be conducted by the maintenance contractor or other qualified personnel

only, as it is possible that a sealed source could be dropped from its container and damaged. If it is dropped or damaged, the source must be returned to its container with a pair of tongs and the surrounding area checked for possible contamination. The integrity of the container of the sealed source must be verified by the maintenance contractor or other qualified personnel.

14. Packing and transporting radioactive material

The [Code of Practice for the Safe Transport of Radioactive Material \(2008\)](#) outlines the requirements for the packaging and transport of radioactive materials by any mode of transport and should be referred to as necessary.

In all cases, the source container must be:

- located in the vehicle so that the radiation dose received by any person in the vehicle is as low as practicable (The maximum dose rate must not exceed 20 $\mu\text{Sv/h}$)
- stowed during transport to prevent any shift under conditions normally incidental to transport
- stored in a locked compartment when the vehicle, vessel or aircraft is left unattended.

If a source container is or appears to be damaged in transport, the user or operator responsible for the container at the time of the incident, or another member, must notify the Radiation Safety Officer (RSO) or if unable to reach the RSO, notify the National Manager Forensic and Data Centres. The manager, coordinator, team leader or station manager of the responsible area must then contact the RSO and ensure that the source container is carefully examined to verify that it continues to comply with the relevant codes of practice.

15. Disposal of unwanted sealed sources and x-ray equipment

Sealed sources may become surplus when use of them is no longer required or if they leak. While a source may not be suitable for its original purpose, it may still be radioactive and must be treated as hazardous material.

When disposing of unwanted sealed sources, team leaders must either:

- obtain permission from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to:
 - transfer the source to another licensed user for application elsewhere
 - return the unwanted sealed source to the original supplier or a source recycleror
- collect and store the source in an adequately shielded containment until the National Repository for the Disposal of Unwanted Radioactive Waste is operational.

The option selected for a particular sealed source will depend on a variety of relevant factors including activity, radioisotope content, terms of the purchasing contract and physical condition of the source. **Prior** approval from ARPANSA must be sought irrespective of which option is selected.

In some cases the source apparatus may become obsolete or difficult to operate. When this occurs, team leaders must obtain permission from ARPANSA to dispose of the unwanted x-ray units. It is important to disable the equipment to ensure it is inoperative.

16. Review of guideline

This guideline and its implementation will be the subject of ongoing annual review. The appropriate mechanism for review is the National OH&S Committee.

17. Further advice

Any queries relevant to the content of this National Guideline should be referred to the National Coordinator, Health, Safety and Rehabilitation.

18. References

Legislation:

- [Australian Federal Police Act 1979](#) (Cth)
- [Occupational Health and Safety Act 1991](#) (Cth)
- [Australian Radiation Protection and Nuclear Safety Act 1998](#) (Cth)
- [Australian Radiation Protection and Nuclear Safety Regulations 1999](#) (Cth)

AFP governance instruments:

- [National Guideline to AFP health and safety management arrangements 2007-2012](#)

Other sources

- [Recommendations for Limiting Exposure to Ionizing Radiation \(1995\) and National Standard for Limiting Occupational Exposure to Ionizing Radiation \(republished 2002\)](#)
- [Code of Practice for Protection Against Ionizing Radiation Emitted from X-ray Analysis Equipment \(1984\)](#)
- [Code of Practice for the Safe Transport of Radioactive Material \(2008\)](#)
- [Code of Practice for the safe use of industrial radiography equipment \(1989\)](#)
- [Revised statement on Cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes \(1987\)](#) [National Health and Medical Research Council]
- AFP Standard Operating Procedure for American Science and Engineering (AS&E) Z Backscatter Van X-ray Inspection System
- AFP Radiation Safety Plan for American Science and Engineering (AS&E) Z Backscatter Van X-ray Inspection System
- International Standard, (ISO9978:1992(E)), Radiation protection - Sealed radioactive sources - Leakage test methods (available from National Health Safety and Rehabilitation Team, Canberra)

Attachment 1 - List of contacts

This is attachment 1 to the AFP National Guideline on safe working with radiation

Radiation Safety Officer AFP	Mr Paul Wong People Strategies National Health, Safety and Rehabilitation Team, HQ Canberra
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	Ph: 167 082 (02 6275 7082) Fax: 167 430 (02 6275 7430)
Deputy Radiation Safety Officer AFP	Ms Bernadette Saw Forensic and Data Centres OHS Advisor, Weston Canberra Ph: 156 152 (02 6203 6152) Fax: 163 869 (02 6223 3869)
National Manager Forensic & Data Centres (NMFDC) AFP Nominee	Dr James Robertson Forensic & Data Centres Weston Police Centre, Canberra Ph: 163 469 (02 6223 3469)
Australian Radiation Protection And Nuclear Safety Agency (ARPANSA)	ARPANSA Sydney Office PO Box 655 Miranda NSW 1490 Ph: (02) 9541 8333 Fax: (02) 9541 8314
Comcare Australia	Manager, OH&S Ph: 1300 366 979 Fax: 1300 305 916

Attachment 2 - Safety information for the Golden Engineering x-ray unit

This is attachment 2 to the AFP National Guideline on safe working with radiation

The Golden Engineering x-ray unit (the unit) is an industrial type x-ray generator that produces hazardous radiation when energized. It is unlawful to use this equipment to intentionally expose humans or to use it for medical radiography. Unauthorised personnel should not have access to the unit.

The operator must be properly trained to safely operate the unit and must wear a personal radiation monitoring device, consistent with the appropriate federal, state and territory standards (Note: an electronic dosimeter will not detect the Golden Engineering X-ray unit radiation pulses).

Due to the short pulse width of the unit, survey meters of the Geiger-Mueller and scintillator type do not accurately detect the radiation emitted from the x-ray source. Survey meters must be:

- be of the ionization gage type
- used in the integration mode, not the rate mode (due to the unit not producing constant radiation)

The unit produces very high rates of radiation for very short periods of time resulting in either unrealistically high readings or no readings for a survey meter in rate mode.

The unit has no explosion proof rating and should not be used in an explosive atmosphere. The spark gap is vented to the air and could be a source of ignition.

The operator must ensure the area is cordoned off (6 metres in radius), and that no person is within the exposure position at any time when the x-ray unit is in operation.

Operating procedures (when used with Polaroid thermo-luminescent systems)

1. Attach fully charged battery pack to the unit or, if using a remote cable, plug into the unit.
2. Place cassette holding the negative as close as possible behind the object to be x-rayed. Make sure silver side of the cassette faces the object.
3. Place the unit 0.7 to 1.5 metres in front of the object with the front of the unit pointing directly at the object and cassette.
4. Insert key into key switch located on top of the unit and switch on by turning the key clockwise a 1/4 turn.
5. Select the desired number of pulses using the unit's counter located just below the LCD. (See chart for approximate pulse settings.)

Option A - Remote cable option

1. Retreat behind the unit the length of the cable.
2. Clear area of personnel referring to established safe operating procedures.
3. Fire the unit by depressing the button on the remote cable. The red light turns on and stays on until the unit stops pulsing. The unit will stop pulsing when the pulse count reaches '00'. The operator may stop the pulsing immediately by releasing the button on the remote cable (the unit will display original pulse count).
4. Check the unit to see that the original pulse count is on the LCD.
5. Turn off the key switch.

Option B - Delay mode option

1. Clear area of personnel referring to established safe operating procedures.
2. Push the delay button and the red light starts to blink. The LCD starts at 59 seconds. If the operator holds the button down for 1.5 seconds the unit goes to 15 second delay. The red light continues to blink and the unit beeps until it begins to pulse.
3. Retreat at least 6.1 metres behind the unit.
4. The red light stays on and the unit makes a snapping sound while it is pulsing.
5. Check the unit to see that the original pulse count is on the LCD.
6. Turn off the key switch.

DUTY CYCLE WARNING. Up to 100 pulses may be used without resting the unit. After every 100 pulses, the operator should allow a rest period of 3 minutes. The unit is a light duty machine and is not made to pulse continuously.