



National Operational Guidance



NFCC
National Fire
Chiefs Council

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Hazard - Exposure to radiation

Hazard Knowledge

Radiation is the general term given to the process by which energy is transmitted away from an energy source. The term can be applied equally to heat, light, microwave, radio or atomic sources of energy. This guidance is only concerned with the radiation arising from atomic sources, as only these along with electrically generated x-rays have the property of causing ionisation when they interact with other substances; they are referred to as 'ionising radiations'.

Two basic hazards which arise when dealing with radioactive materials:

- Irradiation, which is generally, but not exclusively, associated with sealed sources; this can cause harm through an external exposure (the source is located outside the body and possibly some distance away).
- Contamination, which is covered in the [Hazard – Radioactive contamination](#)

In all cases of exposure to ionising radiation, the principle of 'as low as reasonable practicable' (ALARP) applies. This means that, even though there is a legal maximum permitted absorbed dose, all exposures must be minimised.

The principle of time/distance/shielding should be used to protect against the harmful effects of penetrating radiation.

- Time – the shorter the duration of the exposure, the smaller the accumulated dose
- Distance – the greater the distance from the source of radiation, the lower the dose rate (the 'inverse square' law applies - doubling the distance reduces the dose rate to one quarter)
- Shielding – in general, the higher the density and greater the thickness of the shielding, the better the protection.

To manage the dose received when in an area of elevated radiation levels, a survey meter should be used to continuously assess the dose rate being received.

At any site where radionuclides are stored and used, a risk assessment will have been undertaken to determine potential dose rates and working times. A hazardous materials adviser (HMA) can make use of this information at an incident, to ensure the principles of radiation protection are implemented. However, radiation monitoring equipment should always be used as a key risk control measure in radiation protection procedures.



Control measure - Substance identification: Radioactive materials

Control measure knowledge

Radioactive materials can be identified in a number of ways:

- UN hazard warning diamond
- Site registration information and risk-based inspections



Materials with the hazard radioactive will be assigned to UN hazard class 7.

Strategic actions

Fire and rescue services should:

- Ensure there are means of recording known locations with radioactive materials
- Provide the means for accessing specialist advice specific to radioactive materials
- Provide systems for recognising and interpreting radioactive materials signage

Tactical actions

Incident commanders should:

- Use signs, labels, markings and container types to identify the presence of radioactive materials
- Identify the location, physical state (solid, liquid, gas), type and quantity of the released radioactive material
- Use detection equipment to identify and monitor levels of the radioactive materials involved
- Obtain specialist advice from hazardous materials advisors (HMAs), scientific advisers, on-site specialists or other appropriate sources, for example, the National Arrangements for Incidents involving Radioactivity (NAIR) or Radsafe



Control measure - Manage the radiation dose received by firefighters

Control measure knowledge

The radiation dose received by firefighters should be kept as low as reasonable practicable (known as ALARP). Exposure is reduced by managing these factors:

- Time
- Distance
- Shielding

Fire and rescue services may or may not be required to intervene; in any case, a hazard/exclusion zone should be established. Any members of the public or personnel should be immediately withdrawn until specialist advice is available. The perimeter should be set where the background reading is consistent with the normal background reading for that location or where recommended by site-/incident-specific specialist advice.

Should no intervention be required, the cordon should be managed appropriately until such time

as the scene can be handed over to the appropriate authority.

If an intervention is deemed necessary, anyone entering the hazard zone must be equipped with a personal dosimeter and each team should be equipped with a dose rate survey meter. To ensure exposure is minimised, the incident commander should:

- Consider the location and type of the source (i.e. unsealed or sealed). An inventory and local rules should be available where radionuclides are held legally.
- Consider the potential of damage to the source(s)
 - Does any packaging or shielding appear to have been damaged?
- Make use of any transport index that may be available, whilst deploying monitoring equipment (The transport index is the maximum dose rate in micro Sieverts per hour divided by 10 when measured at one metre from the surface of the packaging)
- Keep crews committed to the hazard zone to a minimum
- Ensure each crew has one crew member dedicated to constantly monitoring the detection equipment – where the task can be performed by one crew member the minimum crew can remain at two
- Ensure the person deploying the survey meter is competent in using fire and rescue service radiation monitoring equipment

Strategic actions

Fire and rescue services should:

- Provide procedures and support arrangements regarding the hazards that may be encountered and actions to take when managing radiation doses at operational incidents
- Provide procedures and training for incidents declared as radiation emergencies, including authorisation for using informed volunteers
- Provide equipment to actively measure the dose rate from any potential radiation source. See A foundation for hazardous materials for further information on radiation instrumentation
- Ensure the dose limits and all other regulations are adhered to in all operational guidance
- Consider adopting a dose constraint below the legal dose limits
- Make arrangements with relevant organisations to ensure specialist advice is available from

the scene of an incident. For further information on sources of specialist advice see A foundation for hazardous materials.

Tactical actions

Incident commanders should:

- Keep exposure to ionising radiation 'as low as reasonably practicable' (ALARP) in all cases
- Employ the principles of time, distance and shielding
- Where it is necessary to commit personnel to the hazard area, keep the number of personnel to a minimum
- Establish, record, communicate and continually monitor the level of background radiation
- Ascertain if the packaging or shielding for the radiation source has been damaged
- Determine whether or not the fire and rescue service are required to enter the radiation hazard zone
- Monitor radiation dose rates periodically and keep individual accumulated dose records of everyone who has entered the risk area