Information Sheet: Hazard Management Radiation

Purpose

The purpose of this information sheet is to provide extra information to assist with the hazard management process. This information must be read in conjunction with Hazard Management Handbook Chapter

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Q1 Are there any radiation dose constraints in the University of Adelaide?

A dose constraint is a guideline of exposure that is not expected to be exceeded at the University of Adelaide. It is not the legal dose limit.

The legal dose limit is 20 mSv a year. However the University is committed to an occupational dose constraint of 1 mSv a year (where possible). If a radiation worker is approaching 1mSv in a 12month period the circumstances will be investigated. After investigation an individual will be asked to modify their radiation work.
If a radiation worker approaches 20mSv in a 12 month period they will be stopped from doing further work with ionising radiation until the results of an investigation has been completed.

Q2 What ways can I be exposed to radiation?

The use of x-ray equipment or sealed radioactive sources may result in radiation exposure from radiation sources **external** to the body. The handling of unsealed radioactive materials may result in radiation exposure from radioactivity both **external** and **internal** to the body (through ingestion, inhalation or absorption through the skin).

Ingestion

By drinking contaminated water, eating contaminated food or generally by transferring radioactive material to the mouth, radioactive material may enter the body.

Ingested material is taken up by various organs depending on the chemical nature of the radionuclide, the biochemistry, and the biological pathways.

Inhalation

Breathing radioactive dust and gas introduces soluble and insoluble airborne radioactive materials not only into the lungs but also into the gastro-intestinal and upper respiratory tracts. Different radionuclides have different long-term fates in the body and present different hazards.

Iodine 131 (I131) poses a special problem because of its volatility. Work with materials containing radioactive iodine requires special precautions because volatile iodine may be generated (see Information Sheet – General Radiation Information for more information on I131).

Absorption through the skin

The absorption of radionuclides through intact skin as well as open wounds is a hazard as is the retention of radionuclides in the skin itself.

Q3 How can external exposure to radiation be controlled?

Elimination (i.e. the exposure ceases):

- when you leave the radiation area.
- the source is removed .
- the irradiating apparatus is turned off.

Engineering (i.e. exposure to external radiation is controlled):

- **maximising** the distance from the radiation source.
- **minimising** the time of exposure.
- **shielding** the radiation source.

Note that all three concepts (time, distance and shielding) must be taken together. Be careful that any control measures do not introduce further hazards. Assistance in selecting the correct control measure for external radiation can be sought through the University Radiation Safety Officer.

Engineering (i.e. increase distance by using tools)

Increasing the distance from the source is the most effective and economical means of reducing external radiation exposure.

For point sources (a single localised source) the intensity of the radiation varies inversely with the square of the distance from the source. By doubling the distance from the source the radiation intensity falls to a quarter of the original value.

The variation of the radiation intensity with distance is more complex if the source is large compared with the distances involved (non-point source). The intensity decreases with distance but does not follow a simple law. As a rough guide the inverse square law can be applied if the distance from the source is greater than about 5 times the dimensions of the source.

Distance should be used whenever possible to minimise radiation exposure. Use tongs or other long handled tools rather than fingers for handling radioactive materials. Even short forceps provide a large reduction in the radiation dose from that given to the skin by direct contact.

Administration (i.e. reducing time)

Decreasing the time of exposure decreases the dose proportionally.

Any new procedure should be practised with non-radioactive materials or as dummy procedures so that the final work with ionising radiation takes the minimum time.

Isolation (i.e. shielding)

Shielding placed between the source and the worker absorbs the ionising radiation and therefore reduces the dose rate outside the shielding. It should be used whenever maximum distance and minimum time are not sufficient to reduce exposure to an acceptable level.

The suggested shielding for the radionuclides being used is given in the Properties of Some Commonly Used Nuclide section in Information Sheet – General Information.

There are a number of suppliers in Australia for shielding, however contact Human Resources if you require lead bricks.

Q4 How can internal exposure to radiation be controlled?

This is exposure to radiation from ingested or skin absorbed radioactive material and means the contaminated person continues to be exposed to radiation even after the external contamination is removed. The key to controlling internal radiation is to avoid dispersal of and contact with the radioactive material.

Control of Internal Radiation Hazard

- Limiting the dispersal of the material so that it cannot be breathed or ingested.
- Limiting contact with the material.
- Following clearly defined procedures, working rules and good housekeeping.
- Careful monitoring of workplaces, gloves and protective clothing after use.
- Immediate clean-up of any contamination.

Protective Clothing

Protective clothing must be worn to reduce the risk of contamination.

- Eye protection must be worn at all times when working with radioactive material.
- Laboratory coats or gowns with long sleeves that can be tightened at the wrist are recommended particularly when handling high specific activity or volatile radionuclides.
- Gloves must be worn at all times, It is also recommended that two pairs of gloves are to be worn especially:
    - when dealing with high concentrations of sodium iodide, which can penetrate some rubber gloves.
    - during procedures where gloves frequently need to be changed to prevent the spread of contamination.

Containment

- Using the radionuclides in properly designed laboratories and only use registered radioactive laboratories or areas for work with unsealed radioactive materials.
- Discourage any non-radiation workers from accessing registered radioactive laboratories for social visits.
- Only do work with unsealed radioactive materials in a defined contained work area or fume cupboards.
- Always keep active and inactive work areas separate.
- Manipulations should be performed over trays to contain the spread of accidentally spilled material.
- If aerosols are likely to be produced from volatile radioactive materials such as sodium iodide or tritiated water, or gases such as C14 labelled CO_2 procedures must be carried out in a fume cupboard.

Q5 Where do I obtain further information on the Radiation Hazard Management?

If you require further information, please contact your local HSW Team or Human Resources