RADIATION PROTECTION OF WORKERS

Radioactive Tracers

IAEA

Radioactive tracers are substances labelled with a radioactive atom that allow easier detection and measurement. They are used in the oil and gas, chemical, food and tobacco industries as well as in the management of water resources, in scientific research and in medical applications. In use, they can present an external exposure or, if the radioactive material enters the body, an internal exposure.

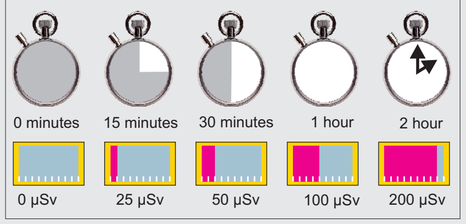
EXTERNAL EXPOSURE

External exposures to staff can occur:

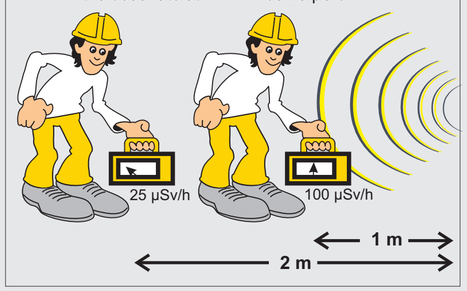
- ☑ When handling primary or stock solutions.
- ☑ When handling transport packages.
- ☑ When cleaning up radioactive contamination.
- ☑ When working near a source storage facility.

External exposures can be controlled by consideration of time, distance and shielding.

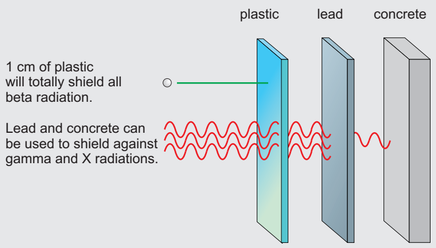
Time To reduce radiation doses, the time spent in radiation areas must be kept as short as possible. The longer the time spent in an area, the higher the dose received.
In an area where the dose rate is 100 ìSv/h, the dose received will be:



Distance If the dose rate at 1 m from a source is 100 µSv/h, the dose rate at 2 m will be 25 µSv/h.



Shielding Shielding material must be appropriate for the type of radiation. For example:



INTERNAL EXPOSURE

Radioactive material can enter the body by inhalation, ingestion and absorption through intact or damaged areas of the skin. The presence of radioactive contamination presents an internal exposure risk to staff for each of these exposure routes.

CONTAMINATION

There may be contamination:

- ☑ Where splashes or spills have occurred.
- ☑ On the inner surfaces of used vials or other containers.
- ☑ On laboratory surfaces.
- ☑ On the hands of users.

Where there is radioactive contamination you should:

- ☑ Wear plastic gloves.
- ☑ Wear protective glasses.
- ☑ Cover cuts and wounds.
- ☑ Never eat, drink, smoke or apply cosmetics.
- ☑ Clean up spills, even minor splashes as soon as practicable.
- ☑ Not touch things unnecessarily.
- ☑ Wash your hands at the end of the period of work.
- ☑ Contact the Radiation Protection Officer.

PROCEDURES

Marking and labeling

Source containers should be labelled “Radiaoctive Material”. The name of the radioisotope, the activity and the trefoil warning symbol should also be shown.

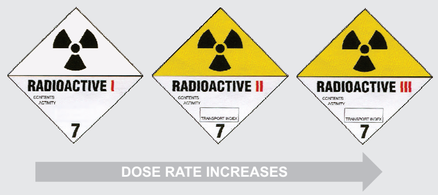
Storage

When radioactive material is not in use, it must be properly stored. A good storage location will be:

- ☑ Only used to store radioactive material.
- ☑ Secure.
- ☑ Shielded.
- ☑ Labelled.

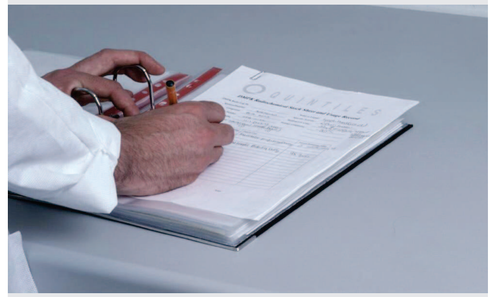
Transport

Radioactive material will be transported in a package that complies with national and international regulations. The package will be labelled according to the dose rate.



Source records

A record must be kept of all radioactive material held on-site at any given time. The record must track the radioactive material throughout a process, up to and including its disposal.



Waste

Any radioactive waste must be disposed of according to strict procedures that follow regulations and requirements. Records must be kept of all radioactive waste.

Survey meters are very important in helping to keep exposures

As Low As Reasonably Achievable: ALARA

RADIATION MONITORING

It is important to check for contamination in the work area and on the hands of the users at regular intervals while radioactive material is being used. At the end of a period of work, the work space must be thoroughly checked for contamination.

Users should measure the dose rate around storage locations, around primary or stock solutions, or wherever there are large quantities of radioactive material.

DOSE ASSESSMENT

Dosimeters

A dosimeter is a means of assessing the dose that the wearer has received. Dosimeters should be worn between the shoulders and the hips and must be returned to the provider regularly so that the dose information can be read. Sometimes, dosimeters are worn on a finger, underneath the gloves, to assess the dose to the hand.

☑ IF CONTAMINTATION IS PRESENT

A contaminated person should:

- ☑ Stay where he/she is.
- ☑ Call for help and alert the Radiation Protection Officer.
- ☑ Do not touch anything.

Others must:

- ☑ Not enter the area unless an injured person needs help.
- ☑ Start decontamination procedures only when trained.

DOSE AND EFFECTS

Units of dose

The unit of absorbed dose is the gray (Gy).

The unit used to quantify the dose in radiation protection is sievert (Sv).

One millisievert (mSv) is 1/1000 of a sievert.

- ▶ Annual doses from natural background radiation vary on average between 1 mSv and 5 mSv, worldwide

One microsievert (µSv) is 1/1000 of a millisievert.

- ▶ The typical dose from a chest X ray is 20 µSv.

Dose rate

Dose rate is the dose received in a given time.
The unit used is microsieverts per hour (µSv/h).

- ▶ If a person spends two hours in an area where the dose rate is 10 µSv/h, then they will receive a dose of 20 µSv.

Health effects of radiation exposure

If radiation doses are very high, the effect on the body will appear relatively soon after the exposure. These acute injuries will occur if the absorbed dose is higher than a threshold value; some sources used as radioactive tracers are capable of delivering such doses. It is therefore essential that procedures for work are followed.

Even if the dose is not high enough to cause serious injury, there is still the possibility of incurring other health effects. These effects, e.g. radiation induced cancer, are risk based, i.e. the higher the dose received, the greater the chance of developing the effect. To reduce the possibility of developing late effects, radiation doses must be kept:

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