Foundation Work Place Supervisor (WPS) Course (Radioactive Materials)

This document is for training purposes only. Please ensure you refer to the latest version of all JSPs and other publications.

Introduction

The role of the Workplace Supervisor (WPS) is to ensure that all work involving ionising radiation is carried out safely and in accordance with current regulations and local orders for radiation safety. This course will provide you with the information to carry out your duties as a WPS.

Workplace Supervisors are appointed by their Commanding Officer to supervise radioactive materials that do NOT require the setting up of designated (controlled or supervised) areas.

If you are unsure whether this applies to you, or for further advice contact:

Nuclear Department on 93834 6053 / 02392 54 6053 or 93843 6073 / 02392 546073

How to use the course

Where a section of text is concluded with the word "LINK", this indicates a hyperlink to further information. A LINK can be opened with a single click of the mouse; e.g. JSP 392. These links are mandatory unless otherwise stated; the examination may include elements from these links.

To successfully complete this e-learning package the student will need to:

- read all the pages
- select the links

You are also encouraged to make your own notes for reference.

The aim of this course is to give the individual the knowledge and resources to effectively perform the role of Work Place Supervisor in accordance with the requirements in JSP392.

Please note that the examination allows for 3 attempts, after a 3rd failure the student will have to attend the WPS course at the Nuclear Department in Gosport.

Objectives

1. Define the structure of the atom and explain the following terms: atomic number, atomic mass, and isotope

2. Identify the properties of alpha, beta & gamma ionising radiation.

3. Explain the units used for measuring the activity of radioactive material and individual exposure to radiation.

4. Describe the effects of radiation on the individual and how these are linked to chance (stochastic) and tissue (deterministic) effects.

5. Explain the terms justification, optimisation (ALARP), and dose limitation.

6. State how time, distance and shielding contribute to ALARP.

7. Explain the difference between radiation and contamination, and the methods of protecting against them.

8. Explain the various roles within the local radiation protection organisation.

9. Briefly describe the purpose and content of relevant legislation and JSPs.

10. Identify the key areas of WPS responsibility within JSP 392

11. Explain how radioactive material is identified.

12. Describe the storage philosophy, requirements and equipment used for radioactive material.

13. State the radioactive source accounting and auditing procedures.

14. Explain the purpose and methodology for conducting leak tests and smear tests.

15. Explain the philosophy and options available for the disposal of radioactive material.

Objective 1 Define the structure of the atom and explain the following terms: atomic number, atomic mass, and isotope.

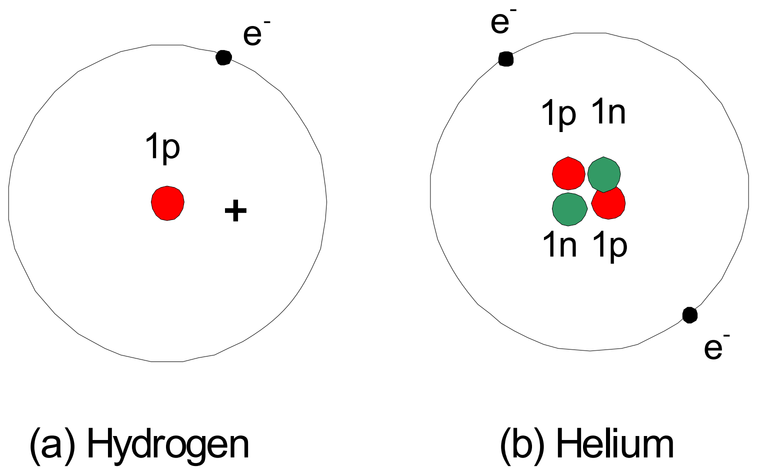
Atoms and Molecules

An atom is the smallest particle to which an element can be broken down. When elements combine to form compounds, individual atoms bond to each other to form molecules; e.g. when water is formed from hydrogen and oxygen, two hydrogen atoms attach to each oxygen atom to form water molecules.

Rutherford Atomic Model

An atom can be considered to consist of a "nucleus" with electrons orbiting around. The nucleus consists of neutrons (zero charge) and protons (positive charge). They are held together by the ‘strong nuclear force’: if some of this force can be liberated, an enormous amount of energy is released (e.g. the sun (fusion) and nuclear reactors (fission)).

Orbiting the nucleus are the electrons, which are bound to the atom by the electrical attraction of their negative charge to the positive charges of the protons.



Atomic Mass Unit

Masses of atomic and radioactive particles are conveniently expressed in terms of the "atomic mass unit" (amu), originally the mass of a hydrogen atom (now defined in terms of the mass of an atom of Carbon).

Atomic Weight of an Element

The atomic weight of an element is the mass of an atom measured in amu

Subatomic Particles

The subatomic particles already mentioned are:

Particle	Mass (amu)	Charge (e)
Electron	0.0005	-1
Proton	1.007	+1
Neutron	1.008	0

Note that the masses of proton and neutron are nearly the same (about 1 amu), and the electron mass is very small in comparison.

'Z' the Atomic number, is the number of protons in the nucleus; for a normal neutral atom there are an equal number of electrons . The atomic number uniquely identifies an element; e.g. for helium Z = 2.

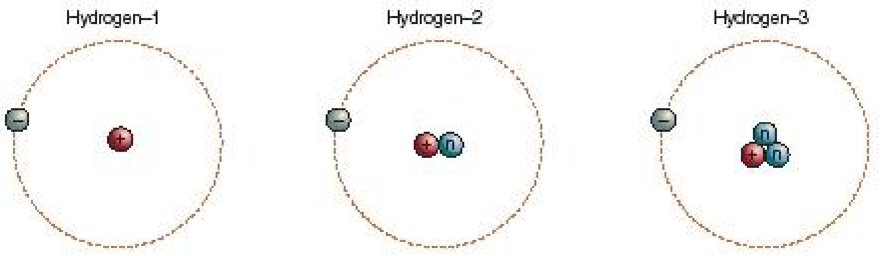
'**A**' the Mass Number, is the total number of nucleons (neutrons and protons) in the nucleus.

A = No of protons + No of neutrons

Isotopes

Isotopes are nuclei having the same atomic number, Z, but different numbers of neutrons (different N and therefore different A).

e.g. ^{1}H, ^{2}H (deuterium) and ^{3}H (tritium) are three isotopes of Hydrogen.



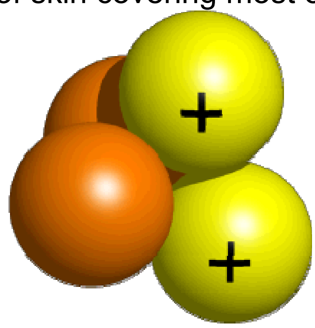
Objective 2 Identify the properties of Alpha, Beta & Gamma ionising radiation

Ionising Radiation

There are 3 main types of ionising radiation, Alpha, Beta and Gamma.

Properties of an **Alpha particle**:

- Only travels a short distance - under 10 cm in air;
- Stopped by paper;
- Stopped by the dead layer of skin covering most of the outside of the human body.

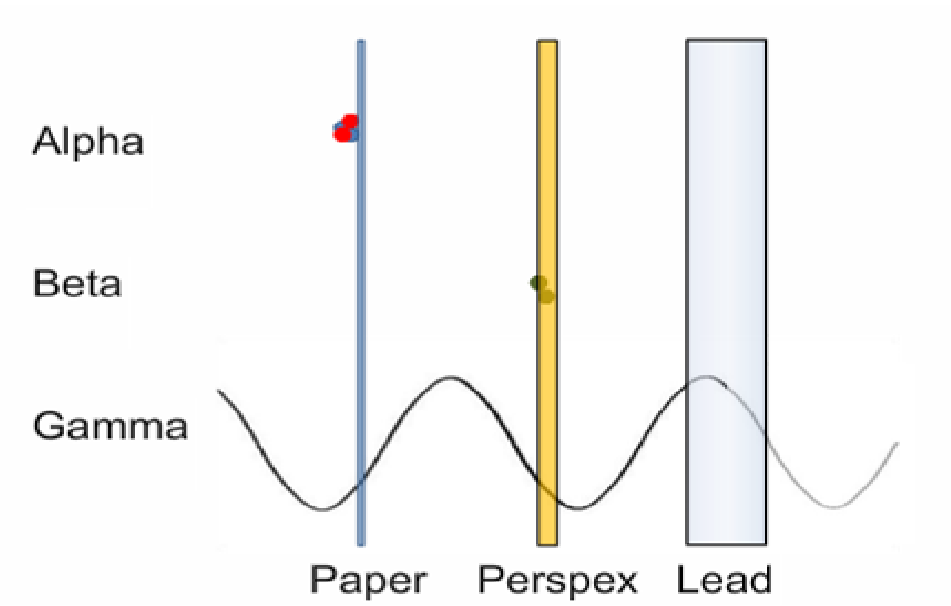


Properties of **Beta particle**:

- Only travels a medium distance - under 5 metres in air;
- Stopped by aluminium, plastic, perspex.

Properties of **Gamma radiation**:

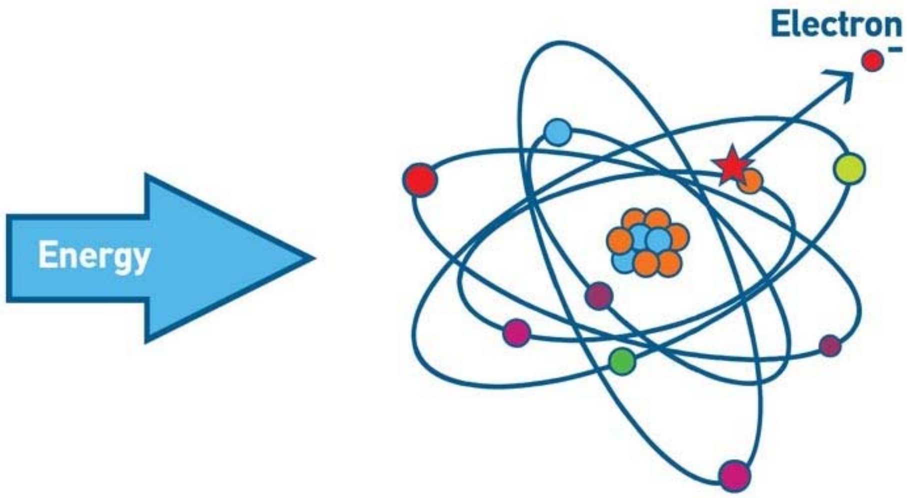
- An electromagnetic wave of pure energy similar to visible light but much shorter wavelength;
- No mass;
- Travels a long distance - over 50 metres in air;
- Requires dense material to shield it; e.g. lead.
-



Alpha radiation is easily stopped by paper or protective gloves. Normally it won't penetrate the dead layer of skin covering the outside of our bodies.

Beta radiation is harder to stop, requiring thicker material such as aluminium or perspex. Normally it will penetrate the dead layer of skin and cause damage to the lung skin tissue beneath.

Gamma radiation is very difficult to stop. Dense materials such as lead or concrete are used to shield against this type of radiation. It travels directly through human tissue, causing damage on route.



Ionising radiation is the term used to describe particles (e.g. Alpha and Beta radiation) or electromagnetic waves (e.g. Gamma radiation) that have sufficient energy to disrupt the atoms they hit. This results in electrically neutral atoms becoming fragmented into positively and negatively charged ions.

These ions are chemically reactive and if the radiation disrupts atoms to produce ions in our body, they can cause us harm.

Objective 3 Explain the units used for measuring the activity of radioactive material and individual exposure to radiation.

As part of the WPS role, you will be required to account for the quantity of radioactive material in your area.

The amount of radioactive material in a given source is termed its activity which is expressed in Becquerel's (Bq).

Becquerel (Bq)

Activity is the rate at which an amount of a radioactive nuclide disintegrates. The Bq is based on the number of disintegrations per second (dps), therefore 1dps = 1Bq. The Bq is a very small unit; radioactive sources usually have an activity exceeding thousands or millions of Becquerel's, which is written using multiples or symbols to represent very large numbers.

For example:

1,000 Bq	=	1kBq (kilo)	=	1xE3 Bq
1,000,000 Bq	=	1MBq (Mega	=	1xE6 Bq
1,000,000,000 Bq	=	1GBq (Giga)	=	1xE9 Bq
1,000,000,000,000 Bq	=	1TBq (Tera)	=	1xE12 Bq

Absorbed Dose

The simplest measure of radiation exposure is called the absorbed dose and is applicable for all types of radiation (particulate and electromagnetic) and all target materials. Simplistically the absorbed dose is the amount of energy deposited per unit mass and is measured in joules per kilogram. It is called the gray (Gy).

1 Gy = 1J/kg

(Sievert (Sv))

The sievert is used to assess the harm and relative biological effect on the human body, from exposure to the different types of radiation. The Sv is a large unit; typical occupational exposures to radiation are as low as one thousandth or one millionth of a sievert, which is written using sub-multiples or symbols to represent very small numbers.

For example:

0.001Sv = 1milli (m) Sv = 1xE-3 Sv

0.000001Sv = 1micro (μ) Sv = 1xE-6 Sv

The average dose to a member of the public in the UK from sources of radiation is 2.7mSv per year (0.0027Sv per year). The most significant contribution is from radon gas**.**

Sieverts are derived from grays by multiplying the dose in grays by a correction factor. This factor, called the Radiation Weighting Factor, differs depending on the type of ionising radiation

Type of radiaiton	Radiation weighting factor
Alpha	20
Beta	1
Gamma	1

For example, If someone receives 2 micrograys of alpha radiation, the dose in microsieverts will be 40 microsieverts.

2 μGy x 20 = 40 μSy

This dose is called the **Equivalent Dose.**

Effective Dose

To cater for the well known fact that some tissues or organs are more susceptible to radiation induced cancers than other tissues or organs it is necessary to introduce a second weighting factor to the absorbed dose to determine the total harm arising from exposures to different tissues. This weighting factor is known as the tissue weighting factor and the dose quantity as the Effective dose. The effective dose also has the unit of the sievert.

Effective Dose = Equivalent Dose x Tissue Weighting Factor

Objective 4 Describe the effects of radiation on the individual and how these are linked to chance (stochastic) and tissue (deterministic) efffects.

Ionising radiation may have the following effects on human cells:

- No damage;
- Cell death;
- Failure to stop dividing (Cancer);
- Damage and self-repair;
- Corrupts information carried. This can lead to the onset of cancer or hereditary effects, for example.

No damage: Providing that the exposure to ionising radiation is sufficiently low enough (for example, from background radiation), the cells can tolerate this and will continue to reproduce themselves at a normal rate, without developing any changes in their structure, that is, no clinical symptoms will develop.

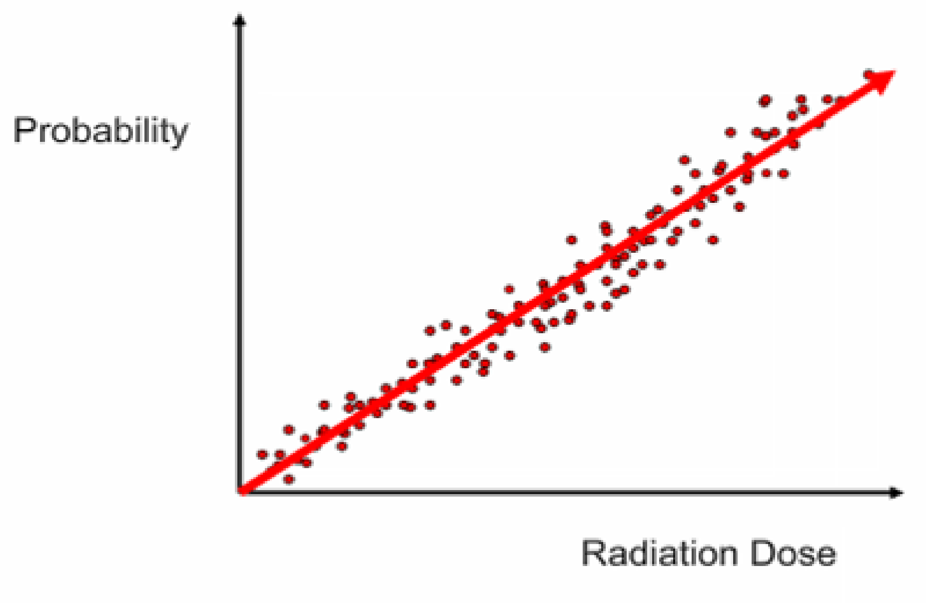
Cell death: If the ionising radiation has sufficient energy, it will kill the cell. If a sufficient proportion of cells of an organ or tissue are killed, the individual exposed will start to show clinical signs of this exposure**.**

Fail to stop dividing (Cancer): Once the key components (DNA) within the nucleus that control the division of the cells have been damaged, the cell may go through its normal division / reproduction process, however it can fail to stop dividing, and continue to multiply uncontrollably, so producing a cancer.

Damage and self repair: where the DNA in a cell is damaged but naturally repairs as it divides and reproduces itself.

Corrupts information carried: If the ionising radiation has damaged the key components within the nucleus, which control the information within the cell, corrupted information will be carried forward as the cells divide in order to reproduce them selves. This may results in the formation of cancers or hereditary effects (effects that occur in the offspring).

Chance effects (stochastic effect)

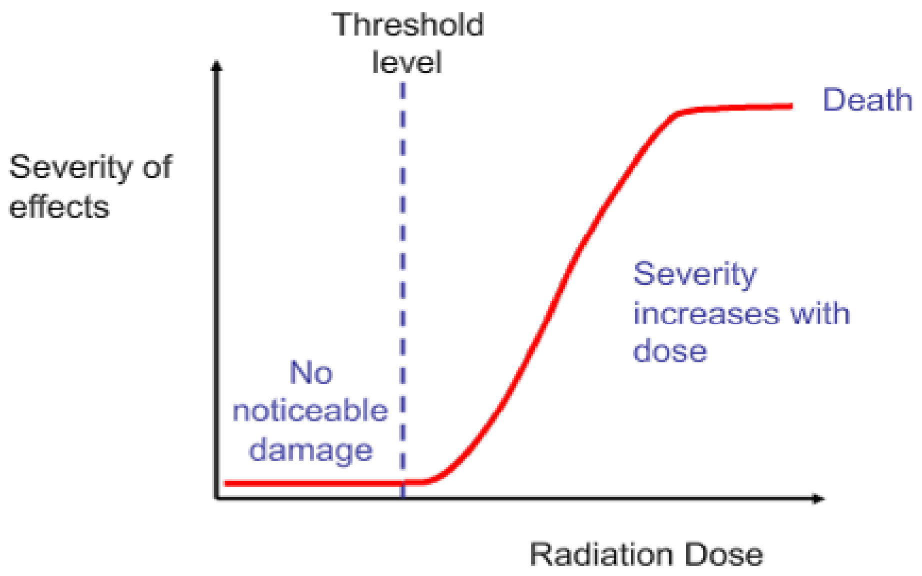


Chance effects are effects that occur on a random basis. The effect typically has no threshold and is based on probabilities, with the probability of **seeing** the effect increasing with dose.

This can be compared with the lottery, the more tickets you buy the greater the chances of winning; however you may win with a single ticket and not win with a thousand tickets.

Chance effects are also known as stochastic effects, cancer being an example.

Tissue Effects (Deterministic Effects)



Tissue (deterministic) effects are effects that can be related directly to the dose received. The effect is more severe with a higher dose, i.e., the burn gets worse as dose increases. It has a threshold, below which the effect will not occur.

Tissue effects are also known as deterministic effects, radiation skin burns being an example.

For work conducted with equipment containing minor radioactive source, even a serious accident (e.g. fire) is very unlikely to result in anyone receiving radiation doses sufficiently high to exceed the threshold for tissue (deterministic) effects.

Objective 5 Explain the terms justification, optimisation (ALARP) and dose limitation.

Although radiation can cause harm, it can have many useful benefits, including medical treatments and within detection equipment.

The aims of radiation protection are:

- To minimise chance (stochastic) effects
- To prevent tissue (deterministic) effects

The picture shows an erythema, which is a common side effect of exposure to ionising radiation. There are also many common causes of erythema such as infection, allergy, acne medication and sun burn.

The three objectives of radiation protection are:

Justification: no activity involving the use of ionising radiation should be carried out unless it provides a net benefit.

Optimisation (ALARP): all exposures should be kept “As Low As Reasonable Practicable”.

Dose Limitation: dose limits are to be applied and strictly adhered to, in order to prevent an individual exceeding their legal annual limits. Note that the dose limits used in the MOD are detailed in **JSP 392, Leaflet 4, Annex E.**

Objective 5 State how time, distance and shielding contribute to ALARP.

The external exposure to ionising radiation can be kept As Low As Reasonable Practicable (ALARP) by applying the following methods of radiation protection: Time; Distance and Shielding.

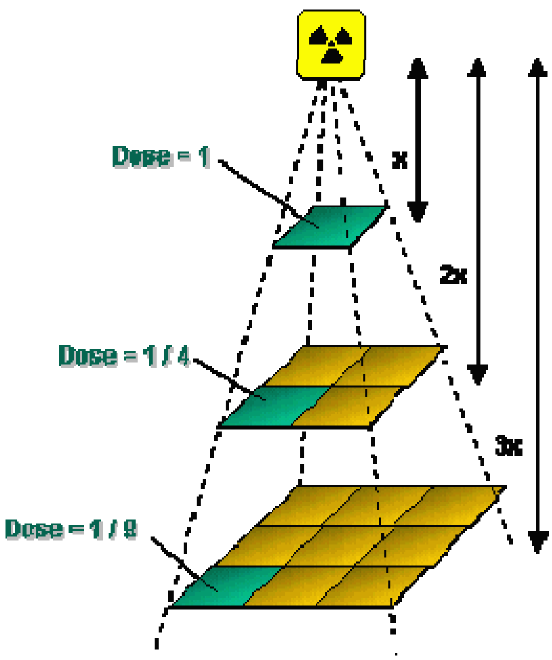
TIME: The dose received by an individual is kept ALARP by ensuring that the exposure time is always kept to a minimum.

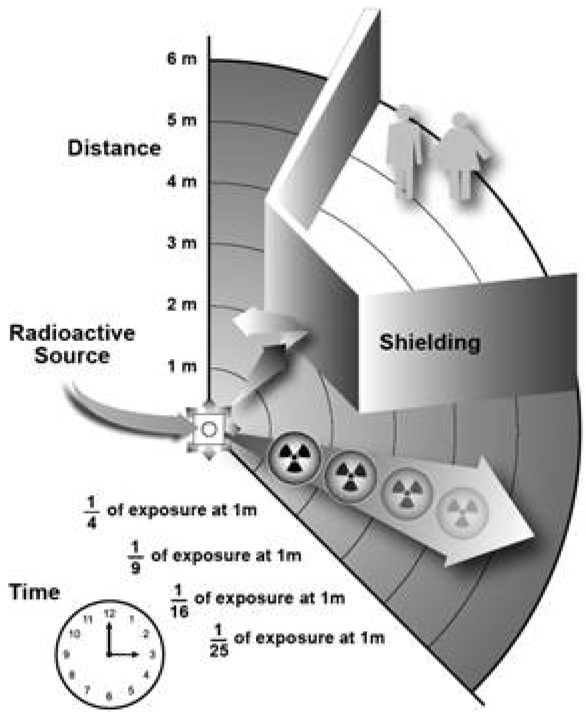
DISTANCE: The dose-rate from a radioactive source reduces as the distance from the source is increases.

The inverse square law states that if the distance from a radioactive source is doubled, the value of the dose is quartered. Inversely if the distance from the source is halved, the dose is multiplied by 4.

SHIELDING: The dose-rate from a radioactive source can be reduced significantly if adequate shielding is used. This is useful, as it allows the individual to work closer to a source without accumulating a large dose. The choice of shielding material(s) used depends on the type of radiation(s) present.

Generally shielding is considered by the manufacturer at the design stage.





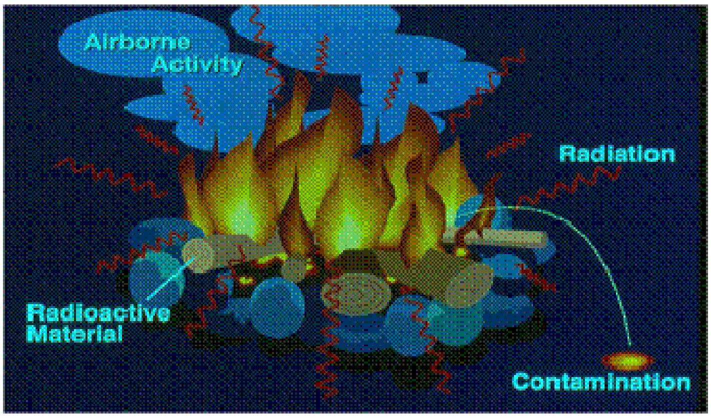
Objective 7 Explain the difference between radiation and contamination, and the methods of protecting against them.

Personnel working with ionising radiation are at risk from both radiation and contamination hazards.

Radiation is the energy emitted from a radioactive source. This energy can either be emitted in the form of alpha and beta particles or pure energy such as gamma.

Contamination is best described as radioactive material that is not contained in any way and constitutes a potential internal radiation hazard. There are 4 routes through which contamination can enter the body:

- Inhalation
- Ingestion
- Absorption (through the skin)
- Penetration (contaminated items puncturing the skin)



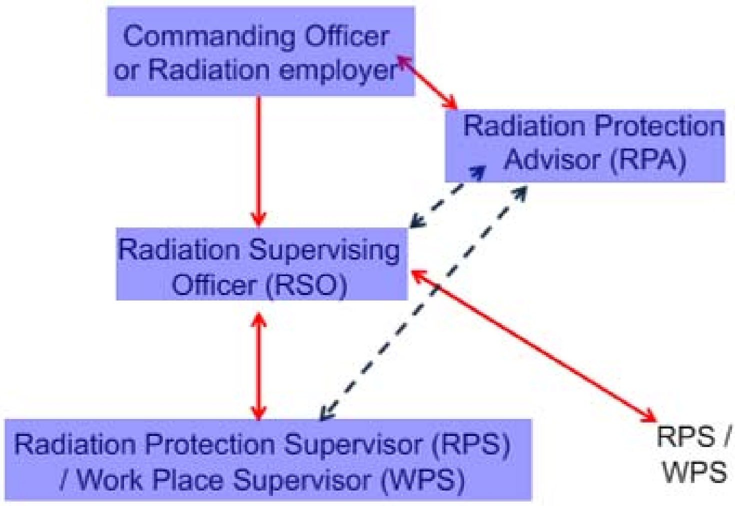
This can be explained by the simple analogy of a bonfire, where the heat emitted is the radiation, and the smoke and any sparks that are emitted from the fire are contamination.

There are many ways of protecting against radiation and contamination. Some examples are included below:



- No smoking, eating, drinking or applying cosmetics in contaminated areas.
- Maintenance of general cleanliness.
- No uncovered cuts or breaks in the skin are allowed within contaminated areas.
- **Engineering solutions** - storing or containing within an enclosure such as a building or suitably designed radiation receptacle.
- **Administration procedures** – including using local orders or systems of work and Personal Protective Equipment (PPE) - always the last resort solution.

Objective 8 Explain the various roles within the local radiation protection organisation.



Commanding Officer (CO) / radiation employer
The CO has a personal responsibility to protect the environment and safeguard the health, safety and welfare of their staff at work. The CO is also required to protect persons not in MOD employment (e.g. members of the public & contactors) against risks to their health and safety arising from the MOD work activities. This includes radiation safety. The CO's authority (but not responsibility) for radiation safety management arrangements may be delegated to appropriate personnel, i.e. Radiation Safety Officer (RSO).
JSP 392 Leaflet 39 Annex A

Radiation Protection Advisor
The appointment of an RPA is a statutory requirement and is made in writing at TLB level. The occasions on which the CO must consult with an RPA are detailed in **JSP 392, Leaflet 7**.

Radiation Safety Officer
The RSO is not a statutory appointment under the IRR99; this appointment is normally to be made by the CO as part of the local safety organisation. In some cases it may be appropriate for one RSO to be appointed to cover a group of local units. Where an RSO is appointed, they are to ensure that they are familiar with the specific radiation hazards at their unit and that adequate radiation protection arrangements are made to minimise the radiation hazards. This is an instruction not a training statement.
See **JSP 392 Leaflet 39 Annex B**.

Radiation Protection Supervisor (RPS)
The appointment of an RPS is in accordance with IRR 99. An RPS is required when it is necessary to designate work areas as controlled or supervised areas. The prime responsibility of an RPS is to supervise work in accordance with the local rules for radiation safety and radiation exposure is kept ALARP. The RPS is to have an understanding of IRR99 in order to ensure compliance with these regulations and is to

understand the necessary precautions to restrict exposure and also what to do in an emergency. See **JSP 392 Leaflet 39 Annex C**.

Work Place Supervisor (WPS)

A WPS is appointed when radioactive material is being stored and used and there is no requirement to appoint an RPS. The prime responsibility of a WPS is to ensure that work is carried out in accordance with local orders for radiation safety. The WPS will normally report directly in this capacity to the RSO. In the absence of an RSO, the WPS will report directly to the CO or Head of Establishment on radiation protection matters. Where a unit holds radioactive material, a WPS is to be appointed for each area where those materials are stored and/or used.

See **JSP 392 Leaflet 39 Annex D**.

Objective 9 Briefly describe the purpose and content of relevant legislation and JSPs

Ionising Radiation Regulations 1999 (IRR99)
IRR99 is a regulation under the Health and Safety at Work Act 1974. It provides the regulatory requirements for radiation protection, which are further explained in the Approved Code of Practice. These include:

- Notification of specified work
- Prior risk assessment
- Restriction of exposure
- Dose Limitation
- Contingency Plans
- Appointment of RPA

Radioactive Substances Act 1993 (RSA93)
Provides control on the use, keeping and disposal of radioactive substances.
MOD sites are exempt but comply.

RSA93 only applies in Scotland and Northern Ireland.

Environmental Permitting Regulations 2010 (EPR10)
Provides control on the use, keeping and disposal of radioactive material.
MOD sites are exempt but comply.

EPR10 only applies in England and Wales.

Carriage of Dangerous Goods and Transportable Pressure Equipment
Describes the legal framework and processes for safe transportation of radioactive material.

JSP 800 Vol 4 – Transportation of Dangerous goods
Provides MODs detailed interpretation of CDG 09 regulations for this forms of transport in 2 volumes:

- Volume 4a - Dangerous goods by air regulations;
- Volume 4b - Transportation of dangerous goods by road, rail and sea.

Objective 10 Identify the key areas of WPS responsibility within JSP 392.

JSP 392 - Radiation Safety Handbook

It is strongly recommended that students ensure they have a current copy of **JSP 392 Volume 2** either by using the links within the course or an existing hard copy.

JSP 392 is the MOD Radiation Safety Handbook and consists of two volumes.

The principal duties of a WPS are:

- Instruction and training of other workers
- Awareness of contingency plans
- Leak testing of radioactive sources
- Storage, accounting and transport of sources
- Record keeping
- Radiation / contamination surveys

Full list of duties at **JSP 392 Leaflet 39 Annex D**

Prior risk assessment - Leaflet 2

IRR99 requires that a new work activity involving work with ionising radiation or radioactive material must not begin until a prior risk assessment has been completed. The main purpose of the prior risk assessment is to identify the measures needed to restrict the exposure of employees and other persons.

Once the process or equipment is operational, the prior risk assessment forms the basis of the working Radiological Risk Assessment. Risk Assessments are to be reviewed annually or when there are changes to the processes, materials, radioactive holdings or location etc. If any of these change, additional training may also be required. See **JSP 392 Leaflet 19 Annex A and B**.

Contingency Plans - Leaflet 40

Contingency plans are required when the prior risk assessment identifies a reasonably foreseeable radiation accident.

A contingency plan sets out an organised, planned, and coordinated course of action to be followed in case of a breakage, fire, explosion, accident, or incident that gives rise to a risk to human health or the environment.

A ‘radiation accident’ is an accident or incident where immediate action would be required to prevent or reduce the radiation exposure to employees or any other persons to ionising radiation.

The contingency plan is to be rehearsed at suitable intervals, at a frequency determined by the ship, unit or establishment in consultation with the RPA. JSP 392 recommends a typical periodicity of annually.

Local Orders - Leaflet 16
Local orders are important instructions developed in-house to describe:
- the contingency plans and emergency procedures;
- dose investigation level;
- organisational details including name of the WPS.

Training of personnel - Leaflet 15
The WPS is responsible for ensuring that all persons carrying out work with the radiation in their area have been suitably instructed in the hazards and radiation protection procedures and are aware of the relevant safety orders and instructions.

WPS's are to receive appropriate refresher training at intervals not exceeding 5 years after the completion of a WPS course.

Prior to undertaking any training, you should consult your RPA to ensure that it is the most appropriate course for your requirements.

Workplace Supervisor Duties - Leaflet 39 Annex D
The prime responsibility of a WPS is to ensure that work associated with the radioactive materials for which they are appointed is carried out in accordance with local orders for radiation safety.

Lost, Theft, Spill or Escape – Leaflet 14

The loss or suspected loss of radioactive material must immediately be reported to the Commanding Officer or radiation employer, via the RSO.
The RSO will investigate this loss with assistance from the WPS, with a formal report submitted to the Commanding Officer or radiation employer by the RSO.

Do not contact any outside regulatory bodies without first contacting your RPA through your RSO.

Objective 11 Explain how radioactive material is identified.

Each source contains the following information:

- Trefoil to show it is Radioactive material;
- The type of radioactive isotope, e.g.
  - Po-210,
  - Co-60,
  - Sr-90
- Radiation type, e.g.
  - Alpha
  - Gamma
  - Beta

Not all radioactive sources introduced into the MOD contain all of the information listed above. Any queries regarding radioactive items, or suspected radioactive items, should be addressed to the RPA via your RSO.

Examples – Miscellaneous:

- Camera lens – (Thoriated)
- Luminescent watch– (Tritium)
- Smoke detector – (Americium-241) (^{241} Am)
- Medical equipment – (x-ray)

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Examples – Army

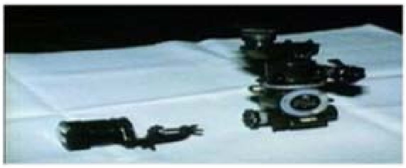
- Gas Mantle – (Thoria powder)
- Susat sights – (Tritium)
- Depleted Uranium round (Uranium)
- Compass – (Tritium)
- Defile Markers – (Tritium)

Examples – RAF

- Rapier – (GTLS)
- Engine Components– (Thorium)
- Air to air refuelling – (GTLS)

Examples – RN

- 986 Magnetron – (microwaves)
- SICS Mk10NHA – (Nickel 63)
- Power control – (GTLS)
- Sea Wolf missile – (GTLS)
- C2 sights – (GTLS)



Tritium

Tritium is a radioactive material that emits low energy beta radiation. A gaseous tritium light source (GTLS) is a sealed glass container filled with radioactive tritium gas. GTLSs may be referred to as betalights, trilux or nuclear lamps and are used to provide illumination. A gaseous tritium light device (GTLD) is equipment containing one or more GTLS. There are many types of GTLDs in service use, including prismatic compasses and SUSAT weapon sights.

Stores containing GTLDs present no radiation hazard when the items are intact due to the fact that the low energy beta particles are unable to break through the surrounding material.

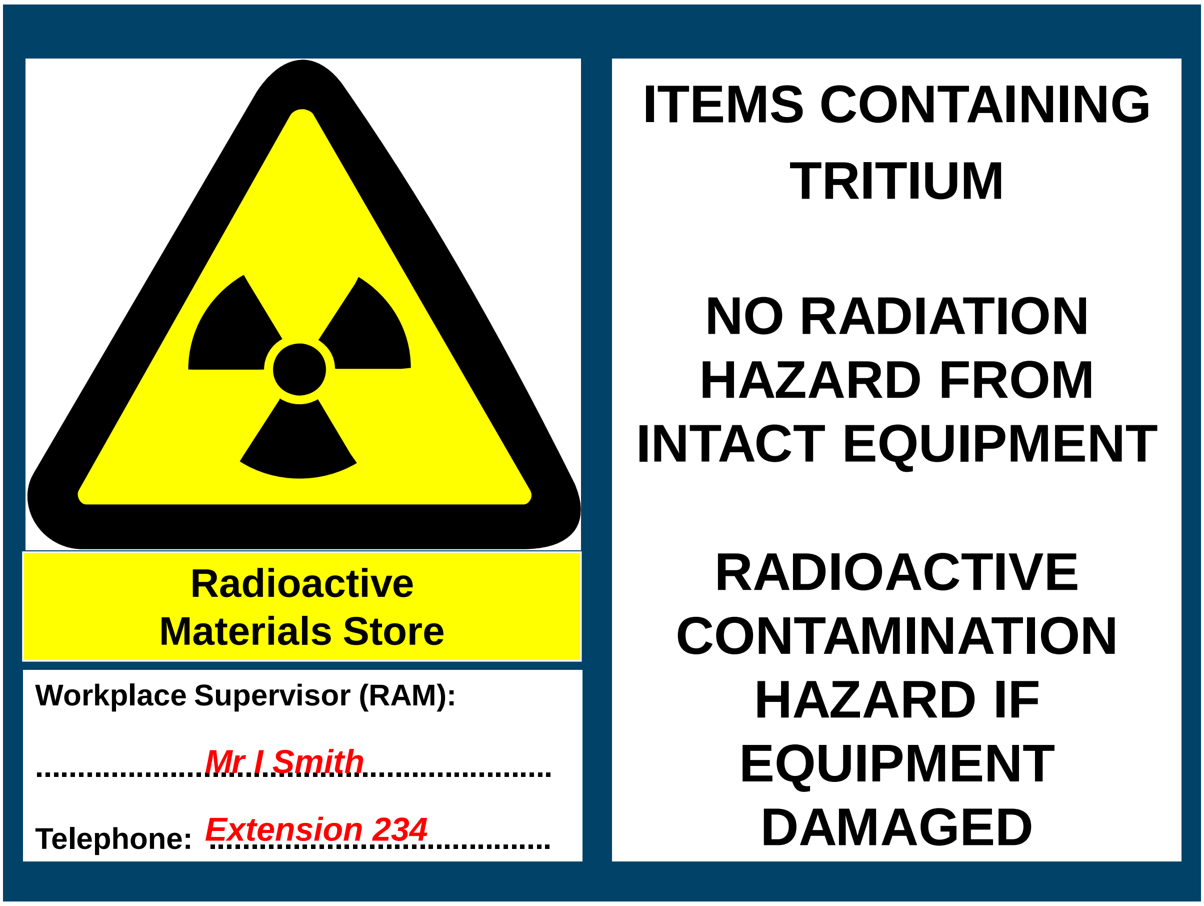
Objective 12 - Describe the storage philosophy, requirements and equipment used for radioactive material.

The permanent radioactive source store must:

- identified by trefoil sign detailing the nature of the hazard and the WPS or RPS details;
- be weather and fire resistant;
- be ventilated
- be rugged
- be secure
- allows all items to be segregated from non radioactive material.

Examples of radioactive stores include:

Examples of the different radioactive source store signs are in JSP 392, Leaflet 9, Annex B.



Temporary radioactive source stores are occasionally required for very large and bulky items (such as thoriated engines), or items in transit or awaiting repair or dispatch.

All the requirements for a permanent store apply, plus within a temporary radioactive source store, sources must be:

- adequately secured;
- designated as a temporary radioactive source store;
- identified by trefoil sign containing the WPS or RPS details (removable);
- adequately packaged.

Within a temporary radioactive source store the items must be segregated.

The local Fire Officer must be notified of any permanent or temporary radioactive store, including the contents.

Objective 13 State the radioactive source accounting and auditing procedures.

All radioactive items must be recorded on a source list and muster sheet and managed as described in **JSP 392 Leaflet 9**.

The following information is required:

- means of identification, i.e. a serial number;
- up to date location of source;
- radio-nuclide and activity at specific date;
- receipt / transfer / disposal details.

All radioactive sources must be accounted for (stock checked) on a regular basis. This frequency is dependent on the degree of movement of the source and the potential for it to go missing. The muster frequency should not exceed a period of 1 month.

An annual check must be carried out to ensure that the accounting records are accurate. This check often forms part of your 'Annual Holding Return' or RPA Audit.

Retention of source lists and muster sheets:

- following the local disposal of a radioactive source, the records are to be retained indefinitely by the unit or establishment;
- following the transfer or return of a radioactive source, the records are to be retained for 2 years.

Annual holding returns are described in JSP 392 leaflet 9, it will:

- provide a summary of radioactive holdings, disposals and transfers;
- provide a summary of the equipment producing ionising or non-ionising (laser & RF) radiation;
- be used to meet EPR 2010 / RSA 93 requirements;
- provide RPA staff with essential information for advisory visits etc.

The Annual Holding Return is normally completed by the RSO, with input from the WPS.

All accounting is to be signed for on the radioactive source list and muster sheet.

Annual holding returns are to contain as much information as possible, including:

- name and address of the unit / establishment;
- name and contact number of RSO or WPS;
- unique stores identification numbers (NSN);
- equipment containing gaseous tritium light sources (GTLS) / gaseous tritium lights devices (GTLD);
- spare GTLS / GTLD;
- Changes to serial numbers;
- Number of items held.

Any changes to the above are to be recorded in RED.

Objective 14 - Explain the purpose and methodology for conducting leak tests and smear tests.

Some equipment and sealed sources require leak tests to be conducted every 2 years as described in **JSP 392 Leaflet 9, annex D**. Leak and smear tests are designed to check if the protective outer layer of the radioactive source has been breached and are conducted using a suitable test kit.

The test kit includes circular filter paper, plastic bags, tweezers and disposable gloves.

Leak tests are conducted every 2 years as described in **JSP 392 Leaflet 9, annex D**. They are designed to check if the protective outer layer of the radioactive source has been breached. The information required includes:

- date of test, reason for test, numerical results (values) and the results of the test (pass or fail);
- any actions taken if a source fails;
- name and signature of person carrying out the test.

The details of common items requiring leak testing are included in **JSP 392 Leaflet 9, annex C**.

If you are unsure whether your equipment requires leak testing, your RSO / RPA will be able to provide further guidance.

A smear test is a type of leak test, but are independently tested. Smears are to be:

- Fixed between 2 pieces of stiff card;
- Sealed in a polythene bag;
- Placed inside a padded envelope;
- Accompanied by a lab request form;
- There must be no reason to suspect significant activity on the smear.

Guidance on returning smears for analysis is given in **JSP 392 Leaflet 9**.

Objective 15 Explain the philosophy and options for the disposal of radioactive material,

A suitably qualified and experienced person or organisation must be consulted at the earliest opportunity to advise on regulatory issues associated with declaration, accumulation or disposal of radioactive waste. This person will often also be the appointed RPA.

Most units or establishments will not accumulate or dispose of radioactive waste, but will return items via the appropriate stores organisation as redundant items. It will normally be the duty of the stores organisation to declare the items as waste, if they cannot be utilised elsewhere.

Disposal of radioactive material that is not waste, for example by sale, loan or transfer, is addressed in **JSP 392, Leaflet 11**.

Returning the radioactive source to the manufacturer or supplier via the stores system is the MOD preferred disposal route. All radioactive waste accumulated abroad must be returned to the UK for disposal (following RPA consultation).

Radioactive valves
Exemption conditions for radioactive electronic values are described in **JSP 392, leaflet 12**, includes:

- Valves may be broken or intact;
- No restrictions on Class 1 valves;
- Maximum 10 Class 2 valves per week;
- Valves to be well dispersed in ordinary refuse;
- No hazard grade value exemption.

Disposal - GTLS / GTLD

Exemption conditions for scrap Gaseous Tritium Light (Source / Device); (GTLS / GTLD):

- No GTLS / GTLD to contain more than 20 GBq;
- GTLS / GTLD to be mixed with ordinary refuge;
- Exemption limited to a small number of GTLS / GTLD

Useful links and points of contact

Websites

Dstl website: http://collab.dstl.r.mil.uk/DRPA/Pages/default.aspx

Army Radiation Protection Website:
http://defenceintranet.diiweb.r.mil.uk/DefenceIntranet/Library/Army/BrowseDocumentCategories/SafEnvFire/RadiationProtection.htm

Service RPA

Royal Navy RPA: 02392 768 281 / 93806 8281.

Royal Air Force RPA: 02392 768231 / 93806 8231.

Army RPA: 02392 768 142 / 93806 8142.

General information

Nuclear Department: 02392 546053 / 93843 6053 or 02392 546073 / 93843 6073.

Examination
The final part of this course is to check you have understood the material.

There are 13 questions in the examination and a pass mark of 60%.

Please ensure you select the "Answer" button to confirm your selection.

You are allowed a maximum of 3 attempts to pass the examination, after that you will be locked out and will need to attend the WPS course in the Nuclear Department.