



**Speaker notes for  
radiation transport  
accident awareness  
course for emergency  
service personnel**

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## 1 INTRODUCTION

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This document provides summarised speaker notes to accompany the presentations that can be downloaded from the RADS SAFE web site ([www.radsafe.org.uk](http://www.radsafe.org.uk)). These notes are designed to assist suitable qualified and experienced personnel to deliver training to their colleagues in the emergency services.

Users are reminded that all materials and pictures, except where specifically acknowledged, remain the property of NRPB. NRPB grants a world-wide, non-exclusive licence for use of the training materials for the non profitable, internal training of emergency services professionals in radiation transport emergencies and awareness in the RADS SAFE and NAIR schemes. Unauthorised duplication of the materials, in whole or in part shall not be permitted without the prior written authority of NRPB.

The materials are reproduced in Adobe PDF format which is freely available on the internet (<http://www.adobe.com/products/acrobat/readstep2.html>), enabling greater access to the training materials.

Additional information regarding RADS SAFE is available on the RADS SAFE web site ([www.radsafe.org.uk](http://www.radsafe.org.uk)).

## 2 STRUCTURE

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Each appendix in this document provides speaker notes for each of the presentations detailed below. Under each heading within the annexes, bullet points provide more information for each slide in the presentation.

The course covers the following elements, times for each of the presentations are given for guidance.

Introduction	5 minutes	Appendix A
Fundamentals of radiation protection	30 minutes	Appendix B
Instrumentation and monitoring	20 minutes	Appendix C
Transport packages	30 minutes	Appendix D
RADS SAFE	30 minutes	Appendix E
Experience of the NAIR Arrangements	20 minutes	Appendix F

### **3 AIMS AND OBJECTIVES**

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This overall package provides an 'Awareness' course intended for emergency services professionals, providing background on:

- Fundamentals of radiation protection
- Instrumentation and monitoring

The course focuses on the transport of radioactive materials, including:

- Radioactive material transport and packaging
- RADSAFE scheme
- NAIR scheme

## APPENDIX A AIMS

### A1 Title slide

### A2 Aims

An 'Awareness' course intended for emergency services professionals, providing background on:

- Fundamentals of radiation protection
- Instrumentation and monitoring

Focusing on the transport of radioactive materials, including:

- Radioactive material transport and packaging
- RADSAFE scheme
- NAIR scheme

### A3 Copyright statement

- For information only.

## APPENDIX B FUNDAMENTALS

### B1 Title slide

### B2 Introduction

- This presentation provides a brief overview of radiation protection. It will include a few definitions and units to ensure that everyone is familiar with the terms used, followed by a short section on radiation protection itself before finally discussing the effects of ionising radiation.

### B3 Radiation

- There are many forms of radiation. In this series of presentations we are concerned only with ionising radiation, that is radiation that produces ionisation in matter. Examples are alpha particles, beta particles and gamma rays. When these radiations pass through the tissues of the body, they have sufficient energy to damage DNA. When radiation is referred to in the remaining presentations we mean ionising radiation.

(Non-ionising radiation does not produce ionisation in matter. Examples are ultraviolet radiation, light, infrared radiation and radio-frequency radiation. When these radiations pass through the tissues of the body they do not have sufficient energy to damage DNA directly.)

- Radiation, the process of emitting energy as waves or particles, arises from both naturally occurring and artificial sources. An important point is that your body cannot distinguish between the source of radiation. The effects from natural sources of radiation are exactly the same as those caused by man-made sources.

### B4 Radioactivity

- Definition of radioactivity: the property of unstable atoms (radionuclides) of spontaneously emitting ionising radiation.
- Unstable atoms “decay” resulting in the release of energy (radiation) and reducing the amount of radioactive material originally present. Unstable atoms will eventually decay into stable atoms but this may take some time

and could be as a result of a series of successive decays through several radionuclides.

## **B5 Penetration powers**

- An important property of the various ionising radiations is their ability to penetrate matter.
- The depth of penetration for a particular type of radiation increases with energy but varies drastically from one type of radiation to another for the same energy.
- Alpha particles can scarcely penetrate the dead, outer layer of human skin - thus radionuclides that emit (only) them are not hazardous unless taken into the body through breathing, eating or a skin wound.
- Beta particles may penetrate a centimetre or so of tissue so radionuclides that emit them are hazardous only to superficial tissues but not internal organs unless they are also taken into the body.
- For gamma rays the degree of penetration depends on the nature of the interactions with tissue - gamma rays can pass right through the body. Heavy, dense materials are used to shield against gamma rays (e.g. lead).

## **B6 Half life**

- Definition: the time taken for the activity of a radionuclide to fall to half its original value is called the half-life, symbol  $t_{1/2}$  - this is the time for half the nuclei to decay
- The half life defines the characteristic of the radionuclide that tells us how fast or slow the radionuclide will decay
- In successive half-lives, the activity of a radionuclide is reduced by decay to 1/2, 1/4, 1/8, and so on. This means we can predict the activity remaining at any future time. As the amount of a radionuclide decreases, the radiation emitted decreases proportionally.

## **B7 Activity**

- The rate at which spontaneous disintegrations (or transformations) occur in a given amount of a radioactive material is known as its activity

- Activity is expressed in a unit called the Becquerel, symbol Bq. Where 1 Bq equals one transformation per second
- As the unit is so small, multiples of the becquerel are frequently used, such as the megabecquerel, MBq, which is 1 million becquerels

## **B8 What is a Becquerel**

- Slide provides an illustration of the number of Becquerels found in some objects.

## **B9 Dose Quantities**

- Absorbed dose is the quantity of energy imparted by ionising radiation to unit mass of matter such as tissue. Unit gray, symbol Gy.
- Equivalent dose take account for the different types of radiation (alpha, beta gamma) by allowing for the different effectiveness of the various ionising radiations in causing harm to tissue. Unit sievert, symbol Sv.
- Effective dose: takes account of the different sensitivities of various tissues and organs. Unit sievert, symbol Sv. Frequently abbreviated to dose. This is the basis of the operational unit used by the emergency services as it takes account of both the different types of radiation and the effect on different organs.

## **B10 Units**

- Recap slide

## **B11 Prefixes**

- Becquerel – small unit hence multiplying prefixes.
- Sieverts – large units hence fractions of a Sv are used. Important to distinguish between milli (m) and micro ( $\mu$ ). The mSv is the most commonly used unit with the emergency services.

## B12 Example doses

- Examples of doses (X-ray, flights, UK annual average exposure). These may be used by scientific support (e.g. NAIR or RADSAFE responder) to put doses into context, for example the level of exposure was equivalent to a “couple of chest X-rays” or “a few days worth of background radiation”.

## B13 Sources of exposure

- The pie chart represents the typical annual radiation dose received by a member of the public in UK, this is approximately equal to 2,600  $\mu\text{Sv}$  or 2.6 mSv. Our exposure derives from natural radiation, about 85% and man-made radiation, about 15%.
- Natural sources include radionuclides that occur in nature and we are even exposed to radiation from outer space. Radionuclides present in the air and soil can consequently end up in our diet.

Radon accounts for the highest component of the average radiation dose. Uranium, mostly uranium-238, (1 part in 10,000) and is found nearly everywhere on earth this decays into radium-226 and radon-222.

- Man-made; greatest part comes from medical applications - diagnostic X-rays and nuclear medicine. Other man-made sources include nuclear power, discharges, fall out from historical atmospheric nuclear weapons testing.

## B14 Radiation Protection

- Section title slide

## B15 Radiation Protection – the external hazard

- 3 principles – time, distance and shielding
- Time – total dose is a function of dose rate and time. Therefore the less time you spend the lower your overall dose will be.
- Distance – inverse square law applies. This means that if you double the distance between you and source of radiation the dose rate is reduced by a factor of 4. Equally if you half the distance between you and the source of radiation the dose rate will increase 4 times.

- Shielding – placing large substantial objects between you and the source can minimise your exposure. However, where possible time and distance should be used to limit exposure.

## **B16 Contamination**

- Radioactive contamination can occur due to the escape of radioactive material into the air, onto surfaces or actually dispersed into materials (foodstuffs, water).
- Being exposed to a radioactive source does not make the item radioactive itself, e.g. X-rays. However, items can appear radioactive if radioactive material is fine spread on them.

## **B17 Radiation Protection – contamination hazards**

- The key for contamination control is to prevent intakes. Possible routes are identified on the slide.

## **B18 Effects of ionising radiation**

- Section title slide

## **B19 Important factors**

- The biological effect will depend on:
  - Type of radiation
  - Total dose
  - Dose rate
  - Total area exposed
  - Radio-sensitivity of the tissue or organ

## B20 Biological Effects

- Biological effects are split into two categories: early effects (also known as acute or deterministic effects) and delayed effects (also known as stochastic effects). With early effects the level of exposures is related to the severity of the effects whilst with delayed effects the level of exposure is related to the probability of the effect occurring rather than the severity.

## B21 Acute Radiation Syndrome

- Some of the early effects can be classified as acute radiation syndromes but these are only observed after very high radiation doses have been received.
- The prodromal syndrome varies in time of onset, severity, and duration according to the level of exposure. Principal symptoms of the are anorexia, nausea, fatigability, diarrhoea and fever. Some effects may be seen at doses of about 1 Gray upwards.
- The cerebrovascular syndrome results from total-body exposure to about 100 Gy of gamma rays and results in death in 30 to 50 hours due to effect on the central nervous system.

The gastrointestinal syndrome results from total-body exposure to about 10 Gy. Death occurs in about 9 days in humans because of damage to the lining of the gut.

The haematological syndrome results from total-body exposure to 3 to 8 Gy. Symptoms result from lack of circulation of blood elements 3 weeks or more later.

- The dose that would be lethal to 50% of the population is 3 to 4 Gy for young adults without medical intervention. It may be less for the young or the old. Antibiotics, platelet infusions, or bone marrow transplants may save some people who would otherwise die.

## B22 Localised exposures

- The previous slide assumes exposure to whole body. If only a small part is exposed, for example your hand, then localised effects may occur.
- Much higher doses can be sustained to smaller areas of the body.
- Erythema = skin reddening

### **B23 Late effects**

- The late effects include induction of cancer in later life and hereditary defects.
- It should be noted that up to a few hundred millisieverts, as dose increases the probability of the effect occurring increases. This means the higher dose the greater the risk. Equally, a very small dose carries a corresponding very small risk. It should be remembered that in the European community there is a 1 in 4 risk (25%) of dying of cancer. Any exposure will add to this already high rate. The risk factor assumed is 5% per sievert. This means the additional risk from exposure to a dose of 1 mSv (1 thousandth of a sievert) is 0.005%.

### **B24 Radiological risks**

- Table of risks placed into context, especially when compared with the following slide of non radiological risks.

### **B25 Non radiological risks**

- This table provides a summary of some non-radiological risks.

## APPENDIX C RADIATION MONITORING

### C1 Title slide

### C2 Introduction

- This presentation will provide an introduction to radiation monitoring and will look at; why we monitor, the different types of monitoring and in particular contamination and dose rate monitoring.

### C3 Why monitor

- See slide

### C4 Types of monitoring

- Radiation cannot be detected by conventional senses, however it can be detected using sensitive equipment. These can give an indication of the level of exposure at the time.
- There is a difference between sampling and direct monitoring. Some media will require samples to be taken back to a laboratory for analysis.
- Usually there is most concern with external dose rate from gamma rays.
- In this presentation we will also look at personal and biological monitoring.

### C5 Contamination

- Contamination monitoring can be difficult in emergencies, especially as it takes a lot of time.
- Self absorption can occur, especially with alpha's, it can therefore be difficult to measure accurately, for example, a thin film of oil or water could shield your probes from the alpha particles. Interpretation can be very difficult.
- Monitoring of soil, food, water contamination requires samples to be taken and processed in laboratory. Mainly used in the recovery phase

- Air samples can be made in almost real time, but equipment is expensive and highly specialised.

## **C6 Contamination**

- The probes are very delicate; some have thin “foils” that are easily punctured. Always a problem considering distance between probe and surface (perhaps less than 10 mm). There is always a danger of either damaging or contaminating the probe.
- Most contamination instruments will report in counts per second. A conversion will be required to give a reading in terms of activity per area ( $\text{Bq}/\text{cm}^2$ ).

## **C7 Surface contamination monitors**

- Examples of different instruments available. See slide.

## **C8 External dose rate**

- External dose rate monitors are used mostly to measure Gamma and X-ray radiation. As far as most dose rate monitors are concerned Gamma and X-rays are the same. Reading are in terms of  $\text{mSv}/\text{h}$  or  $\mu\text{Sv}/\text{h}$ .
- The time spent in a dose rate relates directly to a dose.  
E.g 10 seconds in  $2 \text{ mSv h}^{-1}$  dose rate field  
 $= (10/3600) \times 2 \text{ mSv} = 0.0056 \text{ mSv}$  or  $5.6 \mu\text{Sv}$  dose
- Remember the inverse square law! - Half the distance, quadruple the dose rate

## **C9 External dose rate**

- It is important that you check the batteries before use and that instrument is turned on at an early stage. See slide for other points.

## C10 Personal Dosimetry

- Two types of personal dosimetry; passive and active.
- Passive dosimeters

Widely used as Approved Dosimetry for radiation workers. They measure dose to the wearer – sensitive to approximately 10  $\mu$ Sv dose. They cannot be read by the user, they have to be sent to an approved laboratory for reading. They must be worn in the correct orientation

- Active dosimetry

This does not mean radioactive. They are useful in emergency situations as they display the dose and dose rate by some means that can be read at any time by the wearer. They can be alarmed at dose rate and total dose levels. They can respond to Radio Frequency (eg two-way radio's)

## C11 Biological dosimetry

- Monitoring activity inside individuals can be carried out by either taking samples or directly using very sensitive instruments outside the body looking inwards. This could be used post incident to assess impact if no measurement available at the time
- The picture here shows a transportable whole body monitor used to determine if radioactivity has been breathed or swallowed in by someone.

## C12 Summary

- Monitoring instruments are your best source of information, if used wisely;
  - Select an appropriate monitor (note: note all monitors can detect all types of radiation).
  - Switch on BEFORE entering an area
  - Always check the battery
  - Set any alarm to a sensible level
  - Protect against contamination
- Interpret results with care

## APPENDIX D TRANSPORT OF RADIOACTIVE MATERIALS

### D1 Title slide

### D2 Introduction

- There are numerous movements of radioactive material packages in the UK every year.
- The aim of this lecture is to:
  - raise awareness of the transport radioactive materials,
  - the construction of the packages and the testing required under the legislation
- Labelling requirements and what they mean

### D3 Legislation

- Legislation in the UK is taken from International Atomic Energy Agency (IAEA) and presented in modal transport regulations (i.e. covering the individual forms of transport such as road, rail etc.).

### D4 Hazards

- External and Intake (i.e. contamination) hazards
- Criticality – too much “fissile” material, such as you get in a nuclear reactor, too close together would result in an uncontrolled release of energy.

### D5 Controls

- There is a much greater investment in the packaging to ensure safety.
- There are limits of both the contents, the external radiation levels and levels of contamination.

- Those controls that apply to the carriage of other dangerous goods equally apply to radioactive materials. This includes driver training, emergency arrangements, placarding and documentation etc.
- Segregation is used to maintain distances between fissile material.

## **D6 Packaging**

- The different levels of packaging are commensurate with the hazard of the material being carried. Increase in integrity as you move up the list. Excepted packages are at the bottom, moving up through industrial, Type A and Type B packages to Type C packages at the very top.

## **D7 Which packages to use**

- A number of factors determine which level of packaging is required. The radionuclide being carried, how much, what form it is in (i.e. sealed source or potentially dispersible source like a powder or liquid) and the dose rate from the material.
- In the legislation the schedules provide a list of different radionuclides along with their associated A1 and A2 values. These numbers relate to the amount of material that can be carried in a Type A package. A1 refers to "special form" or sealed sources. A2 refers to "all other radioactive material", that is potentially dispersible sources. There are also data for exempt activities and concentrations.
- A type package carrying a single radionuclide must not exceed the A1 or A2 value, depending on its form. Type B packages must not carry activities greater than those authorised for the package design.

## **D8 Excepted packages**

- Table 3 in Schedule 1 of the Radioactive Material (Road transport) regulations (RAMROAD) 2002 gives the activity limits for excepted packages.
- The external dose rate from an excepted package must be less than 5  $\mu\text{Sv/h}$ .
- An excepted package will have not external trefoils but it will be marked with a United Nations (UN) number (see slide 11).

## **D9 Industrial packages**

- These packages will carry surface contaminated objects (SCO) or Low Specific Activity (LSA) packages. They can range from small barrels to large ISO containers.
- Tables 4 and 5 in Schedule 1 of the Radioactive Material (Road transport) Regulations (RAMROAD) 2002 gives the activity limits for industrial packages.

## **D10 Type A Packages**

- These packages are designed to withstand “minor transport mishaps”, this includes crushing etc. They will not withstand significant accidents including larger fires. Consequently there are limits on the amount of material that can be held.
- The consignor has to demonstrate compliance to the tests identified in the legislation. The tests are covered in more detail on slide 12.
- Labelled and marked including UN number.

## **D11 Type B Packages**

- These packages are designed to withstand “major transport accidents” including large fires. They will include labels as well as an embossed, fire proof radiation trefoil to help identify the package.
- Certificate issued by competent authority to authorise use.
- Each package design will include specific limits on what can be carried. Will usually be termed in multiples of A1 or A2 values.
- Note: Type C packages are to be used for high activity packages transported by air. Due to the cost of design, development, testing and manufacture at the time of printing no one has developed a Type C package. Sealed sources can still be transported in a Type B package.

## **D12 UN Numbers**

- United Nations numbers provide an indication of the contents of the package. A few examples are given here. This information is useful for the responder

who has a complete list and will help them determine the contents and associated hazards.

### **D13 Testing**

- The legislation details all of the testing required for each type of package.
- For type A packages;
  - they are soaked in water;
  - compression tested with large weights stacked on them; and
  - dropped from specified heights.
- Type B package test standards are even more stringent and include a thermal test. For nuclear fuel flasks the regulations state the package must be able to withstand an all-engulfing fire for 30 minutes at 800°C. There is also an immersion test to ensure the packages can withstand specified pressure.

### **D14 Testing**

- Picture illustrating some of the tests. Clockwise: 9 metre free drop test on a nuclear fuel flask; Operation Smash Hit (a train at 100 mph hit a fuel flask); the flask used in Smash Hit after the crash (now on show outside Heysham power station).

### **D15 Package Labels**

- See slide for classification of labels

### **D16 Placards**

- Placards must be displayed on rear and sides of vehicle. Minimum dimension 250 mm. For small vehicles they can be of reduced size (150 mm).
- Carriage of dangerous good regulations apply. Larger vehicles must carry orange plates. Smaller vehicles do not have to carry orange plates but will carry a fire proof notice inside the drivers door.

## D17 Other Requirements

- The total maximum transport index for all of the packages within a vehicle is 50, unless the packages are being shipped under what is termed as “exclusive use”. This places extra requirements on the consignor, including loading and unloading the shipment under supervision.
- Dose rate limits are also applied to the vehicle (2mSv/h at the surface and 100 µSv/h at 2m from the vehicle).
- Contamination limits are applied to the packages.

## D18 Package movements

- See pie chart for percentage of different packages transported.

## D19 Radiation risks and doses

- NRPB assessed the possible doses that emergency service responders may receive when attending a radiation transport accident. A range of accidents were considered. Given the wide variety of radioactive transport packages a reasonably pessimistic approach was adopted. This does not mean that a worse accident could happen but it does provide an indication of the type of doses that realistically might be expected. The report has been summarised on [www.radsafe.org.uk](http://www.radsafe.org.uk) and provides generic risk assessments for the emergency services.

## D20 Doses and risks

- The highest dose assessed from an accident involving a type A package was assessed as 1mSv, or equivalent to a few months of the annual average dose to someone in the UK.
- The dose assessed from a type B package, although containing much more radioactive material, is considerably lower than the type A accident due to the greater integrity of the package. Doses are comparable to less than one days worth of UK annual average radiation exposure.
- An industrial package results in a dose broadly comparable to a Type B package.

## APPENDIX E RADS SAFE

### E1 Title slide

### E2 Introduction

- The presentation will centre on RADS SAFE but will also touch upon nuclear weapon transport and NAIR.

### E3 What's not covered

- It is easier to define RADS SAFE by what it is not.  
It does not cover MoD Convoys. These have their own response arrangements (see MoD LAESI guidance, available on the internet).  
It does not cover movements made by non-RADS SAFE members. Those organisations that do move radioactive packages must have their own arrangements in place. Carriers (i.e. couriers) that carry only RADS SAFE packages will be covered under RADS SAFE.
- RADS SAFE is a consortium of organisations that have come together to offer mutual assistance in the event of a transport accident involving radioactive materials belonging to a RADS SAFE member. The RADS SAFE plan evolved from a number of earlier emergency plans.
- NAIR acts as a long stop to all other plans and should not be quoted as a formal emergency plan. The next presentation provides more details about NAIR.

### E4 Legislation

- IAEA safe transport regulations enshrined within the UK modal transport regulations (e.g. road, rail etc.) require emergency arrangements to be in place. There is consistency between the RADS SAFE plan and the IAEA recommendations.

## **E5 Aim of Radsafe**

- Identifies emergency services as the customers and RADSAFE ensures the early provision of advice and support to the emergency services.

## **E6 Incidents**

- Torness - empty flasks backed into railhead and derailed. The spacer wagon and flat roll dropped a few inches off of the tracks. There was no damage to flasks.
- Dungeness - lorry jumped signals and crashed into leading locomotive. No damage to flasks.
- Manchester train, hot axle box leading locomotive detached and secondary loco pulled free. No damage to flasks.

## **E7 Torness derailment**

- Picture shows the wheels of the spacer wagon and last flat roll (containing a flask) not on the rails. Top left a British transport police officer can be seen. Just out of picture are approximately 60-80 other emergency service personnel. The level of response was partly due to the time and location of the accident. It was 1 week after the Selby rail crash on the same track, the East coast main line. The flasks were empty (discharged) and there was no damage to them.

## **E8 RADSAFE incidents**

- When will RADSAFE respond? To an accident or deliberate interference with the package that means the emergency services require expert radiological assistance. It does not cover mechanical breakdown of vehicles.

## **E9 RADSAFE participants**

- A list of the members of RADSAFE is shown on the slide. All of the major nuclear establishments are represented. MoD included because some of their non-weapons movements are covered by RADSAFE.

- Some members of RADSAFE use qualified carriers. These carriers are being brought into RADSAFE. If a courier is only carrying material from a RADSAFE member it will carry a RADSAFE placard.

## **E10 Operation of RADSAFE**

- The main spine of the RADSAFE response includes:
  - National free phone number (0800 834 153) or 999 call activation.
  - Early provision of advice to the emergency services.
  - The Force Communication Centre acting as a notification centre and communication hub.
  - The level 2 responder providing on the scene advice.
- For a rail incident, ZPC or Zone Production Control is involved.

## **E11 Operation of RADSAFE**

- Three levels of response. Similar structure to the Chemsafe scheme. For RADSAFE levels 1 and 2 are always activated together.

## **E12 Level 1 – Provision of information**

- Illustration of the response - FCC notified.

## **E13 Level 1 – Provision of information**

- Illustration of the response – generic advice faxed back to emergency services.

## **E14 Generic advice**

- Information passed to emergency services in the form of generic advice.

### **E15 Generic Advice**

- Illustration of information on setting a cordon.

### **E16 Level 1 - Provision of information**

- Illustration of the response – FCC contacts the consignor and nearest RADSAFE site to provide the level 2 responder.

### **E17 Level 1 – Provision of information**

- Illustration of the response – Consignor contacts level 2 responder with product specific information. Level 2 responder provides refined advice to emergency services and arranges rendezvous.

### **E18 Level 2**

- Illustration of the response – Level 2 responders attends the incident site and provides on the scene advice. The consignor will provide the PR response.

### **E19 Level 3**

- Illustration of the response – the consigning organisation will provide the clean up.

### **E20 Radsafe placard**

- Example of a placard carried. Important feature is the **site code**, this indicates where the consignment has come from and who is the consignor. This information, if available, should be relayed to the FCC at the earliest opportunity.

## **E21 FCC**

- Phoning the national free phone number will contact the UK Atomic Energy Authority Constabulary (UKAEAC) Force Communication Centre (FCC). They man the phone 24/7. They can contact the sites and act as a communication link.

## **E22 Integrated emergency response**

- Diagram illustrating that RADSAFE fits into the rest of the emergency service plans, RADSAFE provides the expert source of advice for this particular situation.

## **E23 Operation of RADSAFE**

- Diagram illustrating how RADSAFE would fit into the overall response. Providing technical advice to the emergency services.

## **E24 Health Physicist Actions**

- A list of actions the RADSAFE responder would be able to undertake, including:
  - monitoring to determine if there is any contamination
  - other actions indicated on the slide.

## **E25 Fire service actions**

- Actions the fire service would take include, rescue operations, putting out fires etc.
- In the event of large fire on a nuclear fuel flask it is advised to spray cool the flask. This should continue even after the fire is out.

## APPENDIX F NAIR

### F1 Title slide

### F2 Introduction

- As we have already seen radioactive material used in more than just the nuclear power industry. Radiopharmaceuticals and industrial uses mean there are many sources in use.
- Users, carriers, consignors and storage facilities holding radioactive materials must have contingency arrangements in place. However, there may be times where plans are not exist (for example a radioactive source turning up in a public park), may prove inadequate (the responding radiation protection advisor is involved in an accident whilst trying to get to the scene) or the police may not have confidence in the plan proposed.
- The National Arrangements for Incidents involving Radioactivity (NAIR) provide a national long stop to these situations. NAIR is co-ordinated by NRPB and came into existence in 1964. (A similar scheme Radiation in Public Places operates in Northern Ireland.)

### F3 Objectives

- The arrangements are devised around the civil police due to their responsibility to protect the public. For events where, radioactivity is suspected, the public may be at risk and no other expert is available these criteria constitute a valid NAIR call.
- To reiterate NAIR is not there to supplement other people's legal responsibilities and to cover situations where preplanning and contingency arrangements should be in place.

### F4 Initial Actions

- On attending an incident and determining the presence of radioactive material, the emergency services should check for the existence and suitability of contingency plans. This may involve questioning the driver of the vehicle or checking with the control room to ensure there are no local plans in place. If nothing else is available then NAIR can be contacted using

the national free phone number 0800 834 153. (The same number as RADSAFE.)

## **F5 How it works**

- In this hypothetical situation, an incident has occurred resulting in the police and public being involved at an event with radioactive materials. The Police will check for the existence and suitability of plans and on finding nothing they would contact the UK Atomic Energy Authority Constabulary (UKAEAC) on 0800 834 153.
- This phone number connects to the UKAEAC Force Communication Centre (FCC). Here the officers will determine the correct response (NAIR or RADSAFE) and contact the nearest NAIR responder.
- The FCC acts as a communication link between the police and NAIR responder until communications are established between the Police and NAIR responder. Information provided over the phone by the NAIR responder may be sufficient to resolve the situation. However, the NAIR responder may need to attend the scene.
- The final link is the notification of the appropriate environment agency (the Environment Agency in England and Wales and the Scottish Environmental Protection Agency in Scotland).

## **F6 Stage one assistance**

- The initial response, known as a Stage 1 responder, will be able to resolve over three quarters of typical NAIR incidents. With relatively simple equipment they can determine if a hazard does exist and what actions should be taken immediately. Stage 1 responders includes NHS medical physicists as well as nuclear establishments. There are over 80 organisations providing NAIR Stage 1 response.

## **F7 Stage two assistance**

- Stage 2 assistance is provided by the major nuclear establishments. They have much greater resources (both in terms of numbers of staff and equipment). Any situation arising under NAIR can be dealt with by Stage 2 responders.

## **F8 Dose limitation**

- NAIR provides a “first-aid” response to ensure that people are not harmed (i.e. exposed to unnecessary radiation) and to render the situation safe. This does not mean that they will take the material away.
- Whilst it is ultimately the police that have responsibility for the disruption, the NAIR responders provide technical input into the overall incident management.

## **F9 Disposal of waste**

- Only a small proportion of NAIR incidents involve radioactive material whose ownership is untraceable. In respect of the EA disposal arrangements, it should be noted that:-
  - a) the contract is only intended to cover the general, small arisings of radioactive waste under the NAIR scheme, there being a limit on the liability which will be met by the Environment Agency contract.
  - b) the contract provides for removal of waste from NAIR incidents occurring since April 2000
  - c) Environment Agency will continue to investigate vigorously any suspected breach of the Radioactive Substances Act 1993, including circumstances where these arrangements are used
  - d) Environment Agency recognises the valuable public service that NAIR has provided for many years and supports the scheme from the Agency's perspective of environmental concern and interest, rather than any statutory or other obligation.
- In the event of a NAIR incident occurring in England or Wales and an EA representative not being available at the scene, NAIR respondents and/or the police may obtain radioactive waste disposal assistance via the Environment Agency Emergency Hotline (Tel: 0800 80 70 60).

## **F10 NAIR responsibilities**

- Summary slide.

## **F11 Number of incidents**

- Over the past 40 years there have been nearly 400 incidents notified under NAIR. Due to the evolution of plans such as RADS SAFE fewer calls are made upon NAIR from transport incidents. This means that, on average, there may be only 6-10 calls per year nationally.

## **F12 Types of incidents**

- This slide shows the types of incidents. Empty packages and false alarms account for 40% of the calls. Undamaged sources 43% (i.e. correctly packaged but in the wrong place). Damaged packages but sources in tact 12%. Of most concern are the incidents with damaged sources. In the past 40 years there have been 17 cases involving damaged sources with only 2 cases of significant contamination of the local area.
- Even with the high percentage of “non-radiological events”, NAIR still provides an important service in supporting the emergency services to carry out their roles. As we have seen in a large number of cases the NAIR responder will attend an incident and determine that there is not a radiological hazard present.

## **F13 Similarities with RADS SAFE**

- NAIR and RADS SAFE use the same national telephone number. This has the advantage that the emergency services only have to refer to one number for advice.
- In both cases neither the RADS SAFE responder, nor the NAIR responder, are responsible for the clean up. Under RADS SAFE, the consignor has the responsibility. Under NAIR, if the owner cannot be traced then arrangements managed by the appropriate environment agency will handle the situation.
- NAIR stage 2 response is provided by the same organisations that are members of RADS SAFE, so NAIR stage 2 and RADS SAFE involve the same people.

## **F14 Difference with RADSAFE**

- RADSAFE only covers signatories of the RADSAFE contract. Any other organisations transporting radioactive material should have their own contingency arrangements in place.
- NAIR provides a national long stop and is not limited to transport. It is there to cover a situation where; radioactive material is suspected, the public are at risk and no other expert is available.