

# 14 Accident and Incident Investigation and Reporting

## Scope

1. This chapter details the requirement for the investigation, notification and reporting of radiation and radioactive material accidents, incidents, dangerous occurrences and near misses. The chapter describes the type of radiation accident and incident that should be reported both internally to MOD and to external authorities such as the HSE and EA and incidents and near misses that should only be reported within MOD. Defence Authorised sites have a duty to inform ONR who regulate IRR17 in place of HSE. The chapter does not extend to other non-radiological reporting requirements (e.g. for fire, explosion, injury).

## Statutory Requirements

2. In addition to the general requirements of the Health and Safety at Work etc Act 1974 and the Management of Health and Safety at Work Regulations 1999, the following specific legislation applies directly or is applied indirectly through parallel arrangements designed to achieve equivalent standards:

- a. Ionising Radiations Regulations 2017 (IRR17) (apply directly);
- b. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (apply directly) (RIDDOR13);
- c. Environmental Permitting (England and Wales) Regulations 2016 (ERP16) (as amended) (parallel arrangements);
- d. Environmental Authorisations (Scotland) Regulations 2018 (EASR18) (parallel arrangements); and
- e. Radioactive Substances Act (Northern Ireland) 1993 (RSA93) (as amended) and associated Exemption Orders.

## Duties

3. Duties as detailed in Chapter 39 apply.

## Radiation Safety Officer (RSO)

4. Personnel are made aware that if they are involved in a radiation accident or incident that they should act in accordance with MOD policy in JSP 375;

5. The accident, incident or near miss is reported to the relevant Incident Notification Cell (INC) as detailed in JSP 375, Chapter 16.

## Managers

6. In the case of personnel involved in a work-related radiation accident or incident, managers shall ensure that staff are aware of their legal right to have it recorded on a suitable form (meeting the requirements of HSE form 510) and should encourage them to do so. Information contained on the form may be used to provide supporting evidence for

compensation or Social Security benefit claims and be shared with Trade Union safety representatives (unless permission to disclose information has not been granted by the injured person) to aid in accident / incident investigations.

## **Employees**

7. It is the responsibility of all employees to ensure that they immediately report any radiation accident, incident or near miss, affecting themselves or others, to the local RSO, RPS or WPS. Personnel involved in a work-related radiation accident or incident should follow TLB / TLA reporting procedures in accordance with MOD policy in JSP 375.

## **Contractors**

8. In accordance with JSP 375, accidents / incidents involving contractors, sub-contractors and others (non-MOD), permanent or visiting a MOD unit / establishment shall be reported by their MOD host to the "hosts" TLB / TFA INC or equivalent. This does not preclude the need for contractors to report the accident / incident to their respective employers.

## **Definition of a Radiation Accident, Incident, Dangerous Occurrence and Near Miss**

9. A Radiation Accident is defined in IRR17 as - an accident that requires immediate action to prevent or reduce exposure to ionising radiation of employees or any other persons.

10. For MOD investigation and reporting purposes, radiation accidents, incidents, dangerous occurrences and near misses are defined as:

- a. Accidents – the situations listed in paras 12 to 15 that involve a person being exposed to ionising radiation that is likely to exceed dose limits detailed in Chapter 4;
- b. Incidents – the situations listed in paragraph 16;
- c. Dangerous Occurrences – the situations listed in paragraph 16;
- d. Near Miss – the situations listed in paragraphs 12 to 15 that, while not causing harm, had the potential to cause a radiation exposure or contamination of an individual, workplace or environment.

## **Types of Radiation Accidents, Incidents and Dangerous Occurrences Notifiable to Authorities External to MOD**

11. The following radiation accidents and incidents require:

- a. an immediate report by telephone call (followed up by an e-mail) to the appointed RPA, the appropriate TLB / TFA safety authority and the chain of command; and
- b. an immediate investigation by the RSO / RPS / WPS, taking advice from the RPA as necessary (see Annex A for details of an immediate investigation).

## **Radiation Overexposure**

12. If a person working on the site is suspected of receiving an over exposure to ionising radiation that is likely to exceed the limits detailed in Chapter 4, unless the immediate investigation shows beyond reasonable doubt that no overexposure could have occurred, continue with a follow-up investigation, notification and report detailed in Annex B.

## **Release of Radioactive Substances into the Atmosphere**

13. If radioactive substances are released or suspected to have been released into the atmosphere as a gas, aerosol or dust that are not in accordance with an approval (i.e. permit or equivalent) issued by one of the environment agencies (this could include a release from a fire or explosion). Unless the immediate investigation shows that no release could have occurred, continue with a follow-up investigation, notification and report detailed in Annex C.

## **Spillage of Radioactive Substances**

14. If spills of radioactive liquids or solids leading to the spread of contamination are suspected, unless the immediate investigation shows that no spill could have occurred, or the spill was in a fume cupboard or total enclosure or did not exceed limits for disposal in an approval (i.e. permit or equivalent) issued by one of the environment agencies, continue with a follow-up investigation, notification and report detailed in Annex D.

## **Loss or theft of a Radioactive Source or Radioactive Substance**

15. If a radioactive source or radioactive material (including equipment containing a radioactive source or material) is suspected to be lost or stolen, unless the immediate investigation shows that no loss or theft has occurred, continue with a follow-up investigation, notification and report detailed in Annex E.

## **Failure of Industrial Radiography or Irradiation Equipment**

16. The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR 13) requires the following to be reported to the Health and Safety Executive (detailed information on the procedures to be followed is at Annex H):

- a. the malfunction of a radiation generator or its ancillary equipment used in fixed or mobile industrial radiography which cause it to fail to de-energise at the end of the intended exposure period; and
- b. the malfunction of equipment used in fixed or mobile industrial radiography which causes a radioactive source to fail to return to its safe position by the normal means at the end of the intended exposure period.

## **Types of Radiation Incidents not Notifiable to Authorities External to MOD**

17. The following radiation incidents are to be investigated by the RSO / RPS / WPS with advice from the RPA as necessary and notified and reported to the appropriate MOD authorities as detailed at Annex I:

- a. an incident likely to result in a person receiving an effective dose (i.e. whole-body dose) exceeding 6 mSv or an equivalent dose (i.e. dose to eye, skin, hands, forearms, feet or ankles) exceeding three-tenths of the relevant dose limit. This radiation incident also carries statutory dosimetry assessment and record keeping requirements (see Chapter 6). Note that if the dose received constitutes a radiation overexposure it is to be investigated, notified and reported in accordance with paragraph 12.
- b. effective dose (i.e. whole-body dose) accumulated from routine external and internal radiation exposure, exceeding the formal investigation level (see Chapter 4). Note that if the dose received constitutes a radiation overexposure it is to be investigated, notified and reported in accordance with paragraph 12.
- c. any intake of radioactive material by ingestion.
- d. any fixed skin contamination greater than 3 Bq cm<sup>-2</sup> for  $\alpha$ -emitters and 30 Bq cm<sup>-2</sup> for  $\beta$  and  $\gamma$ -emitters remaining after 24 hours.
- e. any contaminated wound.
- f. any release of radioactive material to atmosphere, a breakage or spillage of radioactive material which is below the levels prescribed for notification of external authorities (e.g. HSE, environmental regulators); and
- g. an incident likely to generate press or media interest.

## Types of Near Miss

18. The following near miss situations are to be investigated by the RSO / RPS / WPS with advice from the RPA as necessary and notified and reported to the appropriate MOD authorities as detailed at Annex I:

- a. any event listed in paragraphs 9 to 14 where these events did not, by chance, actually occur.
- b. **Note:** that specific types of malfunction of equipment associated with industrial radiography must still be investigated and reported in accordance with paragraph 16.

## Radiation Protection Advice

19. Radiation protection advice for units and establishments is to be obtained from the appointed RPA. For those units and establishments for which DRPS RPA Body is appointed as the Radiation Protection Adviser, radiation protection advice is available 24 hours by telephoning:

- a. during working hours 02392 768130 or 02392 510517;
- b. during silent hours 02392 768020 or 02392 510517 and asking for the Duty Health Physicist;
- c. or by email: [DRPSenquiries@awe.co.uk](mailto:DRPSenquiries@awe.co.uk)

## **Radiation Medicine Advice**

20. The Royal navy is the lead Service for the provision of radiation medicine. Advice can be obtained from the Submarine and Radiation Medicine section of the Underwater Medicine Division at the Institute of Naval Medicine by the following means:

a. By mail:

The Underwater Medicine Division  
Institute of Naval Medicine,  
Crescent Road, Alverstoke,  
GOSPORT, Hampshire,  
PO12 2DL

b. by email: [NAVYINM-UMD@mod.gov.uk](mailto:NAVYINM-UMD@mod.gov.uk)

c. by telephone: Working hours: Mil 9380 68241, Civ 02392768241

d. emergencies: via the Duty Diving and Radiation Medicine Consultant on 07827821980

e. or via INM main gate on 02392 768020.

## **Reporting Radiation Accidents, Incidents and Near Misses**

21. In addition to the reporting procedures described above, all radiation accidents, incidents, dangerous occurrences and near misses are to be reported to Incident Notification Cell points of contact within relevant TLB / TLA areas.

22. Personnel involved in a work-related radiation accident or incident should report it in accordance with MOD policy in JSP 375 Chapter 16.

## **Records**

23. Records of investigations into radiation accidents or incidents are to be kept in accordance with Part 1 Chapter 3 of this JSP and also the JSP 441 Managing Information in Defence. Where an investigation shows that no unusual radiation event had occurred, the retention period is a minimum of 2 years. At the end of this period, an assessment on the relevance of retaining the document is to be made in accordance with MOD policy at Part 1 Chapter 3.

## **IMMEDIATE AND FOLLOW-UP INVESTIGATIONS**

### **Nature of an Immediate Investigation**

1. An immediate investigation into a radiation accident or investigation is to be conducted by the RSO / RPS / WPS of the unit or establishment on behalf of the CO / HoE. The main purpose of the immediate investigation is to rule out suspected accidents / incidents which can readily be shown did not take place. Also, the immediate investigation is to collect details and information which may be lost due to the passage of time.
2. Once the immediate investigation has been completed, the need, or otherwise, for a report to mod authorities and, in some cases, external authorities will be evident. The RPA is to be consulted regarding the aspects which are to be covered in a follow-up investigation, and the MPE is to be consulted for IRMER notifications.

### **Nature of a Follow-up Investigation**

3. Detailed investigations into radiation accidents and incidents are to be conducted by the RSO / RPS / WPS of the unit or establishment on behalf of the CO / HoE, in consultation with the RPA, unless alternative arrangements are made such as the setting up of a Service Inquiry. The accident or incident is to be thoroughly investigated to determine the extent of the radiation hazard, level of radiation exposures and the causes of the event including the less obvious contributory causes, and to recommend safeguards to prevent its reoccurrence.
4. Reports of investigations into a radiation accident or incident are to contain all the relevant facts, including the following details where applicable:
  - a. time and location.
  - b. names of persons involved, work routine and duties being performed at the time.
  - c. description of any equipment involved.
  - d. summary of relevant local orders, work instructions, safety documents, equipment manuals and maintenance programmes covering the work undertaken at the time or the equipment involved.
  - e. full description detailing the sequence of events including adherence to local orders, work instructions, safety documents, equipment manuals and maintenance programmes.
  - f. results of any radiation or contamination survey for the areas concerned during the period under investigation.
  - g. results of any special surveys or measurements taken (e.g. during a reconstruction advised by the RPA).

- h. in the case of an exposure (or overexposure) recorded on a dosimeter, consideration as to whether the dosimeter could have been left in a radiation area (i.e. exposed whilst not being worn) or worn whilst the employee underwent a medical exposure.
- i. where relevant, estimated quantities of radionuclides involved, estimates of quantities released and spread of contamination both airborne and surface.
- j. estimated (or measured) external dose, level of bodily surface contamination or intake of radionuclide(s), together with details of results of measurements and laboratory analyses – to include employees and any other persons involved.
- k. immediate action taken to lessen the consequences.
- l. medical action taken, including suspension from radiation work.
- m. training, instruction or information received and general competence for the work undertaken.
- n. direct and / or indirect cause.
- o. views of relevant safety representatives or safety committee.
- p. recommendations for future preventative measures.

## RADIATION OVEREXPOSURE INVESTIGATION, NOTIFICATION AND REPORTING

1. Unless the immediate investigation shows beyond reasonable doubt that no overexposure has occurred, immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. the Appointed Doctor and Radiation Medicine at INM Alverstoke (see paragraph 20 for contact details);
  - c. the TLB safety authority and unit's line management; and
  - d. DRPS Alverstoke (for Approved Dosimetry Service (ADS) and RPA Body) or external ADS and RPA (if DRPS not used for either or both);
2. Notify as soon as practicable:
  - a. in the case of an employee of another employer, notify that other employer;
  - b. notify the person affected; and
  - c. local office of the Health and Safety Executive.
3. **Note:** Notification of external body is only to be undertaken once mod authorities have been notified. Notification of the external body will not apply where an overexposure has occurred to a member of a visiting force. External notification will apply for the UK Armed Forces, MOD civilians and other persons.
4. On advice from the RPA, carry out a follow-up investigation of the circumstances of the overexposure and the assessment of the relevant dose to determine, so far as is reasonably practicable, the measures required, if any, to be taken to prevent a recurrence of such overexposure. Details to include in a follow-up investigation are in Annex A, and:
  - a. notify the results and forward the report of the further investigation to the authorities and individuals listed above;
  - b. where the investigation shows that the exposure is below the overexposure level, then the internal MOD procedure for reporting radiation incidents and near misses at Annex I is to be followed, as the exposure will still be reportable internally within MOD;
  - c. all overexposures are to be reported to Incident Notification Cells (INC) points of contact. Records are to be maintained in accordance with paragraph 23; and
  - d. where the person who received the overexposure is an employee who has a dose record, the CO / HoE must arrange for the assessment of dose to be entered into that dose record (see Chapter 6).



## RELEASE OF RADIOACTIVE SUBSTANCES TO ATMOSPHERE INVESTIGATION, NOTIFICATION AND REPORTING

1. Unless the immediate investigation shows beyond reasonable doubt that no release to atmosphere has occurred and the potential release exceeds the quantity specified in Annex F, immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. the TLB safety authority and unit's line management;
  - c. the RPA;
  - d. local office of the Health and Safety Executive; and
  - e. environment agencies, as appropriate, where there is a risk of environmental contamination (see also paragraph 7 below).
2. **Note:** Notification of external bodies is only to be undertaken when MOD authorities have been notified. Notification of external bodies will not apply to HM Ships, except when undergoing refit.
3. The HSE and EA / SEPA / NRW / NIEA are to be provided initially with the following information:
  - a. type of radioactive source or material;
  - b. radionuclides and nominal activity; and
  - c. brief outline of circumstances of release.
4. On advice from the RPA, it may be necessary to carry out a follow-up investigation of the circumstances of the release to determine whether measures are required to prevent a recurrence of another release. Details to include in a follow-up investigation are in Annex A.
5. If a further report is made, notify the results and forward the report of the further investigation to the authorities and individuals listed above.
6. Further details of the release, equipment and areas affected, and personnel contaminated externally or internally may be required by MOD authorities to enable advice / reassurance to be provided.
7. Where the quantity is found not to exceed the relevant level in Annex F, the advice of the RPA is to be sought as to whether a report to the appropriate environment agency is still required in accordance with the terms and conditions which relate to the radioactive material that has been released. If a report to the appropriate environment agency is not required, the internal MOD procedure for reporting unusual radiation incidents at Annex I is to be followed.

8. All releases are also to be reported to Incident Notification Cells (INC) points of contact.
9. Records of investigation reports are to be retained in accordance with paragraph 23.

## SPILLAGE OF RADIOACTIVE SUBSTANCES INVESTIGATION, NOTIFICATION AND REPORTING

1. Unless the immediate investigation shows beyond reasonable doubt that no spill has occurred and the spill exceeds the quantity specified in Annex F, immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. the TLB safety authority and unit's line management;
  - c. the RPA;
  - d. local office of the Health and Safety Executive;
  - e. environment agencies, as appropriate, where there is a risk of environmental contamination (see also paragraph 7 below).
2. **Note:** Notification of external bodies is only to be undertaken when MOD authorities have been notified. Notification of external bodies will not apply to HM Ships, except when undergoing refit.
3. The HSE and EA / SEPA / NRW / NIEA notified above are to be provided initially with the following information:
  - a. type of radioactive source or material;
  - b. radionuclides and nominal activity;
  - c. brief outline of circumstances of spillage.
4. On advice from the RPA / RWA, it may be necessary to carry out a follow-up investigation of the circumstances of the spill to determine whether measures are required to prevent a recurrence of another release. Details to include in a follow-up investigation are in Annex A.
5. If a further report is made, notify the results and forward the report of the further investigation to the authorities and individuals listed above.
6. Further details of the spillage, equipment and areas affected, and personnel contaminated externally or internally may be required by MOD authorities to enable advice / reassurance to be provided.
7. Where the quantity is found not to exceed the relevant level in Annex F, the advice of the RPA is to be sought as to whether a report to the appropriate environment agency is still required in accordance with the terms and conditions which relate to the radioactive material which has been spilled. If a report to the appropriate environment agency is not required, then the internal MOD procedure for reporting unusual radiation incidents at Annex I is to be followed.

8. All spillages are also to be reported to Incident Notification Cells (INC) points of contact.
9. Records of investigation reports are to be retained in accordance with paragraph 23.

## **LOSS OR THEFT OF RADIOACTIVE SUBSTANCES INVESTIGATION, NOTIFICATION AND REPORTING**

1. Unless the immediate investigation shows beyond reasonable doubt that no loss or theft has occurred and the loss or theft exceeds the quantity specified in Annex F, immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. the TLB safety authority and unit's line management;
  - c. the RPA;
  - d. local office of the Health and Safety Executive (within 24 hours from discovery of loss);
  - e. environment agencies (see also paragraph 5 below); and
  - f. MOD Police (where applicable) and the local Police.
2. **Note:** Notification of bodies is only to be undertaken when MOD authorities have been notified.
3. The authorities notified above are to be provided initially with the following information:
  - a. type of radioactive source or material;
  - b. radionuclides and nominal activity;
  - c. serial number;
  - d. brief outline of circumstances of loss.
4. The requirement for a follow-up investigation will be determined by the authorities notified of the loss / theft. Guidance in Annex A may be of use for the content of a follow-up investigation.
5. Where the quantity is found not to exceed the relevant level in Annex F, the advice of the RPA / RWA is to be sought as to whether a report to the appropriate environment agency is still required in accordance with the terms and conditions which relate to the radioactive material which has been lost or stolen. If a report to the appropriate environment agency is not required, then the internal MOD procedure for reporting unusual radiation incidents at Annex I is to be followed.
6. All losses or thefts are also to be reported to Incident Notification Cells (INC) points of contact. Records of investigation reports are to be retained in accordance with the requirements of paragraph 23.
7. All losses or thefts are to be recorded on the establishment / site Annual Holdings Return (see Chapter 3).

**QUANTITIES OF RADIONUCLIDES FOR EXTERNAL NOTIFICATION OF  
RADIATION ACCIDENTS OR INCIDENTS (UNDER IRR17)**

<b>Radionuclide</b>	<b>Lost or stolen (Bq)</b>	<b>Spillage or unauthorised release to atmosphere (Bq)</b>
Hydrogen-3 (Tritium) tritiated compounds	$1 \times 10^{10}$	$1 \times 10^{12}$
Chlorine-36	$1 \times 10^7$	$1 \times 10^{10}$
Cobalt-57	$1 \times 10^7$	$1 \times 10^{11}$
Cobalt-60	$1 \times 10^6$	$1 \times 10^{10}$
Nickel-63	$1 \times 10^9$	$1 \times 10^{11}$
Krypton-85	$1 \times 10^5$	$1 \times 10^{12}$
Strontium-90	$1 \times 10^5$	$1 \times 10^9$
Yttrium-90	$1 \times 10^6$	$1 \times 10^{11}$
Technetium-99m	$1 \times 10^8$	$1 \times 10^{13}$
Iodine-123	$1 \times 10^8$	$1 \times 10^{12}$
Iodine-131	$1 \times 10^7$	$1 \times 10^{10}$
Iodine-133	$1 \times 10^7$	$1 \times 10^{11}$
Caesium-137	$1 \times 10^5$	$1 \times 10^{10}$
Promethium-147	$1 \times 10^8$	$1 \times 10^{10}$
Iridium-192	$1 \times 10^5$	$1 \times 10^{10}$
Polonium-210	$1 \times 10^5$	$1 \times 10^8$
Radium-226	$1 \times 10^5$	$1 \times 10^7$
Thorium-232	$1 \times 10^5$	$1 \times 10^6$
Thorium (natural)	$1 \times 10^4$	$1 \times 10^6$
Uranium-238	$1 \times 10^5$	$1 \times 10^7$
Uranium (natural)	$1 \times 10^4$	$1 \times 10^6$
Americium-241	$1 \times 10^5$	$1 \times 10^6$

Note: For radionuclides not given in the table, notifiable quantities are given in Schedule 8 of the Ionising Radiations Regulations 2017, or advice is to be sought from the RPA

## MALFUNCTION OF MEDICAL OR DENTAL EQUIPMENT INVESTIGATION, NOTIFICATION AND REPORTING

1. Unless the immediate investigation shows beyond reasonable doubt that no incident has occurred, immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. radiation Medicine at INM Alverstoke;
  - c. the TLB safety authority and unit's line management;
  - d. the RPA;
  - e. the MPE; and
  - f. the [Care Quality Commission](#).
2. **Note:** Notification of external body is only to be undertaken when MOD authorities have been notified.
3. On advice from the MPE and RPA, carry out a follow-up investigation of the circumstances of the exposure and an assessment of the relevant dose. Determine, so far as is reasonably practicable, the measures required, if any, to be taken to prevent a recurrence of the incident. Details to include in a follow-up investigation are in Annex A.
4. Notify the results of the further investigation to the authorities listed above.
5. All incidents in this category are also to be reported to Incident Notification Cells (INC) points of contact. Records of the immediate investigation are to be retained in accordance with paragraph 23.

## FAILURE OF INDUSTRIAL RADIOGRAPHY OR IRRADIATION EQUIPMENT INVESTIGATION, NOTIFICATION AND REPORTING

1. Following a malfunction as described in paragraph 16 immediately notify the following:
  - a. appropriate personnel at the unit or establishment;
  - b. the TLB safety authority and unit's line management;
  - c. the RPA;
  - d. the local Health and Safety Executive office.
2. **Note:** Notification of external body is only to be undertaken when MOD authorities have been notified provided that this does not cause the reporting period specified by RIDDOR to be exceeded.
3. On advice from the RPA, carry out an investigation of the circumstances of the malfunction or defect. Determine, so far as is reasonably practicable, the measures required, if any, to be taken to prevent a reoccurrence of this failure. Report the results of the investigation to the MOD authorities listed above.
4. If this failure involves a radiation exposure the Approved Dosimetry Service (ADS, usually the DRPS ADS) must also be provided with a copy of the report.
5. All incidents in this category are also to be reported to Incident Notification Cells (INC) points of contact. Records of the investigation are to be retained in accordance with paragraph 23.



## **RADIATION INCIDENTS AND NEAR MISS INVESTIGATION, NOTIFICATION AND REPORTING**

1. Following any radiation incident or near miss, it is to be established whether the incident constitutes an overexposure, release, breakage, spillage, loss or theft (in excess of quantities in Annex F), malfunction of equipment used for medical or dental exposure or failure of industrial radiography or irradiation equipment – if the incident fits any of the aforementioned categories then the procedures appropriate to that category are to be followed.
2. Carry out preliminary investigation and notify:
  - a. appropriate personnel at the unit or establishment;
  - b. the TLB safety authority and unit's line management; and
  - c. the RPA.
3. On advice from the RPA, carry out a follow-up investigation of the circumstances of the incident or near miss. Determine, so far as is reasonably practicable, the measures required, if any, to be taken to prevent a recurrence of the incident or near miss. Details to include in a follow-up investigation are in Annex A.
4. Send the follow-up investigation report to the line management and TLB safety authority and the RPA.
5. All incidents in this category are also to be reported to Incident Notification Cells (INC) points of contact. Records of the investigation are to be retained in accordance with paragraph 23.