Office for Nuclear Regulation

Ionising Radiations Regulations 2017 (IRR17)

Regulation 8 – Radiation Risk Assessment

Guidance in relation to the civil transport of radioactive material by road and rail

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Contents

1. Introduction

The requirements of the Ionising Radiations Regulations 2017[1] (IRR17) in relation to the civil transport of radioactive material by road and rail are enforced by the Office for Nuclear Regulation (ONR). The following guidance sets out ONR's expectations in relation to what constitutes a 'suitable and sufficient' radiation risk assessment (RRA) as required by Regulation 8 of IRR17. In developing this guidance ONR has liaised with the Health and Safety Executive (HSE) in line with the Memorandum of Understanding[2] relating to effective regulation of the transport of radioactive material.

Reference is made to IRR17, the Approved Code of Practice (ACoP) and supporting guidance contained within 'Work with ionising radiation' (L121, 2nd edition)[1]. Paragraphs 62 to 84 provide helpful information in relation to RRAs.

1.1. What is in scope in relation to a RRA covering transport?

Transport as defined in IRR17 transport means carriage of a radioactive substance by road, rail, inland waterway, sea or air. ONR, as the enforcing authority for IRR17, has a wider enforcement responsibility and will therefore consider IRR17 requirements as they apply to preparation of a package, in-transit storage, loading, and unloading until receipt at destination as well as carriage. As such employers should ensure they have prepared 'suitable and sufficient' RRAs that reflect this range of practices, both in relation to normal transport operations and adverse transport events. Significant assessment findings must be recorded where an employer has 5 or more employees.

1.2. Who needs a RRA and when?

There can be many parties involved in a transport chain and their level of involvement can vary. Some coordinate logistics from afar, and others are much more directly involved. Any employer with any direct involvement with the physical transport of radioactive material, including in-transit storage, as consignor, carrier, packer, loader, filler or consignee must have developed proportionate RRA(s) reflecting their involvement in this work with ionising radiation before it commences.

1.3. What constitutes a 'suitable and sufficient' RRA?

The ACoP provides detailed information in paragraph 70 (a) to (m) in relation to matters to be considered, where relevant, by the employer where a RRA is required. The RRA will help the employer to decide on a range of appropriate next steps, outlined in paragraph 71 (a) to (p).

To be "suitable and sufficient", ONR expects all ACoP paragraph 70 matters to have been considered, where they are relevant, and the employer to have made suitably informed decisions in relation to ACoP paragraph 71 matters, where appropriate.

Table 1 below lists the ACoP paragraph 70 requirements and describes ONR's expectations in relation to the transport of radioactive materials.

Table 1: IRR17 ACoP paragraph 70 requirements in relation to the transport of radioactive materials

Para 70	ACOP requirements	ONR's Regulatory Expectations
(a)	The nature of sources of ionising radiation to be used, or likely to be present, including accumulation of radon in the working environment.	List of radionuclides, a description of their physical form (liquid/solid/gas/special form), typical and maximum activity of source(s), type of emitter (alpha/beta/gamma/neutron etc.) Some employers such as busy Class 7 (radioactive material) dangerous goods carriers may choose to have a generic list of radioactive materials/ sources that they typically transport, considering the risk posed on the basis of a bounding case or cases rather than describing each individual source e.g. special form gamma emitting sources, of typical and maximum activity. This information should be obtained from the consignor. In the main, transport operations are unlikely to take place in or give rise to working environments where significant accumulation of radon is likely. However, exposure to radon should be considered in relation to transport work undertaken in radon affected areas, or where for instance the nature of the sources is such that radon is produced, and where material is stored in-transit for a period.
(b)	Estimated radiation dose rates to which anyone can be exposed.	Estimate whole body doses, doses to hands, eyes etc. (as appropriate) to employees involved in preparing, handling, loading and unloading packages containing radioactive material. Take account of the number and types of packages, accessible dose rates (typical and maximum) and time spent working with them, including them and other persons who may be in the vicinity where dose rates exceed normal background levels. Factor affecting exposure whilst driving will include: Vehicle size, position of packages in vehicle, number and category of package (I-White, II- Yellow and III-Yellow) journey times, number of available drivers for Class 7 work, and shift pattern. This list is not exhaustive.
(c)	The likelihood of contamination arising and being spread.	The physical form the material takes will have a significant bearing on the likelihood of contamination arising and being spread. Consider the potential for contamination arising from the radioactive contents both in routine and accident conditions. Also consider whether the working environment is such that contamination of a package is reasonably foreseeable i.e. are contamination control procedures robust? Note that this should also be considered in the case of the transport of special form radioactive material, although the risk of contamination is extremely low.
(d)	The results of any previous personal dosimetry or area monitoring relevant to the proposed work.	Previous dosimetry results for individuals and area monitoring results can be informative and can support dose estimates at (b) above. If no such information is available then it would be helpful to record the reason for this.

Para 70	ACOP requirements	ONR's Regulatory Expectations
(e)	Advice from the manufacture or supplier of equipment about its safe use and maintenance.	Packages may have specified activity limits or specified radioactive contents so deviating from these could significantly increase associated risk. Consider the impact on employees/others if the package is not assembled, used or maintained in accordance with the advice from the manufacturer/supplier.
(f)	Engineering control measures and design features already in place or planned.	Consider the impact if engineering control measures and design features fail or are not implemented correctly. These may be integral to the package, or could for example be integral to the vehicle i.e. shielding material installed at the bulkhead, separating the cargo area from the driver's cab thereby reducing driver dose. In-transit storage locations may need particular engineering controls and design features i.e. dedicated, shielded, lockable store. [IRR17 Regulation 30 and supporting guidance is relevant here.]
(g)	Any planned systems of work.	There are a range of potential systems of work associated with transport operations. For example during in-transit storage temporary barriers may be required to restrict access to an area where dose rates are elevated, or there may be a particular vehicle loading regime and particular sizes of vehicles required to keep vehicle crew dose as low as reasonably practicable (ALARP). Consider the impact in terms of radiation exposure if planned systems of work are inappropriate or not implemented correctly. For example: If a loading regime is not followed and radioactive material is placed in close proximity to the driver/vehicle crew , or if a smaller vehicle than usual is used, or if shielding afforded by other packages in the consignment isn't available, is there a potential impact on doses received by the driver/vehicle crew? If temporary barriers are not used appropriately during in-transit storage, what is the potential impact on doses to employees working or other persons in the vicinity?
(h)	Estimated levels of airborne and surface contamination likely to be encountered.	For normal transport operations, surface contamination levels should fall within prescribed limits set out on modal legislation relating to transport i.e. ADR, RID etc.[3]. Assuming these have been met, risk should be low. However, is it reasonable to assume a package will be relatively 'clean' considering the working environment it has been in? Does the consignor have robust contamination control procedures?
(i)	The effectiveness and suitability of PPE to be provided.	There are limited practical personal protective equipment options where radioactive material is being transported, and there are none which impact to any significant extent on external exposure arising during transport where gamma radiation is typically encountered. General items such as gloves and protective eyewear are typically available where unsealed material is being prepared for transport, and during carriage. Although, they are not designed to offer particular protection from exposure to radiation, they are likely to offer some limited protection from contamination in the event of a loss of containment.

Para 70	ACOP requirements	ONR's Regulatory Expectations
(j)	The extent of unrestricted access to working areas where dose rates or contamination levels are likely to be significant.	Knowledge of dose rates from packages, consignments and from the surface of the vehicle can be used to assess the impact on members of the public in the event of a reasonably foreseeable event such as vehicle breakdown/accident on roads where pedestrians/other drivers are in close proximity to the vehicle or where packages are ejected from the vehicle. Knowledge of maximum likely dose rates from temporary or dedicated storage areas can be used to assess the impact on workers and members of the public in the vicinity. Contamination levels are unlikely to be significant in normal operations, however in accident situations they could be very significant.
(k)	Possible accident situations, their likelihood and potential severity.	In relation to transport, possible accident situations may include: • Damage to Class 7 consignment arising from vehicle fire, collision, adverse road conditions • Dropped load • Theft of load with or without theft of vehicle This list is not exhaustive. It is reasonable to calculate approximate dose ranges the consequences of events might fall within to substantiate 'severity' and inform the overall risk. ONR expects any use of descriptors such as high/medium/low to be supported by information relating to relevant dose ranges. These could be described as 10's or 100's of microSieverts or milliSieverts, for instance. Assessment should include consideration of ingestion and or inhalation as well as direct radiation exposure from all radiation sources, including any depleted uranium (DU) shielding used as an integral part of a package design. IAEA assumes that in a "median accident" involving a single Type A package with its maximum allowable contents, a dose of 50 mSv could potentially be received by persons in the close vicinity of the package over a period of 30 minutes. Different assumptions may be made for consignments of packages that are designed to withstand accident conditions of transport (Type B packages) for those designed only to withstand routine conditions of transport (for example, excepted packages). Where assumptions are made, it is appropriate to document them. The number and type of packages in a consignment will need to be considered and bounding cases may be used to address routine transport activities for those that transport a variety of radionuclides/packages routinely.

Para 70	ACOP requirements	ONR's Regulatory Expectations
(l)	The consequences of possible failures of control measures – such as electrical interlocks, ventilation systems and warning devices – or systems of work.	It is appropriate to consider reasonably foreseeable scenarios and their dose consequences. Some specialist packages require cooling, or may require particular locking devices to secure the load. Given the mobile nature of transport operations, failures of systems of work are generally likely to have an impact. Systems of work can include package preparation loading regimes, contamination control measures in workplaces from which packages are consigned, or they could relate to contamination control of packages themselves. If these fail, what are the potential consequences?
(m)	Steps to prevent identified accidents, or limit their consequences.	It is appropriate to include details of mitigating measures in place to prevent identified accidents, or limit consequences. Examples include contamination monitoring of packages and measurement of radiation dose rates around packages, correctly assigning Transport Index, and monitoring around vehicles. Training of drivers, carrying of suitable emergency kit, and using of well-maintained vehicles, all have the potential to prevent or limit the consequences of accidents. This list is not exhaustive

Having given due consideration to these and any other relevant issues, employers should be in a position to decide on appropriate next steps on matters detailed in ACoP paragraph 71 (a) to (p), namely they must:

(a) **Specify and take** all actions needed to make sure the radiation exposure of all people is kept ALARP (Reg 9(1)).

(b) **Introduce** the steps necessary to achieve control of exposure by the use of engineering controls, design features, safety devices and warning devices, and in addition develop systems of work (Reg 9(2)(a) and (b)).

(c) **Provide** any necessary personal protective equipment (PPE) (Reg 9(2)(c)).

(d) **Establish** any appropriate dose constraints for planning or design purposes (Reg 9(4)).

(e) **Alter** working conditions as necessary for any pregnant or breastfeeding employee (Reg 9(6)).

(f) **Introduce** an appropriate dose investigation level as an ALARP tool (Reg 9(8)).

(g) **Develop** maintenance and testing schedules required for the control measures selected (Reg 11).

(h) **Prepare** contingency plans for reasonably foreseeable accidents (Reg 13).

(i) **Determine** training needs of classified and non-classified employees (Reg15).

(j) **Designate** specific areas as controlled or supervised and to specify local rules (Regs 17 and 18). This should include the designation of the load compartment of the vehicle whilst transporting radioactive material or the need to designate areas as a result of an accident

arising during carriage where relevant.

(k) **Restrict** access and implement other measures required for controlled/supervised areas (Reg 19).

(l) **Determine** who, if any, will be classified persons (Reg 21).

(m) **Introduce** a suitable programme of dose assessment for certain employees (those that are classified, and those entering controlled areas) (Regs 19 and 22).

(n) **Decide** whether there are any sources requiring leak testing (Reg 28).
(o) **Allocate** responsibilities to managers and workers (including outside workers) as appropriate for compliance with IRR17.

(p) **Develop** a programme of monitoring or auditing of arrangements to check IRR17 requirements are being met.

Relevant action should be taken ahead of transport commencing.

1.4. Further important information

- There is a requirement for the employer to consult with a suitable Radiation Protection Adviser (RPA) about the matters to be considered as part of the risk assessment process [IRR17, Regulation 14 refers as does ACoP para 249 and guidance in para 72] and for appropriate action to be taken in relation to its findings ahead of transport commencing.

- Not all IRR17 requirements relevant to transporting radioactive material are addressed through the risk assessment process. Such as compliance with regulations 6 (registration of certain practices, 7 (consent to carry out specified practices) and 31 (notification of certain occurrences). This list is not exhaustive.

- A suitable RPA will be able to provide any further advice in relation to IRR17 compliance.

- The significant findings of a risk assessment must be recorded where the duty holder has 5 or more employees. ONR expects the employer to be conversant with, and explain at any inspection the risk assessment findings that were significant, so for practical reasons it may help to record this information to demonstrate compliance. [Further guidance is contained in paragraph 77 of L121.]

- Where an employer develops a RRA for a particular set of transport circumstances i.e. a given number of a certain package type for instance, there needs to be a means of readily identifying when those circumstances are not met so that the required RRA can be developed, and action taken accordingly, ahead of transport.

- Risk assessments must be reviewed periodically, and where work changes, and revised as necessary. [Further guidance is contained in paragraph 78 to 81 of L121.] A prompt for the review process may usefully sit within an employer's management arrangements or system.

- The Carriage of Dangerous Goods (Amendment) Regulations 2019 (CDG19)[4] now makes an explicit link between risk assessment (IRR17)[1] and emergency planning (CDG19)[4] specifically requiring those transporting class 7 goods (consignors or carriers) to carry out a radiation risk assessment and implement the findings.

2. References

1. Work with ionising radiation, Ionising Radiations Regulations 2017, Approved Code of Practice and guidance, L121 (Second edition), Health and Safety Executive, ISBN 978 0 7176 6662 1, January 2018. https://www.hse.gov.uk/pubns/priced/l121.pdf
2. ONR - Health and Safety Executive (HSE) Memorandum of Understanding relating to effective regulation of the transport of radioactive material, http://www.onr.org.uk/documents/2018/mou-onr-hse.pdf.
3. European Agreements Concerning the International Carriage of Dangerous Goods : by Road (ADR) and by Rail (RID)
4. Carriage of Dangerous Goods (Amendment) Regulations 2019 (CDG19) http://www.legislation.gov.uk/uksi/2019/598/contents/made