Emergency Response Arrangements for the Transport of Radioactive Materials

Edmund Morgan-Warren

Radioactive Materials Transport Division, Department for Transport, London, UK

1 Abstract

Response arrangements are required for the transport of radioactive materials, under both transport and health and safety legislation, to safeguard persons, property and the environment in the event of incidents and emergencies.

Responsibilities fall on both government and industry:

- government is responsible for ensuring public safety and providing information and reassurance. This responsibility is discharged for each type of incident by a nominated "lead department", supported as appropriate by other government departments and agencies;

- for their part, operators are obliged to have arrangements in place for dealing with the practicalities of any reasonably foreseeable incident, including recovery and onward transport of a package, and any required clean-up or restoration of the environment.

This paper outlines both the government and industry arrangements in Great Britain. The principles of response and intervention are discussed, together with the lead department concept, regulatory requirements, and the plans developed by the transport industry to ensure a nation-wide response capability.

2 Introduction

The transport of radioactive materials owes its excellent safety record over many decades to the careful application of rigorous packaging and operational standards, supported by a stringent and internationally consistent regulatory regime. Together, these include a number of tiers of safety provision to provide defence in depth. The IAEA regulations, TS-R-1 [1] include packaging and labelling standards which are graded according to the nature and quantity of the contents, quality assurance provisions, and a range of administrative requirements designed to ensure effective protection against incidents. Further, recognising that incidents may occur, both the IAEA transport regulations and health and safety legislation require suitable emergency arrangements to be in place.

In response to the need for emergency provisions, both government and industry have produced extensive emergency response plans to provide support in the event of an incident occurring during transport [2]. Government departments maintain plans to ensure the safety and wellbeing of the public and the environment, and operators are responsible for dealing with an incident itself, including minimising any hazardous effects, and remediation of any damage.

3 Requirements for Emergency Arrangements

Regulatory requirements for emergency arrangements are rooted in international regulatory provisions, which are incorporated into domestic legislation. The basic requirement for contingency plans for work involving radioactivity is specified in The Ionising Radiations Regulations 1999 [3] (IRR), which are made under the wide-ranging Health and Safety at Work etc. Act 1974 [4]. The IRR require that before a new activity commences, an assessment be made of the associated risk to any employee or other person for the purpose of identifying the measures required to restrict exposure to ionising radiation. The IRR then state that where this assessment indicates that a radiation accident is reasonably foreseeable, then "the radiation employer shall prepare a contingency plan designed to secure, so far as is reasonably practicable, the restriction of exposure to ionising radiation and the health and safety of persons who may be affected by such an accident." The IRR also implement other provisions of the European Council Basic Safety Standards Directive 96/29/Euratom [5] relating to occupational radiation protection. Articles 48 to 52 of the directive, concerning intervention, are implemented in The Radiation (Emergency Preparedness and Public Information) Regulations 2001 [6] (REPPIR) for premises and rail transport, and

transport across public places which involves non-standard modes of transport (e.g. fork-lift trucks). For road, sea and air transport purposes the intervention provisions are implemented separately in the modal transport regulations.

The IAEA transport regulations [1] go beyond this requirement in the statement that "In the event of accidents or incidents during the transport of radioactive material, emergency provisions, as established by relevant national and/or international organisations, shall be observed to protect persons, property and the environment." Thus the transport regulations apply to any accident or incident, without the qualification "reasonably foreseeable", and are required to protect property and the environment as well as persons. In Great Britain, evidence of a suitable emergency plan is required to gain competent authority package approval. The transport regulations are supported by the comprehensive guidance document, TS-G-1.2 [7], which provides recommendations on all stages of emergency response from the planning process through preparation for response, to the handling of accidents and the eventual post-emergency activities. A key recommendation in TS-G-1.2 is that there should be a national response plan, on which provincial and local plans should be based, and that consignors and carriers should have their own plans to fulfil their responsibilities for preparedness in relation to their shipments.

4 Regulatory Provisions and Principles of Response

The requirements for emergency arrangements are implemented separately for each mode of transport in the appropriate modal transport regulations.

The Radioactive Material (Road Transport) Regulations 2002 [8] (the road transport regulations) specify the duties of the parties involved both in the preparation of emergency arrangements and in the event of a radiological emergency.

Preparation of emergency arrangements for the transport of a package is the responsibility of the consignor who must have drawn up a documented plan of the emergency arrangements before the transport begins. The arrangements have to take into account the following principles (summarising from the regulations):

- intervention may be undertaken only if the damage resulting from the emergency is sufficient to justify the potential harm and cost (including social cost) of the intervention,
- the intervention must be optimised to ensure a positive benefit results from the intervention, and
- regard must be taken of the dose limits provided for in the IRR [3], and of the Emergency Reference Levels specified by the National Radiological Protection Board (NRPB).

The consignor may employ the services of another person with appropriate expertise (including a person who is a carrier) in the preparation of his emergency arrangements, and must review, and where necessary revise, the arrangements and ensure that they are tested at suitable intervals.

A carrier, for his part, must not undertake the transport of a consignment unless he has a copy of the consignor's statement of emergency arrangements.

In the event of an emergency, the driver of the vehicle must notify the emergency services and the consignor, initiate the emergency arrangements, and assist in the intervention. The carrier is required to notify the police (unless the driver has already done so) and the Secretary of State, to assist in the intervention and to arrange for examination of the load and its safe disposal. The consignor, in turn, is obliged to make similar notifications as appropriate, to assist in the intervention and to provide details of the incident to the Secretary of State. The consignor must also arrange for a package that has been involved in a radiological emergency to be examined, and to be satisfied that it complies with the regulations before onward transport.

The road transport regulations also specify provisions for the monitoring of persons, referring to the appropriate sections of the IRR, and ruling that persons involved in intervention must be classified persons according to the IRR and subject to the normal dose limits, excepting that, under exceptional conditions for the purpose of saving lives, the dose limits for employees over 18 and certain other persons may be exceeded provided that the persons are volunteers and have been informed of the risks.

Significantly, the road transport regulations provide an exemption for the transport of a consignment that is undertaken by or under the supervision of the emergency services (including by breakdown vehicles), or in an

emergency intended to save human life or to protect the environment, provided that all measures are taken to ensure safety.

Transport of radioactive materials by rail is now regulated through a provision in The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004 [9]. These regulations are constructed somewhat differently from the road transport regulations and refer extensively to the RID regulations [10]. Thus the duties of a consignor are given by reference to RID, which states that the consignor shall provide in the consignment note a statement of actions required to be taken by the carrier, including the emergency arrangements appropriate to the consignment. The RID regulations place a duty on every person involved in the carriage of dangerous goods (including radioactive material), where there is an immediate risk that public safety may be jeopardized, to notify the emergency services and to make available to them the information they require. All participants in a transport operation are required to take appropriate measures according to the nature and extent of foreseeable dangers, so as to avoid damage or injury and, if necessary, to minimize their effects. The intervention requirements of the Basic Safety Standards Directive [5] are implemented for rail transport through REPPIR [6]. Many types of consignment by rail are exempt from the provisions of REPPIR, in recognition of the high levels of protection provided by compliance with the IAEA transport regulations. Such exemptions include Type B(U), Type B(M) and Type C packages and consignments carried under special arrangement.

Transport of radioactive materials by sea is subject to the provisions of the International Maritime Dangerous Goods Code [11] (the IMDG Code) that is implemented through The Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997 [12], as amended by Merchant Shipping Notices (MSN's) from time to time, and enforced by the Maritime and Coastguard Agency. The IMDG Code contains a number of special provisions for incidents involving radioactive material including the following:

- observation of emergency provisions as established by relevant national or international organisations in accordance with the IAEA guidance material [7],

- restriction of access to a damaged or leaking package and assessment of the package, conveyance and surrounding areas by a suitably qualified person, together with appropriate measures to limit the consequences of the damage,

- removal of packages to an acceptable interim location, and

- reference to the Emergency Procedures for Ships Carrying Dangerous Goods (EmS), and the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), which are appended to the IMDG Code.

Where there is an actual or probable discharge of material from the ship, the master of the ship is required under The Merchant Shipping (Reporting Requirements for Ships Carrying Dangerous or Polluting Goods) Regulations 1995 [13] to notify the incident to the appropriate competent authority.

Ships carrying INF Cargo as defined in the INF Code [14], are required under The Merchant Shipping (Carriage of Packaged Irradiated Nuclear Fuel etc.) (INF Code) Regulations [15] to carry an approved shipboard emergency plan incorporating the procedure to be followed for notification, and a list of the authorities to be notified, a detailed description of procedures to be followed to minimise the consequences of the incident, and the procedures and points of contact for co-ordination of shipboard action with national or local authorities. Reporting of loss or release of INF Cargo or of incidents affecting the safety of the ship are required by the INF Code to be reported as required by the International Convention for the Safety of Life at Sea [16].

Transport of radioactive material by air is regulated by the Civil Aviation Authority. The Air Navigation (Dangerous Goods) Regulations 2002 [17] give effect to the International Civil Aviation Organisation's Technical Instructions [18], which require that appropriate information for use in an emergency be provided by the operator to the pilot in command. There is a further duty on the operator to report accidents or incidents to the appropriate authority, which in Great Britain is the Civil Aviation Authority.

5 Government Emergency Plans

Government plans are designed to ensure the protection of both the public and the environment, by providing information for government ministers, official bodies, the media and the general public. Responsibilities are determined by the nature and origin of the incident, and are based on the concept of a Lead Government Department as defined in the government publication "Dealing with Disaster" [19]. Under this concept, the lead department's responsibilities include co-ordinating the government response and the management of information, and acting as the focal point for communications between central government and other agencies involved, including devolved administrations where appropriate.

The distribution of lead department responsibilities for radioactive incidents is as follows:

- For incidents at civil nuclear installations in Great Britain, the Department of Trade and Industry (DTI) is the lead department. In addition to leading government response in the event of an incident, the DTI chairs the Nuclear Emergency Planning Liaison Group (NEPLG), a forum which brings together organisations having an interest in off-site nuclear emergency planning and produces guidance material for use by responding organisations. The Department for Transport is represented on the NEPLG to cover the transport implications of fixed site incidents.

- For overseas nuclear incidents, the lead department is the Department for Environment, Food and Rural Affairs (DEFRA). DEFRA discharges its responsibilities through the Radiation Incident Monitoring Network (RIMNET). RIMNET consists of a network of monitoring stations throughout the country with links to overseas facilities to provide early warning of airborne radioactivity. The facility incorporates an extensive information handling facility to which may be added supplementary information. This may include data relating to transport incidents or other incidents affecting the transport infrastructure. RIMNET is directed by a co-ordinating committee chaired by DEFRA and including interested parties from both the regulatory and industrial communities.

- In the case of transport incidents, the lead department is mode dependent, and the lead role is taken by the department or agency responsible for enforcement, i.e. Department for Transport (DfT) for road, HM Inspectorate of Railways (part of the Health and Safety Executive, HSE) for rail, the Maritime and Coastguard Agency for sea, and the Civil Aviation Authority for air. Each of these agencies maintains its own arrangements for receiving and distributing information, bringing together the required representatives and facilities for briefing ministers, the media and the general public and for ensuring that the required measures are put in place for handling the incident and for remediation. Memoranda of understanding exist between certain agencies to establish roles and responsibilities. The Maritime and Coastguard Agency has an extensive contingency plan to deal with polluting incidents at sea [20]. The DfT's Radioactive Materials Transport Division (RMTD) is available to provide advice to the lead division for any of the transport modes from its specialist knowledge as national competent authority under the IAEA transport regulations. Since the extension of the International Nuclear Events Scale to include transport incidents, the response includes an assessment of the likely INES rating, although this may be refined as the full extent of an incident becomes apparent. A database of transport events is maintained by NRPB under contract to DfT and HSE, to enable overall safety levels to be monitored and trends in incident occurrence to be identified and addressed [21, 22].

6 Industry Emergency Plans

- RADSAFE

Transporters of radioactive materials have developed cooperative emergency arrangements over many years, and the history and philosophy has been discussed by Kelly [23]. For transport within Great Britain, the plans of the major consignors have developed to contribute to a single set of response arrangements known as RADSAFE. Each member organisation retains its responsibility for its own consignments, but makes its resources available to provide an initial rapid response to an incident occurring anywhere throughout the country. RADSAFE also works very closely with NAIR (see Section 6 below), sharing many facilities including the access telephone number and training courses, and all RADSAFE members are stage 2 (intervention) responders for NAIR.

The RADSAFE response is centred on the RADSAFE communications centre, which is operated by the Force Communications Centre of the United Kingdom Atomic Energy Authority (UKAEA) Constabulary, whose

responsibilities include overseeing the transport of special nuclear material and providing security for the nuclear industry.

In the event of an incident, the RADSAFE communications centre is accessed via a single free telephone number, which is shown on a placard on the vehicle. Response is on three levels as follows:

Level 1: Notification and communication, and provision of generic advice by the Force Communications Centre,

Level 2: Provision of radiological support and advice at the scene by the responding organisation nearest to the scene,

Level 3: Response by the consignor of the material and any necessary "clean up".

The RADSAFE communications centre may be notified either by a member of the public or by the emergency services, and will immediately supply generic radiological advice to the responding emergency services by faxing a standard information sheet (Level 1). They then contact the nearest responding site and request that they provide support (Level 2). At the same time the consignor of the package is identified from information on the vehicle, and notified, so that they can liaise with the Level 2 responding site and make arrangements to take over the response (Level 3). The latter stage could take some time depending on the distance of the incident from the consignor's base, so the Level 2 responder will provide advice to the emergency services until the consignor arrives. Such advice would include informing multi-agency discussions on procedure, making radiological assessments, liaising with health physics teams, and reporting to the emergency services, the consignor, and other organisations involved. Once the consignor's team has reached the incident site, they will assume responsibility for the radiological response, including dealing with any spillage in co-operation with national or local regulatory authorities.

- **Other Plans**

Some organisations also maintain their own separate response plans to cover their specific situations, for example, specific routes and obligations under INF legislation as described earlier. Also many smaller (usually local) consignors have their own independent arrangements appropriate to their particular operations.

7 National Arrangements for Incidents Involving Radioactivity (NAIR)

It is recognised that there may be occasions when the arrangements of consignors break down, or otherwise be non-operational. To address this eventuality, The National Arrangements for Incidents Involving Radioactivity (NAIR) [24] have been set up to provide protection for the public in the event of a radiological emergency which is not covered by industry arrangements or if the industry arrangements cannot be implemented, for whatever reason. The NAIR scheme, which is co-ordinated by the National Radiological Protection Board (NRPB) draws on radiological expertise available throughout the country and can provide two stages of response, advice and intervention. It is available to the emergency services through the police. NAIR is strictly a service to the civil police and is not a substitute for operators' own arrangements that are required by statute.

8 Concluding Remarks

Emergency preparedness for the transport of radioactive materials in Great Britain is founded on a comprehensive suite of regulations and emergency plans which provide for effective response to incidents and the provision of information to government, the media and the general public. Government response is covered by a lead department that is determined by the type of incident and the mode of transport involved. The major consignors have established a nation-wide response network, and an additional comprehensive backup service is provided to ensure public protection.

9 References

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), Safety Standards Series No. TS-R-1, Vienna (2000), ISBN 92-0-100500-8.

[2] MORGAN-WARREN, E.J., Emergency Arrangements for Civil Transport of Radioactive Materials in Great Britain, The Regulatory Framework. International Conference on the Safety of Transport of Radioactive Material. International Atomic Energy Agency, IAEA-CN-101/109, Vienna, 7-11 July 2003.
[3] The Ionising Radiations Regulations 1999, SI 1999 No. 3232, The Stationery Office, London, ISBN 0-11-085614-7.
[4] The Health and Safety at Work etc. Act 1974, The Stationery Office, London.
[5] Council Directive 96/29/Euratom laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation. Official Journal of the EC L159 Vol.39, 29 June 1996.
[6] The Radiation (Emergency Preparedness and Public Information) Regulations 2001, SI 2001 No. 2975, The Stationery Office, London, ISBN 0-11-029908-6.
[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, Safety Standards Series No. TS-G-1.2, Vienna (2002).
[8] The Radioactive Material (Road Transport) Regulations 2002, SI 2002 No. 1093, The Stationery Office, London, ISBN 0-11-042248-1.
[9] The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004, SI 2004 No. 568, The Stationery Office, London, ISBN 0-11-049063-0.
[10] Regulations concerning the International Carriage of Dangerous Goods by Rail (RID), 2003 Edition, The Stationery Office, London, ISBN 0-11-552553-X.
[11] International Maritime Dangerous Goods Code, 2002 Edition, International Maritime Organisation, London, ISBN 92-801-5140-1.
[12] The Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997, SI 1997 No. 2367, The Stationery Office, London, ISBN 0-11-064955-9.
[13] The Merchant Shipping (Reporting Requirements for Ships Carrying Dangerous or Polluting Goods) Regulations, 1995, SI 1995 No. 2498, The Stationery Office, London, ISBN 0-11-053477-8.
[14] International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on board Ships (INF Code), IMDG Code 2002 Edition Supplement, International Maritime Organisation, London, ISBN 92-801-5141-X.
[15] The Merchant Shipping (Carriage of Packaged Irradiated Nuclear Fuel etc.) (INF Code) Regulations 2000, SI 2000 No. 3216, The Stationery Office, London, ISBN 0-11-018900-0.
[16] International Convention for the Safety of Life at Sea (SOLAS), 1974.
[17] The Air Navigation (Dangerous Goods) Regulations 2002, SI 2002 No. 2786, The Stationery Office, London, ISBN 0-11-042971-0.
[18] Technical Instructions for the Safe Transport Of Dangerous Goods by Air, International Civil Aviation Organisation, Montreal.
[19] "Dealing with Disaster", Third Edition, The Home Office, London, ISBN 185-893-9208.
[20] National Contingency Plan for Maritime Pollution from Shipping and Offshore Installations, Maritime and Coastguard Agency, Southampton, 2000.
[21] WARNER-JONES, S.M., et. al., Radiological Consequences Resulting from Accidents and Incidents Involving the Transport of Radioactive Materials in the UK - 2001 Review, National Radiological Protection Board, Chilton, England, 2002, ISBN 0-85951-501-X.
[22] HUGHES, J.S., and SHAW, K.B., Accidents and Incidents involving the Transport of Radioactive Materials in the UK, from 1958 to 1994, and their Radiological Consequences, National Radiological Protection Board, Chilton, England, 1996, ISBN 0-85951-392-0.
[23] KELLY, T., RADSAFE - Experience with the Application of a National Response Plan. International Conference on the Safety of Transport of Radioactive Material. International Atomic Energy Agency, IAEA-CN-101/110, Vienna, 7-11 July 2003.
[24] McCOLL N.P and KRUSE, P., NAIR Technical Handbook 2002 Edition, National Radiological Protection Board, ISBN 0-85951-478-1.