WNTI

World Nuclear Transport Institute

GOOD PRACTICE GUIDE

Radiation Protection Programmes for Road Carriers, Sea Carriers and Port Handlers

Dedicated to the safe, efficient and reliable transport of radioactive materials

Radiation Protection Programmes for Road Carriers, Sea Carriers and Port Handlers

1. Introduction

1.1 International Atomic Energy Agency requirements

The International Atomic Energy Agency (IAEA) Transport Safety Regulations TS-R-1; 2005 Edition (§ 302) requires that:

"A Radiation Protection Programme (RPP) shall be established for the transport of radioactive materials. The nature and extent of the measures to be employed in the programme shall be related to the magnitude and likelihood of radiation exposures…. Programme documents shall be available, on request, for inspection by the relevant competent authority".

An RPP is defined in § 234 as systematic arrangements aimed at providing adequate consideration of radiation protection measures.

An RPP shall incorporate the requirements of paragraphs 301, 303-305, 311 and 563 which cover:

- optimisation of protection and safety;
- training of workers;
- exposure control;
- segregation from workers, members of the public and undeveloped films;
- emergency response.

The IAEA guidance document TS-G-1.1 recommends consideration of the following functional elements in an RPP:

- scope of the programme;
- roles/responsibilities;
- dose assessment;
- surface contamination assessment;
- optimisation;
- segregation;
- emergency response;
- training;
- quality assurance.

1.2 Modal regulations

The requirements of SSR-6 (previously TS-R-1) have been taken up by the modal organisations in their modal regulations including:

Mode	Regulation/code/agreement
Sea	International Maritime Dangerous Goods Code (IMDG Code)
Air	Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO - TI) Dangerous Goods Regulations (IATA - DGR)
Road	European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)
Rail	Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID)

In this regard it should be noted that several RPP requirements to be considered are already covered within the regulations of the relevant transport modes; e.g. segregation of packages is specified in all modal regulations, as is surface contamination. In such cases, reference can be made to the application of existing requirements.

2. Objectives and scope

RPP requirements apply to the various elements of the transport chain including:

- consignors;
- freight forwarders;
- carriers;
- handling organisations at ports;
- consignees.

In some cases nuclear fuel cycle materials are transported by dedicated carriers which already have well-developed radiation protection arrangements in place.


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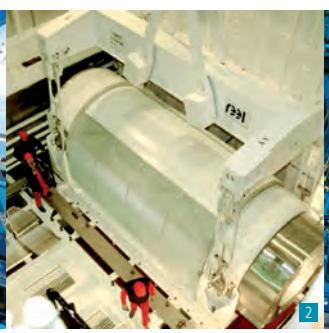
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For many organisations, however, the transport of radioactive materials is only a fraction of their business, including:

- trucking companies;
- sea carrier/liner services;
- port /cargo handler organisations;
- airline services.

Such companies are expected to comply already with the various requirements of the modal regulations for dangerous goods. They may not, however, have a fully developed RPP in place and may be concerned that implementation and application of RPPs, in addition to the existing radiation protection provisions, could have a substantial impact on their business.

In the interest of supporting such organisations in the continued supply of services for nuclear transport, this good practice guide is designed to offer practical advice based on industry experience. However, the requirements of national competent authorities will be definitive.

3. Prior dose assessment

3.1 Dose categories

The level of expected dose exposure forms the basis for a graded approach to the requirements of the RPP, in particular, the degree of dose monitoring which is required. Where it is expected that the effective dose:

(a) is likely to be between 1 and 6 mSv in a year, a dose assessment programme via workplace monitoring or individual monitoring shall be conducted;
(b) is likely to exceed 6 mSv in a year, individual monitoring shall be conducted.

The 1 mSv in a year effective dose is the International Commission on Radiation Protection dose limit for members of the public and therefore the requirements for an RPP are considerably below this level.

The Regulations accept that the likely dose will generally be based on a prior radiological assessment using existing dose data for similar transport activities. This is the reason why it is important to collect reliable dose data relating to transport operations for nuclear fuel cycle materials.

3.2 WNTI Dose Assessment Study (Revised 2006)

Accordingly, in view of the importance of prior dose assessment, the World Nuclear Transport Institute (WNTI) has undertaken a study of the historical dose uptake of various types of workers in the transport chain.

The findings of this study, which analysed both literature data and actual monitoring data of some WNTI Members is that during the various modes of transport of nuclear fuel cycle materials it is very unlikely that any group of workers not classified as radiation workers or any member of the public will receive annual doses in excess of the limit of 1000 μSv (1mSv) under normal conditions.

This is important because all modes of transport for all nuclear fuel cycle materials then fall below the level of expected dose for which workplace or individual dose monitoring is required and the RPP will not have to include this onerous provision.

4. Elements of a Radiation Protection Programme

A consideration of functional elements for an RPP consistent with the WNTI findings follows.

4.1 Scope of the programme

The first step is to define the field of application of the RPP, including a brief description of the type and volume of radioactive materials, package types and transport/transfer activities.

4.2 Roles/responsibilities

The responsibility for RPP implementation and application rests essentially on each independently operating transport organisation involved in the shipment of radioactive material. The relevant management is responsible for the documentation of safety objectives and for the proper implementation of safety-related duties.

The organisational arrangements should clearly identify the roles and responsibilities of the designated persons involved and documentation should be kept within a proper quality assurance system. Those responsible for managing the RPP should be given the authority necessary to implement the programme.

Development and implementation of the administrative and operational functions could be performed by an external qualified expert or expert organisation; for example consignors and transport companies may be able to supply such services to their subcontractors and, where appropriate, to assist in order to maintain operations. Notwithstanding, final responsibility for ensuring implementation and compliance rests with the management of the relevant subcontractor.

4.3 Dose assessment

The WNTI Dose Assessment Study (Revised 2006) found that typical nuclear transport and loading/unloading activities related to the fuel cycle result in individual annual effective doses below 1 mSv, and consequently, work place or individual monitoring is not required in such cases.

Accordingly, if the activities for which the RPP is established are similar to the activities which are described and analysed in the WNTI Dose Assessment Study (Revised 2006), it may be found sufficient to make reference to this document and have it available, on request, for inspection by the competent authority.

In any case, the situation should be reviewed continuously, in particular, when the products to be transported and the methods of transport and transfer change.

4.4 Optimisation

The Transport Regulations adopt the safety principle in work environments where employees may be exposed to radiation, that occupational (and public) exposures to radiation should be "As Low As Reasonably Achievable" (ALARA), economic and social factors being taken into account.

In transport there is a "built-in" ALARA principle because, for strictly commercial reasons there may be an incentive to minimise transport distances and to reduce transfers during transport to a minimum.

Active optimisation methods may, for example, include the increase of segregation distances beyond the minimum requirements specified in the modal regulations.

As noted in section 3.2, this paper covers only transport operations which result in an annual individual effective dose to workers of less than 1 mSv. In such cases the possibilities of optimisation to further reduce this low dose may be very limited.

Paragraph 302.1 of TS-G-1.1 requests that in the interest of optimisation of protection and safety both normal and potential exposures have to be taken into account. In the case of potential exposures "the likelihood of the occurrence of accidents or events … is also taken into account". There already is substantial evidence from literature that the risk from nuclear transport is much lower than any so-called accepted risk. In more than 45 years of nuclear fuel cycle related transport there have been no reported incidents and accidents resulting in a significant radionuclide release or exposure to radiation of the public or transport workers. Also, the Transport Regulations themselves have "built-in" requirements to limit potential exposures by specifying packaging requirements commensurate to the potential risks of the material to be transported.

4.5 Surface contamination control

The limits for surface contamination are specified in the regulations, and consignors are responsible for observing them.

Carriers have to take into account potential contamination of conveyances. The Regulations specify that: "A conveyance and equipment used regularly for the transport of radioactive material shall be periodically checked to determine the level of contamination. The frequency of such checks shall be related to the likelihood of contamination and the extent to which radioactive material is transported".

Except for the transport of spent fuel transport casks loaded in water ponds, the probability that a conveyance becomes contaminated in normal conditions of transport is very low. Experience shows that this is especially true for the transport and transfers of front end fuel cycle materials considered in this paper. Nevertheless, a possibility to perform surface contamination checks should be provided for, perhaps in co-operation with the consignors or consignees at regular intervals.

In all cases where a package has been involved or is suspected of having been involved in an incident, checks for contamination of conveyances have to be performed by a qualified person as soon as practicable and no later than start of discharge at the next port or terminal.

4.6 Segregation

For many years segregation requirements for packages have been part of modal regulations and no additional requirements need to be imposed in an RPP for nuclear fuel cycle materials.

4.7 Emergency response

Requirements for emergency response planning during transport are found in national and modal transport regulations and no additional requirements need to be imposed in an RPP.

4.8 Training

Training requirements are specified in national, regional and modal regulations and no additional requirements need to be imposed in an RPP.

4.9 Quality assurance

The RPP should be an integral part of quality assurance programmes for transport and/or transit operations. In any case an RPP should be subject to such quality assurance rules as approval procedures, documentation and review at regular intervals.

5. Outline examples of Radiation Protection Programmes

The following illustrative examples are intended to assist operators in identifying the minimum requirements to be addressed within an RPP for specific transport modes.

5.1 Radiation Protection Programme for a road carrier – an example

(1) SCOPE

This RPP applies to road transports as specified below:

Company:	*Trucking company XXX, located in YYY, country ZZZ*
Materials:	*Unirradiated uranium fuel in the form of pellets, rods, fuel assemblies*
Packages:	*Type AF*
Transport range:	*Domestic and transboundary shipments within European Union*
Applicable law:	*National regulations and ADR*

(2) ROLES/RESPONSIBILITIES

Name of the responsible manager (for staff and operations):

Responsible for implementation of the RPP:

Since it is necessary in Europe to have an approved dangerous goods safety adviser for the transport of dangerous goods, it would be advisable to assign this duty to him.

Responsible for training and emergency planning:

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(3) DOSE ASSESSMENT

WNTI Dose Assessment Study (Revised 2006) indicates that it is most unlikely that the individual annual effective dose of the vehicle/truck driver will exceed 1 mSv. Therefore, no individual monitoring of workers/drivers will be required.

(4) OPTIMISATION

Optimisation of safety and protection, i.e. to keep occupational exposures as low as reasonable achievable, will be achieved by increasing segregation and separation distances beyond regulatory requirements where possible and by careful training of drivers.

(5) SURFACE CONTAMINATION

The likelihood of surface contamination to occur is very low. There could be an agreement with the consignee to appropriately monitor the conveyance after unloading the packages.

(6) SEGREGATION AND SEPARATION

Segregation requirements of ADR are to be observed.

(7) EMERGENCY RESPONSE

Emergency response planning is in accordance with ADR (emergency cards, emergency phone numbers, instructions to the drivers).

(8) TRAINING

Training requirements should be complied with, to the extent that:

- the dangerous goods safety adviser is trained and approved, and
- the drivers are trained and licensed for the transport of dangerous goods.

(9) QUALITY ASSURANCE

The RPP is implemented as an integral part of the company's quality assurance system.

5.2 Radiation Protection Programme for a sea carrier – an example

(Assuming that the carrier vessel is registered with a Flag State which is a member of the SOLAS Convention.)

(1) SCOPE

This applies to international sea transport as specified below:

Company responsible for RPP:

Shipping line:

Vessel's name:

Port of registry:

Materials:	Unirradiated uranium materials in the form of U3O8, UF6, fuel rods, fuel assemblies
Packages:	Type IP1, AF, H(U), H(M)
Transport range:	International
Applicable law:	Flag State regulations

(2) ROLES/RESPONSIBILITIES

Name of the designated person responsible for RPP:

Name of manager responsible for development and maintenance of the RPP:

Name of Company Manager responsible for training:

Name of Company Manager responsible for emergency response planning:

List of Masters, Names xxx responsible for implementation of onboard RPP:

(3) DOSE ASSESSMENT

WNTI Dose Assessment Study (Revised 2006) indicates that based on historical dose uptake data, it is most unlikely that the annual individual effective doses of staff on board the vessel will exceed 1 mSv, and therefore no individual dose monitoring will be required.

(4) OPTIMISATION

Optimisation of radiation protection will be achieved, as far as possible, by increasing segregation distances beyond the requirements of the IMDG Code and by limiting access of staff to the radioactive cargo.

(5) SURFACE CONTAMINATION

The likelihood of surface contamination to occur is low. The consignor will be consulted concerning the need for contamination checks of the cargo area.

(6) SEGREGATION

Segregation requirements of the IMDG Code are to be observed.

(7) EMERGENCY RESPONSE

For non INF Class ships, emergency response planning is to comply with the IMDG Code requirements.

For INF Class ships, emergency response planning is to comply with the Emergency Response Plan.

(8) TRAINING

Training requirements of the IMDG Code are to be met.

(9) QUALITY ASSURANCE

The RPP is implemented as an integral part of the company's quality assurance system.

5.3 Radiation Protection Programme for a port handling organisation – an example

(1) SCOPE

In considering the scope of an RPP within port areas, all aspects of the International Maritime Organization publication "Recommendations on the Safe Transport of Dangerous Goods and Cargoes: Related Activities in Port Areas" should be consulted.

This RPP applies to port loading/unloading activities:

Company:

Port:

Materials:	Unirradiated uranium materials in the form of U3O8, UF6, pellets, fuel rods, fuel assemblies
Packages:	IP1, AF, H(U), H(M)
Applicable law:	National health and safety regulations for workers within the port area

(2) ROLES/RESPONSIBILITIES

Ensure that appropriate legal requirements, based upon the International Maritime Organization publication "Recommendations on the Safe Transport of Dangerous Goods and Cargoes: Related Activities in Port Areas" are met and reviewed regularly.

Name of the manager within company XXX responsible for development and maintenance of the RPP:

Name of person responsible for the implementation and application of the RPP:

Mr/Mrs. YYY of company ZZZ to whom the functions are delegated by contractual arrangements (if available attach management organisation chart).

(3) DOSE ASSESSMENT

WNTI Dose Assessment Study (Revised 2006) indicates that based on empirical dose uptake data it is most unlikely that the annual individual effective dose of the port workers will exceed 1 mSv. Therefore, no workplace monitoring and no individual monitoring will be required.

(4) OPTIMISATION

Optimisation of radiation protection, i.e. to keep occupational exposures as low as reasonable achievable, will be achieved mainly by instructing workers to keep away from radioactive cargo as far as possible.

(5) SURFACE CONTAMINATION

The likelihood of surface contamination transfer from the cargo to the loading/unloading area and equipment is very low. The radiation protection officer of the contractor will be consulted about the need for checks.

(6) SEGREGATION

Segregation tables of the IMDG Code will be used.

(7) EMERGENCY RESPONSE

The phone numbers of port and public emergency organisations should be available.

(8) TRAINING

Training of staff as recommended in the International Maritime Organization publication "Recommendations on the Safe Transport of Dangerous Goods and Cargoes: Related Activities in Port Areas" with particular reference to segregation and emergency phone numbers.

(9) QUALITY ASSURANCE

The RPP will be subject to approval by the responsible manager and will be reviewed at regular intervals. Training will be documented.

References

1 International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Material TS-R-1; 2005 Edition
2 International Atomic Energy Agency Advisory Material TS-G-1.1
3 Radiation Dose Assessment for the Transport of Nuclear Fuel Cycle Materials, WNTI Review Series No. 2, (Revised 2006)

Photographs

1 Tie-down for fresh fuel transport
2 Loading a vitrified high-level waste cask into ship's hold
3 Spent fuel on overland carrier, Mutsu-Ogawara Port, Japan
4 Off-loading spent fuel cask for radiological inspection
5 Monitoring a test reactor fuel cask

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