



BNFL's Experience in preparing and implementing Radiation Protection Programmes for the control of exposure to workers involved with the International Transport of nuclear cargoes

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Abstract

BNFL International Transport have successfully developed appropriate Radiation Protection Programmes for their business. The business supports BNFL's worldwide Nuclear Fuel Services with key customer bases in Europe, Japan and the UK, utilising marine, rail and road modal transports. Experience in the business spans over 4 decades. The preparation of RPP's for each aspect of its operations has been made relatively straight forward in that the key elements within the internationally recognised model RPP (by WNTI) were already in place in BNFL's procedures to satisfy current National UK and International Regulations. Arrangements are supported by Management systems which comply with International Standards for Quality Assurance. Exposure to key worker groups continues to be within Category 1 (less than 1mSv/y) of the IAEA Transport Regulations TS-R-1 (ST-1 revised)

Introduction

BNFL International Transport (BNFL IT) have over 30 years experience in the movement of packages designed to carry nuclear material including new and spent nuclear fuel and vitrified high level residues. The design, construction and operation of these packages satisfy all the requirements of the IAEA and associated National and International Transport of Dangerous Goods (Category 7). Marine operations are managed directly by BNFL for its own ships and for Pacific Nuclear Transport Limited comprising a total fleet of six specially designed ships.

IAEA publication TS-R-1 (ST-1-Revised) requires the preparation of a Radiation Protection Programme for the management of exposure to workers engaged in transport operations. This paper provides a description of the particular arrangements in place within BNFL IT including PNTL to satisfy the IAEA requirement for RPP's.

Model Structure for the Radiation Protection Programme

Guidance on the content of an individual Radiation Protection Programme has been provided by the World Nuclear Transport Institute, WNTI, (ref. 1) and within the UK the National Radiological Protection Board, NRPB (ref. 2). These Guidance documents build on the key requirements specified within TS-R-1. i.e.

- Optimisation of protection and safety (para 302)
- Training of Workers (para 303)
- Exposure Control (para 305)
- Segregation from workers, members of the public and undeveloped films (para 306 and 307)
- Emergency Response (para 308 and 309)

The model structure for RPP's within BNFL IT has in addition to the above aspects recognised WNTI and NRPB guidance and included arrangements covering: 'Scope of the programme'; 'Roles and Responsibilities', 'Dose Assessment', 'Surface Contamination Control', 'Optimisation' and 'Quality Assurance'. The paragraphs below describe the implementation of these elements of the programme within BNFL International Transport.

Implementation of RPP's within BNFL International Transport

Scope:

Under this section is simply the Company address, a description of the total number of employees, the materials being transported, package types, transport range and Applicable Law.

Within BNFL International Transport the worker groups who are subject to radiological assessment and monitoring comprise port operations, Health Physics personnel, ships crew, and flask engineers.

The materials being transported are by the nature of the business nuclear material including new fuels, irradiated Oxide and Magnox fuels, Vitrified High Level Residues, and Low Level Radioactive wastes.

The package types although principally 'Type B' also comprise IP1, IP2, IP3 and type A excepted.

Key intermodal points on the transport routes include marine port(s) and UK rail heads, associated with the power stations.

Roles and Responsibilities:

This section presents named post holders with key responsibilities e.g. the Radiation Protection Advisor and Radiation Protection Supervisor (appointments under the UK Ionising Radiations Regulations (1999), IRR (99). The Operations Manager and the QA Manager for each business function.

Dose Assessment:

Prior dose assessment has been undertaken for BNFL IT principally based on the results from personal dosimetry monitoring over many years of operation. The results from compliance radiological surveys on packages have also supported the prior dose assessment methodologies.

For the worker groups identified above historically all group average and individual exposures have been controlled to less than 1 mSv/year (category 1). Table 1 below shows a summary of recorded doses for the key groups for 2003.

Table 1 BNFL/PNTL Transport Worker doses for 2003

Worker Group	Average dose (mSv)	Highest individual dose (mSv)	Number of individuals wearing dosimeters
Marine Operations	0.07	0.33	118
Port Operations	0.30	0.40	12
Flask Engineers	0.51	0.75	7

The results shown in table 1 are indicative of exposures to these groups over 30 years operation

As Transport programmes are developed assessment is undertaken accounting for potential significant changes to throughput, package design, package content and worker occupancy.

Under TS-R-1 the requirement for individual monitoring versus workplace monitoring indicates that for all BNFL IT operations sufficient control can be implemented through workplace monitoring only. However, partly for historical reasons and partly for worker reassurance arrangements BNFL IT issue their dockworkers and sea staff with routine, or voyage specific personal issue film badge dosimeters. The Flask Engineer team who as part of their work enter radiological controlled areas in non-BNFL sites are designated Classified Persons and Outside Workers under the UK IRR (99) and are issued with routine (quarterly) film badge dosimeters

The above arrangements have therefore not been implemented out of the TS-R-1 regulations but were already in place to ensure compliance with European Basic Safety Standard/UK legislative/BNFL Corporate Requirements.

Optimisation:

It is recognised by WNTI (ref 1) that for Category 1 exposures ‘...the possibilities of optimisation to further reduce this low dose may be very limited’. Nevertheless within BNFL IT we as part of Risk Assessment reviews undertake analysis of exposure and associated occupancy times in the vicinity of packages in order to

demonstrate ALARA (ALARP). Such reviews may include a re-examination of how the 'hierarchy of controls' is being applied i.e. Can the hazard (radiological source) be removed or, more likely, be reduced by engineered means or procedural arrangements or both. On board ship engineered controls already in place in addition to the package itself include shielding of bulkheads and hold covers. While cargo is loaded hold areas are designated as a Controlled Area and access is restricted to nominated officers.

Port operation exposure is optimised with appropriate planning for individual and team tasks including selection and use of tools and equipment to limit exposure times. Individuals are able to appreciate and control their own exposure with the issue of electronic 'real-time' dosimeters.

In BNFL IT optimisation of exposure for all worker groups is implemented through assessment of these and similar factors for their particular role.

Surface Contamination Control:

The requirements of a Carrier are to take into account potential contamination of conveyances. In due recognition of loose surface contamination being occasionally found on certain European and UK Spent Fuel transports BNFL IT has established, in conjunction with its customers (and their regulators), a comprehensive regime for surface contamination monitoring at intermodal points. This programme of monitoring at intermodal points is in addition to detailed monitoring undertaken at consignment and receipt.

Segregation:

As recognised in the WNTI paper (ref 1) 'segregation requirements have been part of model regulations and no additional requirements needs to be imposed in a Category 1 RPP'.

Emergency Response:

A separate conference paper 'Emergency Response Arrangements for the Pacific Nuclear Transport Fleet' (ref 3) provides a detailed discussion of the arrangements covering BNFL IT's marine emergency response. The components of these arrangements are.

Each vessel has a Shipboard Marine Emergency Plan satisfying IMO guidelines

National Federal Response arrangements for land based emergencies in participating countries

Within the UK the RADSAFE scheme

Within BNFL IT a comprehensive set of Emergency Response Procedures.

Training:

The level of training given to the worker groups (and key individual roles) identified within each RPP is commensurate with their function. For personnel designated as

Classified (Radiation) Persons under the UK Ionising Radiation Regulations training comprises a BNFL Corporately prepared course covering:

- Arrangements for Entering Controlled/Supervised areas
- Emergency Alarms and appropriate response
- Radiation types; Hazards, Units of measurement, Limits Contamination, Fixed, Loose, Airborne, Internal Dosimetry Contamination Control
- Signs and Warning Notices
- Radiation, Detection, Personal Dosimetry

Understanding is tested at the end of the course and all Classified Persons are required to attend refresher training every 5 years (minimum).

For those groups not appointed as Classified Persons i.e. Dockworkers, Sea Staff, Train Crew, training is delivered by the Radiation Protection Supervisor or Designated Training professional. The contents of this local area training is a customised version of that for Classified Persons training. Specifically covering:

- Delineation of the restricted area
- Arrangements for entry/exit from restricted area
- Radiological Monitoring arrangements
- When advice must be sought
- The role of Nominated persons

Refresher training is provided to the crew (sea) by a ships Nominated Person on every voyage.

Quality Assurance:

Both BNFL IT and PNTL are certificated to ISO 9000 (2000) and the RPP and associated records are maintained to satisfy the requirements of the Standard.

Conclusions

BNFL International Transport have established Radiation Protection Programmes which satisfy the requirements of IAEA recommendations TS-R-1

In establishing their RPP's BNFL IT were able to call on robust Radiological Management Systems that were already in place to satisfy National and International regulations.

Average annual doses and individual doses for key worker groups within BNFL International Transport continue to be less than 1mSv/y.

References

- 1 Information Paper on Radiation Protection Programmes (RPP) for Road Carriers, Sea Carriers and Port Handlers.
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- 2 UK Guidance on Radiation Protection Programmes for the Transport of Radioactive Material.
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- 3 Emergency Response arrangements for the Pacific Nuclear Transport Fleet.
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