

TRANSPORTING RADIOACTIVE MATERIALS TO A GEOLOGICAL DISPOSAL FACILITY – AN INTEGRATED APPROACH

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ABSTRACT

The Radioactive Waste Management Directorate (RWMD) of the UK's Nuclear Decommissioning Authority (NDA¹) has responsibility for planning and implementing a Geological Disposal Facility (GDF) in the UK. The responsibility for demonstrating and providing a safe transport operation will be shared between a number of organisations acting as consignors, carriers, and the consignee (the GDF operator).

The radioactive waste transport system is national in scope. Its main objective is to deliver packaged waste to a facility for disposal in a manner that is safe, secure, planned, timely, cost-effective, flexible, environmentally sound and robust against future changes.

To fully appreciate the implications for ensuring transport safety a better understanding of the range of options for a GDF transport system is required. One extreme, the current planning assumption in the UK, is that each waste producer (consignor) is individually responsible for organising their own transport to a GDF. The other extreme is where a single organisation is responsible for the provision of the transport system (an integrated transport service). Intermediate options will exist where the actual implementation could be anywhere on the scale between the two extremes.

A fundamental issue for a GDF transport system for the delivery of Intermediate Level Waste (ILW), High Level Waste (HLW), and spent fuel is the timescale between initial waste packing and final sentencing to the repository. ILW, HLW and spent fuel will need to be managed until a GDF is available and delivery is confirmed. The timescales could be over 65 years given current assumptions.

This paper reviews the feasibility of an integrated transport service for the delivery of ILW, HLW, and spent fuel to a GDF. It defines the key elements of the integrated transport service, highlighting the advantages and disadvantages. Finally, it sets out the key

¹ The NDA manages the UK's civil nuclear legacy and is responsible for developing UK wide LLW strategy and plans, the long-term management arrangements for the UK's higher radioactive wastes, and 19 former UKAEA and BNFL sites.

considerations to be addressed during packing of wastes which will not be transported for up to 65 years.

INTRODUCTION

The current UK geological disposal programme indicates that the operation phase for the emplacement of waste to a geological disposal facility (GDF) will commence in 2040 and end in 2130. At this early stage it has not been decided the extent to which the Radioactive Waste Management Directorate (RWMD) will be directly involved in the transport operation, hence responsibilities for providing and managing a safe transport operation are not yet clearly assigned. Until such time as these management responsibilities are assigned, RWMD will assume the relevant duties and take responsibility for developing and implementing a strategy.

A workshop was held in October 2012 with the RWMD, Low Level Waste Repository (LLWR²) Ltd, International Nuclear Services (INS³) and Direct Rail Services (DRS⁴). The purpose of the workshop was to consider the experience of LLWR Ltd, who in April 2012, launched an integrated transport service for Very Low Level Waste (VLLW) and Low Level Waste (LLW) and to discuss whether the LLWR Integrated Transport Model could be applied to the transport of high activity wastes to a GDF.

This paper summarises the output from the workshop. It defines the various elements of the LLWR Integrated Transport Model, describes the lessons learned during development, and considers the applicability of the LLWR Integrated Transport Model and highlights the advantages and disadvantages of each element for the transport of high activity wastes.

In the context of this paper, ‘an integrated transport service’ means the provision by one organisation (directly or through subcontractor(s)) of a suitable licensed waste transport system (including transport package(s)) and providing the transport service from any UK site to a GDF (including any interim locations/storage facilities). Any references designated herein as ‘LLW’ shall include VLLW and ‘HLW’ shall include spent fuel.

ELEMENTS OF THE LLWR INTEGRATED TRANSPORT MODEL

The LLWR Integrated Transport and Packaging Service was launched in April 2012. This service consists of a number of elements as described below:

Centralised Package Maintenance Facility

LLWR manages a fleet of re-usable containers, designed specifically for the transport of lower activity radioactive wastes. A programme of inspection and maintenance of this fleet

² LLWR Ltd manages the operations of both the site licence company and the UK’s national Low Level Waste Repository.

³ INS is a wholly owned subsidiary of the NDA and is the NDA-appointed strategic authority for transport, providing solutions to specialist nuclear transport challenges, from package design and analysis, licensing, to transport operations.

⁴ DRS is a wholly owned subsidiary of the NDA and the UK’s nuclear rail freight operator delivering safe, secure and reliable rail freight assured services.

is undertaken by LLWR to ensure the containers are fully complaint and functional. They also manage the control and supply of all spare parts for the packages and have modified an existing building at the LLWR site to be operated as a centralised package maintenance facility.

Packaging Services

LLWR provide a packaging design, development and licensing service for new and existing LLW packages. Through framework contracts with the supply chain, LLWR both procure the manufacture of their own container designs and procure other containers directly from the supply chain. LLWR operates a rental fleet of containers and offers the sale of containers to its customers, to support low activity waste management activities.

Following some problems with package manufacturers and inaccuracies with customer package requirement forecasts, a strategic stock of disposable fleet packages has been built to ensure sustainability of package supply for the transport of LLW. These are stored at the manufacturer's premises until the customer requests the units.

Standardisation of LLW Transport Packages

A key part of the LLWR Integrated Transport and Packaging Service is the standardisation of LLW transport packages and operational practices. LLWR implemented a new framework contract with the consignors of waste which enabled them to use any of the services offered by LLWR. This contract introduced the Waste Acceptance Criteria (WAC) that specified the standard transport packages to be used for LLW. Any waste falling outside the WAC would not be accepted at the repository, unless under a variation, subject to compatibility with the LLWR Site Environmental Safety Case.

LLWR Supply Chain

The priorities for LLWR are to attract and retain suppliers to whom their business is important and to encourage healthy competition. In addition, they aim to promote the use of local suppliers and Small to Medium Enterprises (SMEs), wherever possible. They also seek to rationalise the size and scope of their supply chain, while developing improved working relationships and longer term supply chain planning.

Contract Model

LLWR investigated a number of contract options for a transport service ranging from a single integrator, to road and rail suppliers with a logistics team as the integrator, to a hybrid LLWR/DRS approach. LLWR and DRS were formally requested by the Nuclear Decommissioning Authority (NDA) to fully review all options of collaborative working before LLWR contracted with any other transport contractor. This consisted of a review of a transport service and consideration of package maintenance, training functions, etc.

LLWR / DRS Approach

Working in partnership with DRS the LLWR Integrated Transport Model offers stakeholders a range of projected strategic benefits including:

- Reduction of NDA procurement management costs;
- Optimised in-house logistics management control, minimising conflict from a third party integrator;
- Increased utilisation of packaging and transport assets, web based fleet management system to be deployed;
- Environmental benefits from reduced carbon emissions;
- Increased safety and security, promoting rail mode over road;
- Preservation of skills and capability within the NDA estate;
- Alignment with NDA transport and logistics strategy and national LLW strategy;
- Opportunity to centralise resources;
- Single regulatory interface for NDA Low Activity Waste (LAW) packaging and transports.

LESSONS LEARNED

Some of the key learning points from the development of the LLWR Integrated Transport Model were having a good understanding of the problem to be solved, including a better understanding of volumes and types of waste, and engaging with all the stakeholders early. LLWR realised that a standardised approach was essential. By implementing the WAC through the new contract model they were able to drive the appropriate behaviours in the consignors and encourage them to use standard packages and to follow a standard waste loading process.

The identification of issues, learning and areas for improvement highlighted by LLWR has significant advantages in terms of problem recognition, assessment, and development of workable solutions. The feedback of this learning plays an important role in raising awareness and minimises the risk of error repetition by RWMD. RWMD may be in a better position than LLWR as it has more time and opportunity, through learning from experience, to resolve any issues (e.g. package conformity, transport mode selection), alter the strategic direction and specify the requirements at an early stage rather than needing to change existing behaviours. As a result, applying the learning to strategy development would minimise the impact on the project timeline and help develop a robust strategy.

APPLICABILITY OF THE LLWR INTEGRATED TRANSPORT MODEL

There are a number of areas of commonality of the LLWR Integrated Transport Model that could be transferred to the transport of high activity wastes. These include:

- Partnership with DRS – “Rail over road” strategy satisfies NDA requirements.
- Logistics Management Software – Software solutions to improve scheduling, reduce transport costs, improve efficiency and raise customer service levels.
- Nurture expertise and experience – Help solve the experience/time gap that will arise in the future when waste is consigned from “care and maintenance” sites to a GDF.

However, the workshop identified a number of areas where there are differences that would need to be considered for the transport of high activity wastes. These include:

- Volumes of waste – There are approximately 300 containers of LLW waste transported each year to the LLWR, plus a number of transports to national and international treatment facilities. However, greater volumes of high activity waste (approximately 2500 containers per year) are expected to be transported to a GDF.
- Time Lines – The time to develop an integrated transport service for high activity wastes is likely to be longer than the time LLWR had in developing their model. This is likely to ensure a smoother implementation applying the lessons learned from LLWR.
- Design authority and record management – The management of different design authorities and owners of lifetime quality records for different packages over an extended period will require careful management control.
- Interim storage – One fundamental issue that makes the supporting systems for the movement of high activity wastes different to LLW are the timescales between initial packing and final sentence to a repository. In particular, where wastes have been packaged now into waste containers to form a transport package, LLW has a “just-in-time” philosophy of transporting waste to a repository whereas high activity waste will need to be managed until a GDF is available and delivery is confirmed. The timescales could be over 65 years given current assumptions, which has serious implications for continued package licensing.
- Maintaining infrastructure – The NDA is not the owner of the national rail infrastructure. There will be a need to maintain this capability through the supply chain (DRS) as consignor sites go “off-line” or into “care and maintenance”. The strategic right to use this infrastructure may need protecting from challenges from other rail companies if the existing rail paths are not used.

ADVANTAGES AND DISADVANTAGES OF THE INTEGRATED TRANSPORT MODEL

The workshop identified a number of advantages and disadvantages for each of the key elements of the LLWR Integrated Transport Model. These are summarised in Table 1 below.

Table 1: Advantages and Disadvantages of the LLWR Integrated Transport Model for High Activity Waste

Key Elements of the LLWR Model	Advantages	Disadvantages
Centralised Package Maintenance Facility	<ul style="list-style-type: none"> • All spares provided • In house inspectors available • In house package licensing function, single point of contact with the Regulator • Standard and controlled processes and procedures • Eliminate disposal liability 	<ul style="list-style-type: none"> • Integrated schedule required • Remote management required at consignor sites
Packaging Services	<ul style="list-style-type: none"> • Packaging solutions offered • Approved transport and disposal 	<ul style="list-style-type: none"> • Packaging resource a challenge if not started early

	<p>containers</p> <ul style="list-style-type: none"> • Consultation services and optimised solutions for waste management • Standard and controlled packing processes and procedures 	
LLWR Supply Chain	<ul style="list-style-type: none"> • Combined road and rail – cost effective • Transfer of management ownership • Capacity available • Energised supply chain providing innovative solutions 	<ul style="list-style-type: none"> • Surveillance required on carrier operations • Strong partnership approach required
Contract Model	<ul style="list-style-type: none"> • Promotes behavioural change • Demonstrated benefits 	
Standardisation of LLW Transport Packages	<ul style="list-style-type: none"> • Benefit from economies of scale in manufacture • Waste Acceptance Criteria defined • Direct customers away from using up repository space • Controls repository compliance – Environmental Safety Case • Dictates packaging requirements – encouraging efficiencies • Economies of scale 	<ul style="list-style-type: none"> • Common mode of failure (design or single manufacturer approach) • Challenge for new packages • Different design authority for existing packages and responsibilities
LLWR / DRS Approach	<ul style="list-style-type: none"> • LLWR and most consignor sites have rail heads on site or close by • Regulator only needs to visit a single area • Train option economic • Combined road and rail • Web based logistics management system being developed • Reduction on NDA procurement management costs • Environmental benefits from reduced carbon emissions • Increased safety from road to rail mode • Increased security from a rail driven process • Preservation of skill and capability within the NDA estate • Alignment with NDA Transport and Logistics Strategy Opportunity to maintain key/core team of Suitably Qualified and Experienced Person (SQEP) resources • Single regulatory interface for NDA 	<ul style="list-style-type: none"> • Not every consignor site has a rail head on site • Ability to maintain rail networks over the longer term may be a risk, commercially and strategically • Challenges from other rail companies if capacity and rail heads not utilised • Current paper-based customer management system bureaucratic and requires modernising

CONCLUSIONS

The workshop has identified that the LLWR Integrated Transport Model is not automatically an efficient “plug and play” solution as there are a number of areas where there are differences to the transport of high activity wastes that will need to be considered.

As a result, it is proposed that further work is undertaken that includes a Strategic Options Review using the NDA Strategic Management System process [1] to identify all options. (The NDA Strategic Management System is the means by which the NDA develops, controls and communicates its strategy and provides the basis for periodic review of the NDA’s strategic plan). Credible options, ranging from the current planning assumption to a full integrated logistics and transport system, will need to be identified, evaluated and prioritised with engagement from key stakeholders. In order to deliver this work, a knowledgeable team/advisory group will be required and it is considered that much of this knowledge can be derived from the NDA estate (RWMD, INS, DRS, and LLWR) supplemented with external expertise where appropriate.

In conclusion, an integrated transport approach may be one appropriate solution that appears to address the problem of transporting waste to a GDF. However, this approach is only one option available. This paper is intended to open up the debate and act as the catalyst to obtain a better understanding of the range of options for a GDF transport system.

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REFERENCES

1. Nuclear Decommissioning Authority, Strategy Management System – Master Specification, SMS/SSS/Master V2, February 2012.