Proceedings of the 19th International Symposium on the Packaging and Transportation of Radioactive Materials
PATRAM 2019
August 4-9, 2019, New Orleans, LA, USA

MIXED LOADS TRANSPORT

Beverley Stothart
Direct Rail Services
United Kingdom

ABSTRACT

Originally established by British Nuclear Fuels Limited (BNFL) Direct Rail Services (DRS) are a wholly owned subsidiary of the Nuclear Decommissioning Authority (NDA) providing transport of spent nuclear fuel between UK facilities for reprocessing at Sellafield. To this day DRS remain the only rail freight operator to be licenced to carry fissionable material on British rail routes.

The transport of sensitive material demands a unique combination of high security, reliability and extreme safety. Working in close partnership with British Transport Police (BTP), the Civil Nuclear Constabulary (CNC), the Office of Nuclear Regulation (ONR), Office of Rail and Road (ORR), Department of Business, Energy and Industrial Strategy (BEIS) and the NDA, DRS has now been transporting nuclear material on the UK rail network for more than twenty years.

As a world-leading provider of safe, secure and reliable rail logistics solutions for the nuclear industry DRS harness a culture of innovation to provide value for money on behalf of the UK taxpayer. Effective transport solutions are often at the heart of successful programme delivery in the nuclear industry, therefore DRS puts the client first, building bespoke transport solutions to meet their specific requirements.

This can be evidenced through DRS' approach to mixed load transport. Mixed load transport is a train consisting of multiple rail wagons containing packages of different categories of radioactive materials and / or having a different consignor or consignee. Previously within the UK nuclear industry due to issues with insurance liability and waste categorisation it was not possible to transport materials from different clients in the same shipments. This meant that the potential time, cost efficiencies offered by rail could not be accessed, and that road transport, an option less favoured by stakeholders, was the only alternative.

DRS aim to produce a report demonstrating how regulatory, safety and risk concerns were addressed along with a case study of a mixed loads trial service to identify the operational, environmental and financial efficiencies to clients and stakeholders in utilising this approach.

INTRODUCTION

Since its formation in 2005 the NDA has been tasked with the obligation of ensuring the UK's nuclear legacy sites are decommissioned and cleaned up safely, securely, cost-effectively and in ways that protect the people and the environment. The current NDA strategy ensures the strategic direction and long term objectives for achieving this obligation is in place and then disseminated across all Business Units within the UK nuclear family [1].

Direct Rail Services (DRS) was originally formed in 1995 with the primary purpose of transporting nuclear materials on behalf of British Nuclear Fuels Limited (BNFL) and subsequently the NDA, in a safe, secure and reliable manner. Since then, DRS has developed into a stand-alone commercial entity which has marketed its unique skills in contingency planning and exemplary performance to successfully etch out a profitable portfolio to provide bespoke rail solutions in both the nuclear and non-nuclear sector. DRS has a range of high-value blue chip customers in the non-nuclear market.

One of the key benefits of DRS operating in both nuclear and non-nuclear sectors is that the non-nuclear sector derives resilience from utilising the planning, contingency and recovery skill experience, while the nuclear sector gains from DRS' expertise in logistical planning as well as significant cost efficiency developed from operating in a highly competitive, performance driven market sectors.

Direct Rail Services has over 15 years' experience operating a nationally respected Intermodal service, working in partnership leading names in logistics including Eddie Stobart Limited (ESL) and Tesco, amongst others. On average, DRS move over 1,500 containers a week on behalf of its customers within the UK Domestic Intermodal market. On any given Intermodal rail service trains can convey up to 40 ISO containers (the maximum length rail routes within the UK can accommodate). This is the most efficient use of the rail asset allowing for the economic case for rail over road to be achieved. This model was developed further between ESL/Tesco and DRS to allow for the train to be shared with other users to prevent unutilised capacity, thereby maximising transportation, gaining monetary efficiencies, vital in the low margins driven by supermarkets in Intermodal logistics.

Traditionally within the UK nuclear industry trains transporting radioactive materials are short in length, up to four wagons and have only one Category of material being conveyed at any one time. This has led to the development of individual transport solutions for each project which has led to limited opportunities to aggregate volumes and take advantage of economies of scales from larger trains.

In the case where there is only one consignor, with a single category of material the traditional approach of dedicated trains has been adequate. However, with the evolving requirements of the nuclear sector with a variety of packages ranging from Very Low Level Waste (VLLW) to High Level Waste (HLW) that will require transportation across the UK [2], an opportunity was identified to reassess existing transport arrangements to maximise asset utilisation gaining value for money for the UK tax payer through cost efficiencies provided to all organisations involved.

Mixed loads trains was the concept borne from these issues, Mixed load transport is a train consisting of multiple rail wagons containing packages of different categories of radioactive materials and / or having a different consignor or consignee. Previously within the UK nuclear industry due to issues with insurance liability and waste categorisation it was not possible to transport materials from different clients in the same shipments. This meant that the potential time, cost efficiencies offered by rail could not be accessed, and that road transport, an option less favoured by stakeholders, was the only alternative.

CASE STUDY

In 2014, as part of an initiative to reduce security costs at key sites, a number of waste packages containing Radioactive Material (RAM) required a transport solution. Due to the small volumes of

material being transported and other project limitations, the economic case for a dedicated rail service over the less secure solution of the use of road vehicles was proving problematic to justify.

To mitigate these issues and to satisfy concerns raised from local stakeholders, DRS worked to develop a safe, secure and financially viable solution, in line with the strategy of the NDA by utilising excess capacity evident within existing contracts within the NDA estate.

To test the feasibility of the above principles, the first instance of this concept involved utilising an existing spent fuel service. Through engaging with other customers within the NDA estate, DRS was able to demonstrate sufficient benefits to other estate companies to include an additional waste package on the existing service. This then allowed for fixed asset costs including locomotives, drivers, rail paths and rail terminals to be shared along with direct third party charges (fuel and Network Rail Track Access charges).

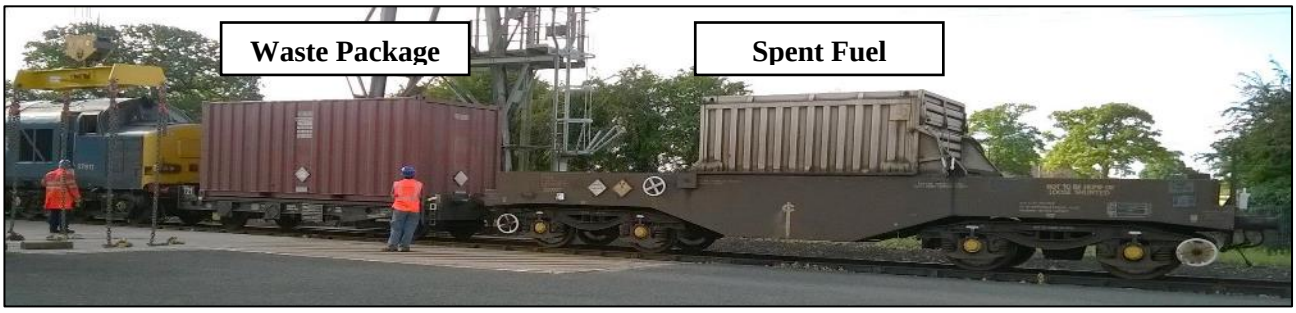

Figure 1 – Mixed Loads Train

Although the development of the commercial proposal was relatively simple to formulate and promote with the benefits previously identified, implementation of the solution required significant stakeholder support and co-operation, particularly from a security and legislative point of view.

The following sections detail the key challenges and considerations taken by DRS in organising and establishing Mixed Loads trains as an approved method of RAM transport.

Legalities / Nuclear Liabilities

One of the first actions was to review the contractual position across the parties and amend the agreements which were impacted with the mixed loads service.

Under Paris convention, traditionally the consignor has nuclear liability for the consignment during transport until delivery of the package to the consignee. In contrast to this as the mixed loads train involved two consignors sharing the train service and an agreement had to be reached whereby the consignee (as a Nuclear Site Licence holder) accepted liability during the transport. To gain approval UK government departments including BEIS and DfT were fully briefed of the project prior to acceptance. Ultimately this solution avoided any potential conflict in insurance cover between the two consignors in the event of an incident.

Categorisation of Load

Categorisation of the mixed load presented a problem as conventionally only one type of material would have been present on any given service. Therefore Spent Fuel is transported under CAT III

and the additional traffic was graded as a CAT IV, it was unclear what the overall service would be classified as from a regulatory perspective.

Ultimately, for the purpose of the 'Mixed Train' the regulator, Office for Nuclear Regulation (ONR) was notified and subsequently confirmed that it was satisfied that the higher categorisation of the train was appropriate.

Discussions were then held with the appropriate regulators to determine the optimum formation of the train. This dictated the order the train would be loaded and unloaded. For the mixed train it was decided that the CAT IV material would be positioned at the front of the train with the CAT III material at the rear to allow the unloading of the train at to be carried out within the constraints of the receiving site.

Method of Work Statement (MOW)

To co-ordinate all movements on rail terminals, UK Rail Freight Operating Companies use a document known as the Method of Work (MOW) statement specific to each site or facility, this document also incorporates the Risk Assessment for the site as well as the entire route.

Developed in consultation with all stakeholders involved, each party required to carry out an activity throughout the moved is referenced and required to acknowledge and agree to the proposed methods through signature of the MOW statement.

For the purposes of the mixed loads trial the first iteration of the MOW was reviewed to support the changes to the services with particular focus on the order of delivery to the rail terminal and the requirement for increased loading times. It was agreed that the unloading of the CAT III materials would take priority over the CAT IV packages to alleviate any potential delay to the heightened security consignments.

Transport Security Plan (TptSP's)

DRS, as a provider of nuclear transport services, must demonstrate a robust and comprehensive security management system, which conforms to all the requirements of its parent organisation, NDA, and statutory regulatory bodies such as ONR-CNS, DfT, MOD and the Office of Rail and Road (ORR).

As a Dutyholder, DRS also have a legal obligation to satisfy requirement of the ONR-CNS in maintaining an approved Transport Security Statement (TSS) and Transport Security Plans (TptSP) that is fit for purpose and fully conforms to current legislation.

DRS strategy is to take a holistic approach for all nuclear transports to ensure effective coverage of the main pillars of total security. These include:

- Physical security;
- Information security;
- Cyber security;
- Personnel security, and;
- Emergency Preparedness & Response.

For the mixed train a bespoke TptSP was developed, focusing on the following points:

- Date of movements
- Consignors
- Carrier Contacts
- Materials being conveyed
- Route
- Transfer of Security Responsibilities
- Contingency arrangements
- Escort arrangements
- Arrangements at Transfer Points
- Load carriers
- Traction
- Train security features
- Communication systems

A working group was then formed with representatives from key stakeholders across the NDA Estate. In addition to the working group support was provided by the DfT, ONR, BEIS, NDA Insurers, NDA Legal Team and DRS' contractors for operating the railhead cranes and provision of security services (Konecranes).

The co-operation and support from these groups was vital to the success of the project and it cannot be underestimated the parts each group played in implementing and establishing the concept of Mixed loads transportation as a viable and sustainable solution.

Rail Paths

In the UK, DRS as a Freight Operating Company (FOC) do not have direct control over the times and dates rail services can run from specific locations, thereby presenting a significant challenge to the specific requirements of the consignors and consignees. Network Rail (NR) own the UK rail infrastructure and provide designated infrastructure capacity or 'rail paths' on the network to Rail Operating Company's through a pre-agreed Track Access Agreement.

For the life of the DRS-Network Rail Track Access Agreement DRS have guaranteed 'Level 1' rights to rail paths to all UK nuclear power stations. Whilst these preferential rail paths are assured the additional traffic on the mixed train presented the potential for loading or unloading times to alter considerably. Therefore due consideration had to be given to additional time upon arrival and departure from the railhead, as a matter of contingency DRS sought additional rail paths from NR ensuring a certain degree of flexibility was in place to mitigate risk of late departure within the timings for the designated rail path.

Whilst there are opportunities to bid for paths at short notice, through Short Term Planning (STP) and at very short notice through Very Short Term Planning (VSTP) there is no guarantee the path is available to plan at the specific date and time the consignee/consignor would require.

Therefore, through research and interrogation of available rail paths through use of the Total Operating Processing System (TOPS) DRS were able to identify suitable spare capacity on the network ahead of time and subsequently placed bids to obtain access rights to these paths to guarantee and safeguard availability and capacity for existing and future rail movements.

Strategic Location and Stabling Points

DRS have a number of strategic depots and secure rail sidings throughout the UK that allow rapid response to any issues involving Traincrew, wagons and locomotives.

These stabling points have been approved by the regulator and can be used in the event of operational incidents that may delay a service once commenced. At these locations RAM packages can be safely held until the service can be completed or returned to the point of origin depending on the nature of the arising issue.

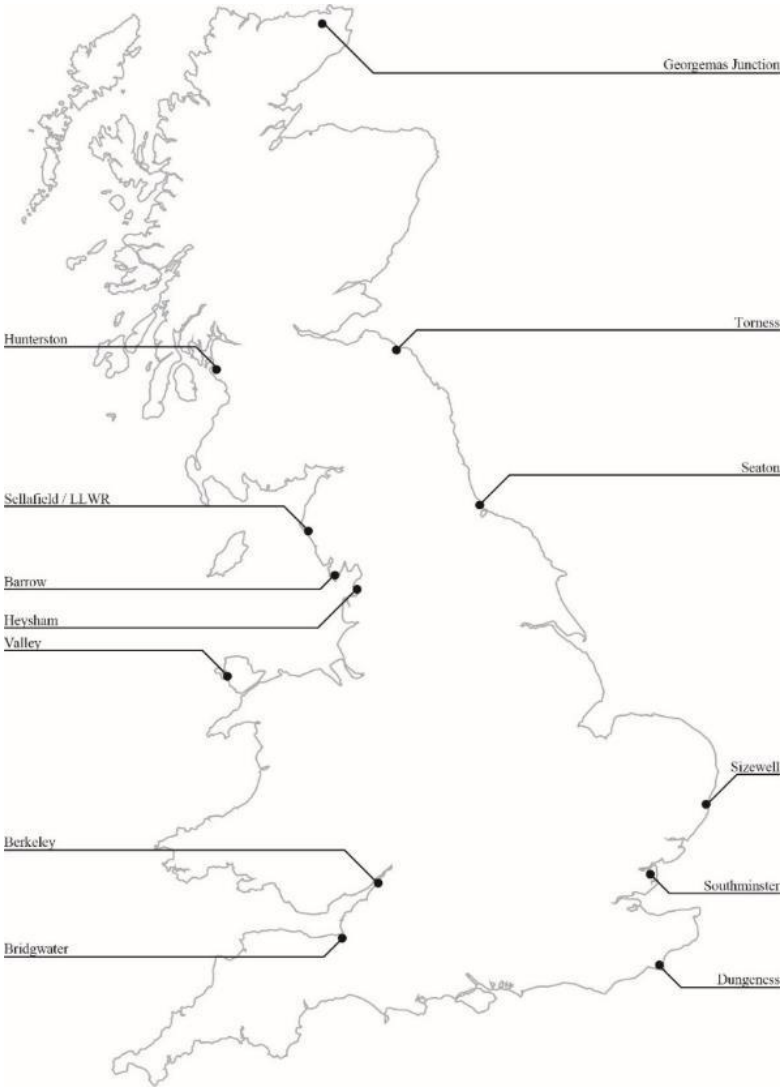

Figure 2 – Strategic Rail Sites Approved by ONR

Route Risk Assessment

In order to support the project a comprehensive route risk assessment was undertaken covering both the road and rail element of the service. Specifically all aspects of the route were assessed in order to ensure that the size and weight of the container was appropriate to the required routes on road and rail. In addition the route was assessed with respect to both from a safety and security perspective. Appropriate rail paths were identified in order to ensure the journey time was

minimised and contingency arrangements were identified as part of DRS' Security and Resilience protocols.

Package Receipt

In order to successfully receive the packages at the destination a readiness review was carried out to ensure that there was sufficient capability to off load the packages with consideration given to the requirement for separate lifting solutions.

Using specific examples, spent fuel flasks with the FNA rail wagon (cuboid flask carrying vehicle) prior to being unloaded within Fuel Handling Plant (FHP) at Sellafield. While Intermediate Level Waste (ILW) packages contained in ISO containers were unloaded utilising a fork lift truck solution and transported to a dedicated storage facility developed for the storage of the packages until waste could be processed.

Stakeholder Engagement

Stakeholder engagement was given a high priority in the planning process prior to any moves. This involved local community engagement with local communities in the surrounding areas. Communication plans were formed to ensure any stakeholder concerns with the change in train formation, packages and loading patterns could be handled and managed with due consideration and notice provided. Key messages were developed and disseminated with reference to safety and risk concerns, cost-efficiencies, as well as reduced road movements and associated environmental benefits including CO_2 reduction (see Safety and Environmental case below).

Successful stakeholder engagement in this scenario was vital for the continued use of the local railhead aiding retention of the rail capability and continuation of transportation of radioactive materials by rail, delivering against the mission of the NDA.

Safety and Environmental Case

Figures released from UK DfT and ORR show that rail is many times safer in terms of fatalities over road [3,4].

	Rail (2017/18)	Road (2017/18)
Accidents	437	170,993
Fatalities	337	1,793

Figure 3 – Accidents and Fatality Numbers in Relation to UK Rail or Road Transport in 2017/18

In addition to this rail freight has a key role to play in the low carbon economy as rail produces nearly 10 times less carbon dioxide per annum ($MtCO_2e$) when placed in direct comparison to a HGV journey [5] (Figure 4).

With growing awareness and urgency of global responsibility for the protection of the environment, with a focus on improving the safety of our domestic transport infrastructure it is essential transport

organisations specifically in the radioactive materials transport industry continue to explore opportunities to optimise transport solutions.

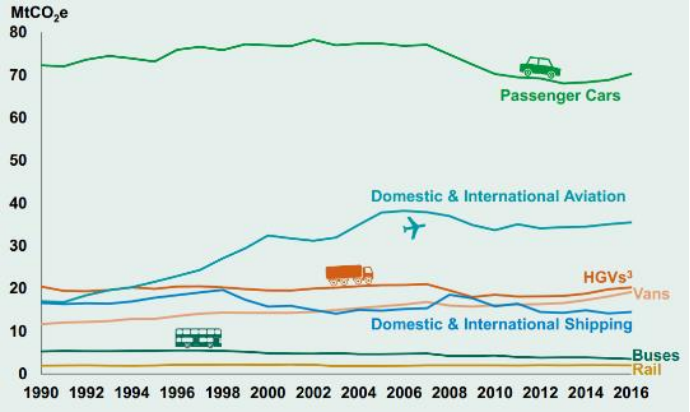

Figure 4 – Domestic and International Emissions by Transport Mode: 1990 to 2016

Trialled and Embedded

Following the successful trial move the mixed loads service has continued for a number of years without incident or objection and has contributed to a significant increase in cost efficiencies and reduced carbon emissions benefiting the tax payer and the environment. On the back of this success the NDA initiated an Integrated Transport Strategy Working Group to continue to develop and optimise further transport opportunities across the estate.

CONCLUSIONS

Our key challenge was to bring the operational and economic efficiencies from blue chip logistics such as Tesco and Asda to the nuclear industry. While mixed trains presented a number of complicated facets, there is no doubt that the benefits discussed in this paper outweigh any initial project complexities. This Case Study demonstrates that with a clear goal and appropriate consideration a successful outcome a novel approach can be achieved in the heavily regulated radioactive material transport industry to become the norm. Through challenging embedded principles and welcoming input and objection the status-quo can be negated to reach beyond our expectations to achieve additional benefits and efficiencies. In the UK this success has allowed for NDA sites a new method of achieving existing programme targets with increased collaboration and sharing of resources between estate business units.

In the future with the development and construction of the UK Geological Disposal Facility (GDF). The building of this facility will involve the excavation of substantial volumes of soil and the import of aggregate materials over a significant timescale. It is envisaged that construction may be on going while materials are being transported across the UK for long time storage. It is DRS' vision to further develop this model of mixed materials. To have trains of radioactive materials entering the GDF facility with spoil material trains departing the facility thereby operating the most efficient logistics service for its customers, driving down costs for the tax payer as well as further reducing potential safety incidents and minimising our carbon footprint as far as is reasonably practicable.

ACKNOWLEGDEMENTS

I would like to acknowledge colleagues from Direct Rail Services Ltd who have supported me in the completion of this paper; Eddie Pollock – Business Development Manager, Angela Hoskins – Business Manager, Philip Murphy - Security and Resilience Project Delivery Officer and Luke Asbridge, Business Development Manager.

REFERENCES

1. NDA Strategy 2016. Gov UK. Available at: https://www.gov.uk/government/publications/nda-strategy
2. BEIS & NDA 2016. Radioactive Wastes in the UK: A Summary of the 2016 Inventory. Gov UK. Available at: https://ukinventory.nda.gov.uk/wp-content/uploads/sites/18/2017/03/High-Level-Summary-UK-Radwaste-Inventory-2016.pdf
3. Office of Rail and Road 2018. Rail Statistics Compendium Great Britain 2017-18 Annual. Available at: https://orr.gov.uk/__data/assets/pdf_file/0010/39871/rail-statistics-compendium-2017-18.pdf
4. Department for Transport (DfT) 2018. Reported Road Casualties Great Britain: 2017 Annual Report. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/755698/rrcgb-2017.pdf
5. Department for Transport (DfT) 2018. Transport Statistics Great Britain 2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/787488/tsgb-2018-report-summaries.pdf