MANAGEMENT PROGRAM FOR SUSTAINABLE TRANSPORTATION OF USED FUEL

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Abstract

A sustainable Transportation Used Fuel program could be shortly defined as a not eventful program that you rarely hear about because it is run smoothly with no or minor events. However, used fuel transports are inherently complex due to the nature of the material and the high visibility. It requires a large range of expertise, specialized assets, public acceptance and extremely high performance between the numerous stakeholders to ensure a smooth coordination. As of today, only a few countries have developed comprehensive used fuel transportation program. In the many countries where interim consolidated storage, recycling or geological repository are not available yet, a similar program will have to be implemented.

For more than 50 years Orano TN has safely shipped more than 7,000 used fuel transport casks. The transportation program that was initially developed in the 1970s has been adapted and enhanced over the years to meet more restrictive regulatory requirements and evolving customer needs, and to address public concerns. The numerous “lessons learned” have offered data and guidance that have allowed for also efficient and consistent improvement over the decades...

Based on Orano TN extensive expertise, this paper will describe the different phases and milestones that need to be met to set up, license and operate a successful used fuel transportation management program. Transportation of used fuel in France is performed effectively and efficiently thanks to strong collaboration with the Nuclear Power Plant (NPP) operator who plays a critical role as the shipper.

1. INTRODUCTION

Volume of used fuel transported each year worldwide is very small compared to other hazardous materials and even other radioactive materials. An average of 400 used fuel transports is performed annually compared to about 20 million consignments of radioactive material (which may be either a single package or a number of packages sent from one location to another at the same time) that take place around the world each year.

Inventories of used fuel continue to grow. However, due to lack of final disposal repositories and limited recycling options, expertise with large scale transport campaign of used fuel is limited, as the need for this expertise is limited. Used fuel is (or has been) transported on a regular basis in Japan, Sweden, Russia, UK and France. The largest number of shipments has been performed through France to the Orano La Hague recycling facility. The model deployed by Orano TN covers different routes and modes of transport. Spent fuel is currently shipped from overseas, several European countries and, of course, France. China, United States and Spain will need to set up a large-scale transportation program in the coming years whatever the chosen solution, centralized pool, recycling plant or final repository.

This paper will describe the main steps for implementation of a sustainable used fuel transportation program, the key operational elements, the lessons learned from the perspective of a nuclear fleet operator, and will provide figures related to the successful program developed by Orano TN.

2. FROM LONG TO SHORT TERM ACTIVITIES

A used fuel transportation program requires dedicated assets and also unique expertise in multiple fields with knowledge of regulations developed specifically for used fuel material transports (engineering, rail, road and maritime transport, inspection, communication, cask operations, quality assurance). Capital expenditures in key assets such as a railway terminal, state-of-the-art transport casks, a maintenance facility and, railcars are needed as well as personnel qualified and trained with the applicable regulations.

The implementation occurs in three key phases:

(a) Long Term activities (15 to 10 years before starting operation): Prepare specifications, design, initiate procurement of assets;
(b) Mid Term activities (10 to 2 years): Acquire and test assets, qualify suppliers and staff, develop IT tools, procedures and processes, and train;
(c) Short term activities (2 to 0 years): Prepare transport, pack and load, submit notifications, …

Long term activities that need to be initiated 15 to 10 years before starting transport operations consist mainly of:

— Define the specifications of the transportation model to include: fuel characteristics, annual volume, transport infrastructure limitations, interface with facilities, safety and physical protection regulations, project scheduling;
— Design and license the transport model to include:
  - Transport routes;
  - Terminals (railway, maritime);
  - Cask design and package model licensing;
  - Rail car;
  - Auxiliary facilities: Maintenance for cask and rail car, cask preparation and receipt, cask transfer;
  - Process and procedures (high level).
— Procure assets:
  - Based upon lead time to design, license, manufacturing, commissioning.

Mid-term activities that need to be initiated 10 to 2 years before starting transport operations consist mainly of:

— Acquisition and fabrication of assets: railway terminals, casks, auxiliary facilities;
— Selection and qualification of suppliers;
— Development of communication program and education of stakeholders;
— Development of emergency response plan;
— Development of procedures and IT tools for tracking, scheduling and fleet management;
— Designing and manufacturing of tools;
— Hiring and training of staff;
— Performing dry runs in various activities.

Short-term activities that need to be initiated 2 to 0 years before starting transport operations consist mainly of:

— Training and testing the integrated model (assets and all stakeholders);
— Transport scheduling;
— Fleet management.

3. OPERATIONS

While it can take up to 15 years to develop a sustainable transport model, a single transport is typically performed within a short time frame. For example, for a domestic French transport of used fuel, the physical transport will take about 4 weeks from empty cask departure from La Hague recycling facility to return of the

loaded cask to this same facility. Notifications to authorities will be initiated about 8 weeks prior to transport departure from the nuclear power plant. The main steps of a shipment can be broken-down as follows:

— Transport coordination with authorities, suppliers and other stakeholders: notification and interfaces with authorities (different level of notifications from advance notice to delivery notification), coordination with shippers, receiver, transport suppliers and stakeholders, preparing document and conformity check-lists. As needed, managing transport events;
— Empty cask and rail car preparation: Before being dispatched a cask to a nuclear power plant, verification of the conformity of the cask and rail car are essential (license, maintenance, internal equipment, radiological conditions, labelling, marking…);
— Empty cask transport: cask is dispatched to nuclear power plant;
— Cask loading operation: Typically, the NPP operator is responsible for all on-site operations. Orano TN may provide assistance to ensure conformity of fuel being loaded with cask loading map and verify the conformity of the transport prior to his departure (radiological surveys, marking, labelling, shipping documentation…);
— Loaded package transport: package is dispatched to final destination. For transport in France from NPP plants to La Hague recycling facilities, commercial trains are used. For reactors not connected to the rail spur, the heavy load truck shipment is initially performed. All package delivered to La Hague are delivered by truck as the facility is not connected to a rail spur (about 30 km by road).

Over the years Orano TN has strengthened the transportation model that was developed more than 40 years ago with two key features:

— Implementation of a Transportation Risk Management™ (TRM) program. An independent team from transport operations teams is responsible of updating transport flows risk analysis, qualifying and inspecting suppliers and managing crisis in case of event;
— Strengthening of crisis management capabilities. In spite of the fact that we never faced an event with environmental impact, our crisis management program has been upgraded to ensure support to local authorities in case of event but also to provide immediate communication responses to media and public. Some examples of upgrades include the establishment of a 24/7 crisis management centre -- with multiple rooms dedicated to technical, communication, command functions and meetings --as well as specific equipment to facilitate a quick response to the crisis. We perform an average of six drills per year with a minimum of one drill conducted on a national level;
— Other enhancements of the ORANO TN model are rigorous security upgrades to ensure alignment with the stringent regulations that have evolved as a result of the increasing threat of terrorist acts.

4. LESSONS LEARNED

Orano TN lesson learned program is a powerful tool that contributes to a reliable and sustainable transportation model. Over more than 40 years of operations, thousands of minor events have been recorded in our data base. Lessons learned are used to improve the reliability of our transportation model. Our procedures, our assets, our specifications have been revised as necessary to increase the transportation security and safety using our lessons learned resulting from either during real-life events but also transport event drills.

Another lesson learned is the close relationship with the NPP operator. Numerous factors have to be taken into account for the scheduling of transports, which is one of the main challenging activities. Especially with:

— NPP overall planning (avoid refuelling outage, maintenance of handling equipment or other equipment, fresh fuel deliveries, etc.);
— NPP human resources;
— Dedicated tools to support loading;
— Availability of appropriate used fuel (cooling time etc.).

With increasing regulatory, safety and security requirements, other constraints affecting the scheduling such as due to special events, weather conditions, strikes, etc have to be managed.

An unscheduled event can have a major impact on the schedule (weather, media, technical events), with a need to be able to react quickly. Transparency and open dialogue between NPP operator and Orano TN are essential elements to success.

As another example of lessons learned, over the years, several discrepancies were detected on the transport documentation, on the labelling, markings or placarding (missing labels, incorrect placard, incomplete transport documentation, etc.).

Even if minor, to avoid these recurring events, we have taken measures to eliminate those discrepancies such as:

— Set up template file to record all survey results that will be used to generate the shipment regulatory documents;
— Independent conformity verification prior to shipment departure;
— Random inspection by our risk management team;
— Establishment of a training center for operators (NPP operator, Orano TN and other stakeholders involved in shipment).

We could summarize our lessons learned with:

— Anticipation to take into account all the constraints and keep contingencies to meet annual transport targets;
— Flexibility and reactivity to be able to respond to unscheduled events;
— Keeping permanent focus on Safety, Security and Quality;
— Seeking continuous improvement using lessons learned;
— Transparency and dialogue between the different stakeholders.

5. CONCLUSIONS

A sustainable, successful and safe used fuel transport model requires a range of expertise and technologies: dedicated assets, up-front investments, well planned, designed and licensed equipment and foremost a knowledgeable and well-trained team that is experienced in all phases and demands of a complex transport chain. Removal of used fuel from pools and transporting it away from the NPP is critical to the ability of a reactor to operate smoothly and cost-effectively. NPP operators and Orano TN have been continuously improving every phase and aspect of the transportation model to ensure it remains a state-of-the-art system that perform as safely and efficiently 100% of the time. Building on years of experience and incorporating new system and technologies to meet new demands will ensure the continued high level of success – and impeccable global track record – for many years to come.