HOW WASTE MANAGEMENT CAN BE INFLUENCED BY TRANSPORT PACKAGINGS

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ABSTRACT

With major D&D projects ongoing or being planned, and also with the daily management of radwaste from nuclear facilities, the potential role of transport packagings has often been overlooked: here will one rely essentially on drums, there several local waste processing units are built, elsewhere decommissioned facilities are cut in small bits to fit into small containers by far less efficient. The present paper proposes to illustrate how integrating a transport system from the start may influence operational choices of waste management:

A transporter's view on Waste Management

In several countries, different fuel cycle and different waste policies have influenced the way operators organize their waste management. This results in common lines of progress and improvement, such as waste minimization programs, careful sorting of different types of waste and corresponding conditioning.

Conversely, some operators already rely on intermediate and low activity waste disposal facilities, that themselves have generated acceptance criteria. Others organize a first step of industrial transformation before final or intermediate conditioning. The identified drivers are economics, availability or want of a diversity of options, reprocessing and recycling policies vs. once-through cycle etc.

One frequently overlooked driver of choice is the consideration of transport options. Transport options can influence in several ways the operator's policy, provided he knew what question he should ask or could ask an experienced transport company.
The answers will be of course influenced by its own unique set of circumstances, of which we can spell a few:

In the USA, the concentration movement have brought in the same company or group a number of nuclear power stations:

- Is there a better practice or a better equipment at any one station?
- Then is there a way to transport waste to that particular facility?
- If not can an efficient transport system be conceived and put on tracks?
- Do the gains offset the cost of transport?
- Would choosing to move the facility (mobile unit) yield more benefits than moving the waste?
- Could I benchmark my plans with other comparable operations?
- Again in the USA, large DOE facilities may even have a comparable advantage to work on the wastes (or of one type of waste) at a particular place onsite. The questions would then be:
- Can we reduce doses and/or handling to get the wastes to there processing facility? With different packagings?
- Is there anything in rather making the facility moveable?
- Can we avoid processing altogether and simply transport to disposal?

More generally, the question of wastes from dismantling facilities are also an interesting issue: very often the long lived contaminants are in very low inventory, while larger quantities are activated in relatively short lived elements such as cobalt 60. Is it then worth using less payload efficient thick shielded containers, or should one envisage to let time and half life take care of the extra rays, so that a lighter package with higher payload will enable to diminish shipments to end disposal.

There is no general and definitive view on this. It is for instance the author's strong conviction that spent nuclear fuel is a precious energy resource for ourselves and for the future generations, and so should not be at all deemed a waste.

Conclusion may be diverse and also partly dictated on how one operator pays for the end disposal of its waste: by the Becquerel, by the kWh generated, by volume or influenced by the manner in which costs are covered.

Let us now look at some results of policies that have considered transport in their inception.

Residues from processing and recycling of spent fuel:

Political and legal constraints make it necessary for the reprocessing users to recover the residues from reprocessing for intermediate then final disposal. As an example, the solutions developed by Transnucléaire for COGEMA and its customers are based on some of the general considerations above:

- long lived actinides wastes are vitrified into a stable glass matrix itself poured in a stainless steel canister. One steel canister contains the wastes from reprocessing from approx. 3 reprocessed spent fuel assemblies, a major volume reduction. When the residual heat and source term are such that the glass can be transported safely, two solutions have been implemented according to the choices of operators, that illustrate options opened by transport and the context:
- some operators (Belgium, Japan) have vault facilities ready to house the canisters: therefore the transport solution developed is a fleet of routine transport cask, the TN 28 VT, that contains up to 28 vitrified residues canisters.
- some other operators, in Germany and Switzerland, have opted for a uniform handling of waste and of vitrified residues, in dual purpose casks: the TS 28 VS and the TN 81 transport .interim storage casks have been developed to serve these markets, and basically travel either to Gorleben or to Zwilag facilities.

Fig. 1. The TN 28 VT

In practice, early dialogue between transport company and reprocessing plant helped define what level of source term and of decay heat would be compatible with a modern high performance cask: this became also a parameter of the sizing of the vault facility.

The more interesting fact is the policy of waste volume reduction and conditioning that COGEMA developed in partnership with its customers: it had been initially envisaged to have several different type of conditioning for residues such as end nozzles or claddings of spent fuel after their recycling. This would have multiplied the number of packages to transport, whereas most activation was rapidly decreasing cobalt 60 and slightly slower Cesium 137: hence the construction of a waste compaction facility at La Hague, which will result in minimized volumes, uniformly conditioned in a standard universal waste canisters. The option to minimize transport results in the need for a new package, the RD 43, which will allow delivery of the compacted waste to different types of receiving facilities.

So, the result of all this leads to the observation,quite surprising indeed, the total number of transports will not depend significantly on the option chosen (closed fuel cycle or direct disposal)

Residues from Electricité de France (EdF) NPPs

Because of its remarkable number of NPPs in operation, EdF has a comprehensive approach to the waste management issues. Training, awareness and reduction are an everyday issue of waste management. Of course there is concern is that the best practice and the best facility be used. Going through one of the processes of thought described above, and discussing with Transnucléaire possibilities, an original concept was arrived at for the contaminated boron acid from the NPPs:

Rather than processing it on each site, or trying to modify it in some ways, EdF elected to have Transnucléaire design and create an original liquid waste transport tank packaging, the TN CIEL. The tank is a type IP2 according to IAEA, and is qualified according to regulations for radioactive materials and for corrosive hazardous goods. Because boric acid sets at room temperature into a rock hard substance, the tank is shielded and has heat tracers to keep it above 50 °C. In addition it has its own generator in order to keep heating even when the truck does not work.

Fig. 2.

Fig. 3.

With this system, each of the EdF 57 reactors are visited once to twice a year, relieved of their boric acid residues, that are shipped to the CENTRACO incineration facility in Marcoule in the TN CIEL: EdF combines thus an efficient incineration facility with simple effluent vessels at the power plants, combined with a practical shipment scheme.

Benefits from this approach are clearly minimizing on site equipment at each NPP, minimizing dose to operators, and relying on a most efficient facility, CENTRACO.

Table I

The TN CIEL tank vehicle in a nutshell.	
License: IP 2 type container	
Dimensional	• overall length : 8900 mm, • overall width : 2500 mm, • overall height : 3500 mm • maximum allowable tank volume : 5 m^3 • maximum mass of the loaded semitrailer : 33 t • maximum mass of the loaded articulated vehicle : 40 t.
Contents	• 5 m 3 of Low Specific Activity of category II such as concentrates of boric acid • maximum activity of 20000 Bq/g of gamma emitting nuclides. • total admissible activity in the tank is 0.1 TBq (or 2,7 Ci). • TN CIEL is also qualified as a Class 8 corrosive goods container

Waste from Melox MOX fuel fabrication plan

In this facility's case, alpha contaminated wastes that are generated are placed in 200l drums. Another facility has the capability to treat very efficiently alpha activity, the La Hague Reprocessing plant in northwest Normandy. Therefore the approach taken to manage this particular waste was:

- use the best suited facility to process it
- minimize the number of transport operations
- minimize handling of drums by staff
- facilitate multimodal ground transportation

The solution worked out by Transnucléaire for Melox was the TN Gemini, a B(U) F licensed packaging, characterized by a large rectangular shaped cavity holding up to sixty liters drums or possibly glove boxes, with a variety of materials of organic or mineral origin. The contents can bear up to 370 g of plutonium. The large capacity provides for minimizing the number of transport.

Because the TN Gemini is loaded by a rear door, it is possible to load it either directly using a fork lift, or using a feeder platform on which dedicated pallets are placed then rolled onto integral rollers, then tied down in place without persons going into the cavity. Drums are placed on the pallets as they are being made ready for tranport.

The TN Gemini solves the issue of multimodal transport by adopting the 20 foot container interface: it is thus easy to place on any truck or railway wagon standard container platform.

Fig. 5.

Fig. 4.

Table II.

The TN GEMINI in a nutshell.	
License: B(U)F container	
Dimensional	• Inside cavity: Width : 1840 mm Hight : 2000 mm Lenght : 4510 mm Mass: 30 t Special feature ISO 20' twistlocks Chassis Weight : 3560 kg Height : 1370 mm
Contents	5 800 kg of goods, several shapes possible (40 x 200 liters drums up to 370 g of Plutonium, 50 g Pu per drum maximum allowable temperature 70°C semi-automatic or manual loading

CONCLUSION

These examples and the questionnaire proposed above illustrate the way operators and transport companies can cooperate to create new solutions to old operational issues of waste management. By looking into modern and efficient transport solutions, it is possible to create processes of waste management by which every one wins:

- with minimized investment
- with optimized treatment
- with minimized doses
- with well managed wastes

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