THE NEW CONTEXT FOR TRANSPORT OF RADIOACTIVE AND NUCLEAR MATERIAL

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Initially considered as "a subsidiary" activity of the nuclear industry, the transport activity is nowadays considered as a keystone for the industry as the whole.

The transportation of radioactive and nuclear materials involves all modes of transportation (road, air, sea, rail) with a predominance for road and for air (air for radioisotopes).
It is but a minute fraction dangerous good transportation. Around 10 millions of radioactive packages are shipped annually all over the world of which ninety percent total corresponds to shipments of radioisotopes. For example, about 200 000 sealed sources are delivered every year in France. In France and in the US, radioactive shipments represent only two percent of the total of dangerous good shipments. This percentage is about the same in all industrials countries.

In spite of the small volume transported, experience, evolution of transport means and technologies, the trend to constantly improve security and safety and public acceptance have modified the transport environment.

During the last few years, new evolutions have applied to the transport of radioactive and nuclear materials in various fields and especially:

- Safety
- Security
- Logistics means
- Public acceptance
- Quality Assurance

We propose to examine the evolution of these different fields and their impact on transportation methods and means:

1. Safety

Most of the radioactive transport regulations are based on IAEA recommendations which are now revised with a two years interval (instead of ten years previously). In 1996, the IAEA has published a new regulation identified as Safety Standard N° TS-R-1. This new recommendation is applicable as of 2001 (with transitional period till 2002).

The International Commission of radiological protection has also issued in 1990 a new recommendation (CIPR 60) applicable in 2000 which has been included in IAEA recommendation: Safety series n° 115 "International basic safety standards for protection against ionizing radiation and

What are the main evolutions of these new recommendations?

Essentially, revisions of the new safety transportation regulation have been prompted by:

- the necessity to transport new material such as various types of waste and reprocessed uranium.

- the introduction of specific requirements for air transportation . Indeed, in the past, the different modes of transportation were not considered an issue. The tests required on packagings in the previous regulation were defined to envelop most accidental situations but the severe air transport condition (even if the probability of an accident is lower) was not taken into account. In the new regulation and for material with high activity, additional tests have been introduced for air transport packages (type C)

- The necessity to take into account the chemical risk associated with UF6 transportation.

Further more, modal transport regulation has been revised. For maritime transport :

- the publication by the OMI, in 1993, of a new code (INF code) with complementary specifications related to : stability, fire, hold temperature controls, stowage, radiological protection, staff training and emergency plan. Three categories of ship have been defined depending of the type of radioactive material and activity inventory. For example, for irradiated materials with an activity from 4000 TBq to 2.10/6 TBq an INF2 ship is required. Specific regulations can apply additionally for example in Japan where the specifications are more restrictive.

The revision of the radiation dose recommendation has also impact transport activity :

- The reduction of the maximum allowable annual radiation dose. As the exposition related to transportation activity is far below the new annual limits, the contamination and radiation levels applicable for transportation have not been revised but some new dispositions are required :

  Beyond the ALARA principle, radiation protection programs are now a requirement for all stages of transport operation. Radiological Protection Plan (RPP) has to be implemented.

But the most significant evolution is probably not the revisions mentioned above but the fact that, nowadays, the Competent Authorities require deeper justifications (safety in depth). A compliance assurance system for design, operation has been implemented in the recent years. For older designs, we faced difficulties providing new formal demonstrations of conformity of the package model. Temporary solutions have been implemented for this older designs and the necessity to produce additional justifications for new ones has been integrated. This evolution has obviously impacted time to market. It has also improved the standard to which new equipment is designed and operated.

It is also important to point out that as there is no complete standardization for research reactor fuel elements and because of the diversity of these fuel elements, casks owners must frequently apply for license amendment in order to include these fuels characteristics in the license. Additionally, for international shipments, validation of the license has to be issued by each country involved (crossed, overflight countries, flag of the vessel). In order to solve these licensing issues, a lot of anticipation is now needed to meet the transport schedule. The organization of a shipment must be initiated at least two years prior to implementation.

Unfortunately, on the other hand, Competent Authorities ask for increasingly more details about the contents to be transported meaning that using "envelope content" is more difficult to define.
A new evolution is for example, the fact that Competent Authorities have recently implemented safety inspection during transport operations. Few inspections have been performed on Transnucléaire shipments during the year 2000. Transnucléaire has also developed its own internal inspection system in order to improve services and maintain a high level of quality.

2. Security

The security related to transportation of nuclear material is regulated by International Conventions but also by complementary specifications enforced by each state. The objective of these regulations is to prevent any loose or robbery of sensitive materials.

For example in France, complementary requirements have been issued:

- For shipment of category 1 and 2 (more than 5 kg of high and low enriched uranium), trucks and containers equipped with specific devices are required to guarantee the material security. Due to the permanent technology evolution, regular improvements are implemented on specifications issued by the Competent Authority.

- For shipment of category 3 (most of the other shipments without irradiated fuels classified in a specific category), new instructions have been issued by the Competent Authority in order to improve security of the packaging: the vehicle must constantly be under control of the truck drivers. Consequently, two drivers are now required for long distance relation.

3. Logistics means

An important evolvement of the nuclear industry is new logistics issues: the routes and the transport means previously commonly used are not always longer valid. As we are confronted to various issues, we are going to examine practical examples to develop the evolution of logistic means:

Ispra shipment:

Transnucléaire was awarded a contract to return to US Spent Essor fuel from the research reactor at Ispra, in Italy. The services consisted of providing a licensed cask and of performing the transport operation from the reactor site to Savannah River Site in South Carolina. The transport operation had to integrate the following constraints:

- no port authorized in Italy for nuclear material

- no route already experienced and authorized through Europe : as the cask used was a German cask (consequently approved in Germany), the option selected was to combine the loading operation onboard the ship in Germany. Because of the incertitude to obtain transport licenses, we have work in parallel on alternatives routes trough Switzerland and Austria, cask validation and transport licenses have been applied in these two countries. For logistic reason and low probability to get transport license through Austria, rail transport have been studied. However, Switzerland State Railway rejected our submission. The only alternative then was to perform a road transport using our affiliated truck company located in South of France (Celestin). Again we had to face difficulties, road transport trough the St Ghottard tunnel was rejected in a first approach by the canton authorities and finally authorized by the Swiss federal authorities trough the St Ghottart alpine pass (with an escort of a Swiss radiation protection vehicle).

Because of their experience as radioactive and nuclear services providers, Transnucléaire have concluded successfully this shipment but however, the time spent for transport preparation and organization trough Europe has been significant.

Studsvik Fresh MTR shipment

On behalf of Cerca, Transnucléaire is shipping every year fresh fuel MTR elements from Cerca plant, south of France to the Studsvik research reactor in Sweden. The packaging used was the MTRD. In past years, 8 casks were needed to deliver the 48 elements. In 1999, due to the difficulties to obtain the French validation of the MTRD (German design), the alternative solution to deliver the fuels was to use the TNBGC1 packaging (developed by Transnucléaire) mainly used for Uranium and Plutonium shipments. Due to its limited capacity for this geometry of material (Only one fuel perTNBGC1), the number of packagings to be transported was multiplied by six. Consequently the type of aircraft previously chartered (a BAE 146 with payload capacity of 12 tons) was not any more compatible. An Airbus with a payload capacity of 42 tons has been chartered.

Additionally, as handling operations have been multiplied by six, the time for loading/unloading operations has been increased significantly.

Acceptance of liner ship and aircraft

A significant change in 2001, has been the rejection by some shipping lines to carry radioactive materials. For example, a Japanese maritime company has announced that no radioactive container would be transported on their liner ship from 2001 on for nuclear liability reason. For the frond end material, new solution based on the utilization of chartered (dedicated) vessel is presently developed. Such a solution includes more complex logistics in order to optimize the combination of radioactive containers and offers a reasonable (affordable) price. For the shipment of fresh MTR fuels from France to Japan, the liner company has temporary agreed to accept the freight but an alternative transport system has to be found for the future.

Further more, aircraft companies are no longer interested in transporting radioactive material. Recently, uranium shipments for a European research reactor, usually transported by a large airline company, have been declined. Consequently, our selection for carrying this material was restricted to one company who fortunately did transport.

We have to face the fact that liner maritime and air companies are not interested in transportation of radioactive and nuclear material: this activity represents a very small turnover and potentially bad advertising even in case of minor problems. New transport systems are going to be developed. Dedicated ship and aircraft can sometimes be a solution but with a new logistic dimension in order to combine different radioactive materials shipments.

4. Communication/Public Acceptance

Radioactive and nuclear material transportation were rarely mentioned by the media few years ago. Nowadays, not only specialized but also general media report more and more information on nuclear activity and especially transportation.

The public wants to understand and we must explain. Communication and public acceptance has also been a growing activity in the recent years.

Further more, some recent maritime accidents (Erica Sun sinking for example) though not related to nuclear activity but to other dangerous goods for which the regulation is not as restrictive, raise more questions about our activity. Our role is also to answer to these questions and demonstrate the high level of safety and security provided.

5. Quality Assurance

More quality assurance is always nowadays required. For example, in France since 1999, all the truck companies have to be certified in conformity with the ISO 9002 code. Each company carrying radioactive goods have developed a checking system to guarantee the conformity of the services under performance.

CONCLUSION

All the aspects developed above have contributed to improve the safety and the security, to answer to new needs from the environment. But they have also disrupt (disturb) the methods and transport system usually practiced. The field of actions is tighter. However, the adaptation to the evolution of our environment is a key for the future.

Our challenge is to continue to built up experience, know how and adapted equipment, develop creative and reliable services for transportation at an acceptable price.