

## Front-end transports: challenges to 2020

Perrine Russias  
TN International (AREVA group)

During this decade, the front-end industry will face many challenges taking part in the nuclear renaissance. Indeed, in each sector, mining, conversion, enrichment and fuel, the industry will invest, innovate, creating new nuclear sites and increasing the whole front end business, to answer the growing demand.

Period of growth are often difficult to manage, some of the investments planed as of today will become a reality, some will be delayed, some will never be completed, and other could be launched.

The transport business will therefore have to follow this trend, and best anticipate it: new routes, new sites, new packages, while providing always the highest level of safety.

This paper will describe some of the challenges that the front end transport will have to face before 2020 in this moving picture.

### 1) Mining

In the mining business, there will be an increase of the Uranium primary production from 52,800 MTU to 80,200 MTU during the next 10 years, with new major projects and capacity extensions in various parts of the world, according to the WNA reference scenario.

Some new sites are located far away from the primary converters (in Africa, Australia) and the transportation could therefore play a role in the final cost of the uranium: time for delivery (and then for payment) as well as cost for the transport itself.

In addition to the cost effectiveness, the complete logistics has to be taken into account to master the environmental footprint of the mining activities: chemicals, explosives for instance are sometime not available in the mines vicinity, this logistic could be part of the optimisation.

Of course, local conditions play an important role in the transport challenge: road or rail network conditions, trucks availability, protective measures, port capability for handling nuclear material, maritime companies allowing the class 7 transport, and available maritime routes – as an example, the recent decisions by the Australian Authorities about the Aden Gulf lead to complex alternative logistics scheme.

Used for decades, the good old 220 l drum is still in use : also in this field, optimisation is realized and need to be further investigated : new shape and size drums for more efficient loading of the container, evolution of the loading plans and means : those points are continuously challenged within AREVA. The industry, in the frame of the WNTI, is also investigated the possibility of alternative package to the drums.

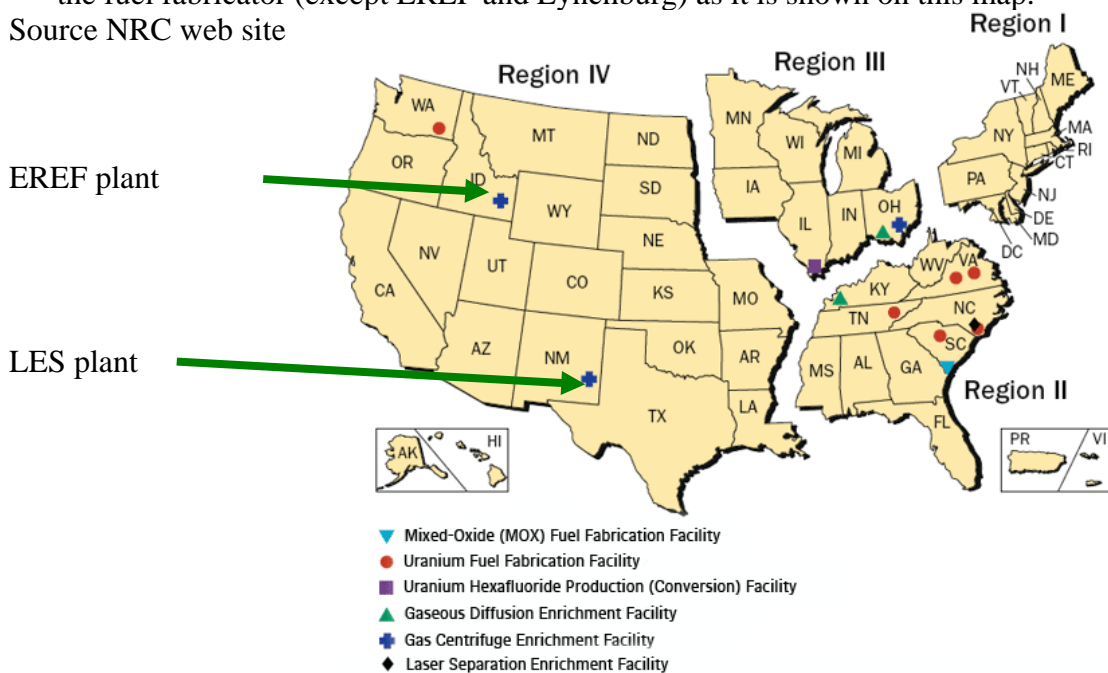


The challenge for the industry is to manage transport organisation of a 50% increasing material in 2020: with such new volumes, it is interesting to re- assess the complete logistics system, and a local approach, including different mining companies located in the same area, could bring optimisation and synergies for the benefit of the safety, cost effectiveness and sustainable development.

2) **Feeding the new enrichment plants**

Large investments are made by the enrichment company, we saw this year the commissioning of the Urenco LES plant in the US. There will be another capacity built by AREVA in the US, the EREF plant. Those 2 new plants are situated far away from the converters (Port Hope (Canada), Metropolis (IL – US) and Pierrelatte (France)) and from the fuel fabricator (except EREF and Lynchburg) as it is shown on this map.

Source NRC web site



The transport solution for the time being is to transport by truck in the US (which is very common in the US, and not so common in Europe for such long distance) but, taking into account the large quantity of cylinders to be transported, one of the challenge will be to reduce the CO<sub>2</sub> emission with a sustainable development approach.

Another challenge will be the fleet management of the cylinders, for natural, depleted and enriched UF<sub>6</sub>: the increase of the transport duration will also increase the need for cylinders, with an effective fleet management to be shared by the operators.

### **3) New reactors fuel deliveries**

In the next decade, new reactors are targeted to be on line, in various areas in the world. About 50 power reactors are currently being constructed in 13 countries. According to WNA reports, 150 new reactors are planned and 340 are proposed, expected to be operated by 2030 <2>.

The new reactors will be of various designs, leading to various design of fuel. In addition to the specific requirements of the local Authorities and the customized design of the reactor units, the industry may face numerous specifications for fuel packages.

In addition, a first core delivery normally has to be performed in a short period of time, requiring numerous fuel packages as well as storage capacity in the fabrication plants.

Challenges for first core transportation are therefore to have the right package available for the delivery, knowing that some unit construction could be delayed and that the delivery planning could move accordingly. Standardization of the packages could be an answer, if standardization of the loading and unloading constraints is effective, as well as Safety Authorities requirements.

AREVA is currently designing its new generation of fuel packages, implementing innovative solutions, and will invest to enlarge its package fleet to ensure fuel deliveries in the next decade.

From a logistic point of view, it is also interesting to know that, for instance, a first EPR™ core represents 250 fuel assemblies, which are currently loaded into 125 packages, which represent 32 flat racks 40 feet type, equivalent to 32 trucks or 32 rail wagon, the cargo value is nearly 200 Million euros.

Splitting deliveries could be of benefit to limit the financial risk and facilitate the public acceptance, as well as reducing the number of packages needed for one shot.

Challenge for the logistics will be also to find route to ship the fuel to new nuclear countries for instance to Vietnam or United Arab Emirates, where implementation of class 7 transport will start from the very beginning.

### **4) Evolution in tails management**

The enrichment companies used to have different strategies in terms of depleted UF<sub>6</sub> management. Conversion into Uranium oxides and storage seems to be the trend for the coming years: after the French de-conversion plant built in 1984 and extended in 1993, one plant has started in Russia in 2009 and there are other projects in the UK, USA. This will lead to logistics challenge because quantities of depleted UF<sub>6</sub> are huge = 7/8 of the produced uranium is depleted uranium. Each de-conversion plant could be compared to a

conversion plant, capacity from 10,000 to 20,000 tUF6/year, with similar associated flows:

- UF6 flows: feeding with cylinders (48Y type) loaded with depleted UF6, and return of heels cylinders which mean cylinder fleet management
- Oxides flow: feeding with dedicated empty packages and delivery to the interim storage place, and further transport from the interim storage to the conversion facility.

Again, anticipation is needed to take care of those challenges, including logistics optimisation for UF6 cylinders and storage capability means: the right place to store the depleted oxides, and the right package which guaranty the reversibility of this intermediate storage when it is time to use those depleted oxides. The DV70 package, used by AREVA, is able to contain 7.5 tU/U3O8, is transported mainly by rail and compliant with the de-conversion plant for loading, Bessines and Pierrelatte storage facilities for intermediate storage and Comurhex plant for unloading and conversion into UF6.

DV70 packages used by AREVA (Storage at Bessines).



## 5) Environment evolution

In addition to the nuclear industry evolution, we have to take into account our environment evolution.

When transport is concerned, you are not in a nuclear site, but in the middle of a road, railway, in an area where nuclear may not be known. The nuclear industry will have to master and to intensify its communication and global acceptance program, so that existing routes remain open and new routes could be used, and explain the increase of volume of class 7 material transportation.

Increasing the volumes will be valuable for the ports and the maritime companies, the industry has to communicate on the potential new business, it is done for instance through the WNA transport group and we could see new maritime operators interested in the business.

The industry will also have to adapt its communication system to the different media, which have an ever increasing power: internet web sites with immediate release of pictures and comments. Because we need to react on time, tracking the materials during the transport will probably become the general rule.

Another evolution we will have to comply with is the transport regulations: in the coming years, some packages will have to be replaced according to new regulations and new customer needs. New countries will join the nuclear community, with the creation of new Safety Authorities, using and adapting the IAEA rules to their own requirements.

## **6) Conclusion**

The aim of transport companies, and especially for the AREVA Logistics Business Unit, is keeping the routes open and the industrial flows as fluent as possible, so that the nuclear industry is able to stay competitive and flexible.

The transport companies and the industry have to work together to assure a smooth transition and take advantage of this period of growth to innovate: taking the best from our past 45 years experience and building the logistics for the next generation.

In that respect, the AREVA Logistics Business Unit has placed innovation as a core strategy.

## **References**

<1> **STANDARD FOR URANIUM ORE CONCENTRATE TRANSPORT DRUM**

*Authors : F. Perrin, W. Martin, P. de Bastiani paper 249 PATRAM 2010 (cancelled)*

<2> World Nuclear Power Reactors & Uranium Requirements dated August 1<sup>st</sup>, 2010

*Source : World Nuclear association web site publication*