Transport of natural UF6 in a challenging environment

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ABSTRACT

At the entrance of the nuclear fuel cycle, the front-end material transportation takes a major and specific place. After years of stability the landscape of front-end industry is going toward significant changes regarding capacity, implementation of new technologies, imbalance of conversion capacity between geographical areas with increasing volumes of natural UF6 to transport and transport issues such as new regulations and denial of shipments by liners and ports.

Facing this evolution the front end-industry is re-organizing its environment to increase robustness of the logistical chain:

- by being active in industrial organizations such as WNTI and WNA to share technical views and develop licensed standard transport equipment usable worldwide
- by developing other safe and reliable comprehensive logistics solutions as an alternative to conventional transport means.

Our paper will describe the solutions under review to meet nuclear fuel cycle companies expectations:
- qualification of several robust logistics systems
- chartered vessels for maritime transport of UF6
- specific 20' flat racks for safer handling of 48Y cylinders with future thermal protections,

I – The transport of natural UF6 : one crucial link of the uranium supply chain

The transport of natural UF6 is one crucial step in the uranium supply chain because it is exposed to large regular international and multi-modal transports as well as diversified and evolving regulatory environment.

In the context of tight flows, a supply outage could cause severe consequences to the industry. Consequently, it is paramount for plants and facilities operations to have access to smoothly running logistics. Reliability of the transport system is equaly important to cover the industrials long-term contractual commitments.

Natural UF6 transport is often considered to be a sensible issue.
Until recently, natural UF6 was mostly transported by small quantities using regular liner vessels with a fairly high frequency.

Today, front-end transport companies face new challenges :

1. Denial of shipment

2004 is the year when the front-end transport companies' face a shortage of transport modes and carriers as a result of decisions by commercial carriers, ports and handling facilities not to accept radioactive material. Fewer actors are now present in the class 7 arena of transports.

Concerning the maritime mode, transport companies have to cope with the reluctancies of regular liner vessel companies to load front-end materials.

The reasons are usually the same: frightened by a potential Dockers' boycott (often due to a misleading or altered information about the material transported) and the fear of a vessel immobilization at the port due to administrative delais. All these reasons represent a potential commercial loss for the maritime companies. Further more, classe 7 cargo implies specific and time consuming training for the maritime carrier team which may be seen as an operational constraint.

2. The major production events ➔ Disruption of transports

Major production events, such as the ConverDyn plant shutdown in 2003 and 2004, emphases the need for transport companies to manage changes in planning as well as improving their capacity to cope with both fewer and larger quantities of material to be transported.

3. The growing demand perspectives ➔ Growing Flows

The world nuclear power production is expected to continue its growth.
At the time being, one can consider that more than 30 reactors are under construction throughout the world and 76 reactors will be put into production within the next decade.
In addition, one should to take into account the practical lifetime extension of some of the existing reactors.

Demand for natural UF6 as well as for all front-end material transport is therefore likely to increase steadily for the years to come.

4. The persistent imbalance of conversion capacity between Europe and North America

Conversions installations in the world (Reference: DCDI COGEMA- 2004)

COUNTRY	SITE	COMPANY	CAPACITY (tU/YEAR)	%
Canada	Port Hope	Cameco	12 500	18,2
China	Lanzhou	CNNC	2000	2,9
United States	Metropolis	Converdyn	14 000	20,4
France	Pierrelatte	Comurhex	14 000	20,4
United Kingdom	Springfield	BNFL	6 000	8,7
Russia	Angarsk	Minatom	20 000	29,2
Total			**68 500**	**100**

Enrichment installations in the world (Reference: DCDI COGEMA- 2004)

COUNTRY	SITE	COMPANY	CAPACITY (MUTS/YEAR)	%
China	Lanzhou Hanzong	CNNC CNNC	0,5 0,5	2,19
France	Tricastin	Eurodif	10, 8	23,73
Germany	Gronau	Urenco	1,9	4,17
Japan	Rokasho-Mura	JNFL	0,6	1,31
Netherlands	Almelo	Urenco	1,7	3,73
Russia Federation	Angarsk Novouralsk Krasnoïarsk Tomsk	Minatom Minatom Minatom Minatom	1 10 6 3	43,95

United Kingdom	Capenhurst	Urenco	2,5	5,49
United States	Paducah	DOE/USEC	7	15,38
Total			**45,5**	**100**

This presented situation as well as the shutdown of BNFL Springfield Conversion Plant in 2006 highlights the large North-American capacity resulting in important and steady flows of natural UF6 to Europe which is in demand for natural UF6, coupled with Europe's relatively important enrichment capacity. Such high level demand and supply implies a reduction of strategic stocks at both ends, and stresses the prevailing importance of safe and reliable transport systems to guarantee the supply chain for years to come.

5. The thermal Protections

The IAEA Regulation TS-R-1 1996 Edition has lead industrials, under the auspices of the World Nuclear Transport Institute (WNTI), to design and develop thermal protections to the commonly used 48Y cylinder for Natural UF6 Transport. Two types have been developed and are being tested to be ready for full implementation as of January 1st 2005.

Needless to say that such implementation will have drastic effects upon the equipment such as tie down systems, used for transporting these cylinders, as well as upon the time required for operations at both ends of the transport. Introducing thermal protections within this already complex natural UF6 transport environment will without doubt, imply important changes to the existing logistics. Furthermore, tailor made logistic solutions must be implemented specificaly for each countries of destination, based upon existing contraints and industrial requirements.

Reaching industrial acceptance of this new logistics involves a strong commitment of all actors concerned with natural UF6.

6. The context of low inventory policies

As less security margins are left in case of a plant shutdown and as inventories are decreasing, risk for disturbance of the supply chain increases. Even if for the nuclear industry it is to some extent possible to cope with delays, it is absolutely crucial for plants and facilities operation have access to smooth running and reliable transport systems.

The newly developing market situation for nuclear power production and the recent trend towards a tight market for the supply of uranium and conversion place new and strong demands upon the companies involved in transporting radioactive materials.

II- How is logistics to evolve within this new environment ?

Facing this environment, the front-end industry is re-organizing and increasing robustness of the Uranium supply chain.

A- The stakes

The stakes of the front-end nuclear transport companies correspond to those of the industry they serve :

- Gain on flexibility
- Be cost effective
- Improve ability to manage complex transports
- Be reliable over long-term periods

The transport of natural UF6 must be more cost-efficient, flexible and even more responsive to the needs of utilities, this within a complex international regulatory framework and an growing consciousness for public acceptance issues.

It must meet the industrials' challenger of today : Guarantee the uranium supply chain overtime.

B- Solutions to meet the challenge

1. Knowing the market – Being part of the market

A thorough knowledge of the market and its trends will allow proper development of logistical activities.

Transport companies, in charge of providing industrials with adequate transport solutions, plan on developing their own activities, on training their own personnel, and on acquiring their own equipment based upon their customers' needs.

Industrials, such as converters and enrichment facilities, whose aim is to guarantee delivery and supply of natural UF6 over long-term contracts, must partner with transport companies and cooperage on similar time-frames.

When improving visibility, the transport company improve its ability to anticipate and plan for the most reliable transport solutions.

2. Industrial cooperation within international organisations

WNTI provides channels that an isolated company cannot open. For instance, as an NGO, it can issue invitations and organise site visits for officials, media representative from various countries and organisations; such invitations would be declined if made by individual operators . WNTI has an observer status with IAEA and IMO, and can supply them a consensus view from industry, for example offer proposal for improvement of regulations. It can perform and publish general-interest studies: it has inter alia demonstrated that the public will not receive doses beyond regulations due to transport. It has also played a major role in resolving the thermal protection issue for 48Y cylinders.

3. Developing new scheme of transport

The best way to face these changes of environment is to improve on creativity and innovation in order to propose solutions helping industrials to face the market trends.

As previously discussed, the key of a successful supply chain of natural uranium is a scheme of transport able to provide the highest level of safety and reliability.
A transport scheme able to improve visibility over the medium and long-term market of uranium industrial operators.

Because of the denial of shipment and because of the current context of tight flows, delays in delivery is prejudicial to the industrial activities of the operators. New transport schemes must be implemented, not to replace but to provide alternative solutions to existing and proven solutions.

… The transport scheme of natural uranium must rest upon:

- The respect of the most astringent international regulatory requirements,
- The reliability of delivery times helping operators to keep their commitments toward fuel vendors,
- The flexibility helping operators to cope with unforeseen events,
- An optimisation of the quantities transported to reduce costs,

The setting up of dedicated means of transports such as a dedicated vessel corresponds to all these criteria.

♦ A scheme of transport allowing industrial operators to better plan their flows :

This new scheme of transport implies transport of largest quantities of cylinders with a decreased frequency of shipments.

Planification shall be based upon a series of sliding schedules within a general yearly overall schedule.

The planning is the cornerstone of a successful dedicated transport, it implies an upstream planification from the operators.
Once this upstream planification elaborated, the transporter can be a support and help setting up the transport planning in adequacy with the flows planning.

A yearly planning allowing a better medium and long term visibility on the market gives a better control on the supplying system.

♦ A scheme of transport able to supply a reliable and safe transport mean :

Once the planning implemented, comes into play the real competence of a transporter : to supply a reliable and safe mean of transport : in the case of a dedicated vessel , it means the supply of :

- A double hull vessel of rescent manufacture,
- A maintenance in conformity with the most stringent regulations of the international maritime transport: IMDG Code of International Maritime Organisation (IMO) , ISPS Code...
- An International Safety Management of the vessel,
- The traceability of transport and the thorough follow-up of the vessel qualified,
- Tested and standardised means of stowing, such as specifically designed 20' flatracks able to provide the required safety and efficiency for handling operations,
- A radiation control protection system.

♦ A scheme of transport able to guarantee a better cost control :

A long-term transport contract is a way to escape to the fluctuation of freight prices.

In the current context of maritime freight prices escalation securing long term contracts with all actors of the transport chain is not only a mean to control long term prices but also to strengthen co-operation and improve commitment of all actors toward nuclear transport.

♦ A scheme of transport able to supply flexibility :

Flexibility is improved with regard to the transport routes or a port modification : a last minute re-routing is always feasible.

♦ A scheme able to face to the mediatic pressure in case of crisis :

The transporter has to be able to manage efficiently in term of communication in case of crisis. The interest of the industrial operators must be preserved throughout the crisis management process

Conclusion

2004 will be remembered as the cornerstone for the natural UF6 transport as industrials will have to cope with many challenges such as larger flows, the implementation of thermal protections, various regulatory constraints, production events and inventory policy changes.

In that respect, Cogema Logistics has proven its ability to mobilize expertise at key steps of the logistical chain providing solutions to face such challenges.

Improving co-operation with transport companies will provide industrials with the support needed to guarantee the uranium supply chain through such complex environment.
Such co-operation must be long-term, thus helping securing each and every actors of the transport scheme and maintaining prices under control over such period of time.