The Future of Used Fuel Transportation in the US

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Agenda

1. Key factors in Used Nuclear Fuel (UNF) transportation
2. AREVA’s day to day business in UNF shipments
3. Situation in the USA
4. The future of UNF transportation in USA
Used Nuclear Fuel (UNF) Management

- Reactor on-site storage
- Reactor off-site storage
- Repository
- Recycling

Integrated Logistics = Success
Safe & Cost Efficient = Public Acceptance

Transportation Management

- Step 1: Define
  - Transportation model
  - Assets (package fleet, equipment, team)
  - Resources needed and organization
  - Transport management model processes

- Step 2: Schedule
  - Key implementation phases

- Step 3: Define
  - Logistic scheme
  - Processes and procedures

- Step 4: Select
  - Equipment utilization
  - Resources and training
  - Assets

- Step 5: Implement
  - Tools
  - Physical Protection and Safety Programs

- Step 6: Inform and Prepare
  - Public acceptance
  - Emergency response
  - Training

- Step 7: Schedule
  - Transportation
  - Transport scheduling

- Step 8: Operational Transport Management
  - Pre-transport preparation
  - Packing and loading
  - Path planning
  - Tracking
  - Emergency response...
1. Key factors in UNF transportation

2. AREVA’s daily business in UNF shipments

3. Situation in USA

4. The future of UNF transportation in USA

More than 40 years of Routine Back-End Logistics

- 5,000 safe rail and road shipments of used fuel since 1981
- More than 200 used fuel shipments per year by AREVA TN
- Fleet of 40 casks licensed for transport
Used Fuel Transport Flows

Worldwide Reactors & Storage Facilities

Rail spur (*)

Railway terminal

Maintenance Facility

Empty cask storage

La Hague Facility

Marine terminal

Crossing several European borders with various regulation situations

Between 400 and 10,000 Km ~ 25 Km

Different Points of Departure

Pool

Dry storage

Dry storage multi-purpose casks
From Pool: Used Fuel Transport Casks

- AREVA TN has a comprehensive range of used fuel transportation casks
  - Fleet of 40 casks
  - Adapted for all types of used fuel

- New cask development
  - TN®G3 S (short) / TN®G3 L (long) and TN®17 MAX
  - High performance casks: short cooling time, high burn-up, high enrichment
  - License expected for 2015

From Dry-Storage: Multi-purpose Casks

1. Loading
2. Interim Storage
3. Transport
4. Final Repository or Reprocessing

- TN® cask at dry storage facility, Belgium
- TN® cask on wagon

AREVA TN

From Dry Storage: Canister Systems

1. Loading / Welding
   - Loading in a welded Dry Shielded Canister

2. Interim Storage
   - Concrete Horizontal Module: NUHOMS® OR Metallic Vertical Overpack: TN NOVA™

3. Transfer Cask and Equipment

4. Transport
   - Transport Cass: the canister is removed from the Overpack and transferred into the transport cask
     For transport only

Final Repository or Reprocessing

MP197HB: Only Transportation Cask Licensed to Transport Canistered High Burnup Fuel

- Only transport package that meets NRC requirements to safely transport high burn-up used nuclear fuel in canisters
- Highest heat-load capacity in the industry -- up to 32 kilowatts
- First universal transport package -- licensed for nine different canister types
- Approved for use by rail, truck or marine transport
MP197HB: Ready to Deploy

- **MP197HB Transport Cask**
  - Currently being fabricated at Hitachi Zosen
  - Ready to deploy as early as 2016
  - Elegant, easy, safe transfer of canisters into transportation cask
  - No risky vertical lift of canister needed

MP197HB Cask is the first and only Transport Cask approved for high burnup fuel assemblies stored in canister-based Systems

Experience with Diverse Logistics Interfaces

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The Future of Spent Fuel Transportation in the US -- M. Valenzano -- January 14, 2015 - p.15
Truck Transport

- Designed, operated and maintained by AREVA TN
- 140 qualified and trained drivers
- Specially-manufactured equipment meets Areva TN design criteria
  - More than 100 special trucks for road transportation
  - Includes a fleet of nearly 20 trucks and semi-trailers of multi-wheel lines, equipped with converters for the low speed operations with payload from 150 to 250 tons
- For export: qualified carriers (TNB, MIT, Indermühle) execute shipments under the AREVA TN supervision

Rail Transport

- 47 rail cars owned by AREVA TN have been developed specifically for Back-End transportation
  - 36 Q70 (1978) / 120 tons of loading capacity
  - 11 Q76 (2000) / 140 tons of loading capacity
- Numerous sub-assemblies are patented by AREVA TN
- Canopies are part of physical protection
- In general no specific train, use “ordinary” freight trains
- 24/7 logistics tracking
- Each country in Europe has its own specialized subcontractor – coordinated by AREVA TN
Valognes Railway Terminal

Link between La Hague recycling facility and the railway network.

- Terminal owned and operated by AREVA
- More than 400 casks per year
- 15 operators
- Includes indoor facilities to perform radiological controls
- Facility for change of configuration of rail cars

Cherbourg Maritime Terminal

- 20 maritime shipments of heavy packages have been performed between France and Japan or the United Kingdom in coordination with our maritime partner
- A specific gantry owned by AREVA TN is used at Cherbourg
- Connection by road or rail is 12 miles from La Hague site
Reception at La Hague

- Facility dedicated to the reception of loaded casks (AML)
- Radiological inspections

Cask Maintenance Facility at La Hague

- AMEC Facility owned and operated by AREVA
- Handles up to 60 casks per year
- Standard activities include:
  - Visual inspection of all components
  - Verification of fuel compartments
  - Dismantling of the trunions and their screws
  - Verification of neutron absorber in basket walls
Maintenance Facility

**Main criteria for the design of AMEC maintenance facility:**

- **Location and access:** situate on the usual cask route
- **Capacity for size and weight of casks**
- **Anticipated contamination levels:** include hot cells and a decontamination cell as necessary
- **Solid, liquid, gaseous waste:** find outlets
- **Availability of trained professionals**

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Emergency Preparedness and Crisis Management

**24/7 Receipt of the alert**
(Transport Tracking Centre + 24/7 on-call duty)

- **Technical Team**
- **Communications Team**
- **Software and common means rooms**
- **Conference Call Room**
  (decision makers)
- **Rest / Lunch Room**
- **Command and Decision Team**
- **Fully restricted room**
  (for use of confidential information)
1. Key factors in UNF transportation

2. AREVA day to day business in UNF shipment

3. Situation in USA

4. The Future of UNF transportation in USA

The Situation in USA: A large, complicated problem

U.S. Independent Spent Fuel Storage Installations
How do you eat an elephant?

One bite at a time!

Key factors in UNF transportation

AREVA’s day to day business in UNF shipments

Situation in the USA

The Future of UNF transportation in USA
What We Know

- Used fuel in the US is stored in pools and in many types of containers of all sizes – vertical and horizontal … metal and concrete
- Used fuel is stored in many locations, many without access to rail infrastructure
- Not all used fuel storage systems are easy to access and unload
- Safety will be a priority for the public and for government
- Speed and cost-effectiveness will be important to all
- The solution will require an experienced company with equipment, understanding of the complexity of logistics and interfaces and a clear commitment to risk management
For nearly 50 years... AREVA TN has provided used fuel management solutions compatible with dry storage at site, centralized storage, road/rail/maritime transport, recycling and final disposal.

- Maritime
- Road
- Rail
10 Main Steps of Used Fuel Transport

1. Reactor site

2. After cask loading, transfer onto transport equipment

3. If no rail spur, transport via road to nearest spur

4. EDF Railway Terminal

5. Transport via rail to Valognes

6. Valognes Railway Terminal
10 Main Steps of Used Fuel Transport

7. Road transport from Valognes to La Hague

8. Reception of transport cask at La Hague

9. Wet or dry unloading at La Hague

10. Fuel storage pool or empty cask storage at La Hague