





International Transportation for Used Fuel, HLW and MOX Fuel

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General Overview of AREVA Back-End Transports

- ▶ **Used fuel transports from NPP to Recycling Plant (La Hague)**
 - ◆ About 250 casks transported per year
- ▶ **High Level Wastes**
 - ◆ HLW : Vitrified wastes – nearly 20 casks transported per year returned to owner (country of origin)
- ▶ **Recycling Products**
 - ◆ Fresh MOX fuel from recycling plant to NPP – More than 50 casks transported each year to France, Germany, Switzerland, Belgium and Japan
 - ◆ Fresh ERU fuel (re-enriched recycled uranium)

Applicable Regulations



▶ International

- ◆ IAEA recommendations
- ◆ International Maritime and Air regulations (OACI, IMDG)

▶ European

- ◆ Road (ADR), Rail (RID)

▶ National

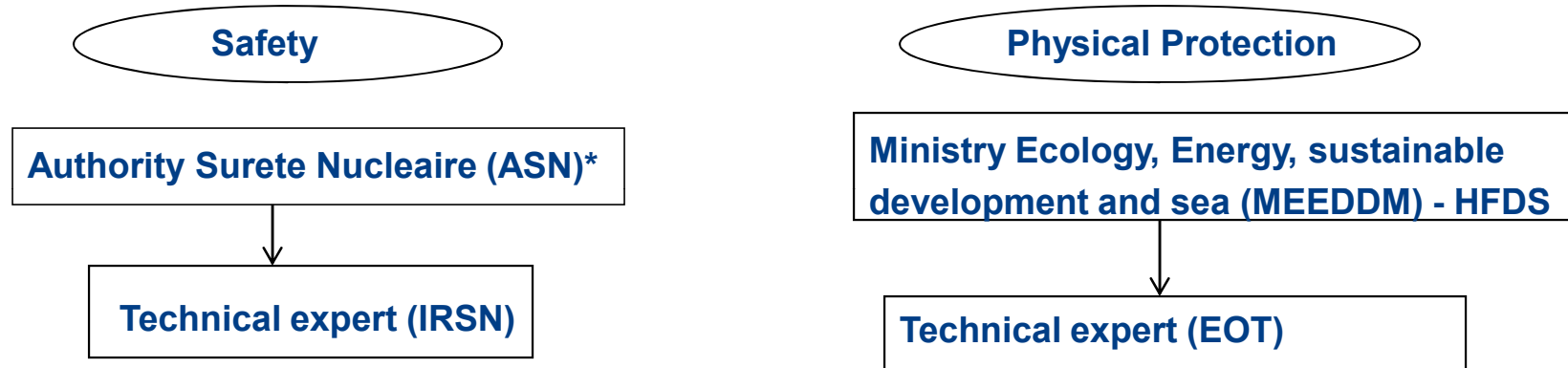
- ◆ French laws for implementation of international and European regulations
- ◆ Other national regulations including physical protection

Regulation Implementation - French Model



► French Model is based on:

- ◆ French Regulator issue regulations based on international recommendations and regulations:



- ◆ French Regulators issue package certificates, security requirements, perform audit and inspections compliance
- ◆ Private Industry implements

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* independent commissioners elected by Government

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Be prepared to explain what private sector really does. For example, they do not implement many of the physical protection functions.

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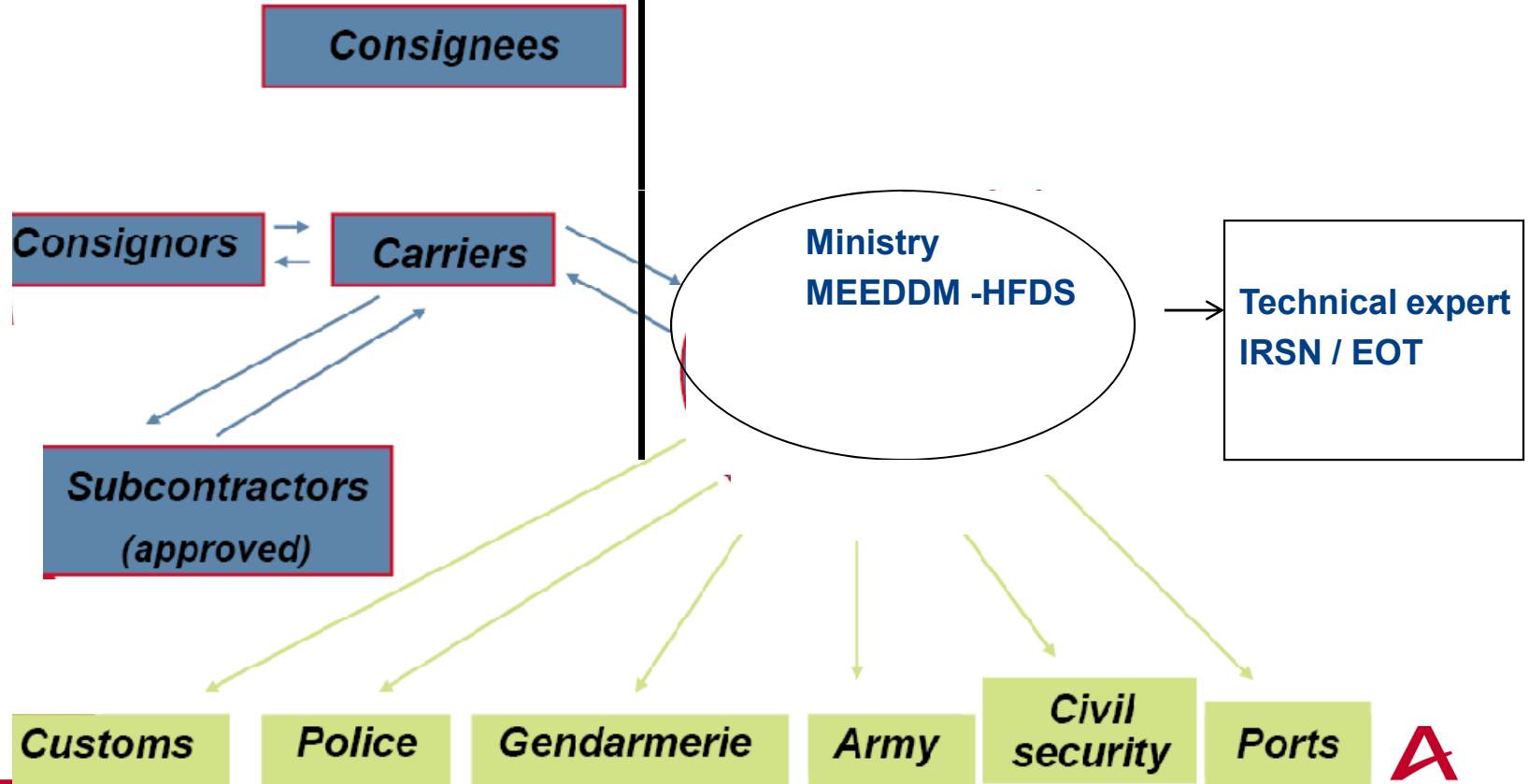
Physical Protection/Security

Commercial Operation

Equipment design, operation and Maintenance, implementation of Other security requirements

Government/Regulator Specification and Control

Equipment specification and security requirements, audit and inspections



Safety



Commercial Operation

Design/licensing preparation/

Package operation and maintenance

Package designer and
license holder

Consignor

Consignee

Package
operators

Package
Manufacturers

Carrier

Regulator specification and control

Review and approve package licenses

Autorite Surete Nuclear
(ASN)

Technical expert
IRSN

Foreign
Competent
Authorities

Diverse and Complex Environment



- ◆ **Safety and Security Regulations (National, European and International)**
- ◆ **Numerous facilities /interfaces**
- ◆ **Numerous packages for different products**
- ◆ **Various transport modes**
- ◆ **Numerous Stakeholders**
- ◆ **High level of sensibility**



Requires an Integrated Logistic Supply Chain

Why an Integrated Approach?



- ▶ **Long Term Strategy/Anticipation of:**
 - ◆ **Regulations Change**
 - ◆ **Available Transport Routes**
 - ◆ **Need for packages and conveyance systems**
- ▶ **Package and Transport Conveyance designs are “integrated”**
 - ◆ **Interfaces including facility interfaces**
 - ◆ **Optimization of operations (minimize risk by reducing number of shipments)**
- ▶ **Standardization and Reliability of Logistic Chain Processes**
- ▶ **Reactivity to unforeseen changes**

Logistic Supply Chain Integrated Approach – French Model



▶ Private Logistic Company is responsible for:

- ◆ Cask design and licensing**
- ◆ Transport Conveyance Design***
- ◆ Operations**
- ◆ Communication/Public Acceptance**

*** Unless design is performed by regulator for category I and II shipments**

AREVA Logistic Models Integrated Approach



Used fuel
TN12/2, TN13/2, TN112, TN17/2



HLW Residues -TN28VT



Uranyl nitrate - LR65



Fresh URE fuel - FCC



Fresh MOX fuel
MX6, MX8, TN12/2 MOX

AREVA Logistic Model Integrated Approach



Tractor & trailer for used fuel and HLW packages

Transfert routier vers AREVA-NC La Hague



Maritime terminal – spent fuel/HLW/MOX



Railway terminal



Transport de combustibles usés

Rail car for used fuel and HLW packages

Example of Integrated Approach : MOX Transport



► Extract of French Law (Article R1333-70)

Un-irradiated Plutonium:

- ◆ Cat I: 2kg or more
- ◆ Cat II: Less than 2Kg but more than 400g
- ◆ Cat III: Less than 400g but more than 3g

► MOX Shipments are classified as Category 1

Example of Integrated Approach: MOX Various Routes/Countries/Regulations



- ▶ **Deliveries to France, Germany, Belgium, Switzerland and Japan**
- ▶ **Truck, Rail, Maritime**
- ▶ **Due to physical protection categorization, additional complexity**

Transportation Means for MOX Shipments

- ◆ **Secured conveyance includes :**
 - **A secured truck*,**
 - **A specific trailer*,**
 - **A specialized secured container*,**
 - **The loaded package(s)**



***Based on French Competent Authority specification, the « Authorized Carrier » performed ;**

The design of the secured conveyance. The design is approved by the French Competent Authority. The design and manufacturing are optimized in order facilitate the loading/unloading operations (open roof)

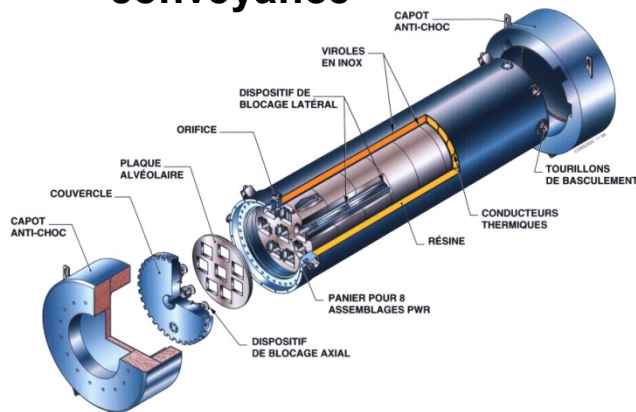
The manufacturing of secured conveyance. The secured conveyance is approved by the French Competent Authority upon inspection

MOX Transport - Package Description

► **MX8 Package - Initially designed for EDF**

► **Main Characteristics:**

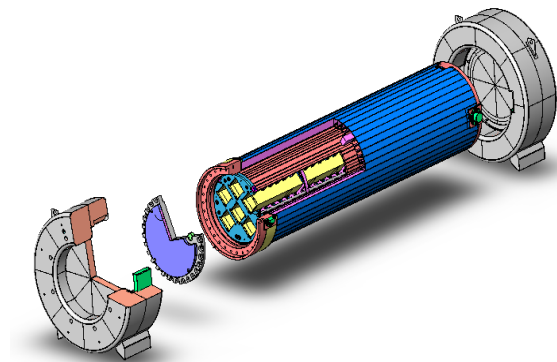
- ◆ 8 PWR 17 x 17 Assemblies
- ◆ Max. Th. Power : 6 000 W and 750 W / FA
- ◆ Max weight loaded: 22,3 MT
- ◆ Dry loading/wet unloading
- ◆ 1 cask per secured conveyance



► **MX6 - Designed for German utilities (longer fuel)**

► **Main Characteristics:**

- ◆ 6 PWR 16 x 16 Assemblies
- ◆ Max. Th. power: 6 600 W and 1 100 W / FA
- ◆ Max weight loaded package : 19,4 MT
- ◆ Dry loading and unloading
- ◆ 1 cask per secured conveyance



Physical protection requirements specific to countries



- ▶ **Transfer of physical protection responsibility between different countries**
- ▶ **Need to use qualified carriers and equipment based on country-specific requirements**
- ▶ **Provide transport solution to perform MOX international shipments while meeting applicable physical protection and maintaining efficient transport systems**

Lessons Learned

How to succeed and remain successful?



► More than 40 years of successful experience with Logistics Integrated Approach in France

- ◆ Readiness : Anticipate the preparation of the transports (Licensing, Manufacturing, Dry-run).
- ◆ Design integration: Facilities, Package, Transport Conveyance
- ◆ Take into account international characteristics of the transports
 - Safety and Security authorities requirements
 - Public Acceptance
- ◆ Reactivity/Communication with all Stakeholders

Integrated Logistic Entity - Continuous Exchanges with Competent authorities