AREVA

Architecture of Transport Systems for Used Fuel and High Level Waste Examples from Europe

Frederic Bailly

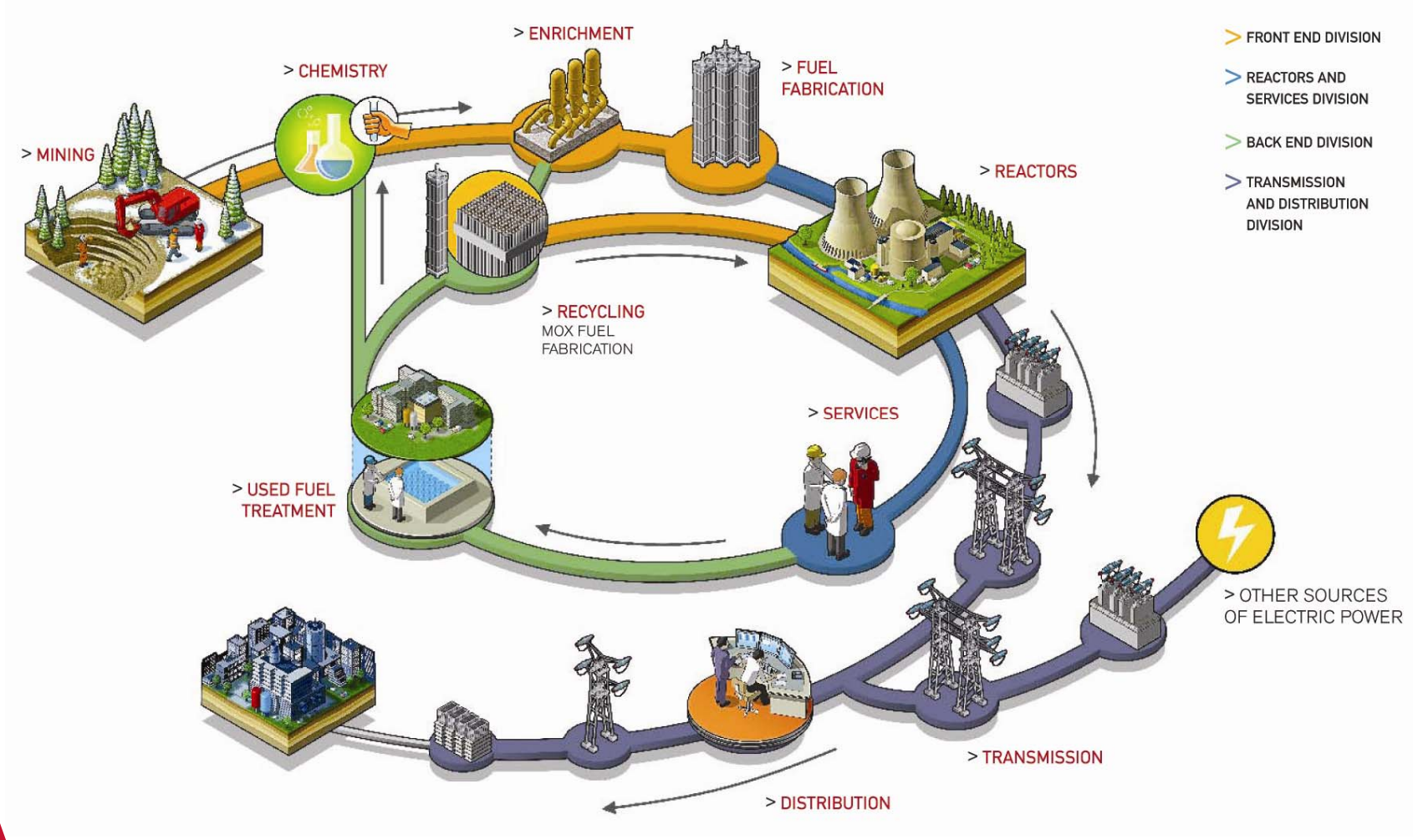
Spent Fuel Management Strategy

AREVA

DOE TEC Meeting

Minneapolis, Sept. 2004

Energy, AREVA's core business



AREVA Group

On June 10th, 2004

AREVA

Energy

Front End Division	Reactors & Services Division	Back End Division	Transmission & Distribution Division	Connectors Division
▶ Mining ▶ Chemistry ▶ Enrichment ▶ Fuel	▶ Reactors ▶ Equipment ▶ Nuclear Services ▶ Nuclear Measurement ▶ Consulting and Information Systems ▶ Mechanical Systems ▶ Technicatome	▶ Treatment ▶ Recycling ▶ Logistics ▶ Engineering ▶ Cleanup	▶ Products ▶ Systems ▶ Automation & Information Systems ▶ Services	▶ Communications Data Consumer ▶ Automotive ▶ Electrical Power Interconnect ▶ Microconnections

TN 12 SPENT FUEL CASK

HIGH LEVEL WASTE CASKS

- Vitrified residues (HLW) are transported in heavy casks
- **Up to 28 HLW canisters per cask**

HLW Cask Loading Operations

TN 28 V HLW CASK

OPERATIONAL EXPERIENCE

The COGEMA group has safely transported Spent Fuel from world-wide customers:

30 000 MTHM over 30 years

Transportation of Vitrified Residues Canisters (HLW):

900 tons of HLW (1800 canisters)

CASK FLEET MANAGEMENT

- **50 Heavy Transport Casks**

- **10 Special Heavy Haul Trailers**

30 Dedicated Railcars

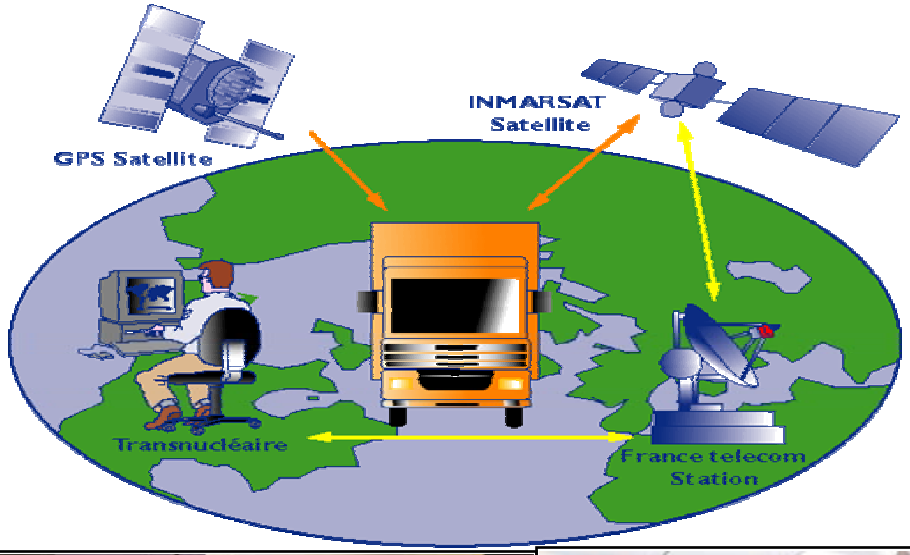
CASK MAINTENANCE

MULTI MODAL TRANSPORTS

RAIL/TRUCK TRANSFER STATION

- **The Valognes terminal. The world's biggest facility dedicated to the transfer of casks from rail to truck.**

REAL TIME TRACKING, CONTINGENCY PLANS



ON THE MOVE: OVER 1000 TRANSPORTS/YEAR

- **Expertise in multi-modal transportation**
  - **(Sea, air, road, rail)**

Nb of annual transports	1999	2000	2001	2002
French spent fuel	157	191	145	185
European spent fuel	9	12	44	61
Vitrified waste (incl. Japan)	6	11	20	22
PuO2 and MOX (incl. Japan)	150	149	187	175
Low Level Waste	643	684	757	700
Total	965	1047	1153	1143

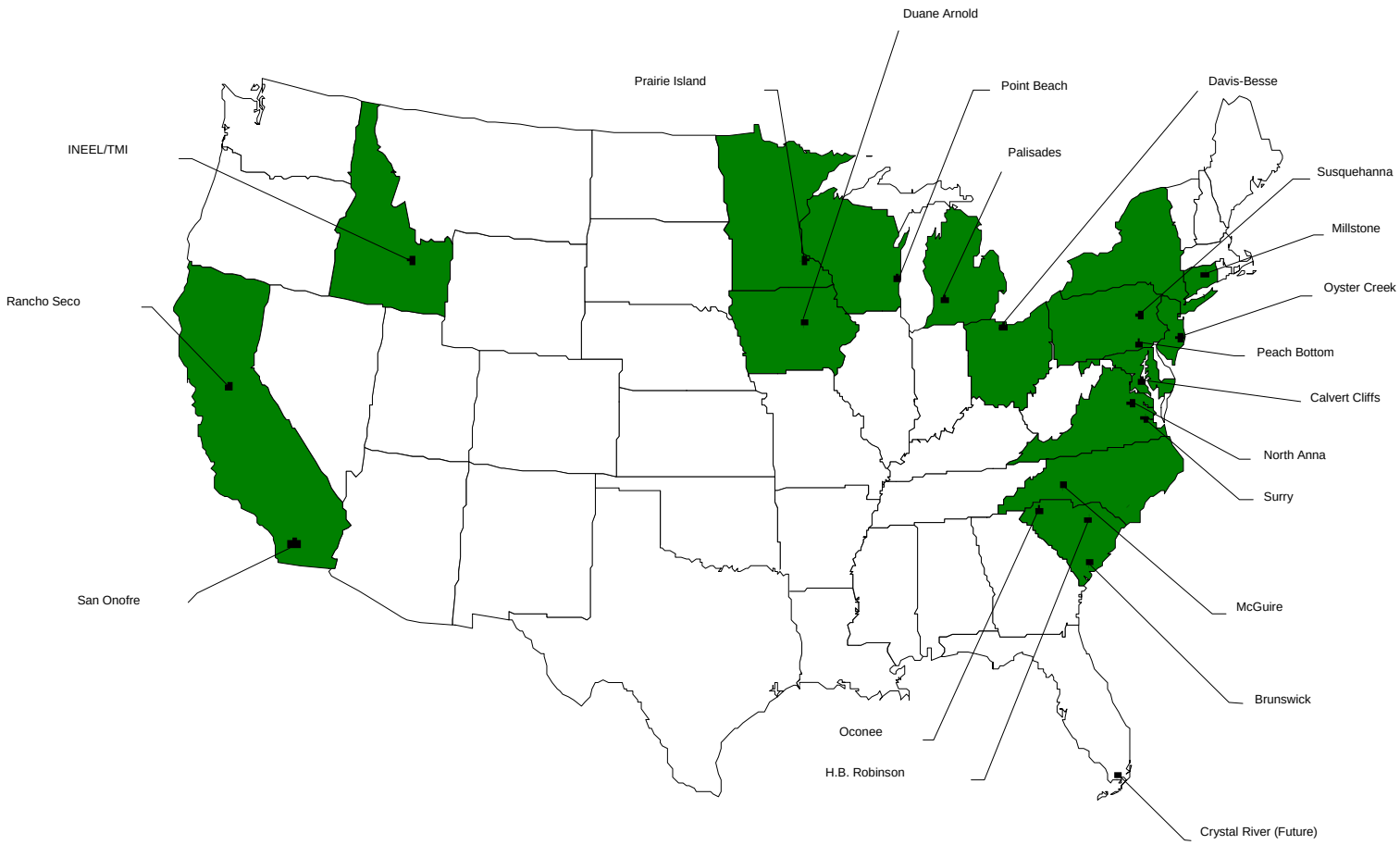
TN Gemini US is TRUPACT-III

PacTec is developing TRUPACT-III for DOE/WTS, based on the TN Gemini.

COGEMA IN THE US

- **TN supplied DOE casks for West Valley shipments**

TN DRY STORAGE SERVING TWENTY ISFSI LOCATIONS

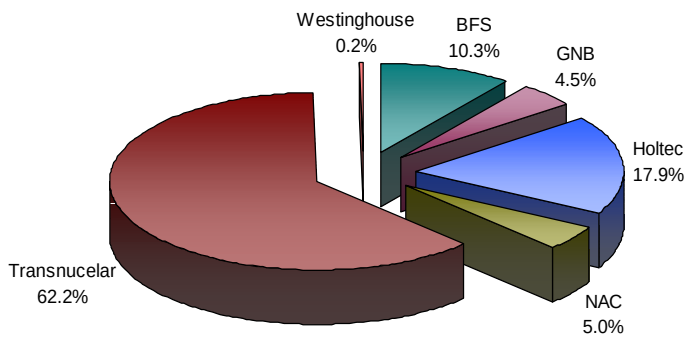


US DRY STORAGE CUSTOMERS

	ISFSI	Model	Loaded	
			Casks	SFA
NUHOMS®	Brunswick	61BT	—	—
	Calvert Cliffs	24P	36	864
	Crystal River	32PT	—	—
	Davis-Besse	24P	3	72
	Duane Arnold	61BT	10	610
	INEEL/TMI-2	12T	29	177
	Millstone	32PT	—	—
	North Anna	32PTH	—	—
	Oconee	24PTH	—	—
		24P	77	1848
	Oyster Creek	61BT	8	488
	Palisades	32PT	—	—
	Point Beach	32PT	—	—
	Rancho Seco	MP187	21	493
	Robinson	24PTH	—	—
		7P	8	56
	SONGS	24PT1	2	48
		24PT4	—	—
	Surry	32PTH	—	—
	Susquehanna	52B	25	1300
		61BT	—	—
TN Cask	McGuire	TN-32	10	320
	North Anna	TN-32	16	512
	Peach Bottom	TN68	20	1360
	Prairie Island	TN-40	17	680
	Surry	TN32	18	576
		Total	300	9404

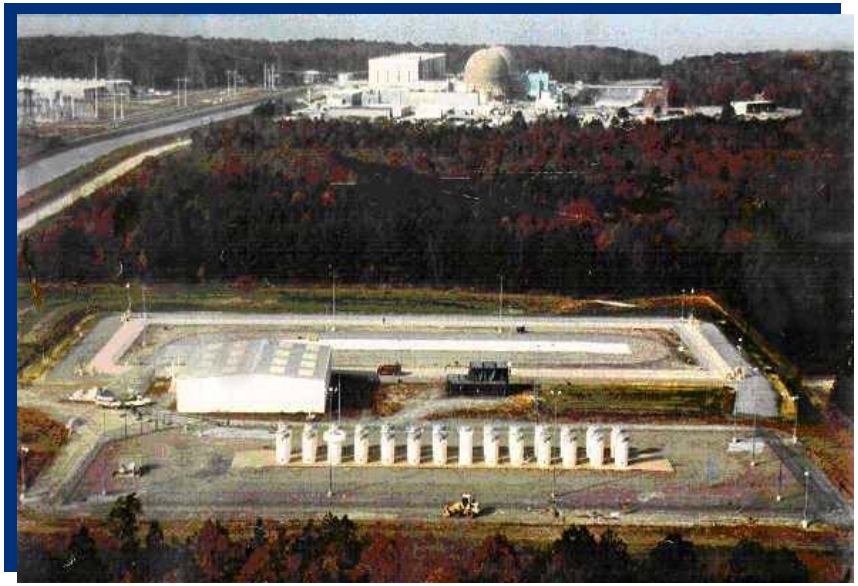
9400 of the approximately 12,500 SFAs in dry storage are stored in TN systems

Total Fuel Stored By Vendor



SURRY AND NORTH ANNA TN 32 CASKS

- Site Specific license
  - First TN 32 loaded in 1996
  - 16 casks loaded at Surry
  - 15 casks loaded at North Anna
  - 53 casks ordered



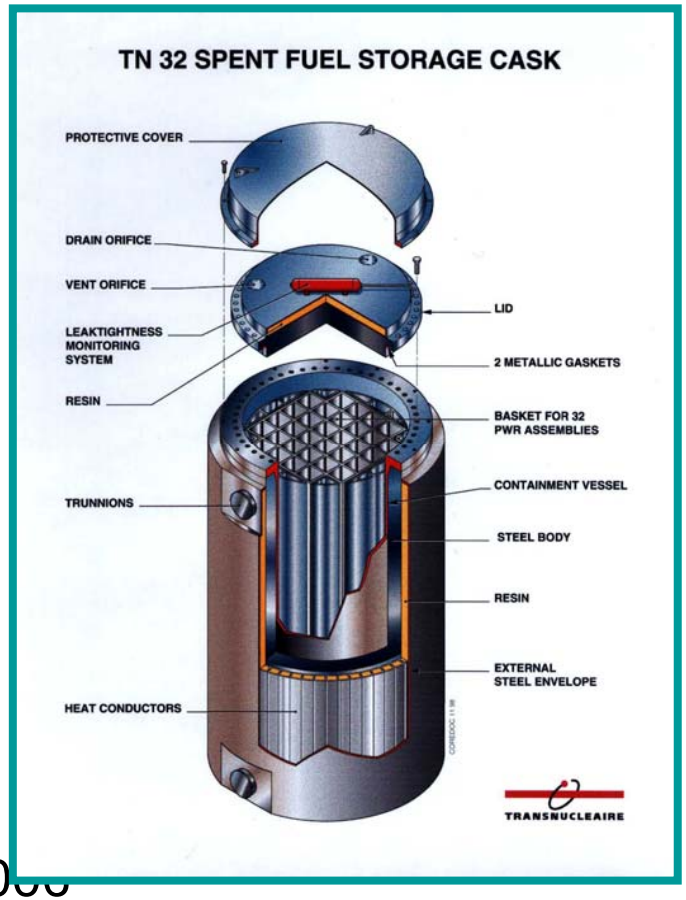
TN 68 CASKS - PEACH BOTTOM

- **Dual Purpose BWR casks (Part 71 & Part 72 licensed)**
- **Ready to ship to Yucca Mountain**

TN 40 CASKS AT PRAIRIE ISLAND

TN 32 HIGH BURN UP CASK

- Dual purpose, 32 PWR
- Improved performance
  - Burn up 60,000 MWd/t(U)
  - Enrichment 5.0%
  - 7 years minimum cooling
  - Up to 45 KW loadings
  - Uses standard TN 32 equipment



- SAR in preparation
- First cask could be ready for use in 2006

Architecture of Transport Systems for Used Fuel and High Level Waste Examples from Europe

Frederic Bailly

Spent Fuel Management Strategy

AREVA

DOE TEC Meeting

Minneapolis, Sept. 2004

Spent Fuel Transport Organization: 40 years experience

- **Solutions are defined by the regulations, but are optimized through the experience**
- **More than 1,000 shipments performed yearly:**
  - **280 SF**
  - **20 HLW**
  - **700 LLW, MLW**
  - **More than 70,000 Spent Fuel Assemblies shipped**

Global Spent Fuel Transportation is a Reality at Industrial Scale

Transport Commissioning and Monitoring: Controlling the logistics chain at each step

- **Assessment of transportation methods and resources**
- **Organization & Assistance for each operation**
- **Ensuring the traceability and safety of transport operations**

Main on-site operations

- *transportation systems controls - cask transfer - cask preparation for loading operation - transfer into pool - loading of SFA and inspection - repositioning of lids - draining, drying - controls - cask preparation for shipment*

Empty cask transfering

Lid removal

Closure operations

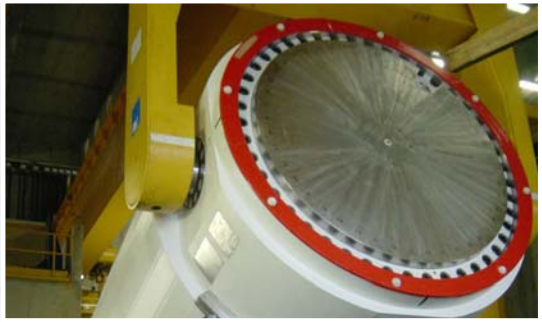
Controls & casks preparation

SNF/HLW Architecture of Transfer System : Our approach

- Identify the needs at the NPP/ISFSI
- Identify the constraints at the NPP/ISFSI
- Identify the administrative framework
- Define the organization for the transport program
  - Multimodal approach :
    - Route
    - Mode
  - Transport equipment
  - Constraint related to handling the packaging/ nuclear facilities
- Define associated means

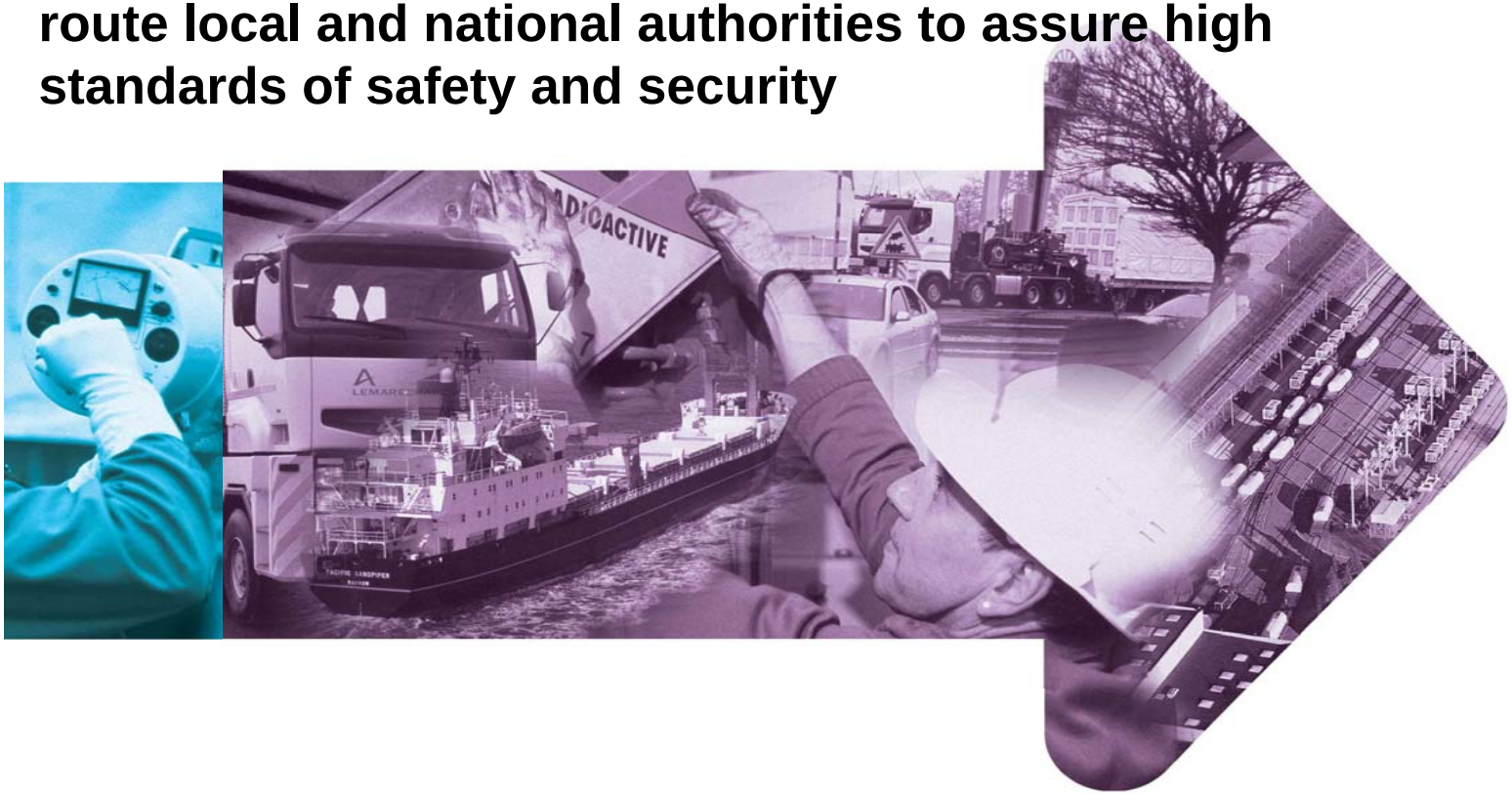
Identify the needs at the NPP/ISFSI: Defining cask design and selecting transport means

- Status of pools/storage
- Characteristics of fuels/canisters
- Handling means
- Loading capabilities
- Transport infrastructure
- Compatibility with proposed/existing systems



Identify the Administrative Framework: Defining transport program and procedures

- National and international framework
- Type of license
- Transport Approval
- Relation with Authorities: Working permanently with en route local and national authorities to assure high standards of safety and security



Define the Transport Organization: Casks availability, means design, handling and transport equipment

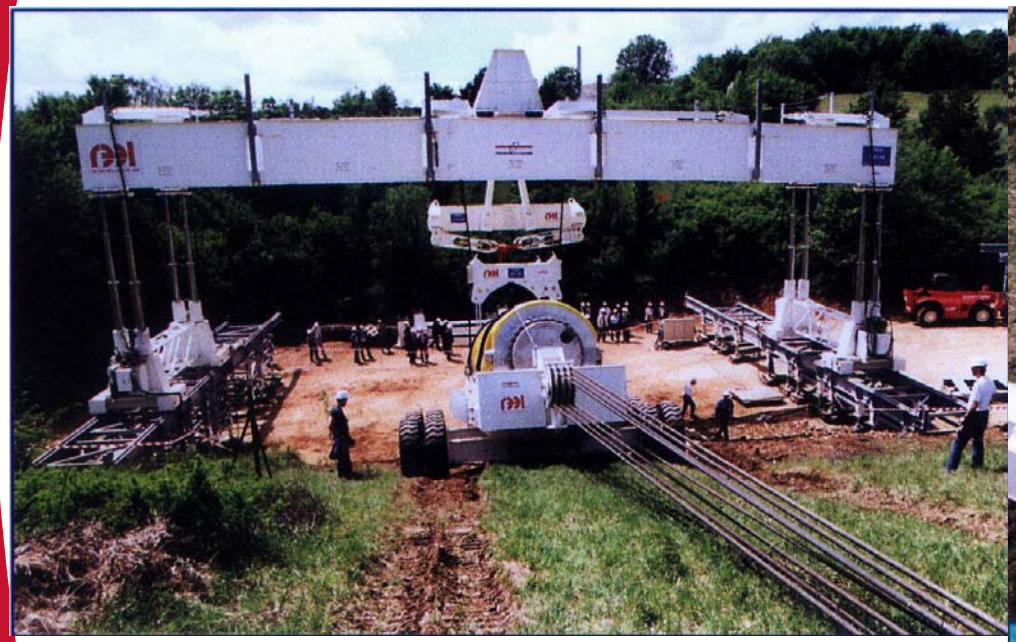
- National and international framework
- Time schedule
- Capacities of the transport means
- New design needed
- Dedicated means
- Multimodal approach
- Security requirements

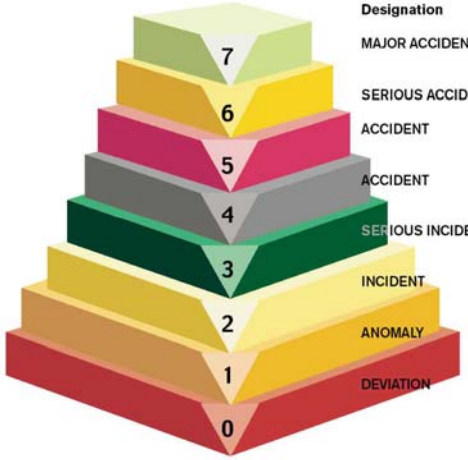
Associated Means: Maintenance, life-time data recording system

- Include maintenance as integral part of the daily planning process

- Dedicated tools to monitor
  - available casks
  - available fuel basket
  - licensing status
  - maintenance status
  - compatibility with NPP
  - compatibility with ancillary equipment

Emergency Response,Tracking system,Communication

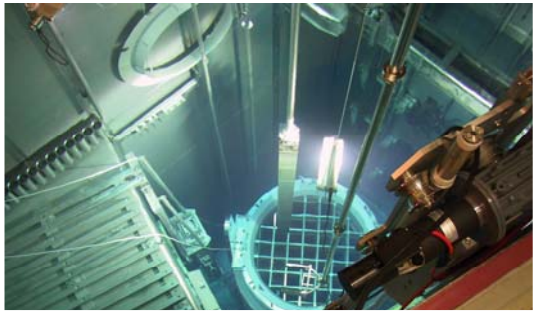




Designation	Defense in depth degradation
MAJOR ACCIDENT	Major release : widespread health and environmental effects
SERIOUS ACCIDENT	Significant release
ACCIDENT	Limited release
ACCIDENT	Minor release
SERIOUS INCIDENT	Very slight release – near accident no safety layers remaining
INCIDENT	Incident with significant failure in safety provisions, significant spread of contamination
ANOMALY	Anomaly beyond authorized operating regime
DEVIATION	No safety significance

European Transport systems … keys to success

- Dedicated rail car (wagon Q76, TFV) for normal commercial velocities on the railway network
- Develops codes and benchmarking
- Standardization of cask interface
- Dry unloading facility
- Make maintenance integral part of the daily programmation process
- Ability to give technical support
- Working closely with local & national authorities and media



In Brief ...

- **Transport is much more than commissioning, and handling at facilities.**
- **It involves a complex chain of decision for the long term reliability and efficiency of a transport system, for which experience feed-back is essential.**