QA: N/A

Office of Civilian Radioactive Waste Management

OFFICE OF LOGISTICS MANAGEMENT BENCHMARKING PROJECT

Report from AREVA, NC Site Visit and Interview, Spring 2007

March 2008

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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EXECUTIVE SUMMARY

The Nuclear Waste Policy Act of 1982, as amended, established the Office of Civilian Radioactive Waste Management (OCRWM) within the Department of Energy (DOE). As part of its responsibilities to license and operate a geologic repository for disposal of spent nuclear fuel (SNF) and high-level radioactive waste (HLW), OCRWM has the mission of transporting those materials from commercial and DOE sites to the repository. The Office of Logistics Management (OLM) benchmarking project began in 2005, and is intended to help OLM identify, document, and better understand best practices for logistics enterprises. The results will help OLM design and implement a system to transport SNF and HLW to the proposed Yucca Mountain repository. A report summarizing the first phase of the benchmarking project was issued in May 2007. Reports from additional commercial organizations that transport radioactive materials, such as this report on AREVA NC, will in time be reflected in an update to the 2007 benchmarking report.

One recommendation of the May 2007 report was to interview and study commercial logistics enterprises servicing the nuclear industry. OLM initiated a series of discussions with AREVA NC, culminating in extensive site visits by Gary Lanthrum, OLM Director, in May 2007, and subsequent staff meetings with AREVA logistics management and personnel. A detailed questionnaire was sent to AREVA points-of-contact prior to the site visits. This report summarizes questionnaire responses, findings from the site visits, and suggests areas for further exploration in coordination with AREVA.

In addition to observing normal operations, AREVA's Business Unit-Logistics (BU-L) provided tours and briefings on their shipment tracking and emergency response infrastructure and capabilities. AREVA also provided briefings on their organizational and regulatory framework to provide a context for their logistics operations. The week spent with AREVA at their corporate offices, at their intermodal facility in Valognes, France, and at the reprocessing facility in La Hague, France, provided highly valuable information and background on key logistics operations decisions that OLM will have to make over the next 2-3 years.

The impressions gained from observing AREVA BU-L's operations are as beneficial to OLM as the explicit answers provided by AREVA to the questions on the questionnaire. The lessons learned from the site visits and the questionnaire responses also have implications for areas of OCRWM beyond logistics, particularly for Site Operations, Waste Acceptance and Emergency Operations/Security.

Key lessons learned in this benchmarking effort include:

- Integrating logistics support for all radioactive material shipments has management benefits that DOE should consider;
- Considerable time needs to be allocated to conduct extensive start-up and acceptance testing prior to initial operations with spent fuel;
- Logistics presence at loading sites is key to managing the quality of shipping package preparation;

- Appropriate application of decision making criteria should be the focus, not an effort to drive common solutions (Some logistics decisions in France are driven by conditions that are considerably different than the ones present in the U.S.); and
- Intermodal operations can be managed effectively, but even under the best circumstances, they have limited utility for long haul shipments.

OLM offers particular thanks to AREVA BU-L for their participation and input in this effort.

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ACRONYMS

ASN	Autorité de Sûreté Nucléaire
BU-L	Business Unit Logistics
COGIC	Centre Opérationnel de Gestion Interministérielle des Crises
DOE	U.S. Department of Energy
HLW	High-Level [Radioactive] Waste
IRSN	Institut de Radioprotection et de Sûreté Nucléaire
MOX	Mixed Oxide [Nuclear Fuel]
OCRWM	Office of Civilian Radioactive Waste Management
OLM	Office of Logistics Management
RAM	Radioactive Materials
SNF	Spent Nuclear Fuel
U.S.	United States

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1.0 PURPOSE OF BENCHMARKING TRIP

In May 2007, J. Gary Lanthrum, Director of the Office of Logistics Management (OLM) within the Department of Energy's (DOE's) Office of Civilian Radioactive Waste Management (OCRWM), visited AREVA NC. The purpose of the visit was to observe and benchmark how a world-class radioactive materials (RAM) logistics organization manages their assets and conducts their operations. The site visit to AREVA is one of several planned for the second phase of OLM's benchmarking effort. Phase I examined logistics operations for the Waste Isolation Pilot Project, the Naval Nuclear Propulsion Program, and the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program. The second phase focuses on integrated domestic and international commercial radioactive operations.

2.0 SCOPE OF INFORMATION COLLECTION

As part of its benchmarking effort, OLM was interested in learning more about AREVA's business model for its logistics operations. For purposes of this report, an organization's logistics "business model" simply means its approach to planning and management, i.e. how the organization makes decisions, assigns responsibilities and holds people accountable. Other management functions that contribute to the business model include use of technical tools (software), and focusing leadership and resources in particular work areas.

Although transportation and logistics functions encompass many different steps, this benchmarking trip report focused on four business processes that are critical to OLM's mission success and can be incorporated into OLM's planning and preparation. "Mission success" for this activity is defined as demonstration of national transportation system readiness. The four processes examined include (1) planning and management; (2) system operations; (3) support/contractor services; and (4) public outreach and communications. These four transportation practices were examined in the context of broader supply chain/logistics functions. For example, logistics for OLM include planning for the movement and handling of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) from the current storage sites around the country to the Yucca Mountain repository for final disposition.

The areas in which OLM sought more information covered a broad range of transportation planning and execution activities. OLM inquired about the procurement, maintenance and use of transportation hardware, the transportation planning and shipment approval process, safety and security, shipment tracking, and emergency response.

A detailed questionnaire was sent to the AREVA points-of-contact prior to the site visit. The report text contains the questions asked, grouped by business practice area, along with AREVA's responses as well as impressions and observations gleaned from the site visit. In addition, in some areas OLM has identified AREVA's planning operations and compared and/or contrasted them with OLM's planning efforts to date.

3.0 SUMMARY OF AREVA TRIP

The AREVA family of companies provides complete nuclear fuel cycle management, including provision of storage and transport casks to customers across the globe. The logistics arm of AREVA is a for-profit company that sells transportation hardware and logistics services to a broad client base. OLM examined AREVA's Business Unit Logistics (BU-L) because of the large number of spent fuel

shipments accomplished to date. AREVA transports approximately 200 spent nuclear fuel casks per year, using both rail and heavy haul trailers. Shipments are made from 58 reactors to one central reprocessing facility.

The OLM Director visited the AREVA NC BU-L in May 2007. In addition to observing normal operations, AREVA provided tours and briefings on their shipment tracking and emergency response infrastructure and capabilities. AREVA also provided briefings on their organizational and regulatory framework to provide a context for their logistics operations. The week spent with AREVA at their corporate offices, at their intermodal facility in Valognes, and at the reprocessing facility in La Hague provided highly valuable information and background on key logistics operations decisions that OLM will have to make over the next 2-3 years.

SIGNIFICANT FINDINGS AND RECOMMENDATIONS

Key lessons learned in this benchmarking effort include:

- Integrating logistics support for all radioactive material shipments has management benefits that DOE should consider;
- Considerable time needs to be allocated to conduct extensive start-up and acceptance testing prior to initial operations with spent fuel;
- Logistics presence at loading sites is key to managing the quality of shipping package preparation;
- Appropriate application of decision making criteria should be the focus, not an effort to drive common solutions (Some logistics decisions in France are driven by geographic and demographic conditions that are considerably different than the ones present in the U.S.); and
- Intermodal operations can be managed effectively, but even under the best circumstances, they have limited utility for long haul shipments.

4.0 KEY BUSINESS PROCESS REVIEWS

In the questionnaire sent to AREVA points-of-contact, OLM covered a range of transportation planning and execution activities. OLM sought information on the procurement, maintenance and use of transportation hardware, the transportation planning and shipment approval process, safety and security, shipment tracking, and emergency response. The questions and responses to the questionnaire, as well as observations gleaned from the site visits and OLM's impressions of how AREVA's operations may compare or contrast with OLM's future program, are below.

4.1. PLANNING AND MANAGEMENT

Question: For background purposes, please provide a brief narrative overview of where and how AREVA's transportation programs began, its current status, and what changes in programs and priorities led to your development of your full-service transportation system.

Response: AREVA's transportation program began as an integral part of France's move to commercial nuclear power. Transportation planning was never a stand-alone activity, but was part of the overall logistics support for the nuclear power program. The original scope was far less than what is currently operating. The growth of the transportation program happened in parallel with the growth of

nuclear power in France. Spent fuel was transported and processed from the very beginning rather than lagging the production of power and the generation of large quantities of SNF.

Question: Please briefly describe the AREVA logistics management structure (an organization chart would be helpful).

Response: Transportation planning is part of the BU-L in AREVA. An organizational chart is provided, showing the AREVA organization starting with the Divisions, then the business units and finally the organizational structure of the BU-L. See Figures 1-3.

Figure 1 – AREVA Logistics Business Unit Overview

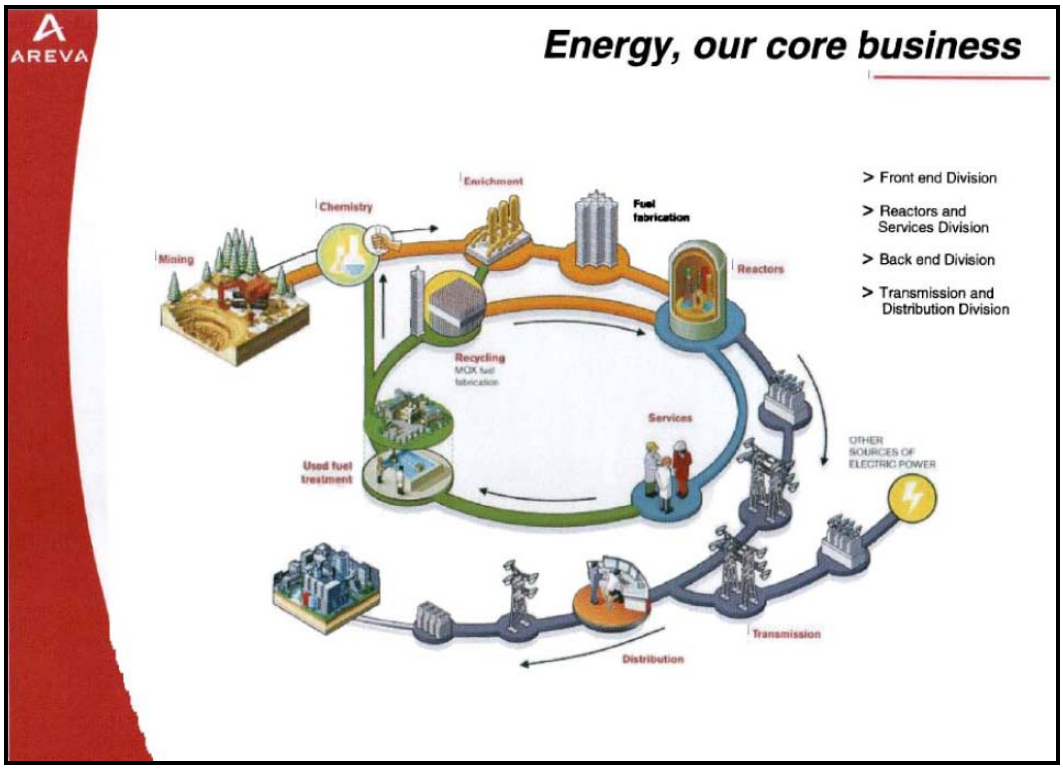
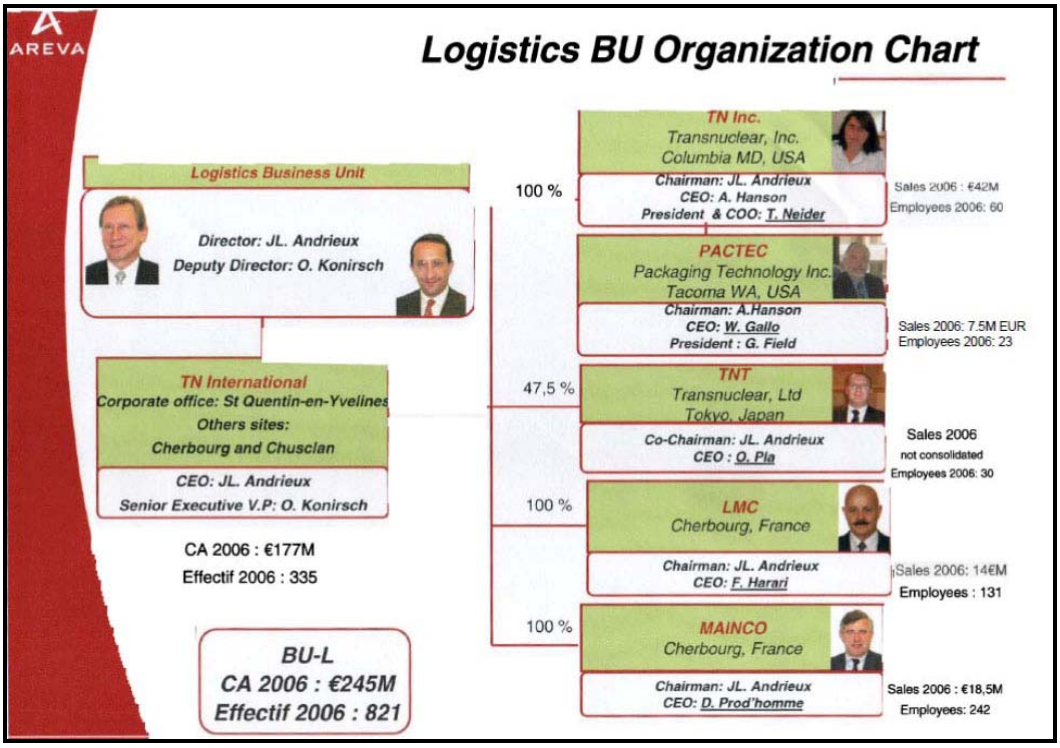


Figure 2 – AREVA Group – Divisions and Business Units

Figure 3 – Logistics Business Unit Organization Chart



Question: Within the logistics operation, please briefly describe the roles and responsibilities of sub-functions such as: transportation operations, maintenance, communications, public information, security, safety and emergency response, planning, shipper interactions, quality assurance, and any other business elements.

Response: All these functions are shown on the BU-L organizational chart. The organizational structure has changed over the 25 years that shipments have been conducted. Merging the COGEMA Transport and Transnucléaire activities into the COGEMA Logistics organization in 2002 also affected the organizational structure. In 2006, the COGEMA trade name became AREVA NC, and the COGEMA Logistics trade name became TN International. TN International is the operating arm of the BU-L of AREVA. The management and organizational approaches to developing the transportation infrastructure were different than the approach being used to operate that infrastructure. A similar transition is expected for developing and operating the OLM logistics system. Security response for these shipments is provided by the national police and gendarmerie, but security escorts do not travel with the shipments. AREVA is ISO 9000 certified and the management team has instilled the necessary quality ethic within the workforce to maintain that certification. One notable characteristic of the BU-L is that their budget is based on sales of products and services to other business units, not on corporate funding of logistics capability.

Question: How does the logistics function integrate its efforts with the rest of the company? Does AREVA use specific enterprise software tools, and what has the experience been like?

Response: AREVA is organized around divisions that address specific aspects of the nuclear fuel cycle. For example, the "Front End" Division focuses on mining uranium ore, chemically refining it, enriching it and fabricating new fuel. Transportation and packaging services are provided by the BU-L in the "Back End" Division, along with treatment, recycling and environmental clean-up business activities. The chart showing the AREVA Divisions and related business units is attached as Figure 2. The BU-L does not have a corporate budget. Funding for logistics activities comes from that business unit selling products and services to the other business units and divisions within AREVA, and to outside customers. As a result, the BU-L must be efficient so it can offer its services competitively.

BU-L has developed proprietary software for tracking the maintenance status of casks and rail cars, and for managing the activities required for conducting successful, efficient shipments. The cask inventory is managed to ensure services can be provided to meet customers' (other business units) needs, while not creating excess inventory and overhead costs. That said, BU-L is not optimized around minimizing transportation capital investments. BU-L is organized around successfully providing seamless services to other business units. Since the shipment workload peaks in the winter months, the number of casks, rail cars and heavy haul transporters is adjusted to meet these peak operations periods, not to maintain a level workload throughout the year. Only 59% of the Back End Division's revenues come from domestic work activities. Jean-Luc Andrieux is head of BU-L, and Olivier Konirsch is his deputy.

BU-L uses proprietary workflow software (Workflow OTN) to begin aligning cask and rolling stock assets with transport schedules 2-5 years in advance of the shipments. Fuel assembly data (manufacturing and burn-up history data) is added to the shipment plans one year in advance of the shipments. The workflow software prepares the optimized cask loading plans three months in advance of the shipment and prepares contractual paperwork for railroads and trucking companies and places these details into a three month rolling transport operations schedule. Three weeks before the shipment, the software prompts the official shipment notifications and logs shipment authorization. Shipment of the empty cask is prompted at this time and approximately 100 characteristics of the shipment are

prompted for entry to manage the shipment preparation process.

Question: What measures does the AREVA transport/logistics organization use to ensure regulations are met, customers are satisfied, and policies of AREVA and the Government of France are achieved? Which requirements have been most demanding or problematic in executing shipments and why?

Response: BU-L uses proprietary workflow software to plan for, organize and conduct its shipments safely, securely and compliantly. The approach being taken by OLM to identify each of the steps in the transportation workflow and the regulations that apply to that step is a precursor to this approach for successful management of shipments. The BU-L workflow software (Workflow OTN) is linked to long-range shipment plans, and prompts the BU-L's actions starting three months in advance of the shipments. Prompts and signoffs for over 100 characteristics related to each shipment are tracked by the software. These include checks of loading plans, asset availability, compliance documents, regulatory notifications and confirmations prior to starting the shipments. This approach to shipment management was transparent for the actions witnessed at the intermodal facility in Valognes. The receipt, surveying and transfer of a cask from the rail car to the heavy-haul truck trailer was handled as a routine process, and no lengthy review of operating checklists was evident at the worksite. The paperwork that accompanied the cask was checked carefully by the workers at Valognes and they entered the updated contamination survey data on this paperwork before removing the cask from the train, and after installation on the heavy-haul trailer. Processing the paperwork that followed the spent fuel was handled efficiently as an integral part of the work process.

Mr. Blachet indicated transition from project development to operations was a very lengthy and involved effort. He added that prior to processing actual spent fuel, extensive dry runs of the personnel and equipment were undertaken to remove any uncertainties and all unreliable process steps to ensure actual operations would be safe, secure and compliant. AREVA emphasized the importance of extensive operational acceptance testing under all potential operating conditions prior to accepting the facilities or equipment as ready for actual operations. It is clear this level of operational readiness testing played a key role in the current safe and efficient operations of the system. The fact that the hot cells at the La Hague plant have been operating for 25 years without requiring personnel access is a tribute to this approach to detailed system validation prior to acceptance for operations.

Question: OLM is putting a system of continuous improvement in place so that, even though initial shipments will be safe and secure, OLM is continually looking for ways to improve logistics operations. AREVA has a proven record of decades of safe shipments. How do you assess performance and drive improvements, if necessary?

Response: The management culture had to be oriented around defining success properly, and then acting on that definition. The focus is not on any specific process or program for improvements but on the suite of activities required for ISO 9000 and ISO 14000 certification. Management took a proactive stance early on to involve employees in the design of systems and operating procedures to ensure quality and operating goals were achieved. Continuous improvement was not an add-on after the plants and the transportation systems were operating. The concepts of continuous improvement are well understood, but getting the management team to implement them in practice is the real challenge. Setting appropriate performance expectations that accommodate the need for continually improving quality and safety as well as operational efficiency is one of the cornerstones of successful ISO 9000 certification, and is clearly imbedded in the AREVA management psyche.

4.2. SYSTEM OPERATIONS

At this time, OLM has four primary areas of interest regarding the operations of AREVA's transport/logistics systems – Safety and Security; Logistics; Maintenance; and Intermodal Operations.

4.2.1. SAFETY AND SECURITY

Question: Please briefly describe, without discussing sensitive issues, AREVA's transport/logistics safety and security programs. Have procedures changed as a result of the terrorist attacks in London and Madrid? Which functions are performed by Government entities and which (if any) by private firms?

Response: Physical security for fixed facilities has been expanded in recent years, but transportation operations for spent fuel are treated as routine hazardous material shipments. Armed escorts or armed guards are not dispatched with the shipments for reasons related to visibility. Security and operational considerations have dictated placing the rail cask cars in normal consists with other commodities rather than in dedicated trains. This is partly an artifact of the physical size of the country. France does not have vast, isolated areas (as in the U.S.) that would present significant time delays for security response. Security response is readily available from each of the prefectures through which the shipments travel. Similarly, there are no gaps in cell phone coverage in France, so there are no communications or tracking blind spots. The heavy haul shipments from Valognes to La Hague do have police escorts, but they are for traffic control, not for security. The police protection is a state service, and AREVA does not pay directly to any of the prefectures (similar to our counties) for that support. There is a general agreement between AREVA and the security forces that addresses the level of support needed depending on the type of material being transported. AREVA's BU-L manages almost all transportation services for shipments of materials from the Front End and Back End of the fuel cycle. That is a different approach than taken in the U.S. Tracking for all radioactive material shipments (Category I, II & III) is provided by the same Institut de Radioprotection et de Sûreté Nucléaire (IRSN) organization (technical advisory arm). A small number of people are directly involved in a rail-to-truck shipment transfer. Only four people were actively involved during the observed transfer at Valognes. The number of people involved in a sea to truck intermodal transfer is far greater. The French Navy provides security while the vessel is arriving and docking. This effort is well coordinated with the gendarmerie and the local police to address national and local security interests.

Question: How does AREVA communicate with police and other public safety officials when planning and conducting shipments? Please discuss the mechanisms AREVA employs in corresponding with local, Government of France, and other government officials before and during shipments.

Response: AREVA communicates its plans with the government's regulator, Autorité de Sûreté Nucléaire (ASN) and the regulator maintains interactions with the public. The regulator has a technical advisory arm, IRSN, and the security interface is maintained by IRSN. The proposed routes are submitted to the National Authorities for approval. That process is facilitated by IRSN. The ministries for Defense, for Industry and for Health and Safety are also involved. The Police Chief Superintendent from the Haut fonctionaire de Défense, the High Official for Defense, is assigned to the technical advisory arm of the government (IRSN) as a liaison to facilitate communications with security organizations. There is significant integration between departments within the French government despite the uncertainty about where some functions will be managed within the government structure being established by the newly elected French President.

Question: The U.S. DOE and other federal agencies have substantial existing emergency response capability. However, State, local, and Native American governments are highly involved in planning to respond to any accidents in transporting SNF. How does the National Government of France coordinate with local governments in emergency response planning and operations?

Response: The prefectures are the local government entities that manage the local police and the emergency response capabilities in the country. Prefectures are similar to U.S. counties in size, but have considerably more autonomy than counties in the U.S. AREVA does not coordinate directly with the prefectures. AREVA coordinates with the federal regulators that, in turn, coordinate with the prefectures. Shipment notifications are made three weeks in advance to the federal regulator, who then approves the routes and the shipments and notifies the prefectures. Management of emergency response is a federal responsibility, but in the case of an accident, the affected prefecture provides many of the response assets.

All emergency response for the country is coordinated through the Ministry of Industry through the Centre Opérationnel de Gestion Interministérielle des Crises (COGIC) Operations Center. Other Ministries are involved in response to defense and/or civil security issues, but all actions are coordinated by the Ministry of the Interior. Four operational and logistical support warehouses are located around the country to support national emergency responses to natural disasters and other disruptions to civil security or defense. The COGIC Operations Center also coordinates emergency response abroad for French protectorates and emergency response support for other countries. For radiation incidents at licensed facilities or for radioactive material transport incidents, the government's technical advisor, IRSN, also maintains an emergency response center. IRSN's Valérie Chambrette guided the tour of this exceptionally well organized center.

The physical layout of this center would be well worth considering when the OCRWM emergency response center is designed. The emergency response center has separate areas with duplicated analytical assets provided for conducting management, technical, and health and safety reviews of an incident. IRSN resources in the response center include on-line access to power plant operating parameters (temperatures, pressures, radiation levels and valve line-ups) as well as hard copies of safety analysis reports with accident scenario consequence assessments. Similar hard copy information was available for potential transportation accidents. During an incident, actual data from the scene would be used to update the consequence evaluations provided in the theoretical accident analyses in the center. Some of the "smart cask" data capabilities OLM is assessing would contribute to effective and appropriate response management from an OCRWM emergency response center. The roles and responsibilities for the tracking center and the emergency operations center will have to be well defined to preclude overlaps.

4.2.2. LOGISTICS

The following includes questions to collect information that will help OLM gauge how AREVA's experience is similar to or differs from operations anticipated for OLM's transportation/logistics.

Question: Within a typical calendar year, from how many different sites does AREVA ship SNF? Also, how many different sites does AREVA ship HLW to in a typical year?

Response: Fifty-eight power plants in France plus shipments to and from Switzerland, the Netherlands, Germany and Japan have been supported in the past. Currently, all SNF shipments from French utilities are reprocessed at La Hague. The plutonium and uranium oxides from reprocessing are shipped to the fuel manufacturing facility in the south of France. The "black rock" HLW, and the compressed fuel cladding hulls from French reactors, are stored in canisters at La Hague pending availability of a geologic repository in France. The utilities regardless of country retain title to the fuel and the waste. Every country is ultimately responsible for disposition of its own waste. Currently, there are no shipments to Germany or Japan, but Italy has just signed a reprocessing service contract. Transports of SNF from Italy and the Netherlands to La Hague are underway and transports of compacted/compressed wastes (hulls and end pieces) are under preparation to return all residues to their owners (in Germany, Switzerland, Belgium, and Japan).

Question: Within the past five years, from how many different sites has AREVA shipped spent fuel? From how many sites has HLW been shipped to during this same time period?

Response: There are 58 nuclear power plants in France that ship spent fuel to La Hague for reprocessing each year. Eight of these plants do not have rail access. These sites use heavy haul trailers to ship the spent fuel to a rail head for intermodal shipments to Valognes, and then shift back to heavy haul highway transport for the last leg of the journey to La Hague. In addition, France has shipped SNF from Japan, the Netherlands, Germany, Switzerland, and Italy. Foreign shipments are consolidated by the foreign government and have a single origin point for shipment to France.

Question: What is the typical number of cask loads of SNF shipped from a site in a single year?

Response: Approximately 200 shipments/year of SNF are made from reactors in France and around the world. Although shipments can take place at any time of year, the bulk of the shipments take place in the winter. France ships SNF after only 6 months of cooling, and most of the refueling outages are in the spring. About 3000 shipments of all materials are conducted by AREVA's BU-L each year. This includes all Front End and many of the Back End materials and waste. Currently, AREVA has excess transport and reprocessing capacity.

Question: Are the loaded spent fuel casks shipped one at a time or are several casks shipped in a single shipment? If several casks are often shipped in a single shipment, what is the typical number in a shipment?

Response: Casks are provided to the utilities as needed and loaded casks are typically shipped one at a time in common carriage (regular freight) shipments. The train stops at Valognes to allow the cask car to be separated from the train for transfer to the heavy haul trailers for the last leg of the journey to La Hague.

Question: Are shipments made in trains that are dedicated to the shipments or in trains that also transport other commodities? OLM would appreciate a discussion of your experience with the type of rail service (i.e. regularly-scheduled or special) that is normally provided for your shipments.

Response: AREVA ships SNF casks on "wagons" (cask on railcar) in common carriage combined with other cargoes. No escort travels with the shipment, and no special handling is afforded these rail cars. The casks are covered by a personnel barrier that provides sufficient stand-off distance from the cask body to prevent exposures above levels allowed for the general public.

Question: How is the schedule for a typical shipment affected by timetables or schedules for rail and, where applicable, intermodal transportation services? OLM is particularly interested in your experience in scheduling with a railroad to pick up shipments and the length of time that is required to conduct special operations such as intermodal transfers.

Response: The rail network in France is heavily used, and there is currently only one government-owned rail operator in the country. Trains run frequently from each of the regions of France where SNF originates. Since these shipments travel as regular freight in common carriage, scheduling shipments is not an issue. Intermodal transfers can be accomplished in about an hour per cask.

Question: OLM would also appreciate any general comments AREVA may offer regarding its considerations that affect decisions concerning how many loaded casks will be in a single shipment. OLM is interested in your comments on qualitative as well as quantitative considerations. These might include: the time needed by a nuclear plant to load casks; limitations on outbound and inbound queues; costs of transportation including costs associated with in-transit security; numbers of shipments that will be seen by the public; safety and security.

Response: The details surrounding turnaround times for loading and conducting a shipment are proprietary, but the whole process can be done in one month from dispatching the initial empty cask from La Hague to emptying the same cask back at La Hague. The process is structured to support customer needs, and there are variations in the timing, but typically, loading and transport operations involve a single cask traveling in common carriage trains carrying other commodities. No security escorts travel with the shipments, although police travel with the heavy haul shipments for traffic control. Incorporating loaded rail cars into regular consists is a regular industrial practice. The casks are covered by a personnel barrier, but the SNF rail cars are distinctive and no effort is made to obscure them.

4.2.3. OPERATIONS

OLM is also interested in your experiences in planning and conducting typical shipments. Specifically:

Question: How many casks does AREVA have in its cask fleet and how many of these are in regular use?

Response: For SNF transports from commercial nuclear reactors there are over 100 casks in the AREVA fleet (around 2209 active casks in existing TN International's fleet for all nuclear material transports), but the certificates have expired on most of these casks and AREVA is beginning its effort to deactivate and decontaminate the casks that are no longer usable. The active fleet consists of approximately 30 casks with multiple basket configurations to accommodate the various fuel types in use. If needed, TN International can have access to their SNF cask fleets; in particular, Commissariat a l'Energie Atomique and Pacific Nuclear Transport Limited fleets.

Question: How many empty casks are dispatched to the nuclear plant at a time?

Response: Typically one at a time per reactor but potentially many casks if there is many nuclear reactors at one nuclear site.

Question: Are casks dedicated for use to ship a particular type of spent fuel or to ship from a specific plant or do AREVA's casks and operations provide flexibility of use for shipments from any plant and for most spent fuel?

Response: AREVA's casks provide universal coverage for European and Japanese spent fuel by changing internal cask baskets. All operating French nuclear plants are pressurized water reactors and the fuel has a similar configuration from plant to plant.

Question: What are the performance characteristics of AREVA's spent fuel casks? Specifically, what are typical limits on the amount of heat that a cask can dissipate, the number of fuel assemblies it contains, and the maximum allowed temperature for spent fuel rods? How do the characteristics of casks that are used to ship mixed oxide (MOX) fuel differ from casks used to ship conventional spent fuel?

Response: France relies on MOX fuel for their operating plants, and is trending towards higher burn-up performance for its nuclear fuel. Current casks are designed for shipping 12-16 assemblies after only six months of cooling in spent fuel pools. This is a radically different approach to that being taken by the U.S., so the design specifics for French casks are not relevant to the U.S. experience. AREVA has the capability to design and construct casks for a wide range of fuel types, burn-ups, cooling times and regulatory requirements to meet specific customer needs. One notable aspect of the French casks observed is the size of the impact limiters. The diameter of the impact limiters is not significantly greater than that of the cask with its cooling fins. This makes for a very compact package that easily fits within the confines of the personnel barrier on the AREVA rail cars. Impact limiters designed for the Nuclear Regulatory Commission certified casks are considerably larger than the cask body which complicates the design of personnel barriers. This is a design area that OLM will explore in more detail.

Question: How many days in advance of the shipment are empty casks shipped to the nuclear plant?

Response: Approximately three weeks.

Question: How many days does it take to load and prepare one cask for shipment and then to release the shipment for transport?

Response: The complete turnaround time from empty cask to empty cask is approximately one month.

Question: How many days for each subsequent cask in a multi-cask shipment?

Response: Multi-cask shipments are the exception, not the rule. The typical shipment is one rail car in a regular freight consist with one cask.

Question: How many hours is a typical shipment in transit?

Response: With 58 power plants located as close as 25 kilometers and as far as 1000 kilometers from the reprocessing facility, the average distance, or average time in transit is not a meaningful statistic. The French railroad system is efficient and the shipments move across the country quickly, with no speed limitations imposed by the nature of the radioactive cargo.

Question: What is the typical distance shipments travel?

Response: Same as above. There is no "typical" distance. Shipments come to La Hague from as close as 25 kilometers, and from as far away as 1000 kilometers. The power plants in France are mostly located along river valleys, or on the coast, just as they are in the U.S.

Question: How much time does it take to receive the shipment, unload the casks at the destination facility, and return the casks so they are available for use in another shipment?

Response: Total turnaround time for a cask from storage, to shipment to the utility, to return to the reprocessing facility, to unloading and return to storage can be done in less than a month.

Question: Following unloading are casks reassembled and redeployed or are they routinely sent to the maintenance facility?

Response: The French SNF casks currently in use require routine maintenance after 15 uses. This typically occurs in less than a year. Maintenance is conducted early if necessary to make casks available for periods of heavy shipments. The baskets that allow the casks to be used for different size fuel assemblies are adjusted for each shipment and the baskets are placed in the casks in the cask maintenance facility. The cask maintenance facility is co-located with the reprocessing facility so casks are not transshipped for maintenance.

Question: How, and to what extent, does AREVA coordinate shipments to make the best use of transport equipment and staff? Is there specific trade-offs, or points in the transportation chain, where opportunities to save time and money are prevalent?

Response: AREVA's logistics organization is not required to provide training for emergency response along the transportation corridors, so the focus is purely on transportation logistics. The cask and rail car fleet is sized to support the peak level of shipments the customers (power plants) request during the year. Since the shipment of SNF is done in common carriage, the bulk of the shipment operation is not controlled by AREVA's BU-L. The main emphasis of BU-L is on compliance and quality activities associated with the shipment. BU-L does ensure that the cask loading plan is optimized, that all of the required transport permissions are obtained and that technical attributes of the shipments are well documented for use at the reprocessing facility. Contamination control for the shipment is also a major focus of the logistics service. The number of times the cask has to be handled is minimized within the constraints of the infrastructure. There are necessary intermodal shipments, from truck to rail, for power plants that do not have rail access, and for rail back to heavy-haul truck for the last leg of all shipments to La Hague. The activities at each interface point have been refined over the years to be as streamlined as possible.

Question: AREVA's transport experience is both long and exemplary; however, knowing what you know now, have there been initial practices or operations you would have done differently?

Response: The system has evolved over time as the utilities, the reprocessing facility and the regulations have changed. Each iteration of the logistics system design was appropriate for the work scope being executed at the time. When the system started operating 25 years ago, it would have been impossible to anticipate the details of the current asset structure. It is important to design a flexible logistics system that can adjust to customer requirements as they change over time.

4.2.4. MAINTENANCE

The following includes questions to help us to better understand the operational requirements for maintaining a fleet of shipping casks, transport vehicles, and associated equipment.

Question: How does AREVA maintain its cask fleet? Specifically, does the fleet size require AREVA to push schedules to ensure that casks are available as much as possible, or is the inventory sufficiently large to allow other things such as fuel receipt to drive schedules?

Response: BU-L assets are sized to support peak shipping demand that typically occurs during the winter months. At other times of the year, the assets are not as heavily utilized. The size of the customer base has also changed over time with increases and decreases in the number of foreign customers needing logistics and fuel reprocessing support. Currently, BU-L has some excess capacity, but that is a situation that is constantly in flux.

Question: How frequently are baskets or internal components removed from casks to facilitate periodic inspections or to make it easier to reduce the levels of residual contamination?

Response: Baskets are removed from the cask after each use and are stored separately, unless a campaign using the same cask/basket configuration is underway. Maintenance of casks takes place after 15 uses, or one year, whichever comes first.

Question: What measures does AREVA employ to limit the amount of reactor corrosion product contamination and other radioactive materials that may accumulate in the cavities of its spent fuel transport casks? Is this an issue of recurring importance between AREVA and nuclear plant operators? Of particular interest would be limits imposed on the amounts and types of internal contamination for casks that are delivered to reactor plants to be loaded. Has AREVA found that dry unloading of spent fuel casks increases or decreases the amount of cask internal residual contamination? Does wet unloading lead to increases or decreases in the amount of cask internal residual contamination?

Response: No special precautions are taken to minimize corrosion for transportation. Corrosion prevention is enough of a focus at the power plants that no additional preventive measures are necessary.

Question: OLM is aware that AREVA has a dedicated facility that it uses to maintain spent fuel casks. OLM would appreciate a brief general description of the facility including its size and the capabilities of major systems such as a pool (if applicable) and cranes. If possible, OLM would appreciate a discussion of the number of casks that are maintained annually in the facility, a general description of the types of maintenance that are done, and an estimate of the amount of low-level radioactive waste that is produced. OLM's safety engineers are also interested in estimates AREVA could provide of the annual collective radiation exposure to workers at an AREVA cask maintenance facility.

Response: The cask maintenance facility is part of the infrastructure at La Hague. This facility has bays for six casks in open bays, and three in hot cells. In addition, stands in the cask maintenance areas are available for adjusting the tensioners for cask baskets. One overhead crane provides all the lifting power for this facility. The facility is staffed by six people per shift and runs three shifts per day. AREVA has never had the condition of a spent fuel assembly change during transit. No assemblies have ever left the shipping site as undamaged and then arrived as damaged fuel. As a result, the casks have had no contamination problems coming out form damaged SNF during transport operations.

Question: How does AREVA maintain the transportation vehicle fleet? Are the vehicles maintained at an AREVA facility, or are railcars and trucks sent to other commercial facilities? If maintenance is done at commercial facilities, has it been necessary for AREVA to follow any special procedures before dispatching them to the maintenance shops?

Response: The vehicle maintenance is managed by a separate element of BU-L. This portion of the business unit is called LMC and is responsible for maintaining the legal weight tractors and trailers, the heavy haul tractors and trailers, and the rail cars. No special preparation for maintenance is necessary. The trailers are checked for any contamination during and after each use.

4.2.5. INTERMODAL OPERATIONS

Because OLM expects most shipments to the Yucca Mountain repository to require on-site (U.S. about 100%) and off-site (about 34%) intermodal transportation, OLM is very interested in AREVA's experience in this area.

Question: OLM is interested in advice AREVA can offer regarding how best to attach and secure a cask's transportation skid to a rail car or transporter and what other handling features should be included in the design of the skid.

Response: AREVA does not use a skid to transport the casks. Rather, AREVA uses stanchions that bolt to the truck trailer or rail bed. Since AREVA uses a number of different cask sizes for hauling various waste and material forms, there are multiple positions the stanchions can be arranged in. Each cask has color coded bolt holes for properly positioning the stanchions. Casks are lifted off of the stanchions horizontally for intermodal transfers, and are pivoted for vertical lifts when received at La Hague.

Question: OLM is also interested in whether in AREVA's experience, there are practical limits on the weight of loaded casks and other components associated with a shipment. Of particular interest to us are the reasons for any limits on weights and what these limits are. What has been AREVA's experience with limits that may apply to handling in facilities, over-the road movement, intermodal transfer, and rail transport?

Response: France allows higher unit loading on their roads than is permitted in the U.S. The cask sizes are both driven by weight limits and the nature of the fuel AREVA ships (high burn-up with short cool-down time) and by transport configurations for movement through the rail and highway system.

Question: Please describe special vehicles that AREVA uses to move heavy casks from railcars and over highways. OLM would like to understand the nature of any restrictions AREVA must meet to move heavy vehicles over roads.

Response: The heavy haul trailers used by AREVA are custom made units with 80 wheels arranged in 10 rows. Each row of eight wheels is divided into two groups of four wheels that pivot on a common vertical shaft to significantly increase maneuverability. To reduce the length of the vehicles, the wheels have a smaller diameter than normal truck wheels (approximately 14"). The overall length of the heavy haul trailer is approximately 19 meters (this compares to 21 meters for the rail cars). Standard heavy duty tractors are used to pull these trailers. Police escorts are used with these shipments for traffic control, but not for security. These trailers have a single traffic-lane width.

Question: Are there any special arrangements required for intermodal transfers of casks containing SNF, such as additional safety measures for lifting, enhanced security measures, or restrictions on where intermodal transfers can be conducted?

Response: There are no special restrictions on intermodal transfers other than ensuring that adequate crane capacity exists. There are eight power plants in France that do not have rail access. Heavy haul from these sites to a railhead is a standard part of transportation operations in France. These shipments are handled in a similar fashion to all other hazardous material shipments in terms of security. The International Atomic Energy Agency requirements for spent fuel shipments have been incorporated into the French Dangerous Goods Regulations for transport and that provides the framework for these shipments.

4.3. SUPPORT/CONTRACTOR SERVICES

The Department expects to enter into contracts with private companies for many of the services that will be used in transporting SNF and HLW to the Yucca Mountain repository. Examples of services that may be obtained from private companies include: transportation services provided by railroads, intermodal transportation companies, barge operators, and trucking companies; vehicle maintenance services; possibly cask servicing and maintenance; third-party logistics services; technical support services; security services; and possibly many others.

OLM is therefore interested in AREVA's experience and advice regarding transportation and logistics related services that it uses and that are provided by other companies to AREVA through contracts. Specific questions follow.

Question: In what areas of logistics (if any) has AREVA found benefit in using support contractors and services? If AREVA outsources some services, how did it make the decision to do so? What benefits has AREVA realized, and what problems have been encountered?

Response: AREVA is essentially a holding company for a suite of operating entities that are arranged in business units. All transportation support comes from these operating units which are a part of the AREVA brand. No outside companies are used. Each of the business units within AREVA contract with the other business and operating units for services, so when La Hague sells reprocessing services to a power plant, they contract with the logistics business unit for transportation services. The current transportation fleet is supported by revenues from sales of transportation services to other business units within AREVA and to outside companies. Transport and reprocessing services are sold in parallel to customers and depending on circumstances there is one contract for all services or two separated contracts.

Question: After contract award, what measures does AREVA use to measure each of the contractors' performance? Are there specific contract incentives to encourage or penalize good or bad performance?

Response: The internal arrangement is a fee for service and the performance indicator is whether the service was delivered as contracted. Each of the business units has their own financial imperatives for efficient performance to allow services to be offered at a competitive price point. The French government is considering the sale of a portion of its stock in AREVA. Uncertain profitability is a further driver for improving the performance of each of its business units, in addition to the expectations of their customers.

Question: What has AREVA's experience been in acquiring transportation/logistics equipment such as shipping casks and transport vehicles? One area where OLM has strong interest is that of lead times for acquiring equipment and the industrial capability to produce the equipment.

Response: AREVA has an organization within BU-L that designs, certifies and fabricates casks. Even with their in-house capabilities, AREVA places orders for cask fabrication three years in advance of the cask need, and allows 2-4 years for development and certification of a new cask design depending on the uniqueness of the cask. Lead times for truck and rail car assets are shorter, but still require three years to bring new designs into the fleet. Special testings are required of the new rail cars.

Question: How has AREVA controlled costs of services provided by outside companies, for example rail companies. Is the market for services competitive? If not, what factors have been most important in determining the costs of the services AREVA has acquired and how have these factors worked?

Response: N/A. All of the truck transportation logistics support comes from companies that are part of the AREVA family. There is only one national railroad in France, so there is no competition for rail services and no negotiation over the cost of shipments. There is an effort to privatize the French rail system, and some individuals in AREVA expressed interest in the potential benefits of competition in the future.

4.4. PUBLIC OUTREACH AND COMMUNICATIONS

OCRWM has an extensive program to educate the public in spent fuel transportation. More importantly, OCRWM relies on other involved organizations, such as State, Tribal and local police, government officials and emergency responders, to notify the public that they are involved in keeping shipments safe and secure, and that information about our program is accurate and credible. OLM would like to learn more about how AREVA interacts with members of the public, their representatives, public institutions, and other stakeholders whose concerns must be addressed to ensure event-free transportation of spent nuclear fuel. OLM's specific questions follow.

Question: Please discuss the objectives AREVA has established for interacting and communicating with members of the general public, public institutions, and other outside parties who are not directly involved in making shipments but who have interests or concerns about shipments of SNF. Specific audiences include community leaders, public safety officials who respond to transportation emergencies, and members of the general public.

Response: AREVA does not communicate with the general public. AREVA communicates primarily with the government who then interacts with the prefectures (like the counties in the U.S.) and with the general public. Considerable information is available about AREVA which is mainly focused on business related information, and TN International is specifically geared towards addressing public confidence in the safety and security of nuclear shipments (TN International's brochures are available upon demand). TN International has a special department in charge of Public Acceptance and Public Outreach, and numerous missions are carried out each year to address local commissions and public hearings, such as Commission locale d'information and Société Française d'Energie Nucléaire public commissions for instance. International missions are also realized to explain international transports around the nuclear fuel cycle to countries unfamiliar with nuclear, and these missions address concerns around nuclear transports close to coastal zones.

Question: How does AREVA determine which routes to use for shipments, and does the public have any role in identifying them. Do you find certain populations expressing a desire to avoid certain areas? What other organizations are involved in determining which routes are to be used?

Response: The routes are approved by federal authorities within ASN, but there is no public interaction over the route selection process. There are discussions with the National Railroad to identify the operational options for integrating an SNF cask car into existing shipments from the region where the reactor is located to the intermodal facility in Valognes. The operationally preferred route is then submitted to the authorities for formal approval.

Question: What kinds of advance notifications are made to public officials before shipments begin? Is there information about specific shipments that is released to the public, or protected because of security concerns?

Response: The planning process starts 2-5 years before the shipment. At this stage, the transportation inventory (casks and rolling stock) is assessed against the long range shipment plans and requests from the power plants. Investments to close any gaps in asset capability are made at this point. One year prior to the shipment, detailed campaign plans are developed with detailed information about the fuel assemblies to be shipped (manufacture, burn-up, cool-down etc.). Three months before the shipment, the contracts with the railroad are finalized, the optimized cask loading plans are developed, and the shipment details are loaded into a three month rolling schedule. Three weeks before the shipment, the workflow OTN software begins prompting completion of the automated shipment checklists. Notification of the proposed routes and confirmation of routing approvals are two of the checklist items that must be completed at this point. The federal authorities complete the notification process with the prefectures.

Question: How do you believe members of the public view the hazards (including terrorism) of shipping of SNF when compared to other societal hazards, including every-day hazards of transporting other hazardous materials?

Response: There was no public dialogue about the safety of spent fuel shipments. There was a lengthy public dialogue about France's options for electricity production back in the 1960s. At that time, France's coal reserves were depleted, their hydro capabilities had been fully developed and they had no oil or gas reserves. The country decided to embrace nuclear power at that time, and all of the issues associated with nuclear energy (like transportation and processing of waste) were accepted as a matter of course back then. There is increased interest in radiation safety in France, but no serious consideration of shifting to reliance on other base load electrical energy sources.

AREVA is aware that nuclear power, and all activities associated with it, is a target of concern by certain environmental activist groups. Although nuclear energy is relatively well-accepted by the French people, international antinuclear interest is keen—issues or problems identified in France could be extrapolated to other countries where support is less general.

Question: Do you have specific programs to provide information to schools, media, and communities to improve understanding of the technology and safety of transporting spent nuclear fuel? If so, OLM would appreciate a copy of any course materials you may have.

Response: Yes. Transports are part of information disclosed around the fuel cycle policy.

5.0 CONCLUSION

The impressions gained from observing AREVA BU-L's operations are as beneficial to OLM as the explicit answers provided by AREVA to the questions on the questionnaire. In an effort to more effectively convey this aspect of the benchmarking effort, Mr. Lanthrum held a series of information sessions at OCRWM offices in Washington, DC, and in Summerlin, NV. The lessons learned from the site visits and the questionnaire responses have implications for areas of OCRWM beyond logistics, particularly for Site Operations, Waste Acceptance and Emergency Operations/Security.

Key lessons learned in this benchmarking effort include:

- Integrating logistics support for all radioactive material shipments has management benefits that DOE should consider;
- Considerable time needs to be allocated to conduct extensive start-up and acceptance testing prior to initial operations with spent fuel;
- Logistics presence at loading sites is key to managing the quality of shipping package preparation;
- Appropriate application of decision making criteria should be the focus, not an effort to drive common solutions (Some logistics decisions in France are driven by conditions that are considerably different than the ones present in the U.S.); and
- Intermodal operations can be managed effectively, but even under the best circumstances, they have limited utility for long haul shipments.

6.0 RECOGNITION

There are many people to thank for the thorough briefings and tours. Table 1 represents some, but not all of the individuals that contributed time and effort to answer OLM's questions:

Table 1 – AREVA Logistics Business Unit Contact Information

Name, Title, Address & Contact Information	Name, Title, Address & Contact Information
Jean-Luc Andrieux Directeur BU Logistique Président Directeur Général TN International 1 rue des Hérons 78180 Montigny-le-Bretonneux 01 39 48 70 70 Phone 01 39 48 71 84 Fax Jean-luc.andrieux@areva.com	Olivier Konirsch Directeur Adjoint BU Logistique Directeur Général Adjoint TN International 1 rue des Hérons 78180 Montigny-le-Bretonneux 01 39 48 72 83 Phone 01 39 48 71 84 Fax Olivier.konirsch@areva.com
Laurent Blachet Business General Manager Americas, Canada, Northern Europe, Russia 1 rue des Hérons 78180 Montigny-le-Bretonneux 01 39 48 70 42 Phone laurent.blachet@areva.com	Eric Blanc Deputy Director Etablissement de la Hague F – 50444 Beaumont-Hague cedex 33 (0)2 33 02 64 01 (Phone)
Tarik Choho Senior Vice President – International BU Logistique 1 rue des Hérons 78180 Montigny-le-Bretonneux +33 1 39 48 72 98 Phone +33 6 08 69 72 53 Fax Tarik.choho@areva.com	Éric Guerel Adjoint Au Chef Du Département Exploitation Direction Ingénierie 1 rue des Hérons 78180 Montigny-le-Bretonneux 01 39 48 73 66 Phone 01 39 48 73 83 Fax Eric.guerel@areva.com
Fleur Cottet Chargée De Mission Relations Extérieures et Communication TN International 1 rue des Hérons 78180 Montigny-le-Bretonneux 01 39 48 70 79 Phone 01 39 48 70 48 Fax Fleur.cottel@areva.com	Daniel Chanson Operations, Safety and Security Manager Business Unit Logistique Senior Vice President Engineering & Transport TN International +33 1 39 48 73 10 Phone +33 1 39 48 73 16 Fax Daniel.chanson@areva.com
Pierre Malesys Deputy Director – Engineering Division Head of Safety and Security Department TN International 1 rue des Hérons 78180 Montigny-le-Bretonneux, France +33 01 39 48 74 95 Phone Pierre.malesys@areva.com	Valérie Chambrette IRSN - Chef de Bureau Bureau d'Exploitation du Centre Technique de Crise Direction de l'Environnement et de l'Intervention BP 17 – 92262 Fontenay-aux-Roses Cedex 01 58 35 70 71 Phone 01 46 54 39 89 Fax Valerie.chambrette@irsn.fr

Name, Title, Address & Contact Information	Name, Title, Address & Contact Information
Jean Jalouneix IRSN Deputy Director Nuclear Defence Expertise Division BP 17 – 92262 Fontenay-aux-Roses Cedex +33 01 58 35 91 06 Phone +33 01 58 35 89 20 Fax Jean.jalouneix@irsn.fr	Linda Nicolle Public Affairs & Communications Etablissement de La Hague, F - 50444 Beaumont Hague Cedex
Eric Plaisant Police Chief Superintendent Service of the High Official for Defense, Ministère de l'Économie Des Finances et de l'Industrie 20, avenue de Ségur 75353 Paris 07 SP – France +33 01 43 19 51 30 Phone +33 01 43 19 50 61 Fax Eric.plaisant@hfd.finances.gouv.fr	Bruno Héron Chargé de Mission Ministere de l'Interieur Bureau des Risques Majeurs Direction de la Défense et la Sécurité Nucléaire Place Beauvau 75800 Paris – 87095 Quai du Docteur Dervaux 92600 Asniéres/Seine 01 56 04 75 83 Phone 01 56 04 75 91 Fax Bruno.heron@interieur.gouv.fr

APPENDIX A

Images from Trip Visit

One of the cask rail cars. The side louvers allow cool air to enter the enclosure. Hot air is exhausted by natural circulation from the top of the enclosure.

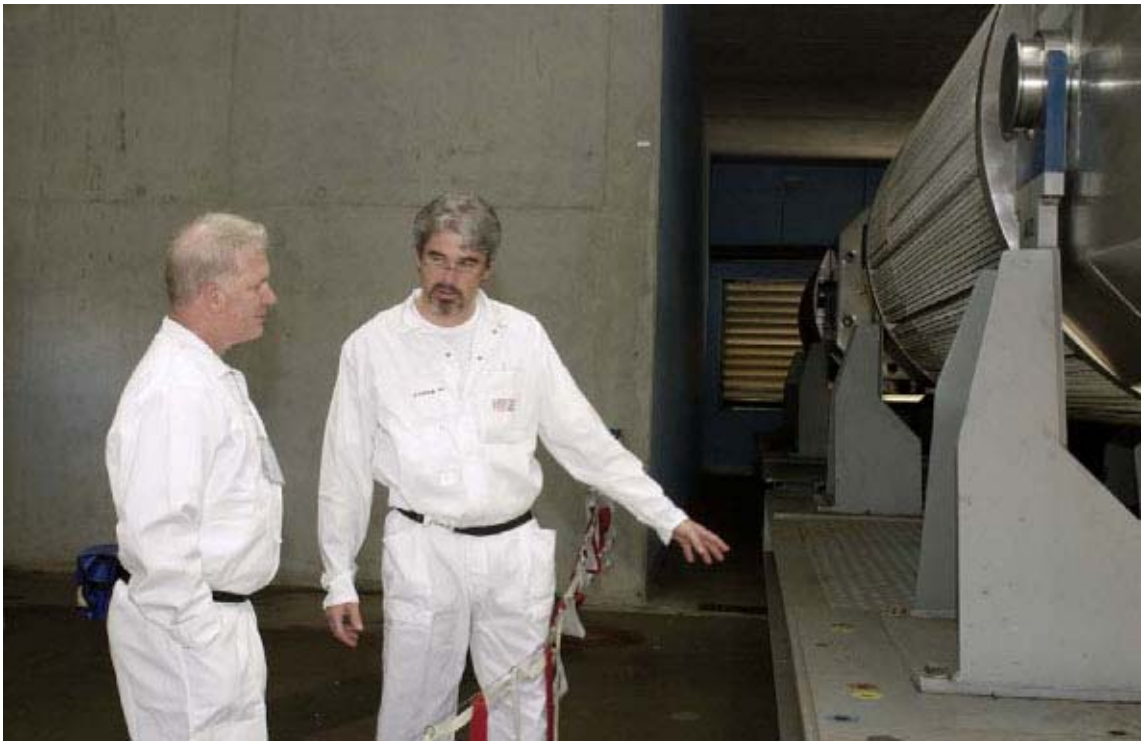
Arrival of the rail car in the intermodal transfer shed for cask removal. Contamination surveys are being conducted prior to cask removal for transfer to heavy haul trailer.

Lifting and rotating the cask from the rail car to the stand prior to loading on the heavy haul trailer.

This shows the cask being lowered onto the staging stand while the rail car is removed from the transfer shed and the heavy haul trailer is brought in. The square object at the end of the cask is the impact limiter. It has a significantly smaller diameter that the impact limiters used on the Nuclear Regulatory Commission certified cask despite the fact that the weight of this cask is comparable (~110 tons). The material of this impact limiter is soft wood with a stainless steel shell. The offloading operation took about 35 minutes.

This is the Heavy Haul Trailer used for shipping the SNF the final 30 kilometers from Valognes to La Hague.

Shifting the cask to the heavy haul trailer from the staging stand.



AREVA does not use skids to transport their casks; they use stanchions that are bolted to the rail and truck beds and to the staging frames. The stanchions have interchangeable jaws to accommodate various trunnion sizes. Color coded bolt holes allow alignment of the stanchions with a range of cask sizes.

This is an example of baskets for fresh MOX fuels that are used together with SNF cask bodies to transport fresh MOX fuels to Japan. The basket internals can be adjusted by several rows of tensioners placed around the circumference of the basket.

This is the control room where remote control of SNF removal from the transport cask is managed. The upper left monitor shows the grapple in the hot cell connected to a SNF assembly, ready for a lift. The SNF is removed from the transport cask, placed in a cooling tube to reduce the temperature of the assembly prior to loading into a rack for placement in the spent fuel pool. This transfer is done in air. The French have never received as assembly in a different condition than when it left the shipping site (no fuel damage during transport).

Office of Logistics Management
Office of Civilian Radioactive Waste Management
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If you have questions or comments regarding this report, please contact:
Alex W. Thrower, OLM/OCRWM, 202-586-7905, email: alexander.thrower@rw.doe.gov