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BENCHMARKING TRANSPORTATION LOGISTICS FOR EFFECTIVE SYSTEM PLANNING

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ABSTRACT

This paper presents preliminary findings of a benchmarking project by the U.S. Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) to identify best practices for logistics enterprises. The results will help OCRWM's Office of Logistics Management design and implement a system to move spent nuclear fuel and high-level radioactive waste to the proposed Monitored Geologic Repository located at Yucca Mountain, NV for disposal. An initial effort examined three Federal radioactive material logistics operations that are widely viewed to be successful: (1) the Waste Isolation Pilot Plant in Carlsbad, New Mexico; (2) the Naval Nuclear Propulsion Program; and (3) domestic and foreign research reactor spent nuclear fuel acceptance programs. More recently, OCRWM examined logistics operations of AREVA NC's Business Unit Logistics in France. A future phase will analyze specific domestic commercial campaigns and significant movements of non-radioactive hazardous materials. The report also suggests topics for additional study.

INTRODUCTION

The Office of Logistics Management (OLM) benchmarking project began in 2005, and is intended to identify, document, and better understand best practices for logistics enterprises. The results will help the Office of Civilian Radioactive Waste Management (OCRWM) design and implement a system to move spent nuclear fuel (SNF) and high-level radioactive waste (HLW) to the proposed repository at Yucca Mountain for disposal.

In 2006, the National Academy of Sciences (NAS) completed a detailed study performed by a multidisciplinary committee of experts on the transportation of SNF and HLW. The NAS study is a comprehensive assessment of SNF transportation and the logistics challenges OCRWM faces. The committee's final report, *Going the Distance? The Safe Transport of Spent Nuclear Fuel and*

High-Level Radioactive Waste in the United States, included a number of conclusions and recommendations, one of which stated: "[t]he committee strongly encourages the [OCRWM] program to seek expert advice (e.g., using consultants and expert advisory groups) to learn about and incorporate best industry practices for designing and operating this transportation system using an integrated systems approach." [i] OLM's benchmarking efforts represent an approach toward implementing the NAS recommendation.

The goal for OCRWM is to adopt best practices and create a "Best-in-Class" organization that adheres to internal and external goals, both through continuous process improvement and through an organizational culture committed to excellence. OLM's benchmarking report compared other organizations' processes and lessons learned with its own planned systems to identify critical process elements, plan approaches for achieving objectives, and identify similarities or differences that may affect implementation of logistics practices for OCRWM.

The project team looked at three Federal radioactive material logistics operations and an international commercial organization that are widely viewed to be successful: (1) the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico; (2) the Naval Nuclear Propulsion Program (NNPP), whose transportation office is located at the Pittsburgh Naval Reactors Office; (3) domestic and foreign research reactor (FRR) SNF acceptance programs, located at the Savannah River Site (SRS) in South Carolina and the Idaho National Laboratory (INL); and (4) AREVA NC's Business Unit Logistics (BU-L) in France.

REPORT METHODOLOGY

The benchmarking team followed an adapted best practices study format described by the General Accounting (now "Government Accountability") Office, entitled *Best Practices Methodology, A New Approach for Improving Government Operations*[ii] and the Department of Defense (DoD) report *How To Prepare For and Conduct a Benchmarking Project*.[iii] The team developed a process description and plan for implementing findings and obtained preliminary management support for the analytical approach. A questionnaire for interviewing best practice benchmarking organizations which was developed and sent prior to each site visit. The questions were intended to examine only specific logistics practices. The team then examined existing plans, studies and analyses.

Subject matter experts were identified to assist in research, analysis, and report development. The benchmarking team included individuals with first-hand experience in Federal spent fuel shipping campaigns and experts in logistics, stakeholder relations, and the OCRWM waste management system.

Benchmarking organizations were identified based on the following criteria:

- Federal organizations with operating, organizational, and financial structures similar to OCRWM;
- Experience transporting SNF or radioactive waste;
- A recognized record of safe transportation;
- Successful stakeholder relations; and
- Ongoing transportation activity.

Areas of Investigation

In conducting the benchmarking site visits, OLM sought answers that covered a range of transportation planning and execution activities. OLM focused on activities critical to the Program's mission success and can be incorporated into transportation planning and preparation in the near term. "Mission success" for this activity is defined as demonstration of national transportation system readiness. These transportation practices were examined in the context of broader supply chain/logistics functions.

For the three site visits with the Federal radioactive logistics organization, OLM focused on four business processes:

- *Transportation Business Model*: the core processes that drive success in moving nuclear waste from sites of origin to an interim storage or disposal site (for example, technology used or management organization);
- *Contract Management/Outsourcing*: the parts of the core business processes that have been successfully executed by contractors, and how excellent performance is ensured;
- *Stakeholder Relations*: how programs work effectively with external parties to prepare for and execute shipments; and
- *Continuity Planning*: how business practices are protected, and how they recover following system disruptions, whether natural or man-made.

OLM's site visit to AREVA NC was broader in scope. The purpose of the site visit to AREVA NC was to observe how world-class commercial radioactive materials logistics organizations manage their assets and conduct their operations. The site visit provided insight on key logistic operations which included procurement, maintenance and use of transportation hardware, the transportation planning and shipment approval process, safety and security, shipment tracking, and emergency response.

BENCHMARKING ORGANIZATIONS OVERVIEW

The functions of each of the logistics operations organizations analyzed are briefly described below.

Waste Isolation Pilot Plant

The WIPP Program transports transuranic (TRU) waste from various Department of Energy (DOE) sites across the nation to a repository in Carlsbad, New Mexico. The project is managed by the DOE Carlsbad Field Office (CBFO) and began operation in March 1999. All shipments are transported by truck and, as of October 1, 2007, the Program has conducted over 6,100 shipments, covering more than 7 million road miles. WIPP operations are overseen by the CBFO and its management and operating (M&O) contractor, Washington TRU Solutions (WTS). The CBFO Office of the National TRU Program is responsible for transportation program implementation, management, and assessment. The M&O contractor coordinates shipments with the generator/origin sites and controls the waste handling facilities at the repository.

Although all WIPP shipments are being made by truck while OCRWM will use mostly rail shipments, WIPP was selected for special focus as an OCRWM benchmarking partner because of similar program demands:

- The host state was recognized in authorizing legislation as having a significant participatory role in planning and oversight of the facility;
- Stakeholders in the cross-country shipments for WIPP were involved from the beginning phases of transportation planning;
- Material to be disposed of at WIPP require special packaging, transportation casks, and (depending on the material) remote handling or special security arrangements, much like SNF; and
- State regional groups and other stakeholders that interact with OCRWM on transportation issues have repeatedly identified WIPP as a model for stakeholder relations.

Naval Nuclear Propulsion Program

The NNPP, which has operated since the 1950s, provides cradle-to-grave nuclear fuel management for the U.S. Navy's nuclear-powered fleet. As part of this mission, NNPP is responsible for shipping SNF from nuclear-powered submarines and aircraft carriers refueled and defueled at naval and commercial shipyards to NNPP's Expended Core Facility (ECF). ECF is part of the NNPP's Naval Reactors Facility currently operated by Bechtel Bettis, Inc., at INL near Idaho Falls, Idaho. On average NNPP ships about 10 SNFl casks a year by rail on 3 to 4 trains. NNPP has a comparatively "flat" organization structure where the primary managers report directly to the program director. Some observations regarding NNPP's shipping program include the following:

- The number of shipments (casks) that NNPP executes (typically 10 or fewer annually) is significantly smaller than the expected number for OCRWM (possibly several hundred annually);
- All shipments for NNPP are done by rail, which will be the mode for most OCRWM shipments;
- NNPP shipments are classified national security shipments, limiting stakeholder communications, while most OCRWM shipments will have less restrictive security classification; and
- From the inception of the program until the mid-1990s, there was not a proactive SNF shipment outreach effort, but external stakeholder relations since that time have grown and are continuously advancing, as necessary.

Foreign Research Reactor SNF Acceptance Programs

The National Nuclear Security Administration (NNSA) is responsible for the FRR SNF Acceptance Program. The current Program was initiated in 1996 and as of July 2007 had completed 39 shipments, which includes 7,992 SNF assemblies. The FRR Program oversees the logistics of accepting spent fuel in foreign countries, and shipping fuel to the SRS in South Carolina. Depending on the country of origin, DOE may be the shipper of record or may assist the reactor's logistics agent in conducting the shipment as a Nuclear Regulatory Commission (NRC) licensee. Overseas shipments enter the U.S. primarily through the Naval Weapons

Station—Charleston, South Carolina. Most of the fuel is stored at SRS, but one fuel type - Training, Research, Isotope, General Atomics fuel - is transshipped from SRS to INL for storage. Shipments from SRS to INL are managed by a separate organization, DOE's Office of Environmental Management, using DOE's Office of Nuclear Energy staff resources at INL. Like the NNPP, the FRR program is a relatively "flat" organization from a management standpoint. The SRS and INL sites also accept SNF from domestic research reactors operated by universities and other government programs.

The FRR SNF Acceptance Program business model has useful similarities to OCRWM logistics planning, such as:

- Overland, FRR shipments are primarily by rail to SRS, but also include truck shipments to INL;
- Intense state and local interest (and litigation) shaped the Program's planning and regulatory framework;
- Acceptance of SNF involves complex international agreements, contract agreements, and cooperation with reactor sites operated by a broad variety of commercial or national entities;
- Loading and shipping activities are usually conducted by commercial logistics companies;
- Shipments are regulated by NRC and governed by internal DOE regulations; and
- Most FRR shipments are not "national security" shipments.

AREVA NC Business Unit Logistics

The AREVA family of companies provides storage and transport casks worldwide. The logistics arm of AREVA is a for-profit company that sells transportation hardware and logistics services to a broad client base. AREVA NC's BU-L has accomplished a large number of "hot" SNF shipments to date (involving fuel cooled at the reactor for about 6 months). AREVA NC transports approximately 200 SNF casks per year using both rail and heavy haul trailers. Shipments are made from 58 reactors to one central reprocessing facility in France. AREVA NC's logistics experience is directly applicable to OCRWM's logistics planning. Some observations regarding AREVA NC's shipping program include the following:

- AREVA NC does not communicate directly with the general public. AREVA NC communicates primarily with the French government, which then interacts with the prefectures (like the counties in the U.S.) and with the general public;
- 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, including the design, certification and fabrication of casks. No outside companies are used. Each of the business units within AREVA contract with the other business and operating units for service;
- The logistics organization is not required to provide training for emergency response along the transportation corridors;
- The typical shipment is one rail car in a regular freight consist with one cask;
- 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;

- AREVA NC's casks provide universal coverage for French SNF by changing the internal cask baskets. All operating French nuclear plants are pressurized water reactors and the fuel has a similar configuration from plant to plant;
- The heavy haul trailers used by AREVA NC are custom made; and
- There are required transshipments from truck to rail for power plants that do not have rail access, and for rail back to heavy-haul truck for all shipments to La Hague.

LOGISTICS PROCESS OVERVIEW

Transportation functions at benchmarking organizations are all viewed as part of a comprehensive transportation logistics enterprise and are not systematically separated from supporting equipment management, or from activities at the originating sites, the destination sites, transfer points or operations management centers. Figure 1 illustrates the planned OCRWM logistics function.

Figure 1: OCRWM Logistics Chain

COMMON ELEMENTS OF A RADIOACTIVE WASTE LOGISTICS ENTERPRISE

The elements of the logistics enterprise at radioactive waste management benchmarking organizations and at OCRWM are identified by common terminology, as described below.

Operations Planning

Operations planning includes development of a comprehensive system plan and protocols covering activities at origin and destination sites, routes, characterizing material to be shipped, regulatory requirements, equipment, vehicles, maintenance, and long-term scheduling. These comprehensive plans are updated regularly, from annually to every 3 years.

Each organization also develops plans for specific shipping campaigns. These plans focus on the regulatory certifications, procedural authorizations, stakeholder interactions, route confirmation, equipment and carrier availability, and site readiness required for safe completion of shipments. Plans may include very specific operational activities.

Waste Acceptance

Part of the logistics chain includes responsibility for contractual and regulatory compliance and Quality Assurance (QA) aspects of taking possession of SNF. Acceptance includes procedures to establish the characteristics of the radioactive material being received and its status in its container. Characterization is essential to compliance with technical packaging requirements, and to successful receipt of the material at the destination site.

Stakeholder Relations

Management of relationships with “stakeholders” is a primary component of operations safety, reliability, and gaining and maintaining public acceptance. Stakeholders include the state and local governments and tribes along potential shipping routes that provide essential police, emergency response, and road condition monitoring services. Planning, routing, notification, training and other operations involve stakeholders, carriers, and interest groups. Stakeholders also include public and nongovernmental organizations.

Equipment Management

In transportation logistics processes, critical components include shipping casks, cars or trailers for rail or highway shipping, cranes and other large-scale equipment at loading and unloading sites and ancillary equipment to manage cask operations. These items are expensive and customized to accommodate the very heavy weight, radiological protection, security, and multiple-use requirements of the system. Procurement and maintenance of these items is a driver of management processes and scheduling.

Maintenance of critical system equipment includes decontamination, repair, safety certification, and tracking. Equipment scheduling includes testing and inspections, maintenance and turnaround time. If equipment or maintenance facilities are not dedicated to the organization’s own transportation needs, availability involves working around the demands of other organizations. These issues affect the cost-benefit analyses for ownership or contracting for key system equipment.

Carriers

Carriers provide the trucks, ships, locomotives, and drivers or crews. Carrier management involves establishing a shipper/carrier business relationship with trucking companies, railroads, and ocean or barge carriers. These carriers may provide some of the critical equipment and may carry out safety procedures. Carriers inevitably form part of the system interface with regulators and stakeholders. Carriers may also form extended companies offering integrated logistics management, inventory warehousing, equipment, and equipment maintenance.

Site Management

Origin and destination sites have primary missions for which transportation of spent fuel or radioactive waste is a support function or an ancillary responsibility; however, preparation for and completion of SNF or HLW loading and unloading is a safety-related and resource-intensive activity. Regulatory compliance, contingency planning, scheduling, and transportation system interface require trained personnel who are part of the system logistics team. Either origin or destination sites may be command-and-control centers for the transportation logistics system.

Origin and Destination Sites

An originating site may be the location where SNF or HLW is generated, a place where it has been in storage, or a place where it has been unloaded for intermodal transfer. A destination site is the terminating site for a specific shipping campaign.

Tracking

A distinct component of transportation logistics is shipment tracking, including a feedback loop of information supporting site readiness and equipment management. For hazardous materials, this often includes real-time communications with carriers and sites.

RESULTS – BUSINESS MODEL AND ORGANIZATION

The project team attempted to identify common elements of the logistics organizations and, where appropriate, to recognize general management practices that appear relevant for OLM planning. The business model analysis suggests areas of common success and concern, both of which can provide insights for transportation planning and future studies.

Extend Logistics Teams to Include Origin and Destination Sites

The team identified the personnel and organizations that specifically carried out responsibilities for shipment of radioactive materials from an origin site to a destination site. The "logistics team" as described may include personnel from different programs or offices, but in successful logistics projects, the interfaces among different elements are reduced or eliminated - cooperation in logistics planning and operations is seamless.

The key functions of the logistics team, as a whole, are similar across organizations:

- Coordination with origin site preparations and loading;
- Scheduling;
- Acceptance at origin and destination site;
- Authorization to ship from origin site;
- Managing shipping through commercial carriers;
- Maintaining availability of casks and carriers (possibly through third-party vendor);
- Enroute tracking and communications;
- Security and emergency response;
- Coordination with unloading at destination site; and
- Stakeholder relations.

Logistics team interactions with origin and destination sites are critical to the ability to manage transportation logistics reliably. At sites where spent fuel loading or unloading is not the critical driver of the site's primary mission, there may be scheduling delays, or there may be difficulties meeting all the receiving sites' requirements.

Generally speaking, origin site logistics responsibilities for the programs examined include:

- Origin site preparations, including scheduling onsite equipment such as cranes;
- Waste characterization;
- Loading;
- Package characterization; and
- Providing information regarding need and appropriate time for pick-up.

These findings suggest OLM should focus on optimizing loading and unloading at sites, and not solely target improved transport times as the key driver for equipment inventory management. Having logistics presence at loading sites is key to managing the quality of shipping package preparation. Days or weeks might be saved in improved loading/unloading processes; considerably less time might be saved in expedited transport times. Benchmarking organizations recommended that OLM have good planning and design interfaces between logistics and the repository, and initiate and test detailed processes for scheduling and executing loading practices at different commercial reactor sites.

Build Multidisciplinary Matrix Teams

In all of the studied organizations, logistics are managed through matrix teams. The teams are usually small, including two to four primary managers who interact with sites, contractors, carriers, and stakeholders. The team members tend to be very close "hands-on" managers of the interfaces—these interactions are not delegated to site M&O contractors. Overall leadership of the team, and the degree to which the team leaders assume overall direction and control, varies among organizations studied. OLM was strongly encouraged to establish clear lines of authority and responsibility and to ensure that responsible managers partner and collaborate to optimize the entire spent fuel shipment transportation logistics network.

Keep Logistics Management Hands-On and Delegation Chains Short

Within the programs studied, overall management responsibility for logistics is generally delegated to a senior official who has hands-on responsibility for determining related design and interface requirements, overseeing loading and unloading at origin and destination sites, and managing shipping containers. This is because loading, unloading, equipment availability, and equipment turnaround times dominate the logistics system operating requirements. This person typically has some latitude to "speak for the program" on logistics matters. Thus, when problems arise and decisions need to be made, the organization can respond rapidly and effectively.

Day-to-day logistics operations are also a centralized leadership function, focused on shipment scheduling, arranging and monitoring transportation services, stakeholder relations, and shipment tracking. Execution of logistics requirements, set by logistics managers, at origin and destination sites, are local site functions. Other functions, such as regulatory compliance, security, and emergency response, require greater coordination at multiple levels and generally have greater headquarters involvement for federal organizations.

Extensively Pilot-Test and Refine Plans, Equipment and Operations

Every organization studied performs testing and inspections of its packaging, vehicles (trailers and rail cars), and response systems. The benchmarking organizations emphasized a commitment to hands-on equipment testing and inspection. WIPP recommended purchasing prototype canisters and vehicles early, then performing extensive testing, and accumulating operating experience over all types of road and railroad operating conditions. Additionally, the interfaces with the shippers or generator sites and the origin-to-destination logistics network should be tested. Testing is needed for procedures for operating new shipping equipment and for regulatory compliance, as well as for the equipment itself. WIPP also recommended that OCRWM consider planning extensive operational readiness reviews with utility sites.

In addition, WIPP recommended developing a demonstration program including prototype casks for stakeholder interactions, emergency response preparedness, public education, and testing. Aspects of testing could include:

- Adequately testing the equipment under routine and continuous operating conditions;
- Providing sufficient repetitions of waste verification and loading processes at the sites;
- Establishing notification procedures for an in-transit emergency, and the joint information center response; and
- Addressing the possible need to reverse shipments due to unexpected rejection of waste at repository.

AREVA NC recommended allotting considerable time to conduct extensive start-up and acceptance testing prior to initial operations with spent fuel. Specifically AREVA NC suggested performing dry runs with personnel and equipment to remove any uncertainties and unreliable process steps to ensure actual operations would be safe, secure, and compliant. AREVA NC emphasized the importance of extensive operational acceptance testing under all potential operating conditions prior to determining that facilities or equipment are ready for actual operations.

Develop and Manage to Comprehensive Transportation Plans

All successful programs developed detailed transportation plans and followed them. The plans themselves had intrinsic value in helping to focus discussions and negotiations between programs and stakeholders.

Integrate New Developments in Tracking and Emergency Technology

Benchmarking organizations suggested that technology developments have played a vital role in transportation management, as well as in continuity planning for waste shipments. These programs all monitor their respective shipments based on individual needs of the program, and provide planning information such as weather developments and forecasts.

The three Federal programs also use voice communications over common carrier systems for primary real-time contacts with stakeholders and carriers, including emergency notifications. Information regarding weather and road or rail conditions, needs for assistance, and potential or actual emergency events is primarily provided by shipment drivers or escorts and local or railroad police.

As for AREVA NC, the BU-L developed proprietary software for tracking the maintenance status of casks and rail cars, and for managing the activities required for conducting successful, efficient shipments. France does not have large, isolated geographical 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.

RESULTS – CONTRACT MANAGEMENT AND OUTSOURCING

OCRWM plans to use private industry to the fullest extent possible in transporting shipments to the proposed Yucca Mountain repository. Since some responsibilities remain primarily Federal, determining essential Federal activities is an important benchmarking objective. However, outsourcing of certain functions does not absolve Federal programs from performance accountability. Effective Federal logistics programs use performance requirements and evaluation tools for its contractors, which can also serve as benchmarking objectives.

Consider Federal Experience in Tailoring Outsourcing Strategies

In nuclear waste transportation by Federal agencies, as in other hazardous or heavy materials transportation industries, certain functions are commonly outsourced:

- Carrier services - carriers generally provide the shipping vehicle and drivers, but shipping programs often own customized equipment such as trailers and shipping containers;
- Manufacturing of shipping containers and ancillary equipment; and
- Shipment tracking information technology and services.

Functions that are not normally outsourced by the programs studied include:

- Responsibility for safety, security, and reliability of logistics system (compliance or execution activities are commonly outsourced, while oversight and performance accountability are Federal);
- Responsibility for design and performance requirements for mission-critical equipment and services;
- Primary interface of logistics with origin and destination sites, and for agreements and contracts;
- Primary Federal emergency response interface;
- Stakeholder relations: primary contact with Government or Tribal representatives (although many programs have extensive contractor support); and
- Authorizing initiation of shipment.

Maintain Strong Control of Mission-Critical Assets and Functions

Tendencies to outsource reflect the mission and structure of the organizations involved. When the Navy began its nuclear reactors program, it had to have absolute security and confidence in the quality and precision of its system components, procedures, and people, because of the key strategic role of the nuclear fleet in national defense. For this reason, the NNPP outsources comparatively few functions and services. On the other end of the spectrum, the FRR program is a decentralized organization with infrequent shipments and relies on commercial suppliers for most offsite activities and equipment. For mission-critical elements, FRR uses either in-house control or close contract management to prevent system disruptions. AREVA NC does not outsource any aspects of the transportation system. AREVA is essentially a holding company for a suite of operating units which are a part of the AREVA brand. Each of the business units within AREVA contracts with other business and operating units for services.

Mission-critical elements normally include:

- Shipping containers and related customized vehicles such as trailers;
- Equipment design, testing, and inspection;
- Equipment maintenance; and
- Carrier availability.

Organizations with closer control over casks and carriers have fewer difficulties with scheduling pick-ups and overall reliability. Control is increased through ownership, through vendor contracts with detailed performance specifications and evaluation, and through dedicated resources that are obtained through exclusive vendors. Control is reduced when carriers or casks are provided by subcontract through another logistics organization.

For mission-critical elements, the organizations studied trended toward having closer control over contracts, contract terms and performance; shorter or staggered contract periods; and closer relationships with contracting officers (onsite or part of program line management). Commercial SNF transport in the U.S. is a relatively low-demand, complex endeavor with high costs of entry and comparatively few participants. At WIPP, FRR, and NNPP, the Federal organization (not the site M&O contractor) deals directly with the entity providing the transportation. Federal contracting and traffic management specialists are key members of the logistics team. Dedicating casks, trailers, and vehicles to the logistics organization, and providing controlled maintenance through a consistent organization, contributes positively to equipment reliability, whether or not the equipment is owned or functions are outsourced. However, these desirable features also add to overall system cost.

WIPP and NNPP own their shipping containers and the customized trailers and railcars. WIPP contracts with the carriers to ensure trailers are maintained to a single, high-quality standard, which ensures interchangeability (i.e., a carrier cannot refuse to use a trailer because it isn't "theirs"). NNPP owns casks and rail cars that are managed and maintained as a single unit.

The FRR shipments are comparatively less frequent, and the overall schedule cannot always be predicted with certainty, which is part of the reason the Program contracts out most equipment and carrier services. Although the FRR program has avoided procurement costs related to seldom-used specialty equipment, the relatively small number of service providers, and the small global inventory of spent fuel shipping casks, together with low volume and low scheduling predictability, has resulted in high overhead costs. The current worldwide fleet of suitable casks is relatively small, and package availability is an important cost and schedule reliability factor. As mentioned, AREVA NC does not outsource any aspects of the transportation system.

RESULTS – STAKEHOLDER RELATIONS

The team looked closely at DOE programs which have adapted their communications processes to meet the needs of their stakeholders and the public. OCRWM's goal is to identify successful best practices of recognized top stakeholder communications programs and incorporate the best principles, techniques, and tools they use. The key objective is to establish a mutually beneficial relationship with stakeholders – particularly with state, tribal, and local governments – to advance reliable, safe operations. A foundation of these relationships is trust, which the benchmarked activities are intended to promote.

As each program's stakeholder processes have matured, activities and stakeholder interfaces have become routine, even with regard to rapidly changing issues such as security and contingency planning. Relatively good overall coordination has not, however, always been the case. At one time or another, each program experienced times when shipments were effectively halted due to opposition from a state, local, or tribal government. Stakeholder relations are not just an indication of functioning relationships among governments; poor relationships can have immediate and substantial costs.

Focus on Safety as the Basis for Relationships

The importance of external stakeholder relationships is illustrated by the evolution of NNPP stakeholder relations. Early on, NNPP conducted its national security shipments in accordance with all applicable Federal regulatory requirements but without the level of external stakeholder engagement it now practices. External stakeholder relations were developed to ensure continuation of operations after state and tribal government actions in Idaho halted shipments in the early/mid-1990s. Since then, this outreach effort has matured and enhanced NNPP's transportation operations, in large part by focusing stakeholder relationships on real, not perceived, safety issues. NNPP's current accident exercise program helps ensure that state, tribal, and local civilian emergency services organizations understand Navy spent fuel shipment operations, the low risk and extreme safety of the shipments, and how to effectively coordinate emergency response for a shipping accident.

DOE transportation organizations follow the Department of Homeland Security (DHS) and other Federal policies in recognizing local police and emergency services providers and State highway and transportation planning organizations as the first line of response for national security, natural emergencies, and highway safety. All Federal organizations studied devote substantial resources to maintaining effective interfaces with stakeholders, and support emergency response training and exercises.

Safety is also a key message for public communications. WIPP noted that public messages must be consistent, unified, and focused on partnering to make safe and uneventful shipments. WIPP works to ensure that DOE, contractors, drivers, and State and Tribal partners carry the same message and that the Program gives the partners all the information they need to understand how the safety partnership works.

Make Cooperative Shipment Planning the Rule, Not the Exception

Analysis of lessons learned reports from decades of radioactive waste shipments shows that stakeholder participation in shipment planning is one of the primary issues of concern to stakeholders, and establishes effective planning tools for operations. Each Federal organization studied involved stakeholders in development of some version of transportation planning.

WIPP representatives noted that years of intensive cooperation with stakeholders was instrumental in creating smooth operations from the beginning of WIPP shipments, and remain fundamental to current operations. One FRR official noted that while including stakeholders in operations planning can add time and resource requirements, one result is greatly increased confidence that any reasonably predictable contingency has been prepared for. Conversely, lack of involvement, and the resulting consequences, can be extremely expensive.

Build Relationships Using Training, Demonstrations, and Exercises

Of the practices and tools available to enhance stakeholder relationships, organizations studied agreed that transferring experience through training, technology and process demonstrations, and preparedness exercises are the most effective. Exercises also involve different levels of government who contribute their own perspectives and messages.

Emergency response training is a well established Federal activity that is supported through DHS, DOT, DOD, and DOE programs. A primary recommendation for training was to coordinate with existing Federal emergency response training to avoid inconsistency or duplication. DOE stakeholder programs have benefited from integration with WIPP programs. Over time, WIPP and other DOE programs, such as the Transportation Emergency Preparedness Program, have worked to make training content and delivery more consistent and, where appropriate, incorporate them into States' hazardous materials response training programs.

Benchmarking organizations recommend demonstration of equipment capabilities by doing "road shows," using an actual (unloaded) shipping cask to show stakeholders what the cask looks like and how it functions as a robust system. This helps communicate and reinforce the transportation safety message. In addition, accident exercises are another tool to inform stakeholders. These exercises have been well attended by representatives from State and local governments and emergency response organizations. The objectives are to familiarize attendees with the shipping cask characteristics and shipping practices, and allow evaluation of simulated accident responses by government agency representatives, and exercise accident communications links. A consistent stakeholder observation from these exercises has been the inherent safety of radioactive material/spent nuclear fuel transportation shipping casks. An understanding is gained that spent fuel transportation is not unusually risky and can be accomplished safely.

The benchmarking organizations suggested objectives for OCRWM to meet when performing demonstration projects which include:

- Demonstrate the operational readiness of the OCRWM procedures;
- Demonstrate the readiness of the carriers;
- Participate in readiness exercises with the States and Tribes;
- Verify the training of the State, Tribal, and local emergency responders; and
- Demonstrate to the elected officials and public the robustness of the system components.

Work through Well-Established Stakeholder Networks

Experience at DOE sites includes decades of interaction, negotiation, and sometimes litigation between Federal programs and governmental and nongovernmental organizations. Resulting written agreements and well-established professional relationships have formed the foundations of mutual understanding concerning hazardous, publicly sensitive, or changing facility functions. Spent fuel and nuclear waste shipping operations involving DOE sites recognize and rely on these established frameworks.

State regional groups have served various roles as critics, advisors, and communications centers for many Federal activities, and today they are a focal point of planning and communication for

WIPP, FRR, and NNPP shipping. DOE's Transportation External Coordination Working Group is cited as another major stakeholder outreach forum by all three Federal programs.

Lessons learned analyses from past shipping campaigns emphasize important roles played in stakeholder relations planning by electric utility organizations where spent fuel originates. The utilities have developed close local relationships in emergency planning, and close relationships with State, local, and Tribal governments.

Integrate Stakeholder Relations and Technical Operations

WIPP, FRR, and NNPP manage stakeholder relations through personnel who are engaged in the extended origin-to-receiver logistics network and who have training and experience in relevant technical operations. WIPP recommends training and updating stakeholder relations personnel in the technical execution of the Program to the extent needed to act as ambassadors and negotiators for the Program.

Manage Commitments to Planning Partners

Building strong working relationships with states and tribes ensures strong partnerships on agreements and commitments to make safe, secure shipments. The Federal shipping programs in this study emphasized the importance of accurately recording and tracking commitments so all participants remember them.

Although Federal funding is always subject to changes and uncertainty through the appropriations process, WIPP found it helpful to show states that the Program was committed to trying to provide stable funding from one year to another for preparedness programs. Fluctuations in funding can make it difficult for states to plan and prepare, and this can lead to delays in emergency preparedness.

RESULTS – CONTINUITY PLANNING

Continuity planning ensures that in the event of an emergency that impacts the system, normal business operations will be protected. Continuity planning is distinguished from vehicle-specific enroute emergency incidents and accidents. Emergencies might include hurricanes, tornados, power blackouts, and communications disruptions that affect operations service centers. DOE and DHS directives provide the foundation for continuity planning, and program-specific guidance has also been developed.

Integrate Back-up Plans and Communications

WIPP centralizes the primary communications center and support for the key logistics functions – TRANSCOM, vehicle and cask inspections, training - at the receiving site, because that is where the operations intersect.

Redundant systems for the TRANSCOM communications system, which is the primary tool for communications with vehicles and drivers, are at locations within 60 miles of the site. Additional back-up is provided through the satellite and communications systems of QUALCOMM© Inc., located in San Diego, California. QUALCOMM© maintains back-up systems for TRANSCOM at undisclosed locations in other parts of the country.

In the event the TRANSCOM equipment fails on the vehicle, drivers are to report the equipment problem via satellite or secure cellular telephone. The drivers are to report to the TRANSCOM Central Monitoring Room every 2 hours until the vehicle can be repaired or the equipment replaced. Specific procedures are described in the WIPP Transportation Plan and the Program Implementation Guide, and have been incorporated in carrier contracts by reference.

AREVA NC's BU-L 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.

CONCLUSIONS

Benchmarking and identifying best practices are process tools for continuous improvement. This is especially true in a field like logistics, where competition and technology innovations drive constant change. Many of the findings are activities that logistics teams should strive to incorporate into their planning efforts and their day-to-day work. The benchmarking team's research and analysis also resulted in some findings that could be implemented on a programmatic level in the near-term and could also inform future studies on best practices.

Suggested Next Steps for Additional/Expanded Analysis

- Compare a detailed checklist of benchmarked findings with current Program plans;
- Continue to benchmark domestic and international commercial radioactive operations;
- Compare Federal projects with commercial logistics trends and practices;
- Identify logistics enterprises unrelated to SNF transportation;
- Work with Federal benchmarked organizations to consider more detailed analysis of additional logistics components/factors, such as:
  - Load and shipment planning and dynamic routing and consolidation to optimize loading efficiency, asset utilization, and carrier availability;
  - Asset tracking, communications, and security network technology;
  - Onsite loading and unloading process improvement; and
  - Carrier, equipment management, and equipment maintenance contracting.
- Examine and recommend developing tailored outsourcing solutions where specialized markets or market limitations exist;
- Develop specific recommendations for OCRWM planning timelines based on experience in acquisition and operations;
- Develop and implement tools such as surveys to objectively measure public trust and confidence, and use them to assess current stakeholder involvement programs.

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