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ACHIEVING READINESS FOR THE LARGEST COMMERCIAL CROSS-COUNTRY SHIPMENT OF SPENT NUCLEAR FUEL IN THE U.S.

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ABSTRACT

The West Valley Demonstration Project (WVDP) is an environmental cleanup project at the site of the only commercial nuclear fuel reprocessing plant to have operated in the United States. Nuclear Fuel Services, Inc. halted reprocessing operations in 1972 and left 750 used commercial nuclear fuel assemblies (previously sent to the site for reprocessing) in the facility's fuel storage pool.

A total of 625 assemblies were returned to the utilities that owned them in the 1980s. This paper will discuss a significant two-year effort to ensure readiness and complete operations to load the remaining 125 spent fuel assemblies into specially designed casks for transportation from the WVDP to the Idaho National Engineering and Environmental Laboratory (INEEL).

INTRODUCTION

The U.S. Congress authorized DOE, in 1980, to conduct a demonstration of the solidification of liquid high-level radioactive waste remaining at the former reprocessing facility near West Valley, New York. The WVDP is being operated by the West Valley Nuclear Services Company (WVNSCO) for the DOE, who works in cooperation with the New York State Energy Research and Development Authority (NYSERDA), owner of the site.

Between 1983 and 1986, 625 of the used fuel assemblies were returned by truck to the utilities that owned them. DOE took title to the remaining 125 assemblies and, as part of an agreement between the state of Idaho and the U. S. Navy, prepared to ship the assemblies by rail to INEEL for storage in 2001.

Specific challenges were encountered and successfully met during the course of the spent fuel project related to readiness, operations, and engineering activities.

Readiness:

In order to prepare for all aspects of readiness, WVNSCO and DOE initially focused on assessing the operations group in the area of Conduct of Operations (Con Ops). This assessment reviewed

all main areas of Con Ops. Several key deficiencies were noted with logkeeping, labeling, required reading, and housekeeping.

Shortly after this assessment, the DOE-Ohio/West Valley Demonstration Project Office (OH/WVDP) also performed a Con Ops review of spent fuel shipping Operations personnel. Results of this review mirrored those of the WVNSCO Con Ops review and spent fuel shipping management formulated a corrective action list that addressed the deficient areas.

Because the Operations staff was a group of operators that had been recruited from other existing site operations groups to work on spent fuel shipping as a temporary assignment, and since the Fuel Receiving and Storage (FRS) Facility had not been the focus of attention for more than ten years, these Con Ops deficiencies were not unexpected. Both increased working presence in the FRS and a renewed training of Con Ops expectations with the Operations group were factors that would increase emphasis on spent fuel shipping Con Ops.

Initially, a major factor in maintaining safe operations was the resumption of periodic maintenance activities on all lifting equipment in the Fuel Receiving and Storage (FRS) facility. The bulk of the activities involved with spent fuel shipping operations involves use of one piece or another of this lifting equipment. When the preventive maintenance system of this equipment was reactivated, the equipment was inspected, routine maintenance was performed, and any necessary repairs were completed.

Operator safety was also a point of great emphasis, and a very successful safety record was achieved through a rigorous operator training program. The key to the training was the implementation of 43 different control manipulations, on-the-job training guides, and proficiency demonstrations into both operator and supervisor qualification standards, which needed to be completed as part of the qualification and certification process.

Although each of these proficiency demonstrations, control manipulations, and on-the-job training guides could be completed through either actually performing the evolution or simulating it, lessons learned from the WVNSCO Vitrification Operational Readiness Review (ORR) process dictated that actual performance of these training evolutions was the preferred alternative for a successful training program. By performing these evolutions, operators were able to practice each specific evolution and become more familiar and accomplished with each piece of equipment. Fuel assembly mock-ups that closely approximated each type of fuel assembly were especially helpful in familiarizing operators in the feel, weight, and grappling method for these fuel assemblies. All these evolutions, combined with effective classroom training sessions and numerous other shipping cask readiness evolutions, created a polished Operations crew.

Not only was this beneficial to Operations personnel, but also to the supporting staff as well. Key to this effort was the decision to demonstrate the entire shipping cask handling and fuel

loading evolution for several different readiness review teams. This was done just as it would be done during the actual fuel loading process, with around-the-clock operations consisting of full operations and support staff. These demonstrations included shift turnover meetings, full procedural adherence, actual cask dunking into the fuel pool, and loading of a mock-up fuel assembly into several different compartments of the cask. Upon completion of this, the casks were removed from the fuel pool, decontaminated externally, and placed back into their storage locations.

These actual demonstrations were especially beneficial in identifying any problems with procedures, equipment, and operator performance areas. Added benefits were obtained from having the operations and support staff working together on each shift. This helped create a unified team on each of the three respective shifts. This teamwork was particularly noteworthy to the DOE ORR Team during its on-site review.

Shift crews consisted of Operations personnel (3 operators and 1 supervisor), Quality Assurance and Radiation Protection support technicians (1 each), and Engineering support personnel (1 each). Additional support was available as needed on a call-in basis. These crew "teams" were able to efficiently perform spent fuel loading functions through their combined efforts and willingness to overcome obstacles, their attitude to take on any issues together, and their drive to get the job done, while keeping safety as their top priority. This team's work ethic was also evident in the amount of preparation that was put into self-study training efforts by each individual. Review teams' interviews with employees verified that all involved in this project wanted to put forth their best effort in helping achieve the number one priority for the WVDP site for FY2001.

Operations:

Spent Fuel Shipping Operations began October 2000. Staffing for such a short-term project was uncertain due to the number of unanswered questions that were encountered from the beginning:

1) How long would actual fuel loading take?
2) Were full load or half load shipments to be done, and if half loads, where would the staff go between loading periods?
3) How many operators were required?
4) Where would the operators come from?
5) How much training was required?
6) How extensive was the Readiness Review process?
7) How much "hands-on" practice was required?
8) How could we demonstrate dunking the cask in the pool while still maintaining an As Low As Reasonably Achievable (ALARA) approach to radiation work?

Many more similar questions also required answers, and it seemed as if loading the fuel would be an impossible task.

From the beginning, it was recognized by both WVNSCO and DOE-OH/WVDP personnel that any lessons learned from the Vitrification readiness efforts must be incorporated into the SFS Readiness Program for it to be successful. This was especially important in the area of training. Two of the most important lessons in the training arena were to: 1) Perform as many actual training evolutions as possible, rather then trying to simulate these efforts, and 2) Ensure that each employee's training records were thoroughly and properly documented to meet all of the requirements in DOE Order 5480.20A.

The training program materials were developed by WVNSCO personnel with the assistance of an independent consultant. This provided site-specific knowledge along with a broader-based background that proved especially helpful in the area of dealing with outside reviewers.

The course materials provided a history of spent fuel at the WVDP, the types of potential problems that could be encountered during fuel handling operations with both types of fuel and their respective casks, the different fuel handling and lifting devices (fuel grapples, the fuel hoist, the fuel canister crane, and the grapple, etc.), and the absorber rod installation details, among many other important facets of the project. Much of this material was covered by classroom-type training that was followed up by field verifications and activities involving topics that were covered earlier the same day. This type of hands-on activity proved to be extremely beneficial in the learning process.

The Operations staff was recruited from four other existing operations functions. A total of nine operators either volunteered or were selected, in accordance with an agreement between WVNSCO management and the local union. Although the four existing operations staffs would be shorthanded for the duration of the SFS Program, the overall impact on each department could still be managed with their remaining staff and overtime, as required. The agreement also stipulated that upon completion of the SFS Program, SFS Operations personnel would return to their original departments. By spreading the load across four departments and maintaining a short duration schedule, the SFS Department staffing was accomplished without increased staffing.

Personnel who were experienced in spent fuel shipping were not readily available at the WVDP because previous fuel shipping had ended in 1986; only one operator and one supervisor had any previous experience. However, these two individuals used this experience to help train the rest of the staff. Both were approved on-the-job (OJT)-qualified training instructors and both were very helpful in the performance of hands-on training evolutions which were used to assist in the training of the remaining staff. This experience provided enough initial assistance with the new personnel to keep them focused on the more important aspects of each evolution. This in turn enabled the training process to proceed at a pace fast enough to keep up with the scheduling

commitments that were necessary to meet the internal and external review dates, while still being completed efficiently. Training also ended up being a team effort, and its success was due in large part to this team work ethic.

Engineering:

Initial planning for the WVDP to INEEL spent fuel shipment was based on two individual rail shipments, each of which would contain both spent fuel shipping casks loaded to half their capacity. The first shipment was to be off-loaded at INEEL in Idaho and the fuel stored there until the shipping casks were transported back to the WVDP, where both casks would be loaded with the second half of their respective fuel assemblies. Then they were to be transported by rail back to Idaho where the first shipment of fuel would be loaded back into the casks. The fully loaded casks would then be ready for dry cask storage.

This effort of two half-loaded shipments would be costly, labor intensive, and time consuming for work forces located on opposite ends of the country; however, the Nuclear Regulatory Commission (NRC), at that time, was not yet convinced that the borated stainless steel plate assemblies, which comprised each cask compartment (in which the fuel assemblies were to be loaded), would be strong enough to withstand the stresses of full-load shipments.

Because the borated stainless steel, which the cask compartment plates were manufactured from, was not a recognized American Society of Testing Materials (ASTM) metal at the time they were made, justification to use these plates for full-load shipments was not easy. Some testing was required to assist in defending these plates to be as good as the ASTM-recognized borated stainless steel version. SFS Engineering helped prove, with some initial plate tests, that the non-ASTM-recognized plates were as good as the ASTM-recognized borated stainless steel plates. Although NRC was in agreement with this, they had to be sure that all the existing plates within each cask were free from tear-type defects that could potentially occur to this metal during fabrication. WVNSCO Engineering agreed to perform testing on a representative sample of the plates and the NRC used a statistical sampling analysis to prove that all the plates were tear-free. This statistical sampling was an alternative to sampling and analyzing each and every cask compartment plate. This would have been a much more expensive and labor-intensive undertaking; however, it was the most sure-fire method to prove that these plates were not damaged in any way. Getting the NRC to accept the use of statistical sampling was an important engineering achievement.

Following field inspection testing and application of the statistical analysis, the full-load shipments were approved by the NRC. This greatly reduced the shipment costs to Idaho and the additional Idaho operational handling costs required to unload the first shipment of fuel and then to reload the fuel upon the second shipment's arrival.

Another significant obstacle that was overcome was the recovery effort that took place upon the breakdown of the 100-ton crane, which is used for cask lifting operations. In early 2000, this crane was upgraded to be capable of handling up to eight pre-engineered lifts of approximately 104 tons. The upgrades included the replacement of several gear assemblies. The crane was load-tested and put into service in the spring of 2000. In December 2000, during a cask lifting evolution, the crane failed. No injuries or equipment damage resulted, but the crane needed repairs to the internal gear, drive shaft components, and related bearing assemblies. Damage was too extensive to repair the existing components and replacement parts were long lead-time items. With the December holidays also in this schedule, the manufacturing of these components would be even further delayed.

WVNSCO Purchasing stepped in and with some excellent support from a crane vendor, WVNSCO Engineering, and WVNS Quality Assurance repairs were accomplished in less than one week, being completing just prior to the December holidays.

WVNSCO Engineering, Operations, and Maintenance personnel then worked together with the crane vendor to complete reassembly and load testing before year-end. This enabled the DOE to maintain their scheduled ORR assessment in mid-January 2001. Only through the efforts of the WVNSCO and vendor personnel, which included working many additional hours, including weekends and holidays, was this crane rebuild accomplished with no overall schedule impacts.

WVNSCO Engineering was also the lead group in the effort to revise or develop Standard Operating Procedures (SOPs) for the spent fuel loading and associated supporting work required for the fuel loading effort. The revision of existing SOPs, which had not been used in almost 15 years, was no easy task. These SOPs were in need of some major revision due to the fact that most of them had not been used previously.

Interactive review sessions were held in which the procedures were reviewed by the Operations and supporting staffs. Changes were made to comply with updated safety, radworker, and procedural use requirements. Then the procedures were further revised to ensure they could be used as written. Lastly, interactive walkdowns with all the same work groups were performed to ensure that each procedure would work as written.

These procedures, which were previously thought to be the weakest link in the Spent Fuel Shipping Readiness Program, turned out to be more than adequate for their intended use, thanks to the hard work and involvement of all those affected by SFS Engineering.

SFS Engineering was also instrumental in integrating the technical support (SFS Engineering) group, the Operations Group, and the other main support groups (Rad Protection and Quality Assurance) to work as a unified team. This was evidenced during the fuel loading process in which both casks were loaded within a three-week period. All the groups functioned as one unified group during this process to achieve the goal of safely loading all the spent fuel into the

shipping casks. Clear communications of objectives was an integral part of this team unification process and DOE, as well as WVNSCO, was instrumental in the process of educating the entire site to support the top priority for FY2001: loading the spent nuclear fuel assemblies into the casks and staging the casks for shipment.

The end result of all this detailed planning, preparation, and communication was the safe and successful loading of all 125 spent nuclear fuel assemblies into two specially designed shipping casks. These casks, which were also designed to be used as safe storage vessels, were then placed on rail cars in preparation for transport to INEEL in 2001.

Although this transport has been delayed, this project has been a success as noted by the integration of existing staffing resources, the development of a highly successful training program, the unification of several distinct and diverse work groups into one unified team, the successful completion of several different readiness audits, and the safe and expeditious fuel loading campaign.