Success Strategies Utilized for Development of Hanford's SNF Project Authorization Basis

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Background

The Department of Energy (DOE) Hanford Site, located north of Richland, Washington, has approximately 2,100 metric tons of spent nuclear fuel stored underwater in basins directly adjacent to the Columbia River. Continued long-term storage of this fuel in the current configuration provides high risk (i.e., proximity to the river, amount of fuel, condition of the fuel, and aging storage facilities). The Spent Nuclear Fuel (SNF) Project was established to perform the task of moving the fuel away from the Columbia River, processing it, and providing safe interim storage until a final disposal option is chosen. The process involves three basic steps; 1) cleaning and loading of the spent fuel into a canister and the transport cask underwater in the K Basins; 2) removal of the cask from the basin and transportation to a new facility, the Cold Vacuum Drying (CVD) Facility, where the water is drained from the cask and canister and the canister is vacuum dried; and 3) transport to another new facility, the Canister Storage Building (CSB), where the canisters are removed from the shipping cask and placed in an underground concrete vault for interim storage (40 years).

The spent nuclear fuel is currently stored in two large underwater basins adjacent to the K West Reactor and the K East Reactor. The design of these reactors and basins is 1950's era. The reactors have been shutdown since the early '70's but the basins, however, continue to be used to store spent nuclear fuel from the N Reactor and a small amount of single pass reactor fuel. The N Reactor is also located at the Hanford Site several miles away from the K Reactors. The N Reactor discontinued operations in the mid 1980's. Continued storage of the fuel at the K Basin presents an unacceptable long-term risk to the public due to its proximity to the Columbia River, the deteriorating condition of the fuel and the age of the basins. The basins are constructed of concrete without liners, although the K East basin has an epoxy coating. Since the K Basins are operating facilities, a Safety Analysis Report (SAR) and Technical Safety Requirements (TSR) exist for the storage functions of the basin. The SAR and TSR required updating to include the new facilities for fuel handling, fuel cleaning, and loading into the multi-canister overpacks (MCO) and transport cask. Safety Analysis Documents (SADs) were developed and approved by DOE to authorize construction and installation of the new facilities in the K Basins. The K Basin SAR was updated in two phases. The first authorized hot testing of the Fuel Retrieval System (FRS) and the Integrated Water Treatment System (IWTS). The second authorized all additional testing and full operation of the new facilities including the Cask Loadout System (CLS).

After the MCO and cask are loaded, the cask is transported by tractor-trailer to the new CVD Facility. This facility is located ~500 yards from the K West reactor. The tractor-trailer with the cask is backed into one of four bays where the drain rigs and drying apparatus are connected. The cask and MCO remain on the trailer during all operations at CVD Facility. The basin water is drained from the cask and MCO and ultimately pumped to a tanker truck for transport back to the K Basins. After draining is completed, the MCO is vacuum dried to predetermined criteria and the MCO is backpurged with pure helium and sealed.

The CVD Facility is a green field facility with no existing SAR. The SAR was developed in phases to allow determination of equipment classification and authorize construction. The Final Safety Analysis Report (FSAR) and TSRs have now been completed for the CVD Facility.

Once the drying operation is completed, the MCO and cask are transported to another green field facility, the CSB, where the MCO and cask are removed from the trailer using an overhead crane and placed in an underground pit. The CSB is ~8 miles from the CVD Facility and located on the Hanford plateau. A specially designed shielded machine, the MCO Handling Machine (MHM), then retrieves the MCO from the cask, transports it to the weld station where the cap is welded onto the MCO, then places the MCO into a storage tube in the underground vault. The MCOs will remain in the storage tubes until a more permanent storage location is approved. The ultimate storage location is planned for the national repository at Yucca Mountain, Nevada. As was the case with CVD Facility, the CSB SAR was developed in phases. The FSAR has been approved for operation of the CSB facility.

The MCO is a 304L stainless steel ASME stamped vessel, 13.77 ft long and 2 ft in diameter. The shell is ½ inch thick with a shielded plug on top. The MCO contains up to six baskets stacked on top of each other that contain the spent nuclear fuel. The safety analyses associated with the MCO are not contained in any of the facility safety analysis reports. A topical report was completed which describes these analyses and will be included as part of the authorization basis.

In addition to all of the safety documents described above, the generic or programmatic requirements are described in the Project SAR. The facility SARs refer to the Project SAR for programs and details common to all SNF Project facilities. The Project SAR has been approved for facility operation.

Transportation along site roads is also not covered by the facility FSARs. A SAR for Packaging (SARP) was developed to authorize shipment between the facilities.

As is evidenced by the large number of interacting safety documents, development and approval of these documents provided many unique challenges. The SNF Project is scheduled to begin removal of spent nuclear fuel from the K Basins by the end of November 2000. A Tri-Party agreement has been signed between the DOE, the State of Washington, and the Environmental Protection Agency that targets this date. The schedule pressure to develop the safety documents to support the down stream implementation activities and operational readiness reviews was substantial. The purpose of this paper is to describe some of the innovative methods used, and to convey lessons learned from this process that can be applied at other facilities and sites.

Problem Description

This paper will focus on activities after the development of the Phased SARs. In the spring of 1999, a number of problems were perceived to exist in the development of safety documents at SNF Project. Many of these perceptions were shared by the DOE customer as well as the SNF Project management.

These problems are summarized as follows:

- Meeting schedule commitments
- Overall quality of the documents
- Consistency among the documents
- DOE review and approval process

Solutions

The SNF Project management contracted a team of experts in development of safety documents to perform an assessment of the process at SNF Project and make recommendations for improvement. It must be noted here that improvements in some areas were already taking place and that the intent is to point out where improvements could be made and not to be a criticism of the previous management. Many of the recommendations from the team were adopted and proved successful. In addition to this team, management changes in the higher levels of DOE brought about a different approach, which focused on calculated risk management versus strict compliance to Orders. This contributed to the removal of many barriers to getting agreement on approaches to problem resolution. Each of the problems identified above will be addressed in detail in the following sections.

Meeting Schedule Commitments

Several improvements were implemented that focused on meeting schedule commitments and issue resolution. A War room was established and a manager designated to drive schedules and issues. A plan of the day (POD) was initiated with mandated attendance to maintain focus on schedules and highlight significant issues. Before any War room manager could establish schedule compliance, however, detailed, realistic schedules had to be developed. A knowledgeable, dedicated scheduler was brought in to work out detailed schedules with each of the facility SAR development leads and ownership of the schedules by these leads was emphasized. Once the detailed schedules were approved, these were tracked in the POD along with major issues. It became readily apparent that for the War room manager to be effective he must also have authority. The War room manager was designated as the Deputy Manager for Nuclear Safety with all of the SAR development leads reporting directly to him. Once the detailed schedules were developed, nearly all schedule milestones were met except those for where the basic assumptions on which the schedules were based changed, at which time, the schedules were rebaselined.

It was noted by the team of experts that the schedule logic for the SNF Project had all downstream implementation activities tied to DOE approval of the safety documents through issuance of Safety Evaluation Reports (SER). This unnecessarily placed SAR/TSR development on or near the critical path. When the detailed schedules were integrated into the overall project level 3 schedules these logic ties were changed to reflect transmittal of draft documents much earlier to the Procedures, Training, and Operations groups so that implementation activities could proceed. Throughout the final safety document development process, these groups became an integral part of the effort so that they were aware of changes as they were made and were part of the development of strategies.

Document Quality

Improvements in this area centered primarily on the willingness from the management that the documents would not be submitted until the required quality was in place. This was demonstrated in a few cases where schedules slipped until the quality checks could be completed. Quality checks were instituted that included several knowledgeable people reading the entire document prior to submittal, emphasis on chapter author reviews (example, the author of chapter 3 would be required to read the other chapters), and providing sufficient time in schedules for technical editing and word processing.

Consistency Among Documents

For the most part, the SAR for each facility is a standalone document. The teams that developed the SARs had little interaction with teams from other facilities. The funding for SAR development at each facility was provided by the specific sub-project and, therefore, was under the control the Project Manager for that facility who was focused on getting his facility completed. The structure of the previous Nuclear Safety organization allowed this to happen. The resources for developing the safety documents were given to the leads who then had responsibility for developing each chapter. The organization structure was changed to establish functional managers for safety analysis and safety controls. Experienced personnel were brought in to lead these new groups. Their charter was to provide consistency among the facility safety documents and control the resources to meet the established priorities. The difference with this approach is that if the lead for development of the CSB, for example, needs work on chapter 3, then he/she would get the manager of the safety analysis group to provide the work. The safety analysis manager is then responsible for developing the chapter, not just supplying the resources. Since the safety analysis manager is now responsible for developing the same chapter for each facility, and in many cases, using the same resources, consistency is assured. Having each of the facility SAR development leads reporting directly to the War room manager also helps improve consistency.

DOE Review and Approval Process

DOE used a review team made up of subject matter experts from across the country to perform the reviews of the Phased SARs and TSRs and the initial submittal of the CSB and CVD SARs. The team was coordinated through the review team leader located at the Hanford site. The review team consisted of ~30 different reviewers. Also, a formal review comment record (RCR) process was used which generated records which had to be officially dispositioned. The overall process involved the following steps and approximate timeframes:

- Make copies and submit to team members 2 weeks
- Review period 6 weeks
- Review team meeting with SAR development team 1 week
- Issue final RCRs 2 weeks
- Disposition RCRs 8 weeks
- Revise SAR/TSR and resubmit 6 weeks
- DOE final review and issue SER 8 weeks

The durations above are approximations and was more or less depending upon the magnitude of the documents being reviewed.

The reviewers, many of whom were located in the Washington, DC area, were not dedicated to this task and, depending on their priorities could not commit to supporting the schedules outlined. Much difficulty was encountered resolving issues due to their unavailability. The team leader assisted as much as possible, but was limited in what he could do. The process outlined above does not indicate that in reality several iterations of this process were required to finally resolve comments. In many cases conflicting comments were received and proved especially difficult to resolve due to the various locales of the reviewers.

The above process does not lend itself to producing DOE approved safety documents in an expedited manner. In no way is this intended to be a criticism of the review team members or the review team leaders. The large majority of the comments received were valid and were incorporated and ultimately improved the overall quality of the documents. It is the process that is inefficient and which could not support the reviews and approvals needed to meet the fuel removal milestone in November 2000. A different approach to the DOE review and approval process had to be implemented.

In the spring of 1999, new DOE senior management was brought on board at the Hanford Site that supported new ways of resolving issues. The management directed that calculated risk management versus a strict compliance based approached be utilized where appropriate. This approach helped resolve some long-standing technical issues without increasing costs and extending schedules while maintaining the safety of the facilities. This new management team also supported a new approach to the DOE review and approval process.

A team of Senior DOE and contractor management was formed to monitor safety document development performance and to resolve issues when necessary. The team approved a new approach to the DOE review and approval process which included the selection of a dedicated, knowledgeable team of five reviewers (most of whom were local) that would perform parallel reviews of the documents as they were being completed. The reviewers worked in parallel with the development team. DOE comments were resolved and incorporated as the documents were written so that final submitted documents would already have DOE concurrence. This process was first used in the final development of the revision to the K Basin SAR and TSR that included the FRS and IWTS system. DOE issued an approved SER within three weeks of contractor submittal with no open issues. This was a schedule improvement of almost three months over the previous process. The process was also used successfully on the final revision of the K Basin SAR and TSR and on the final revision of the CSB SAR and TSR. A smaller team helped provide final resolution of DOE comments on the CVD SAR and TSR and the MCO Topical Report so that DOE could approve these documents without open issues. This same process was used on the final revision of the SARP and plans are to implement this strategy across the Hanford site. This is a true indication of the kind of success that can be achieved when the DOE and contractor work together to resolve issues.

Summary

The specific problem areas were discussed individually above, but in reality; some of the solutions helped resolve many of the different problems. It was clear that improvements to the safety document development process at the SNF Project at Hanford were necessary for the project to meet its schedule goals. Many people were involved in helping to make this a success story included the team in Nuclear Safety (many of whom have been involved for a number of years at the site), the contractors brought in to assist, the SNF Project management, and the DOE team. Hopefully, these lessons learned can be applied at other DOE sites as well as commercial sites.