EM-5.22 Lessons Learned Bulletin

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Fort St. Vrain Independent Spent Fuel Storage Installation Facility Improvement Project

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Statement:

The Fort St. Vrain Generating Station was the first and only nuclear power plant to operate in Colorado from 1979 to 1989. It was one of two high temperature gas cooled reactors to operate in the United States. Following the reactor shutdown, the plant was converted to a natural gas-powered electricity generating facility with a capacity of approximately 1000MW. When the nuclear plant was shutdown to be decommissioned, the spent nuclear fuel (SNL) was to be shipped to Idaho for disposal. Transfer to the INL had begun; however, this plan fell through, necessitating that an Independent Spent Fuel Storage Installation (ISFSI) facility be built to store the SNF. The SNF and the facility were transferred to the INL to honor commitments made to the utility in a contract by the Atomic Energy Commission prior to construction of the reactor.

The Fort St. Vrain Facility Improvements Project was approved as a DOE EM Capital Asset Project with a Total Project Cost of slightly below $12 Million. The project included infrastructure upgrades for the facility that was completed at the end of 2017. The project compiled lessons learned in five main categories: Contract Considerations, NRC Interactions, Contractor Interactions, Onsite Activities and Best Practices.

Discussion:

Background

The Fort St. Vrain High Temperature Gas Cooled Reactor (HTGR) plant, a one-of-a-kind, 330 MWe reactor owned by the Public Service Company of Colorado (PSCo), was shut down in 1989 after approximately ten years of commercial operation. The first step in the decommissioning process required disposition of the spent nuclear fuel. PSCo and the Department of Energy (DOE) had an agreement to ship the fuel to a location in Idaho. However, the Idaho governor objected to this arrangement, leaving PSCo with no choice but to construct an Independent Spent Fuel Storage Installation (ISFSI) facility. After loading the spent nuclear fuel into the ISFSI, decommissioning of the reactor was initiated and completed. Concurrently, the site was repowered using a natural gas combustion turbine to generate electricity. DOE and PSCo agreed that DOE would take title to the SNF in the ISFSI, and obtain a Nuclear Regulatory Commission (NRC) license to operate the facility. On 5 August 1997, the NRC determined that the plant site is available for "unrestricted use" and subsequently terminated the plants' reactor license. The license for the ISFSI was transferred to the DOE in 1999. Operations are currently being accomplished by a Maintenance and Operations (M&O) contractor.

Discussion

The ISFSI is a passively cooled, stand-alone facility that stores the hexagonal graphite fuel elements vertically in steel canisters. Each of the six vaults in the modular dry vault storage system contains 45 storage locations. Each storage location is closed by a removable shield plug allowing for easy access to load and eventually unload the SNF. The modular dry vault storage system is cooled by natural circulation. Cool air is drawn in from the outside, passes through each vault, is warmed and rises through the chimney structure for discharge into the environment. Since the air is never in contact with the fuel, only the outside of the storage containers the air remains free of any contamination.

The Facility Improvements Project involved providing upgrades to the ISFSI to provide assurance that the systems do not pose any unreasonable risk to the environment or to the public. The primary task of the project was to design and construct a Perimeter Intrusion Detection and Assessment System (PIDAS) around the ISFSI. In addition, other project scope included:

- Install a vehicle barrier system and vehicle gate,
- Redirect the access road,
- Construct two auxiliary buildings,
- Harden an existing building, and
- Upgrade the owner-controlled area boundary fence

The scope of the project was to design, procure, install, and test all system components. The project used commercially available, off-the-shelf technology.

Conclusion

This project was performed by hiring an Architect/Engineer (A/E) contractor who designed and planned the scope tasks, and then acted as the General Contractor to supervise the construction and upgrade of facility. The installation of new equipment and facility upgrades were performed under the requirements of the external oversight authority. The project was performed under an existing contract and used non-defense funding.

Numerous lessons learned for this project were developed and are published below.

Recommended Actions:

The project presents the following lessons learned in five categories: Contract Considerations, NRC Interactions, Contractor Interactions, Onsite Activities and Best Practices.

- Contract Considerations
    - Do not initiate construction projects while changing the Operations Contractor.
    - Because of the difficulty in obtaining non-defense funding, add 30% contingency to the estimated Total Project Cost (TPC) for the funding request. Utilize Monte Carlo risk analysis if practical.
    - Between cooperating offices within DOE, it is both permissible and easier, and therefore, preferable to use the Inter-Entity Work Order (IEWO) funding mechanism rather than a Fin Plan.
- NRC Interactions
    - Initiating a project under the external oversight of the NRC requires the Federal Project Director (FPD) to obtain the services of appropriate personnel with NRC operating and legal expertise.
    - The FPD should deputize a single point of contact for direct communications with the NRC.
    - For questions to the NRC, the FPD should expect responses to require a minimum period of ninety days.
    - While the NRC appeared to discourage informal contacts, increasing those contacts to improve the partnering and feedback opportunities could have reduced risk.
- Contractor Interactions
    - Should a design and construction contractor be utilized separately from the facility Operations Contractor, the FPD should deputize a Contractor Interface Manager with decision authority to manage inter-contractor relations.
    - The Operations Contractor should participate in all of the design review cycles and final design approval.
    - Review of final design should include a separate and complete review of project objectives and requirements. Requirements may be derived from both DOE and NRC drivers.
    - The Operations Contractor should routinely participate in planning sessions for onsite activities.
    - Ensure that the contract with the Operation Contractor adequately defines

responsibilities regarding training, receipt, maintenance and management of new equipment and facilities.
    - The FPD should deputize a Government Acceptance Testing (GAT) Director early in the project to participate in the development and review of the Integration Contractor's Test Plan.
    - Government Acceptance Testing (GAT) Team members should include subject matter experts (SME) from both the Integration and Operations Contractor. The establishment of the GAT Team would also define the roles and responsibilities.
    - Updating the Test Plan (and other turnover documents) with field changes as they occur would improve execution of turnover during GAT.
    - Better definition of the roles and responsibilities between the Integration and Operation Contractors would improve the process of GAT and project turnover.
- On Site Activities
    - For activities that necessitate the disabling of a security requirement, the FPD should plan for work arounds or compensatory measures that are ascertained to accomplish the security objective.
    - Routine operational activities (of the Operations Contractor) should be clearly defined prior with regard to project construction, installation, and testing activities (of the project Integration Contractor) to reduce conflicts and potential schedule impacts.
    - A cost-benefit analysis should be performed on the comparative value of utilizing:
        - A phased approach to construction and turnover of equipment, systems and facilities maintain electronic system capabilities during the project, or
        - Utilizing compensatory measures, or
        - Utilizing a construction free zone.
- Best Practices
    - The following practices are determined to have improved project outcomes during design and planning activities.
        - Preparation of the Test Plan prior to the 45% Design allowed stakeholders to be aware of how systems would be tested and understand the definition of "acceptable".
        - Preparation of the Cutover Plan with current stakeholder input and buy-in improved project outcomes.
        - Preparation of the Requirement Verification and Traceability Matrix (RVTM) provided a clear and concise capture of the applicable requirements and standardized references to design implementation (design report) and verification methods (Acceptance Test Plan).
        - Use of the Change Management System with Change Request forms and an associated Log to track changes provided a clear history of project scope, cost, and schedule decisions.
    - The following practices are determined to have improved project outcomes during construction and implementation activities.
        - The Integration Contractor utilized a Plan of the Day meeting to provide the Operations Contractor clear understanding of work and priority for guard support.
        - The Integration Contractor utilized a Weekly Schedule meeting to provide the Operations Contractor a firm schedule for the current week's activities and the proposed schedule for the following two weeks. This meeting highlighted time critical activities for operations support to be arranged ahead of time. This meeting consisted of select members of the Integrated Project Team (IPT) led by the Integration Contractor with participation of the Operations Contractor (management and site staff) and DOE-ID IPT members.

- The Integration Contractor involved the Operations Contractor in safety and procedure reviews for critical activities to ensure that site requirements were being met and to reduce risk.
- The Integration Contractor utilized a phased turnover of facilities, equipment, and capabilities to the Operations Contractor instead of a single turnover at project's end. This practice also included training. The result provided an extended burn in period for the facilities and equipment as well as on the job training to the Operations Contractor while the Integration Contractor was still on site.
- The Integration Contractor developed an appropriate oversite process for subcontractors during digging and trenching activities to prevent contact with marked utilities and enforce safety procedures documented contractually.
- The Integration Contractor developed an appropriate control of requests process for additional scope by the Operational Contractor thereby reducing confusion.
- The Integration Contractor developed a post acceptance Maintenance Work Order System for work required after installation and client (DOE) acceptance. This system included a log, and tracking capability for work proposed, performed and completed to resolution. The Integration Contractor also developed a nuisance alarm rate (NAR) and false alarm rate (FAR) log for tracking alarms and their resolution. These combined records were turned over to the Operations Contractor providing approximately eight months of system data and performance history.
- FPD designation of a GAT Director and Contractor Interface Manager improved the process of GAT and project turnover.
- DOE-ID designation of a Contractor Interface Manager improved onsite inter-contractor relations.

Critical Decision(s):	CD-0 to CD-4
Facility Type(s):	All
Work Functions(s):	Project/Program Management, Engineering, Contract Management, ESH&QA
Technical Discipline(s):	All

References:

1. Technologies for Gas Cooled Reactor Decommissioning, Fuel Storage and Waste Disposal, IAEA, Vienna, Fisher, M., Fort St. Vrain Decommissioning Project, Public Service Company of Colorado, Denver, CO, 1998.
2. Borst, T., Fort St. Vrain – A DOE Success Story, file:///C:/Users/Owner/Downloads/Fort%20St.%20Vrain--a%20DOE%20success%20story.%20-%20PubMed%20-%20NCBI%20(1).html, Health Physics, 2003.
3. Ramsey, Ronald O., Lessons Learned Report, Fort St. Vrain Independent Spent Fuel Storage Installation Facility Improvements Project (ID-0012.C) Rev 0., US DOE EM Idaho Cleanup Project, Idaho Operations Office, February 2018.