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Lessons Learned
Bulletin

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Lessons Learned on Waste Solidification Building Project Y473

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Statement:

For decades the Department of Energy has used waste processing and stabilization as part of its remediation practices. A new treatment facility at the Savanah River Site was constructed and achieved CD 4 in 2015. The mission of the Waste Solidification Building (WSB) is to process radioactive waste streams from the Mixed Oxide Fuel Fabrication Facility (MFFF) into the following two waste forms: (1) a waste form that is suitable for shipment and disposal as transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP), and (2) low-level waste (LLW) that is suitable for disposal at the Nevada National Security Site (NNSS). The WSB will be operational to support both the MFFF startup and operation.

Discussion:

The Waste Solidification Building (WSB) is a 33,000 square-foot facility located within the F Area at the Savannah River Site. This NNSA project will take the waste streams from the Mixed Oxide Fuel Fabrication Facility (MFFF) and process them into a transuranic (TRU) form and a low level waste (LLW) form. Both forms are cemented, using a newer process of in-drum paddle mixing, within 55 gallon drums and shipped to their final repositories. The National Nuclear Security Administration (NNSA) directed that the WSB be placed in a modified lay-up mode to provide sufficient maintenance and protection to the facility to minimize undue equipment degradation. Based on this direction, only those systems which are required to be operational were commissioned. Equipment testing was limited to that which was necessary to demonstrate the ability to operate habitability support systems during layup. The remaining systems were placed in layup consistent with the facility layup plan developed by engineering. At the conclusion of startup testing, the WSB completed a Readiness to Operate Assessment to verify that the WSB Project met the core requirements necessary to satisfy the DOE Order 413.3B, “Program and Project Management for the Acquisition of Capital Assets” in preparation for Critical Decision (CD) -4 approval.

The WSB Project (Y473) complied with American Society of Mechanical Engineers Nuclear Quality Assurance (ASME NQA-1, 2000) and also DOE Order 413.3 (Project and Program Management), using Earned Value Management System (EVMS) requirements. Savannah River Nuclear Solutions (SRNS) performed the conceptual, preliminary and final design, and used Fixed Price or Fixed Price Design/Build subcontracts to procure critical long lead (tanks, evaporators, glove boxes) and specialty engineered equipment (cementation system/enclosures). Subcontractors were also used for the installation of electrical and underground utilities ahead of the general construction subcontractor responsible for performing the process facility civil, mechanical, and electrical work scope.

This Lessons Learned bulletin includes lessons learned from the WSB project relative to design, procurement, construction, startup, and commissioning. During the Planning, Execution, and Closeout of this project, fifty Lessons Learned and Best Practices were shared through the Waste Solidification Building Project Y473 Lessons Learned Report. The first fourteen focused on Project Management. The project struggled with turnover and managing higher risk procurements. The project added an orientation program that supported a greater understanding of the project, and provided staff with orientation on how they support the project. The implementation of a change control program early on, supported the project through quickly addressing and correcting design issues. The project also aligned their contracting strategy to best suit the project and manage their risks. The facility is ready to begin processing the waste from future operations. The following Lessons Learned and Best Practices were taken from *Waste Solidification Building Projects Y473 Lessons Learned Report V-PMP-F-00085, Rev0*.

Project Management Lessons Learned

LESSONS LEARNED:

1. **Collocation of the Project Team** – Collocation fosters teamwork and open communication. The WSB co-located the entire staff including engineering, construction, project management, project controls, startup, operations, maintenance, procurement, project owner, design authority and quality. Functions such as fire protection, structural mechanics, piping stress analysis, procurement specification writers, and architectural designers were not. Prior to co-location of staff, they were less responsive to project needs, due to their support of multiple projects. After collocation, the staff was more responsive to project needs.
2. **Match Subject Matter Experts to Processes** – Matching the talents and experiences of subject matter experts with the technologies needed will ensure optimization of the technologies. During the development process, the project recognized that industry was developing processes similar to those needed for the project. By bringing on the right people, they could shift technologies to the benefit of the project. They did find that not all design opportunities were practical due to cost and schedule impacts.
3. **Critical Staffing, Marketplace Competition and Technical Expertise** – Projects are significantly more successful when knowledgeable, cognizant engineering personnel from detailed design phase to support construction phase are available to resolve emergent issues during the procurement/construction/testing phases. This project was impacted by unanticipated high turnover due to competing projects and outside market conditions. Organizational commitment to projects and providing rate adjustments due to market conditions help maintain critical staff commitment.
4. **Procurement of Safety Related Items and Materials** – It is recommended that Safety Significant and Safety Class materials be procured by the M&O. These materials require cradle-to-grave monitoring and would benefit from having more visibility and control by the M&O.
5. **Lead Construction Subcontractor American Society of Mechanical Engineers Nuclear Quality Assurance Qualification** – Subcontractors who have been previously qualified for NQA-1 work with several years of experience should be used for NQA-1 projects. The time and cost required to certify an inexperienced subcontractor can significantly impact a project.
6. **Document/Record Submission** - The exchange of records/submittals between the Construction subcontractor and the project should be well planned and coordinated. There were occasions when WSB Project work was delayed due to less than timely exchange of submittals. A majority of the records were not provided until the end of the project contract. This created a bow wave of submittals and reviews at a critical time during the project

BEST PRACTICES:

1. **Employee Orientation** - The WSB staffing needs required the use of a significant number of staff augmentation subcontractors and other resources from elsewhere onsite. These personnel were not familiar with SRS and/or WSB Project procedures and processes. Organizations developed project specific orientation/ training packages in order to quickly orient personnel and minimize inefficiencies in the amount of time for subcontractors and reassigned onsite personnel to become familiar with WSB Project procedures and processes. Engineering developed an orientation checklist identifying key safety basis documents, desktop instructions, project policies and procedures, responsibility matrices, key specifications, location of network databases, etc. to facilitate quick familiarization with the WSB project and how business was conducted. Completion of the process was documented via the Required Reading process.
    a. Projects should develop a plan for project familiarization and an orientation package. Task specific training should be provided for employees based upon the planned staffing curve. Action Item Database - A single database was used to track all technical issues, cost, and scope and was updated weekly. This allowed for a centralized location of all actions which received a high level of visibility.

2. **Early Involvement of System Engineering** - The inclusion of Systems Engineering Group as part of the WSB Project Team early in the project aided in the development and continual maintenance of critical project documents that ensured technical baseline documents remained current.
3. **Good Utilization of Trends** – The project team instituted a strong change control process earlier than required. This allowed for the tracking of all changes and trends for better decision making early on, and a traceable audit trail.
4. **Early and Ongoing Engagement of People** (Site Experts, Regulators, and Oversight Personnel) – The engagement of experts, regulators and oversight personnel early in the design process allows for better results with fewer impacts. Examples of working with concrete professionals led to a new process of in-drum mixing. Engagement of DNFSB regarding known trouble spots allowed for an easier implementation of significant changes.
5. **Active Engagement of NNSA Customer** – The NNSA customer was an active member of the WSB team and was available when issues evolved. This allowed for the transparency of issues and working collaboratively on options for resolution.
6. **Use of an Integrated Project Team** – The WSB project team ensured that the IPT was fully represented, and that the right expertise was available. As changes occurred, the team was modified as necessary. Because of the variety of knowledge and skill sets available within the team, the project was able to benefit from the experience and lessons learned from each member.
7. **Contracting Strategy** – The project benefited from the use of several smaller contracts that could be closely managed and changes as needed. The construction procurement strategy for WSB included multiple smaller contracts for the site preparation, electrical power from the substation and the process sewer installation. The Balance of Plant (BOP) subcontract included all the structures, the installation of the process equipment and all the commodities for the facility. The project success was closely tied to the performance on the BOP subcontract scope. Large NQA-1 construction subcontractors at DOE sites sometimes face large challenges due the complexities involved, limited experience on the subcontractor's part and difficulty in obtaining safety related material on time based on the current nuclear supply chain capability.
8. **Effective Use of an Acquisition Strategy** – It is advantageous for projects to acquire specialty/critical equipment as Government Furnished Equipment. Due to the NQA-1 requirements of this project, the site M&O SRNS procured the Specialty and Critical equipment. This removed some of the risks variability that could occur in the design/build portions of the scope and supported the reduction of lead time concerns.

Recommendations:

EM Site Managers and FPDs should review this Lessons Learned Bulletin and determine applicability for current and future projects. Some of the applicable Lessons Learned on this project include:

1. Projects should develop a plan for project familiarization and an orientation package. Task specific training should be provided for employees based upon the planned staffing curve.
2. The timely development of the System Design Description documents is a key element in communicating design requirements to the design team.
3. Recognizing shifts in technical strategies early in projects allows matching the talents and experience of Subject Matter Experts to the technology being utilized so that timely application of these resources will ensure that the process technology employed is optimized throughout the design.
4. A project trend process utilized early that ensures any and all proposed changes that impact project cost, schedule and technical baseline should be evaluated by the Project Team.
5. Maintaining knowledgeable, cognizant engineering personnel from detailed design phase to support construction phase greatly reduced the time needed to approve/implement changes and resolve emergent issues during the procurement/construction/testing phases.
6. By engaging oversight groups early in the design process, the timely development of solutions alleviates rework. For example, Defense Nuclear Facilities Safety Board (DNFSB) standards and expectations for new projects are higher than existing projects.

7. Formal, pragmatic use of Integrated Project Team (IPT) facilitates the identification of issues, provided focus/priority, identified impacts, assigned ownership, and identified actions/sequence necessary to resolve issues.
8. Consider breaking the large contracts into smaller segments where practical or establishing performance phase gates within the contract to allow changes earlier in the process if subcontract is not meeting the project objectives. This will allow for changes in the strategy or subcontractors and provide the Project with more options to complete without adversely impacting the cost or schedule baselines.
9. For equipment acquisitions, it is advantageous for a similar project to acquire a larger portion of critical/specialty equipment in parallel with establishing the Construction subcontract, particularly when the selection and acceptance of "or equal" equipment and the supplier's design documentation can significantly impact compliance with design and NQA-1 requirements. Also equipment changes can impact design and layouts due to trickle down effects of space requirements and utility connection configurations. This practice minimizes misunderstanding of equipment requirements and avoids multiple organizations handling engineering document submittals.
10. Requirements and expectations for engineering and quality record submittals by subcontractors need to be established and agreed upon during the early phases of construction. Document submittals without the proper formatting or submitted months after the work was performed, limit the ability to tie the record to the applicable system or equipment. Work packages associated with shop and field installation, including inspection and test records need to be contractually required for submission on a timely basis.

Critical Decision(s):	CD-0 to CD-4
Facility Type(s):	All
Work Functions(s):	Project/Program Management
Technical Discipline(s):	All

References:

1. Savannah River Nuclear Solutions, October 2015, *Waste Solidification Building Project Y473 Lessons Learned Report V-PMP-F-00085, Rev 0*.