EM-5.22 Lessons Learned Bulletin

November 2017

Salt Waste Processing Facility Lessons Learned and Best Practice for Construction Work Package Closure

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Date: **11/09/2017**

Statement:

The Salt Waste Processing Facility, or SWPF, was built to treat radioactive salt solutions presently stored in underground tanks at SRS. Construction of the plant commenced in 2009, and construction complete was declared in April 2016. As is the case with many DOE construction projects, SWPF is a complex, major project with a Total Project Cost through the start of operations of approximately $2.3B. The development and use of construction work packages are vital to defining, assigning and completing the necessary activities to successfully build the plant.

Proper development and use of work packages can make the project and its systems much easier to validate completion. Based on their experience in developing, tracking and closing their construction work packages, SWPF has established a number of lessons learned and best practices. This bulletin, as shown in the following Recommended Actions section, provides the lessons and best practices as learned on this project.

Discussion:

Background

The Salt Waste Processing Facility, or SWPF, was built to treat radioactive salt solutions presently stored in underground tanks at SRS. SWPF will pretreat Tank Farms salt waste into three waste streams:

- Decontaminated Salt Solution (DSS) suitable for grouting at the SRS Saltstone Production Facility (SPF) and disposal at the Saltstone Disposal Units (SDUs)
- Highly concentrated, strontium-actinide sludge suitable for vitrification at the SRS Defense Waste Processing Facility (DWPF)
- Concentrated Cesium (Cs) solution suitable for vitrification at DWPF

SRS houses more than 30 million gallons of waste in over 40 underground tanks. About 90 percent of that waste is salt waste, and has been processed using a pilot facility. The waste will eventually be processed through the SWPF. Once operational, SWPF will increase the processing rate from 1.5 million gallons/year to 6 million gallons/year. Construction began in 2009 and construction was declared complete in April 2016, eight months ahead of schedule and $65M under the target cost. The system is currently in the testing and commissioning phase and is on pace for a December 2018 startup. Removing salt waste is a major step toward emptying and closing the site's remaining high-level waste tanks.

Discussion

An important step in project definition is development of the Work Breakdown Structure (WBS). Considering the size of most DOE construction projects, it is necessary to divide the work into manageable units. Subdivisions can be varied but they should be logically structured, documented, made known and incorporated into the schedule. The resulting arrangement defines the hierarchy of deliverables and is called the WBS.

Once the organization is established, the project manager can define and assign the work within the scope of his organization. These items are identified in the WBS and can be assigned to the organizational units in manageable portions called Work Packages (WPs). The work package is a document between that defines an activity to be done for project management by the line organization. A work package typically contains information such as:

- Task identification;
- Start/end dates;

- Ownership (lead engineer);
- Budget data;
- Task description;
- Changes;
- Outputs (project documents, data);
- Associated hardware items.

At SWPF, there were 71 systems identified for construction and testing. In order to complete construction and move into testing, a number of activities were required to be performed. These included finishing construction installation, completing construction checks and tests, completing commissioning planning, and conducting the turnover process of the 71 systems. In addition, all systems had initial and final system turnover walk downs, and all major open punchlist items were closed out. From a DOE oversight review perspective, SWPF implement a Line Management Review Board as a forum for DOE management review to ensure that integrated readiness oversight activities adequately assessed achievement of operational readiness. All 71 systems went through the LMRB to get to testing phase. Included in this activity was the close out of all construction work packages.

Conclusion

Work packages are an important and necessary part of any construction project. They are used to define and assign the specific scopes of work necessary to build and integrate project systems. Since most DOE construction projects are significant and complex, there are a multitude of work packages developed. Their completion and validation of closure are an important component to a successful transition from construction to testing. Proper development and use of work packages can make it much easier for the project validate completion of construction activities. Based on their experience in developing, tracking and closing their construction work packages, SWPF has established a number of lessons learned and best practices. The following Recommended Actions section provides this important information.

Recommended Actions:

In completing construction and closing the construction work packages for SWPF, a number of lessons learned and several best practices were identified. These lessons learned and best practices are summarized below:

LESSONS LEARNED

1. Establish the Specific Work Package Sections that Constitute Quality Records:
   Identify the specific sections and elements of the Work Package that contain objective quality evidence (OQE). OQE documents evidence that an item conforms to requirements. The primary objective of the construction Work Package is to document work authorization and to provide direction for the supervisors and craft through work instructions, safety requirements, supplier instructions and manuals, fabrication instructions, or in the case of SWFP, direction from engineering in the form of Construction Requests for Information. Although these provide historical context, they are not examples of OQE. The hold points embedded in the work instruction comprise the major set of OQE. If Quality Control Inspections are documented in a separate set of records, then the hold points may be the only quality record contained in the WP. Overly conservative designation of the WP as a Quality Record unnecessarily invokes the requirements of NQA-1 for quality records for information that is not OQE.
2. Work Package Scope:
   Before construction starts, identify the optimum approach to subdividing the WPs into discrete work scopes. Smaller discrete work scopes create more administrative work at the beginning of the installation process but fewer problems with the closure process. Work Packages that cover broad scopes of work require less effort to develop; however, the broader the scope of work, the longer the WP remains open. Maintaining open documents for months or years introduces a greater chance of configuration control issues. Larger work scopes become more challenging to close as the population of supporting Quality Records

increase in number and undergo multiple revisions. More challenging, personnel responsible for the supporting inspection reports or completing the installation stand a higher chance of changing jobs, and are unavailable to answer questions.

3. Quality Control Inspection Reports:
   QC inspections can be documented in the WP or as separate reports. SWPF documented QC hold point inspections in QC Inspection Reports. The controlling procedure did not place restriction on the number of hold point inspections documented in one QCIR. The approach prevented explicit linkage between specific WP hold points and QCIRs. Limiting the inspections to one hold point per QC inspection allows more efficient linkages to be made in cross-database queries and simplifies reporting and tracking for closure.
4. Early Establishment of Work Package Closure Group (WPCG) and Timely Review:
   A group of discipline-specific, QC, and QA reviewers should be formed early in the construction phase to ensure timely and efficient identification and correction of quality issues. A systematic and uniform approach to reviewing WPs and supporting documents such as NCRs, DCNs, and QCIRs should be documented in a procedure. The WPCG should be trained so that there is a clear understanding of functions and responsibilities. Identification of issues with feedback to management tends to rectify misunderstandings of quality expectations for the personnel preparing the WP. The sooner an understanding is reached on the quality expectations, the less rework that is required over time.
5. Trending Errors:
   The sooner an error tracking and trending process is developed and implemented, the sooner trends in specific errors types can be corrected by management.
6. Timely closure:
   If WPs are effectively designed, then they serve primarily as a road map to the supporting QCIRs, NCRs, DCNs, etc. A significant work scope includes reconciliation between all of these documents. The longer efforts are delayed in completing, reviewing, correcting and approving the WP the more difficult it becomes due to multiple changes to the supporting design and inspection documents and the greater the chance of personnel attrition.

BEST PRACTICES

1. Data Architecture:
   Develop an internally consistent alpha-numeric identification scheme to cross link databases used to retrieve electronic records listed in the WP. Defining and adhering to systematic control fields provides efficiencies in linking databases as the number and scope of these records increases. Prior to construction, identify the critical quality records that will be associated with WP development, completion and closure, e.g., Inspection Test Plans (ITP), QCIRs, DCNs, NCRs, Warehouse Release Vouchers, and establish an internally consistent alphanumeric identification scheme that afford simple linkages to the WP, e.g., include field in the databases for each of these records that references the WPs associated with the NCRs or DCNs. It is also advisable to maintain a hold point databases, cross linked to the QCIRs and ITPs.
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4. Work Package Design for Effective Configuration Management:
   Work packages should only contain information and direction that is unique to the scope of work. From a quality records perspective, this will include the instructions that specify hold points and a cross walk to the QCIR number. To the extent practical, drawings, specifications, datasheets, DCNs, etc. should not a part of the WP. These design documents have unique Document Control numbers and can be referenced instead of being managed as part of the WP. Attempting to maintain change control for design documents within a work package is unnecessary in most instances and for a complex project with tens of thousands of design documents and hundreds of WPs, is impracticable.
5. Field Document Control:
   As an outcome of 3.1, SWPF was able to maintain WPs with two Field Document Control personnel. Design documents were referenced by the WP, but not maintained as a part of the WP. Design documents were updated at a Field Document Control stations within the facility during construction and were routinely self-assessed to ensure files were up to date.
6. Work Package Closure Group (WPCG):
   A multidiscipline WPCG was formed late in the construction phase under a single manager. The multidiscipline organization functioned and performed work to an approved set of procedures to ensure consistency. This greatly enhanced communications and consistent performance quality among the disciplines (electrical, mechanical, civil/structural), QC and QA, and increased efficiency in the closure process.
7. Trending Errors:
   SWPF identified few issues that required NCRs. SWPF maintained a database of issues identified during the final QA review. These data provided a means for providing feedback to management so that specific performance problems can be rectified in a timely manner. The data also provides a perspective to various stakeholders and the DOE on the nature and significance of identified errors.
8. Record Error Management Tools:
   Work package reviews result in thousands of errors that should be categorized and managed based on their significant. The project identified three classes of record errors that included 1) minor typographic errors, 2) errors requiring quality record correction, and 3) errors requiring an NCR. The first type of error was managed through a formal Generic Resolution process where each minor error was documented in a database and denoted as such on an attachment to the WP. The second type was corrected through controlled Errata Sheets, attached to the Work Package and or QCIR. The latter avoids pen and ink changes of field records and provides background information and an explanation for the amendment or correction. The third type of error requires resolution by the Design Engineering organization and was managed through the NCR process. Once resolved by Design Engineering, any necessary corrections were made to the WP.

Critical Decision(s):	CD-3 to CD-4
Facility Type(s):	All
Work Functions(s):	Project/Program Management/Construction Management
Technical Discipline(s):	All

References:

1. Parsons, “Lessons Learned and Best Practices: Construction Work Package Closure Proposed Outline”, Document No. 00-700-26000, October 16, 2017.
2. Marks, Pamela, “Transition from Construction to Commissioning/Startup and Managing Risks, Salt Waste Processing Facility”, Department of Energy Project Management Workshop, March 2017.
3. International Atomic Energy Association, “Project Management in Nuclear Power Plant Construction: Guidelines and Experience”, February 2012.
4. West, Craig, “Lunch & Learn – Salt Waste Processing Facility”, DOE-HQ, March 30, 2017.
5. Weapons Complex Monitor, “SRS Waste Facility Remains in Deliberate Ops”, Exchange Monitor Publications & Forums, October 27, 2017.