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**Salt Waste Processing Facility Project (SWPF) Project Management Improvements:
Working under a Cost Cap Contract - 15523**

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ABSTRACT

The Salt Waste Processing Facility (SWPF), located at the Savannah River Site (SRS) in Aiken, South Carolina, is a multi-billion dollar LRW processing facility that represents the keystone for the U.S. Department of Energy (DOE)-EM clean-up mission at SRS. In June 2013, DOE and Parsons agreed to Contract Modification 0116 that definitized the remaining work to achieve Construction Complete with a target schedule and a cost cap contract structure.

The SWPF project is currently 85 percent complete with construction, and approximately 10 percent complete with commissioning. To date there have been numerous lessons learned with regard to contract and project management, procurement, construction, safety and quality assurance approaches (both good practices and mistakes). These lessons learned are considered to be of significant value in improving the state of major project execution within the DOE-EM clean-up program as well as to the wider DOE complex.

An overview of the current SWPF project status is provided, along with challenges associated with operating under a cost cap environment within a cost-plus contract structure. Key lessons learned will be discussed including contract management, baseline development and acceptance under DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets* requirements, cost and schedule control, change management and risk strategies.

INTRODUCTION

For more than 20 years, Parsons has supported the DOE at SRS. The site, originally constructed in the 1950s by the Atomic Energy Commission, had produced the basic materials required to fabricate nuclear weapons (primarily tritium and Pu-239) in support of our nation's defense programs. By the end of the Cold War, SRS changed its focus to waste disposition, environmental restoration, and remediation. In 2004, recognizing Parsons' strong reputation for constructing unique, first-of-a-kind facilities with advanced technology processes, DOE selected Parsons to design, build, commission, and operate (for the first year of full operation) the SWPF. SWPF will eventually process 33 million gallons of radioactive liquid salt wastes currently stored in large underground tanks.

Parsons is responsible for complete technology development and implementation of the SWPF project, including the first-of-a-kind Cs extraction and actinide removal, at a production level. The SWPF design includes a full capability analytical laboratory that will support independent operations. Major design challenges included substantial upgrading of seismic structural design, after the conceptual design was completed.

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In 2003, the Phase I conceptual design was completed on schedule and under budget, and in January 2004, DOE selected Parsons as the Phase II contractor to complete the SWPF project. A major factor in the Phase II award was Parsons' initiative to develop a large pilot-scale test facility of the Cs removal Caustic-side Solvent Extraction technology. Parsons fabricated the pilot test equipment for SWPF at the technology development and fabrication complex in Pasco, Washington, and then conducted test operations in Aiken, South Carolina, under observation of representatives from SRS, the South Carolina Department of Health and Environmental Control, and the South Carolina Governor's Nuclear Advisory Council.

The 30 percent preliminary design milestone was completed on April 18, 2005. Parsons created more than 700 engineering design drawings issued for interactive review meetings with DOE. More than 140 Parsons personnel and specialty subcontractors working on the SWPF project helped complete this project milestone.

Parsons and its project team continue to develop enhancements to SWPF processes to increase waste throughput during the facility life-cycle. Parsons projects these value engineering efforts will result in a reduction in life-cycle operation by about six years and a cost avoidance of more than \$3 billion.

Construction of the SWPF is more than 85 percent complete and is scheduled to be completed in the April-May 2016 timeframe. Parsons is self-performing approximately 80 percent of the construction effort on this first-of-a-kind nuclear facility.

Structural and mechanical features of SWPF include:

- 13,000 square meters
- 2.5 meters thick basemat
- 34,400 cubic meters of concrete (formwork, placement and finishing)
- 5,000 tons of reinforcing steel (pre-fabricated sections, and installation in place)
- 37 kilometers of piping
- Approximately 80,000 welds
- 4,000 valves
- 85 tanks
- 1,500 instruments
- 244,000 meters of wire and cable

Testing began in 2012 and commissioning will be completed when SWPF starts to treat radioactive waste. SWPF is the key facility for disposition of Cold War legacy waste at SRS. When operational, SWPF will separate highly radioactive Cs and actinides from the salt solution using Caustic-side Solvent Extraction and Monosodium Titanate filtration, absorption/respectively. After completing the initial separation process, concentrated Cs and actinide waste will be sent to the nearby Defense Waste Processing Facility to be immobilized in a glass matrix and stored in vaults until it can be placed in a geological repository. The

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decontaminated salt solution will be mixed with grout at the nearby Saltstone Facility for disposal on site. Operation of SWPF will support the earliest closure of aging waste treatment tanks at SRS and significantly reduce the risk posed to workers, the public, and environment.

DISCUSSION

During the 2011 timeframe, the SWPF project was experiencing delays in the manufacturing and delivery of 10 large ASME vessels critical to maintaining progress with construction. After terminating one manufacturer due to quality concerns, Parsons awarded a second contract for delivery of the 10 ASME vessels. After further manufacturing delays, the 10 ASME vessels were finally delivered to the project during June and July 2012. This delay caused significant cost and schedule impacts to the construction, and ultimate start-up of SWPF. Parsons implemented broad and innovative construction mitigation actions to continue construction of the facility despite the delay in the delivery of the 10 ASME vessels. These measures include utilizing embedded drop lines for construction openings, cast-in-place formwork and using mesh covers for rebar. Upon delivery the 10 ASME vessels were lifted into place through the roof openings of the facility.

In March 2012, Parsons had developed a comprehensive Estimate at Complete for the DOE that accounted for the significant delays in delivery of the 10 ASME vessels and commensurate cost and schedule impacts to the overall project. At that time, the Total Project Cost for the project was \$1.339 billion. The Estimate at Complete represented an increase of \$477 million, but assumed continued steady funding and the ability to maintain a full 2-shift construction schedule. The DOE ultimately could not support the funding level necessary to maintain the full construction crews, and was reduced to one full construction day shift. As a result, the additional schedule impact resulted in even more cost increases in both the construction phase and ultimately the Testing and Commissioning phase of the project, along with escalation costs. The valuable lesson learned during this period was that earlier notification and acknowledgement of the broader cost and schedule impacts could have allowed the DOE more time to secure adequate funding to maintain construction progress. Management attention was focused on manufacturing and delivery of the 10 ASME vessels and continuing with construction mitigation measures. The results of these mitigation efforts were successful in that the enclosing of the SWPF was achieved within one week of the contractual milestone for Roof Complete. However, the increased budget necessary to continue construction could not be provided due to the cost increases and funding limitations.

Although the delay in delivery of the 10 ASME vessels was the key contributor to the overall project schedule delay and was highly visible, there were several other factors that contributed to the schedule delay. The atrophy of the ASME NQA-1 supply chain within the United States caused significant cost increases to Parsons and the project that were not anticipated. The inability for vendors to meet the stringent ASME NQA-1 requirements for manufacturing and submittal documentation required many more resources from Parsons in Engineering, Quality Control, Quality Assurance, and Procurement. These resources were required in order to deliver material and equipment such as pipe, valves, and pumps that were ASME NQA-1 compliant. Additionally, the Southeast region of the United States has numerous Federal and commercial

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nuclear construction projects underway. There is strong competition for highly qualified resources such as welders, pipefitters, electrical craft, and inspection personnel required to meet the construction requirements of a nuclear facility.

In February 2013, Parsons delivered a Cost Proposal Under a Constrained Funding Profile to support contract negotiations for the balance of the SWPF scope. The DOE had decided to bifurcate the negotiations for the remaining scope and focus on achieving Construction Complete as soon as possible at the lowest cost. With approximately 68 percent of Construction Complete, the DOE was seeking a more aggressive contract mechanism to ensure Parsons would complete construction and assume greater contractual and financial risk in order to control cost and achieve Construction Complete. The result of the negotiations was codified in a major contract modification (Contract Modification 0116) that provided a “Cost Cap” for the remaining construction scope with a Target Schedule for completion of December 31, 2016. The DOE included cost and schedule incentives, as well as an Interim Project Milestone incentive. Parsons assumed significant cost risk with a Target Cost at \$530 million, where the DOE and Parsons would share costs between \$530-540 million at a 50/50 share ratio and for all costs above \$540 million has 100 percent liability. The DOE provided cost incentives at varying share ratios down to \$480 million. This risk/reward seems appropriate given that construction was almost 70 percent complete and all major mechanical systems had been delivered to the site.

The real challenge with this approach comes with implementing a Cost Cap contract structure, which functions very similarly to a Firm Fixed Price (FFP) contract, but within the overall framework of a Cost Plus Incentive Fee (CPIF) contract structure. Given the risk and financial liability assumed by Parsons, the SWPF management team operates with a FFP mentality with aggressive cost and schedule controls, comprehensive risk identification and mitigation, and enhanced Estimate at Complete calculations and reviews. However, this approach sometimes creates conflicts given the overarching terms and conditions in a CPIF contract structure. Parsons and the DOE have been partnering to identify and resolve conflicts and challenges that have resulted from a dual type contract structure with positive results. The dual type contract structure also provides challenges for the SWPF Project Office to conduct the appropriate level of oversight of the SWPF project and activities while also being responsible for the fiscal and technical compliance of the contract terms and conditions under a CPIF structure.

Under a traditional commercial FFP contract structure, the client defines “what” they want and at what cost and schedule. The contractor provides limited (if any) reporting and the client provides minimal oversight and ensures that the project is proceeding at a reasonable rate consistent with the overall contract deliverables. Under a CPIF contract structure there can be both the “what” and the “how” of what the client desires, in addition to the cost and schedule objectives stipulated in the contract. In addition, there are many more requirements relative to oversight, project management, and reporting that require additional contractor resources not necessary on a FFP contract. Under this dual type contract structure, this conflict is heightened. Most Government contracts contain language and requirements that are subjective and can be interpreted differently by multiple parties. Resolution of these types of issues takes significant time from both technical, management, and contract resources. Most Government contracts

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contemplated to be executed under a cost-plus structure for the entirety of the period of performance are difficult to modify to accommodate alternative structures such as a Cost Cap or even FFP. The solution to this challenge is to resolve issues and disputes in a timely manner without using valuable resources that could be focused on project execution. Both parties should be focused on issues that only affect the safety, overall cost and schedule, quality, or functionality of the facility to be constructed and operated and implement resolutions that result in minimal administrative actions.

Another challenge posed during this contract phase was transitioning the project schedule that was designed for construction but now needs to address the system turnover from construction to testing. The SWPF construction schedule was developed using a room-by-room, area-by-area approach. The transition to Testing and Commissioning is conducted system-by-system. Additionally, the contractual milestone for Construction Complete is largely defined by the formal turnover of the 72 systems within SWPF. It was necessary to transform the schedule from the room-by-room approach to the system-by-system activities. Using the extensive data on the SWPF Project Collaboration Portal, Parsons was able to tie all of the mechanical, electrical and Instrumentation and Control equipment to isometric drawings, work packages, rooms and systems. The Parsons Project Controls schedulers were able to transform the schedule to system-by-system over a 3-month period. From a baseline perspective, Parsons maintains labor hours, quantities (pipe, electrical, and Instrumentation and Control) at the work package level. The transition to a system-by-system basis was accomplished without changing the hours or quantities by work package therefore negating the need for a Baseline Change Proposal. This transformational process should be a shared lessons learned for future nuclear facility construction projects within DOE and NNSA.

As with most Government contracts that have been in effect for long periods of time, programmatic objectives and technical requirements may evolve over time that may be different than what the original contract authors envisioned and included in the contract. With design/build contracts that span many years, it is critical to maintain the Code of Record in order to avoid cost and schedule impacts associated with ever changing requirements. This is sometimes difficult as with the SWPF where design and construction have lasted over 12+ years. Both the client and the contractor have to be vigilant to maintain a consistent Code of Record in order to sustain project progress and achieve start-up of the facility.

There are three major elements remaining on the SWPF project with Parsons. These are categorized as Contract Line Item Numbers (CLINs) in the existing contract.

- CLIN 0005AB represents the remaining work scope necessary to complete the construction phase of the project. At the time Contract Modification 0116 was signed in June 2013, there was approximately 70 percent of the physical construction complete. Currently, Parsons is almost 85 percent complete with construction, with an anticipated Construction Complete milestone in April 2016. Construction Complete is defined (in part) as the formal turnover of 72 individual systems from the construction organization to the Testing organization.

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- CLIN 0006 represents the Testing and Commissioning Phase of the project. While Testing and Commissioning has been underway for several years, the major ramp up in Testing and Commissioning personnel will occur in 2015, in preparation for Construction Complete in April 2016. It is anticipated that there will be a 29-month schedule duration to complete the Testing and Commissioning phase once construction is complete.
- CLIN 0007 represents One Year of Operation that includes the Hot Commissioning phase of the contract. When the original acquisition strategy was developed for SWPF, it was envisioned that the remaining years of SWPF operation would transition to the Liquid Waste contractor at the site. It is uncertain at this time, what the DOE will decide relative to the operations at SWPF.

The challenge remains for Parsons and the DOE to continue to operate under a contract that has one major element of the work scope definitized and incentivized while the remaining major elements are not. The ultimate goal of both Parsons and the DOE is to safely startup and operate the SWPF at a high enough capacity to significantly reduce the liquid waste volumes in the tanks and achieve major risk reduction at the SRS.

CONCLUSIONS

The contract structure, incentives, and controls implemented by the DOE under Contract Modification 0116 and the management approach and execution deployed by Parsons are yielding positive results. The dual contract type resulting from combining multiple contract strategies and structures within another overarching contract structure is not desirable or conducive to focused and effective execution of the contract work scope. However, with proper management and attention, and a shared common vision for success, this can be managed.

The SWPF project is unique unlike most other DOE and NNSA large first-of-a-kind construction projects in that there are no major technical or regulatory issues on the project. This is the result of a combination of actions, approaches and relationships experienced throughout the project. First is the relatively simplified design with slope piping and actinide removal processes that operate close to ambient temperature and pressure. Second is Parsons' and the DOE's approach to actively engage with the Defense Nuclear Facilities Safety Board to identify any issues and resolve them with sound technical justifications in a comprehensive and timely manner. Third is the cooperative relationship between the DOE and the South Carolina Department of Health and Environmental Control, along with the U.S. Environmental Protection Agency to achieve significant risk reduction at SRS and providing for a closed loop solution to the liquid waste challenge.

The SWPF project is back on track and is anticipating Construction Complete in April-May 2016 under budget, with a facility start-up date of late 2018. The SWPF will be capable of processing at least 6 million gallons a year with the potential of up to 18-20 million gallons per year with incorporation of the Next Generation Solvent. The remaining challenge is to optimize the liquid waste system in order to maximize feed to SWPF at a rate that can sustain the output and minimize the overall operation life of the facility and reduce the overall life cycle cost.