Salt Waste Processing Facility Independent Technical Review

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ABSTRACT

The U.S. Department of Energy (DOE) selected Parsons as the Engineering, Procurement, and Construction (EPC) Contractor to design, construct, commission, and operate for one year the Salt Waste Processing Facility (SWPF) at the DOE Savannah River Site (SRS). The SWPF is intended to remove and concentrate the radioactive strontium (Sr), actinides, and cesium (Cs) from the bulk salt waste solutions in the SRS high-level waste tanks. The sludge and strip effluent from the SWPF that contain concentrated Sr, actinide, and Cs wastes will be sent to the SRS Defense Waste Processing Facility (DWPF), where they will be vitrified. The decontaminated salt solution (DSS) that is left after removal of the highly radioactive constituents will be sent to the SRS Saltstone Production Facility for immobilization in a grout mixture and disposal in grout vaults.

The EPC provided the 35% design package to DOE for review in September 2006, and subsequently completed the remaining design products and documents for the Preliminary Design. DOE chartered an Independent Technical Review (ITR) Team to review the Preliminary Design of the SWPF, with a focus on evaluating the technical sufficiency of design to support development of a baseline cost and schedule (Critical Decision-2 [CD-2]) per DOE Order 413.3A. The ITR Team concluded that the SWPF project is ready to move into final design.

INTRODUCTION

The U.S. Department of Energy (DOE) selected Parsons as the Engineering, Procurement, and Construction (EPC) Contractor to design, construct, commission, and operate for one year the Salt Waste Processing Facility (SWPF) at the DOE Savannah River Site (SRS). The SWPF is intended to remove and concentrate the radioactive strontium (Sr), actinides, and cesium (Cs) from the bulk salt waste solutions in the SRS high-level waste tanks. The sludge and strip effluent from the SWPF that contain concentrated Sr, actinide, and Cs wastes will be sent to the

SRS Defense Waste Processing Facility (DWPF), where they will be vitrified. The decontaminated salt solution (DSS) that is left after removal of the highly radioactive constituents will be sent to the SRS Saltstone Production Facility (SPF) for immobilization in a grout mixture and disposal in grout vaults.

The EPC provided the 35% design package to DOE for review in September 2006 and subsequently completed the remaining design products and documents for the Preliminary Design. DOE chartered an Independent Technical Review (ITR) Team to review the Preliminary Design of the SWPF, with a focus on evaluating the technical sufficiency of design to support development of a baseline cost and schedule (Critical Decision-2 [CD-2]) per DOE Order 413.3A. The scope of the ITR was defined in the form of Lines of Inquiry (LOI) that served as the framework for review team activities and for selection of review team members. The LOIs were grouped into three categories: (1) Civil/Structural Design, (2) Facility Safety, and (3) Engineering. The ITR Team focused their attention on the specific subjects identified by the LOIs. The review was conducted between August 29 and November 22, 2006.

The purpose of this paper is to describe the process used to conduct the Independent Review and to summarize the findings of the review.

DISCUSSION

Background On The SRS Salt Processing Program

The SRS in South Carolina is a 300-square-mile DOE complex that has produced nuclear materials for national defense, research, and medical programs since it became operational in 1951. As a waste by-product of this production, there are approximately 36 million gallons of liquid radioactive waste currently stored on an interim basis in 49 underground waste storage tanks. Continued, long-term storage of these liquid radioactive wastes in underground tanks poses an environmental risk (eleven of the SRS tanks have a waste leakage history). Therefore, SRS has, since Fiscal Year (FY)-1995, been removing waste from tanks, pre-treating it; vitrifying it; and pouring the vitrified waste into canisters for long-term disposal. Since FY-1996, over 2,000 canisters of waste have been vitrified. The canisters vitrified to date have all contained only sludge waste. Salt waste processing was suspended in FY-1998 because the existing facility could not cost effectively meet both the safety and production requirements of the Tank Waste System. DOE selection of a new salt processing technology was completed in FY-2001, with the SWPF scheduled to be operational in late 2011.

The ability to safely process the salt component of the waste stored in underground storage tanks at SRS is a crucial prerequisite for completing high-level waste disposal. The two primary regulatory drivers for waste removal are: the Federal Facilities Agreement and the Site Treatment Plan. The Federal Facilities Agreement requires that the 22 non-compliant tanks be emptied and closed on an approved tank-by-tank schedule. The Site Treatment Plan requires that the processing of all tank waste (both existing and future) be completed by FY-2028. Without a suitable method for salt management, DOE will not be able to place the tank waste facilities in a configuration acceptable for safe closure.

Description Of Salt Waste Processing Facility

A detailed description of SWPF functional requirements is provided in *SWPF Functional Specification*, P-SPC-J-00002[1]. The primary functions of the SWPF are as follows:

- Accept liquid waste from the F- and H-Area Tank Farms,
- Produce streams that meet the criteria for vitrification at the DWPF, and
- Produce Decontaminated Salt Solution (DSS) that meets the waste acceptance criteria for the SPF.

Waste from area tank farms will be pumped to a blending tank for blending to meet the SWPF feed specifications. Feed batches of up to 1 Mgal of waste will be prepared at a time. After sampling to confirm that the blended waste meets feed specifications, the waste will be pumped to a staging tank from where individual batches of 23,200 gallons will be delivered to the SWPF for treatment. The SWPF will process each batch in approximately 22 hours. This will result in an instantaneous maximum capacity of 9.4 Mgal per year.

Figure 1 shows an upper level SWPF flowsheet. The SWPF treats salt waste in three successive basic unit operations: Alpha Strike Process (ASP), Caustic-Side Solvent Extraction (CSSX), and Alpha Finishing Process (AFP). These processes separate the radioactive elements (primarily actinides, Sr, and Cs) from the bulk salt waste and concentrate them into a relatively small volume. This small volume is then transferred to the DWPF for vitrification. The remaining bulk salt waste contains only low levels of radioactive materials and is sent to the SPF for incorporation into grout. The ASP occurs first and is used to separate Sr/actinides from the waste feed by monosodium titanate (MST) adsorption and filtration. The CSSX process follows the ASP and is used to remove Cs from the ASP filtrate by solvent extraction. The AFP is a process step that mimics the ASP and is used as necessary for multistrikes which provide additional Sr/actinide removal downstream of the CSSX process.

The ASP is operated as a batch process. Each batch of salt waste received in the SWPF is chemically adjusted and MST is added. The tank contents are mixed to allow the MST to adsorb the Sr and actinides (12 hours for single strike and 6 hours each for multiple strikes). The resulting MST slurry is filtered to produce a (1) concentrated MST/sludge slurry and (2) clarified salt solution (CSS) filtrate. The concentrated MST/sludge slurry is washed to reduce the sodium ion (Na^+) concentration and transferred to DWPF, while the CSS is routed to the CSSX process.

The second SWPF processing stage is CSSX, which is a continuous flow process utilizing 36 contactor stages for extraction, scrubbing, stripping, and washing of aqueous and organic streams. The Cs is removed by contacting the CSS (aqueous phase) with an engineered solvent (organic phase) in the extraction stage contactors. The Cs-depleted aqueous outlet stream is sent to the AFP for sampling and analysis prior to transfer to the SPF or for another Sr/actinide removal operation. Following extraction, the Cs-enriched solvent is scrubbed to remove impurities (primarily sodium and potassium). The solvent is then contacted with a dilute nitric

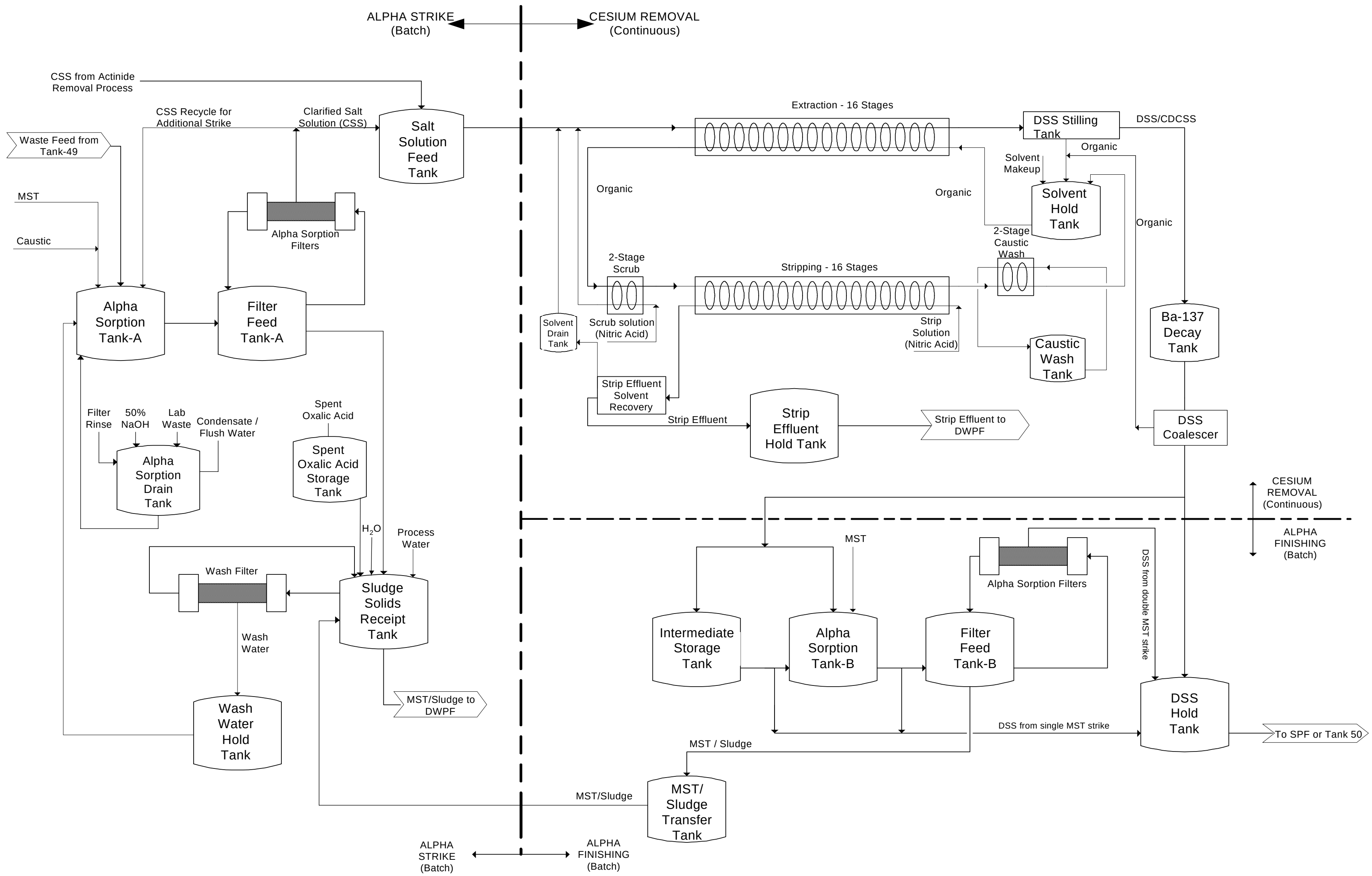

Fig. 1. SWPF process flow sheet

acid strip solution in the stripping stages, where the Cs is transferred to the aqueous strip effluent. The strip effluent (containing a high concentration of Cs) is sent to DWPF for vitrification.

If the Sr/actinide concentration in the CSS sent to the CSSX process is sufficiently low, the aqueous raffinate from the extraction stages (DSS) is sent to the SPF to be solidified with a cementitious grout mixture. If the Sr/actinide concentration in the CSS is too high, the aqueous raffinate from the extraction stages (referred to as Cs-depleted CSS [CDCSS]) is sent to the AFP for a second MST strike.

The AFP, which is located downstream of the CSSX process, is the third SWPF processing stage. When the SWPF is operated in single-strike mode, DSS from the CSSX process is sent to the AFP for confirmatory sampling and staging prior to transfer to the SPF. If the Sr/actinide content of the waste feed is sufficiently high that a single MST strike cannot reduce the concentrations low enough for the CDCSS to meet the Saltstone Waste Acceptance Criteria (WAC) limits, the CDCSS will be sent to the AFP to perform a second MST strike within the AFP. Since the CDCSS contains a limited concentration of Cs, the process equipment located in the Alpha Finishing Facility (AFF) can be operated and maintained without the extensive shielding and remote handling provisions required in the ASP.

The Independent Review Team Process

DOE established an Independent Technical Review (ITR) Team to review the Preliminary Design of the Salt Waste Processing Facility. This independent review focused on evaluating the sufficiency of design to support development of a baseline cost and schedule (CD-2) per DOE Order 413.3A[2]. As such, the design should be mature enough to support development of "detailed, resource loaded schedules and cost estimate for the entire project…". In addition, the Performance Baseline "shall account for risks and mitigation strategies…". The results of the review will be used to determine if the current design is mature enough to request CD-2.

The scope of the ITR was defined in the form of LOI that served as the framework for review team activities and for selection of review team members. The LOI are listed in the ITR Charter and are grouped into three categories: (1) Civil/Structural Design, (2) Facility Safety, and (3) Engineering. The ITR Team focused their attention on the specific subjects identified by the LOIs. DOE indicated that general review priority will be Central Processing Area (CPA), Alpha Finishing Facility (AFF), and remaining support facilities in that order. The ITR Team focused only on the technical aspects of the Preliminary Design and did not review cost and schedule estimates. Further, the ITR did not conduct an independent review safety analysis or peer review all calculations or specifications. Calculations and specifications were reviewed on a selected basis to verify findings and conclusions.

The ITR Team was composed of experts with extensive experience in design, engineering and management of chemical processing and radioactive waste management systems. Individual expertise and experience was matched with the LOIs. The Team members' expertise is summarized in Table I. The ITR was divided into three Sub Teams for each of the three categories identified in the Charter. A leader was selected for each Sub Team to support the

Team Leader and to serve as a single point of contact to answer any questions/issues in the appropriate area. Hoyt Johnson and Carl Lanigan were the DOE-Headquarters and DOE-SR points of contact, respectively.

Table I. Independent Technical Review Team Expertise

	Area of Expertise
Team Lead	Nuclear materials processing, radioactive waste management
Civil/Structural Sub Team	Nuclear safety engineer, integrated safety management
	Civil, structural engineering, and seismic analysis (4 members)
	Geotechnical engineering, soil dynamics (2 members)
Facility Safety Sub Team	Radiation control , Decontamination & Decommissioning (D&D) (2 members)
	Remote equipment design, material handling equipment
	Integrated safety management; environment, safety and health
	Nuclear operations, integrated safety management
	Quality Assurance (QA)
Engineering Sub Team	Project management, construction management
	Process engineering (2 members)
	Mechanical engineering (2 members)
	Electrical engineering, engineering management
	Instrumentation and controls
	Heating, ventilation, and air conditioning

The ITR Team started their review on August 29, 2006, after the initial kick-off meeting. The initial review focused on design deliverables that had been completed previously. The 35% design package was provided to DOE on September 15, 2006. A number of design documents were completed or issued as drafts for formal DOE comments during the course of the review. Two Facility Safety and Engineering Sub Teams meetings were held during September and October, and the Civil/Structural Sub Team met once in October. The meetings included presentations, study of design deliverables, discussions with the EPC staff, and writing sessions.

During the ITR Team review, findings were categorized following an approach used in the review of the Demonstration Bulk Vitrification System[3]:

- **Fatal Flaws**: Items which could cause the failure of SWPF and cannot be resolved.

- **Technical Issues**: Items which could result in a failure of the SWPF system to meet established SWPF system performance requirements unless addressed prior to startup of hot operations.

- **Areas of Concern**: Items which may result in a change to design or require additional testing to determine if the design is adequate (now or later).

- **Suggested Improvements:** Items the SWPF project should consider to enhance safety, cost, schedule, or efficiency during the test operations, final design, commissioning and startup.

- **Positive Findings**: Items that the ITR Team felt were commendable and deserved recognition.

The categorization was conducted by the Team Leader and the three Sub Team Leaders. Although qualitative in nature, the categorization process was effective in identifying the highest priority findings. Findings are numbered using the two-digit section number in the report where they are identified, and then each category of finding is numbered sequentially throughout the report. For example, "Area of Concern 3.1-2" is found in Section 3.1, Central Processing Area, and is the second Area of Concern in the report. The corresponding recommendation for this Area of Concern is "Recommendation AC 3.1-2".

A report summarizing the findings in the review was transmitted to DOE on November 22, 2006[4]. The report provided a completed technical assessment to the DOE-Headquarters External Independent Review group as they began their review of the SWPF CD-2 submittal.

Results of the Review

The ITR Team focused their attention on the specific subjects identified by the LOIs. Responses to the LOI are summarized briefly in Table II. Essentially all design areas met or exceeded the 35% design expectation. Use of the term "partially met" in Table II indicates that the LOI could not be answered unequivocally and some exceptions or special circumstances were described in the ITR report. However, space is not available for the full discussion in this paper. Activities that need additional effort were conversion from ISO-9001 to NQA-1 and management of new risks identified by the ITR Team.

Table II. Summary of Responses to Lines of Inquiry

Number	Abbreviated Lines of Inquiry	Response
	Civil/Structural	
LOI I.a.1	Structural design progress on the CPA meet 35% design expectations?	Met.
LOI I.b.1	Structural design progress on the Support Facilities meet 35% design expectation?	Met.
LOI I.c.1	Geotechnical investigation support design requirements for the PC-3 CPA?	Partially met.
LOI I.d.1	All structural risks been identified and addressed; do any remain?	Not met.
LOI I.d.2	Risks resulting from the conversion from ISO-9001 to NQA-1 been adequately addressed?	Not met.
	Facility Safety	
LOI II.a.1	Tanks, piping, structure provide sufficient confinement of radiological material consistent with PC-3 requirements?	Met.

Table II. Summary of Responses to Lines of Inquiry (Continued)

Number	Abbreviated Lines of Inquiry	Response
LOI II.a.2	Concrete walls of sufficient thickness to meet 10 CFR 835 requirements?	Met.
LOI II.a.3	Penetrations and galleries adequately designed to meet 10 CFR 835 requirements?	Partially met.
LOI II.a.4(i)	All radiation protection risks been identified and addressed; do any remain?	Not met.
LOI II.a.4(ii)	Risks resulting from the conversion from ISO-9001 to NQA-1 been adequately addressed?	Met.
LOI II.b.1	Planned operating envelop of overhead cranes/hoists safely support radiation/ contamination controls, maintenance and operation of all components?	Partially met.
LOI II.b.2	Planned operating envelop of monorails/transfer carts safely support maintenance and operation of all components?	Partially met.
LOI II.b.3	Handling systems adequate to safely support movement, analysis, and disposal of samples?	Met.
LOI II.b.4(i)	Material handling risks been identified and addressed?	Not met.
LOI II.b.4(ii)	Risks resulting from the conversion from ISO-9001 to NQA-1 been adequately addressed?	Met.
LOI II.c.1	Has the design of the SWPF followed ISM principles?	Met.
LOI II.c.2	Appropriate facility hazards been identified and analyzed in the Preliminary Documented Safety Analysis (PDSA)?	Met.
LOI II.d.1	QA assessments of ISO-9001 implementation effective in identifying issues in preliminary design and have corrective actions been taken?	Met.
LOI II.d.2	Impacts of conversion to NQA-1 after preliminary design been assessed adequately?	Not met.
LOI II.d.3	Impacts of NQA-1 challenge any of the completed design?	Partially met.
	Engineering	
LOI III.a.1	Maturity of the process design support 35% completion status?	Met.
LOI III.a.2	CSSX test plans and results provide sufficient assurance that engineering development for this technology has reached the necessary technical maturity required for final design?	Partially met.
LOI III.a.3	MST/Filtration test plans and results provide sufficient assurance that the necessary technical maturity required for final design?	Met.
LOI III.b.1(i)	Maturity of the equipment/piping/tank/HVAC design support 35% completion status?	Met.
LOI III.b.1(ii)	Design designations for the PC-3 and PC-1 piping, vessels, and equipment adequate?	Met.
LOI III.b.2(i)	Maturity of the HVAC design support 35% completion status?	Met.
LOI III.b.2(ii)	Adequacy of PC-3 and PC-1 HVAC design?	Met.

Table II. Summary of Responses to Lines of Inquiry (Continued)

Number	Abbreviated Lines of Inquiry	Response
LOI III.c.1	Electrical portion of the design sufficiently mature to define all major components (e.g. transformers) and sufficient electrical capacity?	Met.
LOI III.c.2	Basic cable tray layouts sufficiently developed to provide an accurate construction cost estimate?	Met.
LOI III.d.1	I&C design sufficiently mature to define all major components and sufficient surplus capacity to provide for future expansion?	Met.
LOI III.d.2	Basic cable tray layouts sufficiently developed to provide an accurate construction cost estimate?	Met.
LOI III.e.1	Scope identified for the Limited Construction has a completed design and a CD-3 level construction cost estimate?	Insufficient information to review.
LOI III.e.2	Scope identified for CD-3A provide a reasonable optimization between schedule improvement and risk reduction?	Insufficient information to review.
LOI III.f.1	Design include features which will adequately support future operation, maintenance and D&D of the facility?	Met.
LOI III.g.1	All engineering risks been identified and addressed; do any remain?	Not met.
LOI III.g.2	Risks resulting from the conversion from ISO-9001 to NQA-1 been adequately addressed?	Not met.

During the ITR Team review, 136 findings were identified. These findings were categorized as follows:

- 0 Fatal Flaws
- 10 Technical Issues
- 48 Areas of Concern
- 67 Suggested Improvements
- 11 Positive Findings

No fatal flaws were identified that could cause the failure of the SWPF and cannot be resolved. However, there were 10 significant Technical Issues identified that the ITR Team believes could prevent or impair the ability of SWPF to meet project requirements. These Technical Issues and the associated recommendations are described below.

- **Verification of Lumped Mass Model Spectral Results:** Seismic analyses of the SWPF structural configuration have been conducted. Concerns were raised about the adequacy of the computed in-structure response spectra from the lumped mass stick model soil-structure-interaction analyses. The adequacy of the GTStrudL® lumped mass model spectral results should be verified to ensure that they are sufficiently conservative and accurate for continued use in the design.

- **Use of SRS Sitewide Seismic Hazard Recommendations:** The current structural acceptance document indicates that the vertical/horizontal (V/H) ratio being used for design of the Central Process Area (CPA) does not agree with the recommendations available in the site-wide seismic hazard documents. The project team should replace the vertical ground motion spectrum developed from the constant V/H ratio model to that consistent with the available site-wide seismic hazard recommendation.

- **Material for Diagonal Braces in Support Facilities:** The EPC had indicated using hollow-structural steel or structural steel tube sections for the diagonal braces. Thin wall rectangular tubes have had serious performance issues in recent earthquakes and new, as yet unpublished, research has added increased concerns about their performance. The ITR recommended that the design team consider either round steel pipe or wide flanged members for the vertical diagonal braces in the Support Facilities.

- **SWPF Feed, Product, and Waste Stream Requirements:** The SWPF feed, product, and secondary waste streams requirements need to be updated or re-established. It was recommended that a high priority be given to negotiating new WACs for both Saltstone and DWPF, having these WACs approved by the interface parties, and replacing those currently in the contract documents. Also, the specifics of acceptance of waste feed from the tank farm need to be established. After agreements are reached, the quantitative design information needs to be incorporated into the Interface Control Documents.

- **Characterization of Undissolved Solids:** There is no clear definition of the properties of the undissolved solids coming in with the waste. The ITR recommended that the EPC obtain characterization from SRS of the undissolved solids properties coming in with the waste. This information should be used to determine an input property box or envelop, and actions should be taken within equipment limitations to handle material outside the box. The information should be provided in an Interface Control Document that is approved by both the tank farms and SWPF.

- **Centrifugal Contactor Testing:** The ITR understood that failure of one centrifugal contactor will remove the entire SWPF Plant from production until it is repaired. The potential for high vibration levels could result in contactor bearings, internals or case failures and failure in the interconnecting piping. The ITR recommended that the contactor support configuration should be designed, built, tested, and vibration tuned prior to their actual installation in the plant. The testing of the contactors should be in the supported configuration that is intended to be installed in the SWPF and the test anchorage should match the stiffness and restraint characteristics of the actual in plant anchorage as closely as possible.

- **Performance Category-3 (PC-3) Remotely-Mounted Valves:** The ITR expressed concerns with the PC-3 remotely-mounted valves in the dark cells. These are PC-3 control valves that are in the dark cells and are remotely accessible via access tubes. These valves are to be seismically qualified by the vendor to ensure they meet their design function. The ITR recommended that the specification and qualification of these valves needs to be very carefully done to preclude difficult and costly design and testing requirements. For the manual valves, the ITR suggested that the EPC may want to consider a commercial dedication approach using experience based seismic qualification criteria as a cost effective approach to procure and qualify these valves.

- **Non-Destructive Examination (NDE) of Dark Cell Piping:** The EPC stated their current intention on weld NDE is to follow the criteria of B31.3 Section 341.4.1(b) which requires 5% of the girth butt welds be volumetrically inspected on a random basis. On the Hanford Waste Treatment Project, all black cell process piping and Important to Safety (ITS) piping must be 100% volumetrically inspected by Radiographic Testing (RT) or an automated Ultrasonic Testing (UT) process. The ITR recommended that all dark cell process piping and ITS piping welds should be 100% volumetrically inspected by RT or by UT if RT is not possible.

- **High Energy Line Break Evaluation:** A 100 psig steam system is supplied to the Process Area. The temperature of 100 psig steam would be on the order of 325^{o}F, and this piping is classified as High Energy. The effects of the postulated breaks in this steam system and any other system meeting this criteria need to be considered in the design of the SWPF. It was recommended that a High Energy Line Break evaluation be conducted to determine if there could be any impacts on any PC-3 systems, structure, or components.

- **Potential Damage to 13.8 kV Power Feeds**: The 13.8 kV power feeds are vulnerable to damage where they pass through the manholes. The EPC should separate to the greatest extent possible the power feeds in the manholes from the other 13.8 kV cables and rack them accordingly. Some means of fire protection for these power feeds should be provided; as a minimum each power feed should be wrapped from the point of entry to the point of exit with fire retardant tape.

Response to the Technical Issues the will be required to ensure successful SWPF system performance. Also, response to the Areas of Concern and Suggested Improvements will enhance the robustness of the design and the operability of the facility.

Remaining Technical Risks

In the Charter, the ITR Team also was requested to determine if all technical risks had been identified and addressed and, if not, to identify new or remaining technical risks. The ITR Team did not attempt to conduct a quantitative risk assessment. However, the Team did try to differentiate between findings or issues that had a straightforward engineering solution versus those that have significant uncertainty or unknown outcome. Based on this rationale, the ITR found that the highest priority technical risks that remain are:

- Completion of further design without final geotechnical data potentially could result in requiring redesign of the PC-3 Central Process Area base mat and structure due to changes in the soil-structure interaction as well as changes to the in-structure response spectra.

- Cost and schedule impacts arising from the change from ISO-9001 to NQA-1 quality assurance requirements.

- The "de-inventory, flush, and then hands-on maintenance" approach may result in unacceptable maintenance worker radiation exposure.

- The uncertainty related to the ability to procure a number of manual and automatic valves of a unique design which must be seismically qualified.

- Process or equipment impacts caused by inadequate characterization of the undissolved solids coming in with the waste feed.

Lessons Learned

The Team evaluated the process used in conducting the SWPF ITR to identify potential improvements that could be used by DOE in planning and conducting future ITRs. The major lessons learned are briefly described below:

- **Timing of the Review:** The ITR of the preliminary design of SWPF was started before the completion of all preliminary design deliverables. While this was done to enable early completion of the ITR, it proved difficult for the ITR Team due to unavailability of some key deliverables, such as higher tier design criteria documents. Also, the timing was difficult for the EPC due to their workload and schedule pressure to finish preliminary design.

- **Access to EPC Staff and Documents:** Accessibility to EPC points of contact is critical for a successful review and their availability is needed from the beginning of the review. The EPC provided internet access to their design deliverables, and this was extremely beneficial due to the large volume of documentation and to enabling the Team to work offsite without hard copies.

- **Availability of Adequate Facilities:** A dedicated conference room or "War Room" is a very valuable resource for the ITR Team. The EPC provided a conference room with hard copies of SWPF preliminary design deliverables for the Team's use during onsite meetings.

- **Fire Protection Expertise:** The SWPF ITR Team did not have a member with specific expertise in fire protection. Fire protection is an important area for DOE projects and the preliminary design included several fire protection deliverables. A fire protection expert would have strengthened the Team.

- **Focus on Safety:** The SWPF safety reviewers focused primarily on Integrated Safety Management System implementation and the Preliminary Documented Safety Analysis.

Specific Lines of Inquiry drove this focus, but in hindsight the Team felt that more effort could have been given to review of OSHA implementation, hazards identification, and process safety.

- **Training on Quality Assurance:** The SWPF ITR charter was revised after the first meeting to add specific Lines of Inquiry on NQA-1 implementation, and a new Team member was added with NQA-1 expertise. Several Team members had QA-related lines of inquiry in their disciplines and up front coaching by our QA resource would have been beneficial to ensure consistent approaches were taken.

- **Guidance for D&D:** The SWPF ITR reviewed the design to determine if appropriate features were incorporated to facilitate future D&D. A Team member prepared a D&D checklist to guide the review. The checklist was found to be very useful, and it was provided to DOE for use in future ITRs.

- **Time for Report Preparation:** More time was needed in the ITR schedule for internal discussion of findings and recommendations by the Team prior to drafting the report. Also, additional time was needed for internal review of the draft report, for DOE review of the draft report, and for final editing after all comments have been resolved.

CONCLUSIONS AND RECOMMENDATIONS

The SWPF ITR Team focused only on the technical aspects of the Preliminary Design and did not review cost and schedule estimates. Further, the ITR did not conduct an independent safety analysis or peer review all calculations or specifications. The latter were reviewed on a selected basis to verify findings and conclusions. Based upon the technical review, the following conclusions were reached:

- The SWPF project is ready to move into final design.

- Technical Issues associated with the structural design of the facility can be addressed as part of the normal design evolution. However, geotechnical investigations are behind schedule for a project at this stage of design. This represents a significant project-level risk.

- The primary processes (MST sorption of actinides and Sr and Cs removal by CSSX) are technically sound, and the planned large-scale equipment tests will provide very useful data to confirm and/or improve upon the current design.

- The SWPF project has experienced several major changes in requirements since conceptual design: PC-2 to PC-3, conversion from ISO-9001 to NQA-1, and DOE Interim Safety Guidance. The full impacts of these changes are still being assessed by the EPC and DOE.

- The unique operations and maintenance approach (dark cells with no expected maintenance and other equipment maintenance by flushing and hands-on maintenance) will require rigorous design and quality assurance measures to support procurement and construction.

- The current design is dependent on procuring a seismically qualified valve that isolates the process system in the event of an earthquake. The design of this valve is very different from other valves which have been seismically qualified for nuclear applications. If this valve cannot be purchased, a significant change to the current design will be required. An immediate effort should be made to determine if the valve can be procured.

- The level of maturity of several areas of design, notably Instrumentation and Control and electrical, is in excess of that expected at the 35% design point.

- A number of common design issues and process concerns exist between SWPF and the Hanford Waste Treatment Project. A technical exchange between DOE's major waste treatment projects should be considered to address common concerns and share lessons learned.

Finally, the ITR recommended future focused independent reviews on critical ongoing activities including geotechnical studies, air pulse agitator testing, large-scale cross-flow filtration, and full-scale CSSX centrifugal contactor testing.

PLAN FOR CLOSURE OF ITR REPORT FINDINGS

DOE-SR transmitted the ITR report to Parsons on November 22, 2006. In parallel with Parsons' initial review, the DOE-SR Integrated Project Team performed an impact assessment to determine if any of the findings would impact the cost and schedule baseline. Their evaluation concluded that any realized risks identified by the ITR report could be covered by project contingency. DOE-SR will work with Parsons to develop and execute a closure strategy and plan for the findings in the ITR report. The closure plan will include prioritization of the findings, schedules for closure of findings, and follow-up with the ITR Team for review of closure actions. The strategy also will include how DOE-SR will monitor the resolution process.

REFERENCES

1. Parsons, 2004, *Salt Waste Processing Facility Functional Specification*, P-SPC-J-00002, Rev. 0, January.

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