# Salt Waste Processing Facility Independent Technical Review

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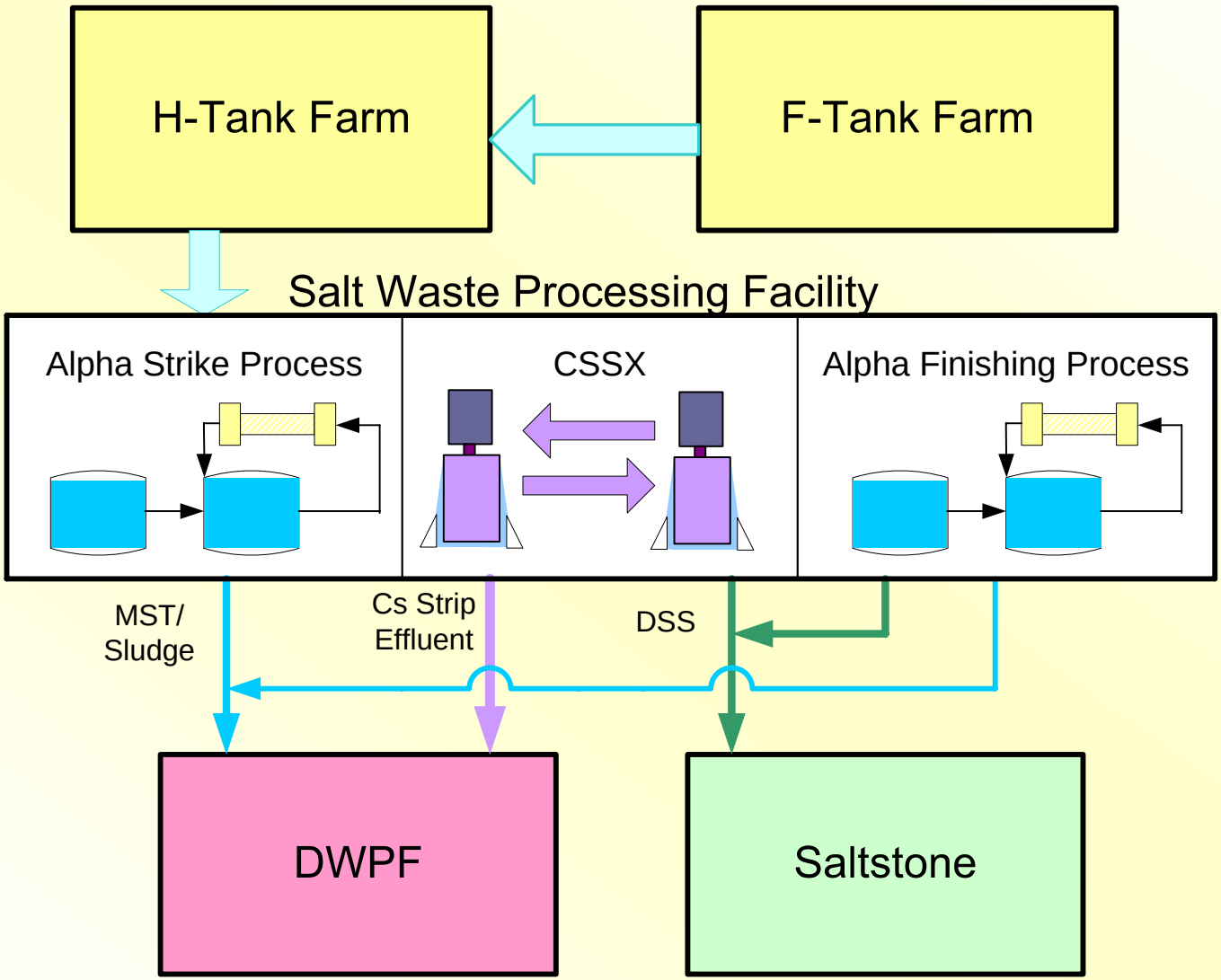
# Outline

- SWPF Process Overview
- Major Risks
- Approach for Conducting Review
- Discussion of Findings
- Conclusions

# Salt Waste Processing Facility

# SWPF Process Overview



# BOTTOM LINE

The SWPF Project is ready to move into final design.

# Major Risks

- Final geotechnical data potentially could result in redesign of the PC-3 CPA base mat and structure.
- 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 unique manual and automatic valves which must be seismically qualified.
- Process or equipment impacts caused by inadequate characterization of the undissolved solids coming in with the waste feed.

# SWPF ITR Charter

GOAL: Evaluate sufficiency of design to support development of a baseline cost and schedule (CD-2).

- Charter drafted by DOE-SR, reviewed and approved by Team Leader, DOE-SR, and DOE-HQ.
- Lines of Inquiry in three areas:
  - Civil/Structural Design
  - Facility Safety
  - Engineering

# List of ITR Team Members

| Harry Harmon, Lead | | |
|---|---|---|
| Civil/Structural | Facility Safety | Engineering |
| Peter Lowry* | James Langsted* | George Krauter* |
| Tom Anderson | Jerry Evatt | Timothy Adams |
| John Christian | Todd LaPointe | Oliver Block |
| Carl Costantino | Norman Moreau | Ken Cooper |
| Robert Kennedy | Chuck Negin | Patrick Corcoran |
| Loring Wyllie | Richard Stark | Art Etchells |
| Les Youd | | Stephen Gosselin |
| | | |

*Sub Team Leads

# Definition of Finding Types

- 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.

# Summary of Findings

| Category | Civil/ Structural | Facility Safety | Engineering | Total |
|---|---|---|---|---|
| Fatal Flaws | 0 | 0 | 0 | 0 |
| Technical Issues | 3 | 0 | 7 | 10 |
| Areas of Concern | 10 | 11 | 27 | 48 |
| Suggested Improvements | 2 | 16 | 49 | 67 |
| Positive Findings | 0 | 5 | 6 | 11 |
| Total | 15 | 32 | 89 | 136 |

# Technical Issues

- Adequacy of the computed in-structure response spectra from the lumped mass stick model soil-structure-interaction analyses.
- Vertical/horizontal ratio being used for design of the CPA does not agree with recommendations in site-wide seismic hazard documents.
- Hollow structural steel or structural steel tube sections for the support facility diagonal braces have performance concerns.
- The SWPF feed, product, and secondary waste streams requirements need to be updated or re-established.

# Technical Issues (Continued)

- No clear definition of the properties of the undissolved solids coming in with the waste.
- High vibration levels could result in failures of contactor or interconnecting piping.
- PC-3 remotely-mounted valves in the dark cells could be difficult and expensive to seismically qualify.

# Technical Issues (Continued)

- Design criteria for non-destructive examination of dark cell piping is inadequate – should be 100% radiographic or ultrasonic testing.
- There is 100 psig steam supplied to the Process Area and the potential for High Energy Line Break should be evaluated.
- The 13.8 kV power feeds are vulnerable to damage where they pass through the manholes.

# Conclusions

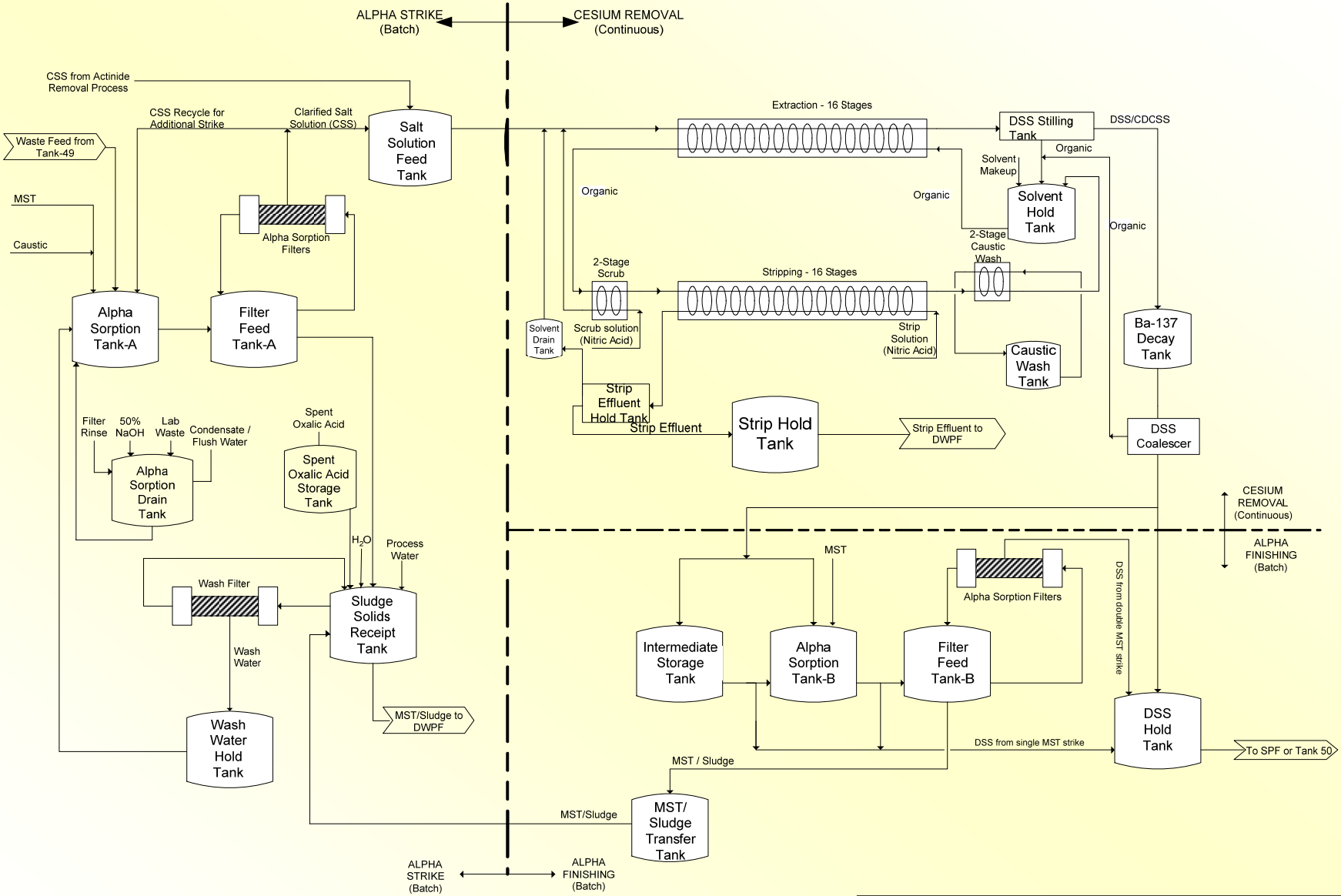
- The SWPF project is ready to move into final design.
- Technical Issues associated with the structural design of the facility can be addressed as part of the normal design evolution. However, geotechnical investigations are behind schedule for a project at this stage of design.
- The primary processes (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.

# Conclusions (Continued)

- 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.
- 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.

# Backup Slides

# SWPF Flowsheet

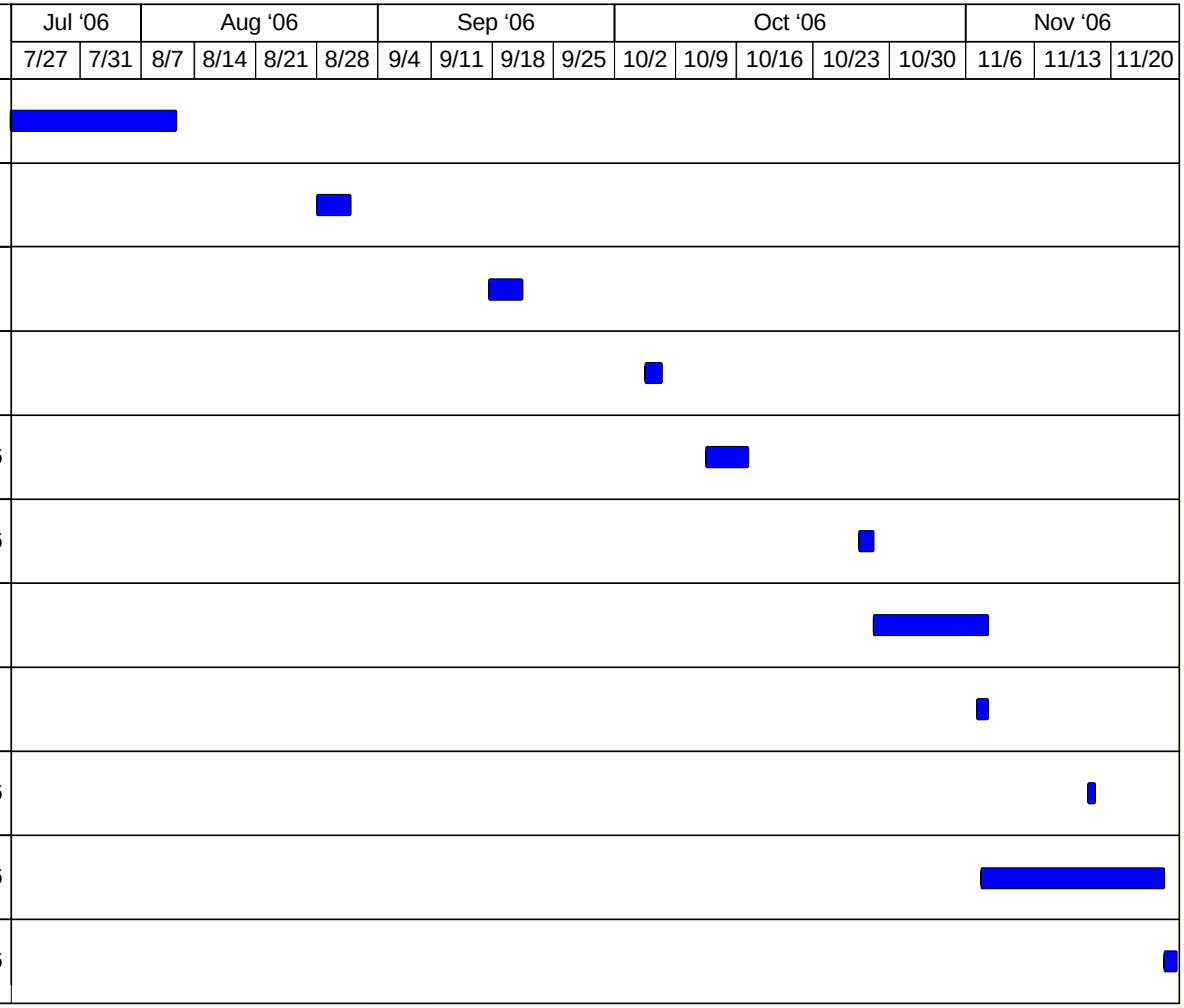


# Approach for Conducting Review

- Kick-Off Meeting for project overview, engineering discipline reviews, and site tour
- Studied preliminary design products via hard copies and EPC “Livelink” internet site
- Sub Team Meetings for detailed presentations, discussions with EPC Points of Contact, and writing
- Final Meeting focused on validation of findings, Sub Team discussions, and report writing
- Conference Calls between Sub Team Meetings and during report review/comment cycles

# ITR Schedule

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | Develop Charter & Select Team Members | 7/24/06 | 8/10/06 |
| 2 | Kick-Off Meeting | 8/29/06 | 8/30/06 |
| 3 | Safety & Engineering Sub Teams Meeting | 9/18/06 | 9/20/06 |
| 4 | Civil/Structural Sub Team Meeting | 10/3/06 | 10/4/06 |
| 5 | Safety & Engineering Sub Teams Meeting | 10/11/06 | 10/13/06 |
| 6 | Draft Report to DOE | 10/26/06 | 10/26/06 |
| 7 | DOE Review Period | 10/27/06 | 11/9/06 |
| 8 | DOE Comments to ITR | 11/9/06 | 11/9/06 |
| 9 | ITR Response to DOE Comments | 11/17/06 | 11/17/06 |
| 10 | Incorporate Comments to Draft | 11/9/06 | 11/21/06 |
| 11 | Final Report to DOE | 11/22/06 | 11/22/06 |



# Summary of Answers to Lines of Inquiry

| Answer | Number |
|---|---|
| Met | 21 |
| Partially Met | 6 |
| Not Met | 7 |
| Insufficient Information | 2 |
| Total | 36 |

# Summary of Answers to Lines of Inquiry

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| | *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 |

# Summary of Answers to Lines of Inquiry (Continued)

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| *Facility Safety* | | |
| LOI II.a.1 | Tanks, piping, structure provide sufficient confinement of radiological material consistent with PC-3 requirements? | Met |
| 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 |

# Summary of Answers to Lines of Inquiry (Continued)

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| *Facility Safety (Continued)* | | |
| 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 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 |

# Summary of Answers to Lines of Inquiry (Continued)

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| *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 | Maturity of the HVAC design support 35% completion status? | Met |
| LOI III.b.1(ii) | Adequacy of PC-3 and PC-1 HVAC design? | Met |

# Summary of Answers to Lines of Inquiry (Continued)

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| *Engineering (Continued)* | | |
| 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 |
| LOI III.e.2 | Scope identified for CD-3A provide a reasonable optimization between schedule improvement and risk reduction? | Insufficient Information |

# Summary of Answers to Lines of Inquiry (Continued)

| Number | Abbreviated Lines of Inquiry | Answer |
|---|---|---|
| *Engineering* (Continued) | | |
| 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 |

# Civil/Structural Areas of Concern

- Need to add two external buttress walls to strengthen upper level of Central Process Area (CPA) structure.
- The lumped mass and finite element models of the CPA have not been adequately verified against each other.
- Design of the underground PC-2 high activity waste transfer lines are not addressed specifically in the structural acceptance criteria.
- The results of the ongoing geotechnical testing program could raise new issues that will have to be addressed.

# Facility Safety Areas of Concern

- Maintenance experience at facilities (both onsite and offsite) must be used to help understand the maintenance worker dose.
- Equipment needed for removing and replacing failed bridge crane components via the maintenance platform.
- Head room for crane hoist lifting of process vessel agitators is not adequate in the Alpha Finishing Facility.
- There is a significant inconsistency between the approved contract scope and the current design scope.
- The software QA management program is not fully understood and implemented.

# Engineering Areas of Concern

- Vacuum protection with redundant relief valves on the dark cell common header is considered insufficient protection.
- Fine particulate solids can adversely affect coalescing and mass transfer devices.
- None of the equipment specifications that are marked Safety Significant evoke NQA-1.
- This fire protection designation as General Service and PC-1 seem to be in conflict with the DOE Interim Safety Guidance.
- The CPA confinement system may be compromised due to General Service classification where the exhaust duct header exits the CPA boundary.
- The Standby Diesel Generator can reach an overloaded condition.
- EPC plans to purchase all instrumentation with an arbitrary Safety Integrity Level II.

# Nature of Suggested Improvements

- Suggestions for future design work or enhancements to current designs
- Clarifications for design and procurement
- Calculations to support completed design
- Increased formality in work practices or design procedures
- Document revisions
- Test plan modifications
- Operations guides
- Evaluation of SRS or WTP practices

# List of Positive Findings

- The SWPF laboratory preliminary design.
- MicroShield® software and lead analyst experience.
- Shielding calculations were verified by ITR.
- Quality assurance for shielding analysis.
- Interaction between the ESH&Q and Design Group.
- Including Operation and Maintenance early in the design phase.(2)
- Detailed General Arrangement drawings.
- Corrosion allowances are conservative for all PC-3 and PC-1 vessels and piping.(2)
- Highly reliable system architecture for both the Distributed Control System and Safety Instrumented System.

# Lessons Learned

- Do not begin review until all design deliverables are completed.
- Make contact with key EPC staff at first meeting.
- Internet access to EPC documents was very helpful.
- Allow more time for discussion of findings and recommendations and for writing assignments.
- Ensure availability of adequate facilities.
- Use D&D checklist in other reviews.
- Include fire protection expertise on ITR Team.
- Focus safety on OSHA implementation, hazards identification, etc., in addition to ISMS implementation.
- Provide up-front coaching on QA to all Team members who have QA-related Lines of Inquiry.