Report of Findings, Conclusions, and Recommendations Concerning the Waste Treatment and Immobilization Project (WTP) at Hanford

Submitted by the Environmental Management Advisory Board Tank Waste Subcommittee
September 15, 2010

Introduction

In May 2010, the Department of Energy established the Environmental Management Tank Waste Subcommittee (EM-TWS). The EM-TWS was charged with conducting an independent technical review of liquid waste capital and operations projects related to the Office of Environmental Management (EM) tank waste cleanup programs at Hanford, Washington; the Savannah River Site in South Carolina; the Idaho National Laboratory; and the West Valley Demonstration Project in New York. The EM-TWS's review focused on the facilities being planned, designed, and constructed at those sites, as well as operations/lifecycle costs.

This report covers the work plan observations and recommendations concerning the Waste Treatment and Immobilization Plant at Hanford (WTP). The charge is summarized below.

> ***Charge 1: Verification of closure of Waste Treatment and Immobilization Plant (WTP) External Flowsheet Review Team (EFRT) issues.***
>
> *The Subcommittee should verify that technical resolutions for the 28 issues identified by the EFRT are being or have been successfully implemented to ensure that engineering and design activities can be completed to reduce WTP project risk.*
>
> ***Charge 2: WTP Technical Design Review***
>
> *The WTP is at approximately 80% design completion. The Subcommittee should perform a systems-based review of the design against the contract functional requirements.*
>
> *The Subcommittee should address and provide advice on the following areas related to the design: 1) technical risks have been adequately addressed in the design, and 2) design is sufficiently mature to allow proceeding with needed procurements and construction activities to meet WTP requirements.*
>
> ***Charge 3: WTP Potential Improvements***
>
> *The WTP will treat 53 million gallons of highly radioactive waste in 177 underground tanks at Hanford over several decades. Therefore, the Committee should consider any technical improvements that could result in a net reduction in the life cycle cost and schedule of the tank waste cleanup provided that the improvements do not have an adverse impact on the WTP Total Project Cost or project completion date.*

The WTP is a large, complex, first-of-a-kind plant involving five integrated facilities with more concrete, steel, and piping than a large nuclear power plant. The WTP represents state-of-the-art

technology derived from both British and U.S. nuclear waste management best practices. The WTP integrates nuclear materials and chemical process industry design principles. In addition, this is a project with a history that spans more than a generation of programmatic and policy evolution. The plant design and construction have progressed under the leadership of five DOE field office managers, four contractor project managers, and three Federal Project Directors.

Concerns regarding the escalation of WTP project cost and schedule began in mid-2002. An independent commission, reporting to the Secretary of Energy, indicated that cost estimates had escalated by about 40 percent just months after construction began. As baseline estimates increased, the project introduced a "minimum essential" approach that reduced design margins and flexibility. An effort was made to use "value engineering," to produce more value for the project. Although WTP has always been considered the first phase of a two-phase treatment program, the WTP was reconfigured so that it could treat all of the high-level radioactive waste; therefore, only the low-activity waste would require a second phase.

In 2005, the Secretary of Energy commissioned a distinguished group of experts known as the "Best and Brightest" to review the project technology, cost, schedule, and management (all of these areas having been subject to many other expert reviews before and since). The Best and Brightest issued a report in 2006 that provided a number of important findings:

"…. DOE should act more like an owner since it will have to run the facilities for decades, and a substantially greater amount of contingency in both cost and schedule should be budgeted given the unique and complex nature of the project…."

The EFRT report provided specific recommendations, including more than two dozen technical issues that needed to be resolved. DOE revised its baseline consistent with those recommendations. The baseline has remained fairly constant since then, at a final estimated cost of $12.263 billion and startup date in late 2019. The resolution of the technical issues has continued since that time and is nearing completion.

The EM-TWS charter calls for the technical review and expert opinion as to how this project must move forward concerning closure of the EFRT issues as well as observations on technical risks, design sufficiency, and potential improvement areas.

Charge 1: Verification of closure of Waste Treatment and Immobilization Plant (WTP) External Flowsheet Review Team (EFRT) issues.

The Subcommittee should verify that technical resolutions for the 28 issues identified by the EFRT are being or have been successfully implemented to ensure that engineering and design activities can be completed to reduce WTP project risk.

Summary of the Findings for Charge 1

The EM-TWS's observation is that the current WTP Contractor, with DOE's concurrence, has met the WTP procedures and protocols that constitute issue closure and is continuing to pursue the resolution of remaining technology issues in parallel with engineering, procurement, and construction (EPC) activities. The only EFRT issue that does not have full concurrence of the DOE/Contractor Technology Steering Group that it satisfies all closure criteria is that part of the M3 issue, *Inadequate Design of Mixing Systems*, involving the design of the pulse-jet mixing (PJM) systems for five WTP non-Newtonian vessels. Closure of the corresponding non-Newtonian vessel assessment was deemed to be a risk-based management decision by the Federal Technology Steering Group membership.

The EM-TWS finds that the professionalism and effectiveness of the current WTP Contractor are adequate to meet the challenge of keeping the project on track to meet the project schedule.

Background for Charge 1

The External Flowsheet Review Team (EFRT) assessed hundreds of possible concerns involving the WTP design. The scope of the EFRT's review involved an assessment of whether the WTP, as designed in 2006, would meet the throughput capacity specified in the contract and required for the long-term mission. Three fundamental capacity aspects were considered by the EFRT:

1) Basic sizing of the plant and equipment,
2) Process capacity based on the process design, and
3) Actual capacity. Actual capacity is the ability to sustain product output at the desired rates after including plant availability. The scope of the review did not consider many issues, including evaluation of alternatives, cost and schedule, hydrogen in piping and ancillary vessels (HPAV), supplemental low-activity waste (LAW), or waste forms and qualification (EFRT 2006a).

After completing the evaluation, the EFRT identified 28 remaining issues. These issues were classified as either *systematic* or *process area-specific*. The items were further categorized as either *major* or *potential* (i.e., that <u>will</u> or <u>could</u> prevent meeting contract rates with commissioning and future feeds, respectively). Major issues must be fixed to ensure that WTP will meet design throughput for all feeds identified at the time of the EFRT review. The EFRT believed that all of the major and potential issues it identified had possible solutions and provided example fixes for selected issues (EFRT 2006a).

Issue Response Plans for the 28 issues were developed that included at least one closure criterion (and often several criteria) for each EFRT issue. All 28 issues were considered closed at the time of the EM-TWS review. Closure was defined as satisfying the requirements of the closure criteria in the appropriate Issue Response Plan (IRP). When necessary, the plans identified actions to be tracked in the Office of River Protection (ORP) Action Tracking System (ATS) to address residual risks.

Findings and Observations:

The EM-TWS reviewed the following areas of concern identified by the EFRT and concluded that none would prohibit continuation and completion of the EPC efforts. The following list summarizes the depth of review and the timeline of confirmed closure to adequately establish that EPC activities should continue as scheduled and planned.

Status Summary of Issues Identified by the EFRT

EFRT Issue(s)	Title	Date Closed
M1	Plugging in Process Piping	02Mar09
M2	Mixing Vessel Erosion	10Oct09
M3	Inadequate Design of Mixing Systems	20Aug10
M4	Designed for Commissioning Waste vs. Mission Needs	13Nov07
M5	Must Have Feed Pre-Qualification Capability	18Oct07
M6 / P4	Process Operating Limits Not Completely Defined / Gelation / Precipitation	08Dec08
M7	Inconsistent Long-Term Mission Focus	13Nov07
M7a / M7b	Lack of Spare LAW Melter / Lack of Spare High-Level Waste (HLW) Melter	02Nov06
M8	Limited Remotability Demonstration	15Oct07
M9	Lack of Comprehensive Feed Testing during Commissioning	18Oct07
M10	Critical Equipment Purchases	15Oct07
M11	Loss of WTP Expertise Base	17Mar08
M12	Undemonstrated Leaching Processes / Pretreatment (PT) Facility	29Sep09
M13	Inadequate Ultrafilter Surface Area and Flux (PT)	24Sep09
M14	Instability of Baseline Ion Exchange (IX) Resin (PT)	18Oct07
M15	Availability, Operability, and Maintainability (PT)	15Apr08
M16	Misbatching of Melter Feed (LAW Vitrification Facility)	18Oct07
M17	Plugging of Film Cooler and Transition Line (LAW Vitrification Facility)	15Apr08
P1	Undemonstrated Decontamination Factor (PT-Evaporators)	15Apr08
P2	Effect of Recycle on Capacity Evaporators (PT-Evaporators)	13Nov07
P3	Adequacy of Control Scheme (PT–Evaporators)	12Dec06
P5	Inadequate Process Development (PT-IX)	21Dec07
P6	Questionable Cross-Contamination Control (PT-IX)	18Oct07
P7	Complexity of Valving (PT-Ion Exchange)	17Mar08
P8	Effectiveness of Cs-137 Breakthrough Monitoring System (PT-Ion Exchange)	18Oct07
P9	Undemonstrated Sampling System (Analytical Laboratory (LAB) and Sampling)	05Nov09
P10	Lack of Analysis before Unloading Glass-forming Chemicals in Silos (Balance of Facilities (BOF))	15Oct07
P11	Incomplete Process Control Design (Design of Control Systems)	21Dec07

The EM-TWS has adopted the standard for verifying closure as being demonstrated compliance with all corresponding IRPs. Each IRP is customized to the nature of the corresponding issue being addressed, but in general, an IRP defines the issue of concern, conditions necessary to address the concern, and a path forward for doing this within ongoing EPC activities, based on industry best practices.

The closure of an issue does not mean that all related technology issues are completely resolved. Industry experience shows that resolution of technology issues frequently continues during construction and startup. For example, the procedures and protocols might require a modification to plant components and/or operating conditions and further require that this modification be demonstrated during the startup and commissioning process. A plan for development and implementation of this modification based on acceptable industry practice would constitute IRP compliance and issue closure, but, given the first-of-a-kind nature of WTP, unanticipated further concerns could possibly arise during this demonstration process.

The EM-TWS's observation is that the current WTP Contractor, with DOE's concurrence, has met the IRP procedures and protocols that constitute issue closure and is continuing to pursue these IRPs in parallel with EPC activities.

The only EFRT issue that does not have full concurrence of the Technology Steering Group that it satisfies all closure criteria is that part of the M3 issue, *Inadequate Design of Mixing Systems*, involving the design of the pulse-jet mixing systems for five WTP non-Newtonian vessels. Closure of the corresponding non-Newtonian vessel assessment was deemed a risk-based management decision by the Technology Steering Group's Federal membership.

Charge 1, Recommendations 2010-02 through 11

In further review of the EFRT activities, the EM-TWS felt that there are some areas of concern and improvement that should be investigated and completed; however, these observations should not delay the WTP EPC execution of work. Chapter 3 of the report[1] articulates these items in detail; however, below is a summary of those observations and recommendations:

[1] To be issued on Sept 30, 2010.

Summary for EFRT Issues with Significant Recommendations per the EM-TWS

EFRT Issue	Description	Impact on Commissioning	Additional Concerns	Significant Recommendation(s)
M1	Plugging in Process Piping	The impact of modifying piping specifications on the commissioning cost and schedule depends greatly on the timing and extent of the changes.	Potential for plugging in WTP lines, especially outside normal operations and the risk of plugging in transfer lines being too high.	**2010-02** Analyze to identify high-risk lines for plugging, reanalyze current transfer line design to ensure acceptable risk of plugging, consider physical processes for reducing or removing plugs in long lines and transfer lines, consider redundancy in high-risk lines.
M3	Inadequate Design of Mixing Systems	Additional equipment and instrumentation may be required to ensure adequate mixing in WTP vessels using PJMs; additional simulants may be needed, specific mixing tests may be defined (especially if neither prototypic nor full-scale testing is performed before commissioning), operations may be refined to accommodate mixing results, and contingency plans may be developed for internal changes to vessels.	Bubbler issues including solids entrainment; the PJMs potentially not meeting Technology Readiness Level (TRL) 6; undocumented / formal analysis supporting closure of non-Newtonian vessels.	**2010-03** Document the formal cost-benefit analyses to evaluate potential benefits of additional testing; clearly document the basis for the final vessel assessment closure, and, if high-risk, confirm the technical basis for scaling and ensure access to the vessel if changes are needed; evaluate the safety basis assumptions and methods and test vessel clearing methods.
M5	Must Have Feed Pre-Qualification Capability	The detailed technical basis for waste feed prequalification will need to be completed (e.g., to confirm that sufficient laboratory space will be available and to validate key assumptions, models, and experiments).	Incomplete technical and test specifications (and corresponding uncertainty if LAB is adequate); two-phase sampling difficulties; need to integrate pre-qualification unit operations; and testing for precipitates and gels in pre-qualification protocol	**2010-04** Develop robust and integrated prequalification protocols and "facility;" develop detailed technical basis for waste feed prequalification and use to confirm adequate laboratory capability; ensure representative sampling of two-phase mixtures in the Tank Farm.
M8	Limited Remotability Demonstration	The development of plans to address remotability issues (e.g., remote replacement of piping and remote repair "sprung" pipes) may require testing that would impact commissioning.	Lack of experience with large (> 10") jumpers; how to empty vessels with only a single outlet pump and valve in event of failure; potential to damage connectors for flexible electrical and pneumatic jumpers during replacement; and how to handle a failed IX column.	**2010-05** Develop plans and possible training mock-up to address remotability concerns (i.e., gain experience with large jumpers, remote replacement of piping, remote repair of "sprung" pipes, removal and decontamination of failed IX column, how to empty vessels with only a single outlet pump and valve in the event of failure).
M10	Critical Equipment Purchases	**N**o impact.	Limited documentation of bases for decisions concerning "best value" approach.	**2010-06** Provide additional documentation regarding the criteria used for best value selection; evaluate single supplier for IX resin seed; and need to keep "best basis" concepts current.
M14	Instability of Baseline Ion Exchange (IX) Resin (Pretreatment Facility or PT)	There may be impacts on commissioning and operations if the resorcinol formaldehyde (RF) resin is not available due to seed supplier viability.	Testing appears to be limited to support operations.	**2010-07** Extended testing to confirm ion exchange capacity and resin physical stability/lifetime at this temperature; conduct hazards and operability study (HAZOPS) to determine if the Cesium Ion Exchange Process System (CXP) temperature might increase above 65°C during abnormal operating conditions
M15	Availability, Operability, and Maintainability (PT)	**T**his should be converted into an ongoing project evaluation that continues through WTP Contractor-supported commissioning activities. The lessons learned in planning for operations should provide valuable insight, provide continual interchange between the design/builder and operator, and help to define the appropriate timing and method of handoff during commissioning and startup.	Compliance margin based on current Operations Research (OR) model availability may be insufficient.	**2010-08** Update OR model more frequently (evaluate Reliability, Availability, Maintainability, and Quality Control (QC) Inspection information); review current OR model and the state of knowledge from similar crane operations; establish ongoing coordinating function.
P1	Undemonstrated Decontamination Factor (PT-Evaporators)	Simulant review should take place prior to radioactive functional testing.	Technical specification and performance documentation for the procurement specification have not been confirmed based on the most recent G2 model; possibility and impact of foaming uncertain; lack of simulant testing.	**2010-09** Continue to review the impact of foaming; review simulants.
P4	Gelation/Precipitation	Risks, judged to be acceptable at the time of issue closure, will be carried forward to commissioning and operations.	Impacts of changes to prevent gelation have not been assessed throughout affected systems.	**2010-10** Assess impact of changes to prevent recently observed gelation / precipitation throughout affected systems.
P5	Inadequate Process Development (PT-Ion Exchange)	No impact.	Availability of resin seed for WTP Operations has not been confirmed.	**2010-11** Ensure the availability of RF resin seeds for WTP operations.

Charge 2: WTP Technical Design Review

The WTP is at approximately 80% design completion. The Subcommittee should perform a systems-based review of the design against the contract functional requirements.

The Subcommittee should address and provide advice on the following areas related to the design: 1) technical risks have been adequately addressed in the design, and 2) design is sufficiently mature to allow proceeding with needed procurements and construction activities to meet WTP requirements.

Summary of the Finding for Charge 2

Based on its review of the design processes and systems being employed, the EM-TWS has concluded that, independent of the EFRT issues that are discussed above: 1) no substantial risk to compliance with contract functional specifications was identified, and 2) the design appears to be sufficiently mature to proceed with completion of EPC.

Background for Charge 2

As the WTP project advances toward completion, it will approach what has been described as "a pivot point," at which time the principal focus of management attention will begin to shift from EPC to engineering, procurement, construction, and commissioning (EPCC). The two principal questions raised in this charge concern

- where the project now stands in relation to this pivot point; namely, whether the technical risks associated with EPC have been sufficiently resolved (i.e., is the remaining risk sufficiently low); and

- whether the design has advanced to a sufficient level of maturity or completeness such that WTP is now at this pivot point.

WTP consists of five standalone facilities, the first four of which are shown in the aerial photograph in below.

High-Level Waste;

Low-Activity Waste;

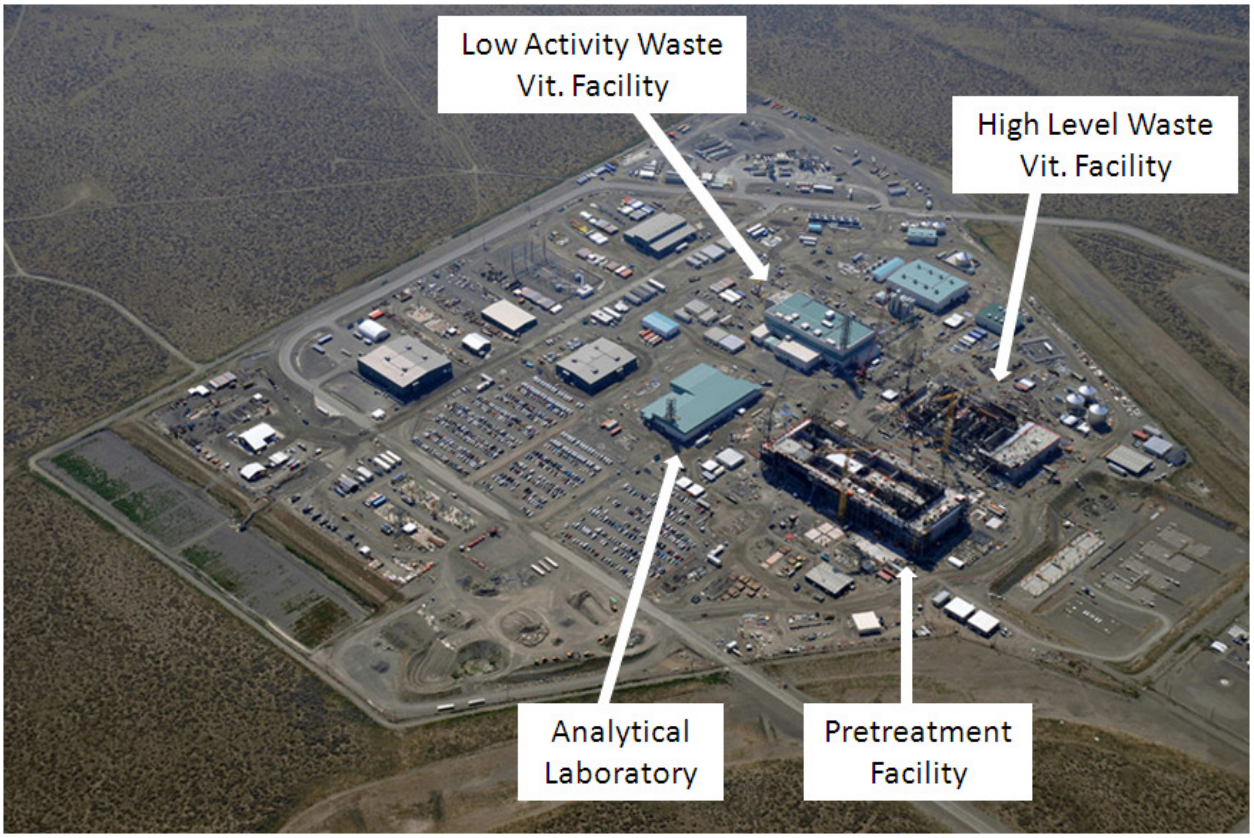
Pretreatment;

Analytical Laboratory; and

Balance of Facilities, a collection of smaller support facilities, e.g., process water.

In order to assess the relative progress of WTP, it is necessary to first understand the EPC process that is currently being deployed. The contract between DOE and the prime contractor for

this project calls for all of the EPC elements to be performed as an overlapping, sequential process in order to "fast-track" completion of the WTP project and achieve the lowest feasible cost. Each WTP facility is being developed in this overlapping manner by defining individual work areas, typically starting at the lowest physical level in a given facility and working upwards.



Aerial View of the WTP Construction Site, July 2010

Contract-Derived Plant Specifications

The fundamental project reference document consists of the technical sections of the DOE contract that define the feed that WTP will receive from the Hanford Tank Farms, in addition to the plant productivity and the product quality of the vitrified waste product. The contract also defines safety and quality requirements, contractor engineering work product deliverables, and verification of performance through the post-construction startup and commissioning phase.

For the EM-TWS review, completion of the contractor's work product was determined by whether it complied with contract-derived specifications in a comprehensive and professional manner. To the extent that the work product was not complete due to nonconformance with these specifications, there is an associated future risk.

WTP Conformance with Project Specifications

One common method to determine if a capital project is in conformance with project specifications is to perform a system-by-system review of the physical plant and compare the work products for each system with the documented specifications for a given system and for each of the components within that system. The size and complexity of the WTP project together with the two-month timeframe for the review presented practical challenges in performing a comprehensive system-by-system review.

Consequently, the EM-TWS realized that it needed to take a more holistic approach. The EM-TWS reviewed the methods and procedures used to develop, maintain, and utilize project specifications and to maintain consistency in its system-by-system application among work areas within the plant. The EM-TWS also reviewed the application of these methods to two of the many systems chosen from the WTP Work Breakdown Structure: Pretreatment In-cell Handling (principally, the overhead crane that handles most materials within the hot cell) and the Cesium Ion Exchange process. The EM-TWS also reviewed an extensive WTP system-by-system configuration management review commissioned by the current WTP contractor in 2008 and 2009.

Methods and Procedures for Compliance with Contract Functional Requirements

The current WTP contractor initially developed a set of planning documents that defined the safety envelope, basic process flowsheets that define the strategy for achieving the contract-specified throughput capacity, the glassified product production strategy to meet the contract-specified quality, the operations and maintenance strategy, the environmental compliance strategy, and plant external interfaces. These planning documents formed the platform for developing a comprehensive Basis of Design document, which provides instruction as to the general plant layout, purpose, and requirements; the applicable codes and standards to be utilized by all EPC disciplines and the safety and quality requirements; and the technology issues that require further development. The Basis of Design document also provides high-level guidance for initiating a research and technology program to address these issues.

The most fundamental question regarding technical risk is whether the plant has been built to these specifications and will likely continue to be built to them until completed. The basic answer to this question entails a confirmation that the systems and work processes in place are adequate to ensure compliance and that sufficient oversight exists to confirm that these systems and process are being properly employed.

Management of Change within the EPC Process

The nature of the EPC process being used at WTP, and the duration of this project, has resulted in a large number of changes. The project has employed an array of change management processes to ensure that these changes are properly implemented.

At any given time, a large number of changes within WTP activities are in process. The notation of these changes on design drawings and other work products (e.g., procurement specifications)

is managed in part by the project automated database management system. However, it also depends on expert judgment by supervisors and subject matter experts.

Independent Review and Oversight

The WTP project has instituted redundant control systems:

- All work products, and changes thereto, are subject to supervisory and disciplinary review and signoff.
- Work processes are subject to a project-independent QC function, whose purpose is to ensure that established procedures are being properly implemented.
- Work products are subject to a project-independent Quality Assurance organization, whose responsibility is to randomly audit work products to ensure they are in compliance with applicable procedures and specifications.
- Work products and processes are subject to an additional independent review by the current WTP contractor's disciplinary chief and a review by the contractor's chief engineer.
- DOE, through ORP, conducts regular independent audits of WTP work processes and work products.

System-Specific Review of Compliance with Contract Functional Requirements

The EM-TWS asked the contractor for a demonstration of the configuration management system described above for two separate WTP systems: the Pretreatment In-cell Handling (principally, the overhead crane that handles most materials within the hot cell) and the Cesium Ion Exchange process systems. The EM-TWS reviewed the overall design approach documentation, a preliminary documented safety analysis for the PT Facility, and engineering specifications. The EM-TWS also reviewed the applicable procedures for design change requests, design change notices, facility change requests, and facility change notices that were applied to the engineering of these systems. It appeared that the current development of both systems were in compliance with this documentation and with the configuration management system in place.

2008 Broad-Based Review of WTP Configuration Management

The current WTP contractor initiated this review using a team of professional experts independent of the WTP staff in response to ongoing issues of nonconformance identified within the project. The review, which took place in 2008, entailed 10 teams with a total of 60 personnel. The teams conducted both vertical and horizontal "slice" reviews. In total, 1,370 specific requirements were identified, and, when these requirements were compared with the components in the systems chosen, about 8,000 specific component/requirement pairs were identified. The teams reviewed a total of about 14,000 documents.

The audit teams identified 938 potential issues. Aside from documentation concerns, there were just two concerns related to hardware and inspection, neither of which would impede the plant from safely performing its mission.

Maturity of the WTP Design

The WTP design and associated procurement and construction have now been progressing for almost 10 years. Early in the project, when both cost and schedule were beginning to escalate, cost containment measures were employed to reduce the footprint of several facilities within WTP and eliminate spare capacity in many areas under a "minimum essential" philosophy. Subsequently, a number of issues regarding more conservative compliance with codes and standards—most notably, seismic design bases—further reduced engineering reserve margins.

Addressing these and subsequent issues raised by the EFRT has, over time, caused a shift in emphasis in the resources being applied to different facilities within WTP. Therefore, the state of maturity varies from one facility to another.

WTP Completion Status

The following is a summary of the current completion status for WTP as of July 2010.

Current Completion Status of WTP Facilities

High-Level Waste	
Engineering (%)	85
Procurement (%)	58
Construction (%)	29
Low-Activity Waste	
Engineering (%)	92
Procurement (%)	79
Construction (%)	62
Pretreatment	
Engineering (%)	81
Procurement (%)	44
Construction (%)	32
Laboratory	
Engineering (%)	82
Procurement (%)	71
Construction (%)	66
Balance of Facility	
Engineering (%)	82
Procurement (%)	44
Construction (%)	59

In general, it appears that procurement and installation of basic components are somewhat lagging the progression, which might be expected. It has been indicated that this is primarily due to cash flow management. The most schedule-sensitive area is the PT Facility.

Flexibility for Future Changes

One measure for a parallel-design construction project is to consider the constraint on future engineered changes being placed by procurement and construction already completed. Another consideration is the remaining margin at this later stage of the project. The EM-TWS discussed these potential constraints to future changes in a meeting with senior project staff, and the general status can be summarized as follows:

HLW The facility is physically constrained, with minimal floor space to implement future changes. For example, a relatively small air-handling unit on the facility roof could not be relocated inside at the highest level because no space could be identified in which to place it. Although the upper-level structure is not completed, it is essentially fixed because it must conform to the levels below it.

LAB The facility is essentially constructed, with all exterior and interior walls now fixed. The remaining work consists of the procurement and installation of laboratory furniture and some detection equipment.

LAW The LAW is at the most advanced state of the major WTP process facilities. The structure is essentially complete, as well as embeds to set components. The major components are all procured, and most are being installed.

PT This is the least complete of the major process facilities, but it is still highly constrained. Similar to HLW, there is little opportunity to change the still-uncompleted higher elevations of the structure. The efforts to expand capacity and to resolve EFRT issues have congested the available floor space such that, similar to HLW, there is little room for modifications. This is particularly true in the hot cell area.

BOF Most spare capacity for the major utilities; i.e., air, water, steam, and electrical, has been utilized as the design has progressed. The sizing and procurement of emergency diesel generators has been held back and is currently not constrained.

Observations and Findings, Charge 2

The EM-TWS offers the following observations and findings:

- The WTP project has reached the "pivot point," where the principal focus of management attention is shifting from EPC to EPCC. The technical risks associated with EPC have been sufficiently resolved (i.e., the remaining risk is sufficiently low), and the design has advanced to a sufficient level of maturity.

- The WTP is being built to contractual functional specifications and will continue to be built to them until completed. The systems and work processes in place are adequate to ensure compliance, and sufficient oversight exists to confirm that these systems and process are being properly employed.

- At the present stage of construction, the WTP project is physically constrained, with minimal ability to implement future changes.

- On the basis of its review, the EM-TWS has concluded that, independent of the EFRT issues:

  – No substantial risk to compliance with contract functional specifications was identified,

  – The design appears to be sufficiently mature to proceed with completion of EPC activities.

Charge 2, Recommendations 2010-02-12 through 16

The EM-TWS makes the following recommendations related to Charge 2:

2010-12 The EPC process should proceed to completion.

2010-13 Given the size and complexity of WTP and the irrefutable necessity that these processes rely on sound project management and expert judgment, some future level of nonconformance could evolve; therefore, diligence should be maintained in conducting regular and redundant audits to identify and mitigate potential impacts.

2010-14 With the project at its current advanced state of maturation and given the closure of the outstanding EFRT issues, the focus of attention should shift from EPC to EPCC. This focus requires a coordinated effort by a single owner/operator representative in marrying the WTP and Tank Farm activities.

2010-15 DOE, as the project owner/operator, should take near-term action to create a resource base that is concerned with operability and the proper integration of operability concerns and commissioning activities with Tank Farm and WTP processes and activities.

2010-16 In support of this new resource base, DOE should take action to obtain an integrated Tank Farm / WTP plant operator as soon as practicable.

Charge 3: WTP Potential Improvements

The WTP will treat 53 million gallons of highly radioactive waste in 177 underground tanks at Hanford over several decades. Therefore, the Committee should consider any technical improvements that could result in a net reduction in the life cycle cost and schedule of the tank waste cleanup provided that the improvements do not have an adverse impact on the WTP Total Project Cost or project completion date.

Summary of the Finding for Charge 3

The EM-TWS has a number of recommendations that focus on enhancing system safety, providing improved accountability, and strengthening project management oversight and execution, which will promote early startup and testing, provide added design efficiency, reduce lifecycle cost, enhance plant reliability, reduce operating risk, and improve chemical and nuclear conduct of operations.

Introduction

Current DOE monthly progress reports show that the WTP design is greater than 81 percent complete and construction is at 52 percent completion. At this point, the possibility of making changes to the WTP design that do not adversely affect the total project cost or project completion date is limited. The EM-TWS believes that the project should complete the final design and proceed with construction, considering some areas of recommended focus.

Observations and Findings, Charge 3:

The EM-TWS makes the following observations:

- The WTP and Tank Farm parts of the mission are not well integrated. Two different contractors, who use a variety of planning tools that contain different assumptions and scenarios for mission completion, hold WTP and Tank Farm contracts.

- DOE has been heavily focused on the design and construction of the WTP. It appears that the earliest execution of a contract for a WTP operator is at least two years away. Successful chemical and nuclear industry projects have generally incorporated a strong owner/operator presence from the very beginning to ensure that plant design, construction, startup, and operation proceeds smoothly and results in a facility that successfully completes its intended mission at the lowest feasible lifecycle cost.

- The EM-TWS observation concerns modifying the current contractual startup plans to conform with standard chemical industry practice. Plant performance testing and acceptance (contractual) should not take priority over the early demonstration of plant systems based on easier-to-process feed streams. Current plans focus on early, full-capacity plant performance and acceptance testing with challenging wastes. The WTP, when operating, will be a chemical plant that processes radioactive materials. Standard specialized chemical industry

practice starts with low-throughput runs using easy-to-process wastes; however, it often takes a year or more for chemical plants to attain smooth operations and reach full capacity.

- Because WTP will be a complex facility to operate, operator training should be extensive.

- Plant availability is critical for achieving the ORP mission.

Charge 3, Recommendations 2010-02-17 though 21

The EM-TWS makes the following recommendations related to Charge 3:

2010-17 ***Unify the mission with single-point authority and oversight.*** The EM-TWS recommends that the ORP mission be run as a single program that incorporates the WTP and Tank Farms and functions under a unified baseline with a consistent set of assumptions and models. As discussed by the EM Acquisition and Project Management Subcommittee, no matter the number of contracts issued for a given activity, the program should be led by a single Federal Project Director. The Federal Project Director at the ORP Office level would have the singular field-directed authority and responsibility for integrating the entire mission.

ORP should develop cost/benefit models that integrate the WTP Project and mission and provide a uniform basis for evaluating potential improvements against the existing WTP Project/mission baseline. The models should include factors that balance cost against reduction in Project/mission risk and duration. The models should also conservatively consider the cost and schedule implications of maturing technologies to levels where they can be incorporated into the baseline with a minimum of risk.

2010-18 ***Create a Strong Owner/Operator Group.*** The EM-TWS recommends the immediate creation of a strong Owner/Operator Group comprising specialized plant operations expertise to plan and oversee commissioning and startup, and, most importantly, to conduct an operator review of final design and construction approvals. Under the direction of a Deputy Federal Project Director, the Group would function as the owner/operator until all or part of that function is assumed by the new WTP/Tank Farm operator. Because the WTP will be a chemical plant that treats nuclear waste, the Group should include substantial specialty chemical industry startup and operations experience and expertise as well as dedicated Tank Farm and WTP personnel. The initial tasks of the Group should consist of the following:

- Evaluate operability uncertainties at the Tank Farm and WTP;
- Evaluate the Tank Farm inventory and its effect on operations;
- Augment the standard DOE nuclear safety basis review by conducting a comprehensive Hazards and Operability Study that conforms with chemical industry standards;
- Confirm regulatory compliance (e.g., Federal Facility Agreement/Tri-Party Agreement, Washington Administrative Code, Environmental Protection Agency, and state and local regulations)

- Define commissioning and operations objectives;
- Assess the risk of delaying certain design decisions based on forward commissioning activities and specifications (e.g., the project has deferred substantial risk in PJM into commissioning, where modifications may be difficult, costly, and time-consuming). The Owner/Operator Group should complete a commissioning readiness analysis that evaluates the magnitude of the risk that has been deferred, determines the potential impacts of the deferrals, and investigates ways to lessen the impacts;
- Establish an integrated commissioning plan that includes simulant definition and development and a feed sequence suitable for hot startup;
- Review the prequalification sampling capability criteria and plan and review the adequacy of sampling to comply with current and future needs;
- Develop the integrated WTP/Tank Farm cost/benefit models described in Recommendation 2010-17, above; and
- Consider a chemistry-oriented model to aid in operational control and confirmation of instrument and control logic, and develop inputs to that model.

The EM-TWS believes that the establishment of such a Group will lead to commissioning, hot startup, and operation improvements that will shorten mission duration, reduce lifecycle costs, and reduce mission risk.

2010-19 ***Alter current contractual startup plans to conform with chemical industry best practices.*** The EM-TWS recommends that the WTP start with easier-to-process waste batches and not attempt to confirm full capacity until the plant operator has confidence that plant operations have been optimized.

2010-20 ***Begin development of operator training plans and tools.*** The EM-TWS recommends that WTP develop training plans and tools with required certifications and operator minimum requirements for service.

2010-21 ***Evaluate options for improving availability.*** The EM-TWS recommends that the WTP begin to evaluate options for improving availability, including workarounds and scheduled outages.