The External Technical Review Process
A Discussion of Process Guidelines and Recent Review Results - 10155

John R. Shultz, Steven P. Schneider, Monica C. Regalbuto
Office of Engineering and Technology
Office of Environmental Management
U.S. Department of Energy

ABSTRACT

The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) was established to achieve the safe disposition of legacy wastes, and facilities, from defense nuclear programs. A large majority of these wastes and facilities are 'one-of-a-kind' and unique to DOE. Consequently, many of the programs to treat these wastes have been 'first-of-a-kind' and unprecedented in scope and complexity. This has meant that many of the technologies needed to successfully disposition these wastes were not yet developed or required significant re-engineering to be adapted for DOE-EM's needs.

The Office of Environmental Management is conducting External Technical Reviews (ETR) as one of several steps to ensure the timely resolution of waste disposal engineering and technology issues. EM is working closely with Federal Project Directors to provide independent reviews of such issues as technology development, systems integration, design, operations, maintenance, and nuclear safety. EM has completed many successful ETRs over the last several years. This paper will present a summary description of the ETR process and a brief discussion of recent ETR findings and recommendations.

INTRODUCTION

The reason for, and future of, and the ETR process can best be summed up by an excerpt from a September 24, 2008 memorandum [1] from Dr. Triay (Principal Deputy Assistant Secretary for Environmental Management) that was sent to all federal and contractor personnel in EM. The memo says, in part, the following:

"The Office of Environmental Management (EM) is conducting External Technical Reviews (ETR) as one of several steps to ensure the timely resolution of engineering and technology issues. EM is working closely with Federal Project Directors to provide independent reviews of such issues as technology development, systems integration, design, operations, maintenance, and nuclear safety. EM has completed several successful reviews over the last two years, and expects ETRs to become a mainstay of the EM program."

EXTERNAL TECHNICAL REVIEWS - SUMMARY

External Technical Reviews are independent reviews advisory to DOE (i.e., not the site or project contractor) that focus on technical scope and risk. The ETR is conducted by personnel who are independent from the project team implementing the technical scope and external to the office responsible for the technical scope. Rigorous ETRs enable DOE-EM to trend technical risk and implement technical risk reduction strategies. ETRs enhance project execution through timely identification of technical issues and corresponding response actions. Further, ETRs bolster assurance that technical issues have been thoroughly addressed and thereby support project management's bases for critical decision approvals. While not an explicit ETR objective, ETRs afford another opportunity to identify safety issues.

ETRs are focused on project technical risks and uncertainties. An ETR is not a contract or management review, nor is it an External Independent Review (EIR) of a project baseline. For example, the DOE guidelines for project management reviews are given in DOE Order 413.3A, "Program and Project Management for the Acquisition of Capital Assets" [2]. This Order recognizes that reviews are an important project activity and must be planned as an integral part of the project and tailored, as appropriate, to project risk, complexity, duration, and Critical Decision or construction phase. ETRs are not required by DOE O 413.3A. However, Section 9.5 of DOE Manual 413.3-1 states that "technical reviews are necessary when there is uncertainty in the outcome of a project effort. If a design [technology, process, or system] is new, untried, or unproven….then a review by….knowledgeable peers is in

order." The focus of DOE O 413.3A reviews are broad-based (i.e., scope, cost, and schedule) while ETRs focus on technical risks (i.e. does the process work, is the technology appropriate).

OBJECTIVES OF ETRs

The three key objectives of an ETR are: 1. To determine if the technology, process, system, or design under review will meet project objectives and requirements; 2. To identify any issues (showstoppers) preventing successful implementation of the technology, process, system, or design under review, and; 3. To identify issues or data needed to support critical or other project or program decisions.

THE ETR PROCESS [3, 4]

ETRs will be requested by the Federal Project Director or Headquarters EM staff and approved by EM-1, EM-2, EM-3, or EM-30. ETRs should be conducted to reduce the technical risk and uncertainty of DOE-EM projects. There are three major components of the ETR process: 1. Pre-assessment planning; Onsite Activities; 3. Reporting. Table I provides a listing of the specific actitvities during an ETR, and an approximate timeline of how long a typical ETR will take.

Table I Typical ETR Timeline

Activity	**Typical Time Frame (relative to 'Begin Review')** **Total time approximately 5 months**
Team Selection	-8 weeks
Consultant contract & funding (as required)	-8 to -6 weeks
Charter issued	-8 to -6 weeks
Pre-Assessment Meeting (optional)	-6 weeks
Advanced Material Reviewed	-2 weeks
Begin Review (onsite activities)	0 (team spends 3 to 5 days on site)
Complete Onsite Review/ Presentation to Field Office	+1 to +2 weeks
Summary to DOE-EM	+2 weeks
Draft Report	+4 weeks
Review and Comment resolution	+6 weeks
EM Management Exit Briefing	+6 weeks
Final Report issued	+8 weeks
Issue Response Plan completed for tracking	+10 weeks

SUMMARY OF COMPLETED REVIEWS [5]

DOE-EM has completed many successful reviews using expert engineers and scientists from private industry and academia over the last three years. Table II is a listing of those reviews from calendar year 2006 to 2009, and a summary of what the ETR team found. The rest of this paper is devoted to an expanded discussion of the key findings/conclusions noted in those reviews.

Table II Listing of ETRs conducted by DOE-EM since 2006

Number, Date, Title Summary of Results
ETR-1 Mar-06 Flowsheet for the Hanford Waste Treatment Plant (WTP)
The ETR team identified 28 issues, seventeen of which were categorized as major issues that would prevent the WTP from meeting contract rates and identified one issue, plugging, that could prevent the WTP from running consistently, and that the design approach did not minimize this risk.
ETR-2 Aug-06 Tank 48 at the Savannah River Site (SRS)
The ETR Team's over-arching conclusion was that while TPB processing alternatives are being properly and

Number, Date, Title Summary of Results
thoroughly evaluated, the issues necessary to achieve timely Tank 48 return-to-service have not been fully addressed.
ETR-3 Sep-06 Demonstration Bulk Vitrification System (DBVS) for Low Activity Waste (LAW) at Hanford
No fatal flaws were identified at the current state of the project. However, 19 technical issues that could result in a failure of the DBVS to meet established performance requirements, 26 areas of concern which could result in a change to design or additional development, and 13 suggested improvements to enhance safety, cost, schedule or efficiency were identified.
ETR-4 Nov-06 Salt Waste Processing Facility Design at the Savannah River Site (SRS)
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.
ETR-5 Feb-07 Remedial System Performance Improvement for the 200-ZP-1/PW-1 Operable Units at Hanford
The ZP-1 treatment system is well run and maintained. The operators are knowledgeable and have a strong dedication to maintaining and improving the system. The Review Team believes that additional extraction wells open to deeper portions of the aquifer are needed for future contaminant extraction and plume capture.
ETR-6 Jun-07 Operational Issues at the Environmental Restoration Disposal Facility (ERDF) at Hanford
The ETR team concluded that Washington Closure Hanford (WCH) and Stoller Corporation (Stoller) identified key issues that led to falsification of the compaction data and have proposed a management plan that will greatly reduce the probability of data falsification in the future.
ETR-7 Jun-07 Caustic Recovery Technology
The consensus was that the NaSICON electrochemical process for recovering sodium hydroxide is a viable technology at its current state of development. Additional work was identified, some of which was already in progress with the Ceramatec development program
ETR-8 Aug-07 Building C-400 Thermal Treatment 90% Remedial Design Report and Site Investigation, Paducah, Kentucky
The ETR Team found that C-400 TCE source zone clean-up is a challenging application of the selected Electrical Resistance Heating technology in a unique and complex setting. The team agreed that ERH is a potentially viable remedial technology to meet the remedial action objectives adjacent to C-400.
ETR-9 Aug-07 ARROW-PAK Container
The ETR Team concluded that the current approach for the ARROW-PAK container does not have a high probability for successful certification by the NRC because the NRC concerns are significant and the DOE has not addressed concerns in key areas such as applicable design and inspection codes, cold temperature behavior of fuse joints, drop test orientations, and deflagration testing pressure and temperature.
ETR-10 Dec-07 Idaho CERCLA Disposal Facility (ICDF) At Idaho National Laboratory (INL)
The independent review team found no issues of immediate concern affecting the performance of the ICDF.
ETR-11 Feb-08 Environmental Management Waste Management Facility (EMWMF) at Oak Ridge, TN
The ETR Team found no issues of immediate concern affecting the performance of the EMWMF.
ETR-12 Feb-08 Proposed On-Site Waste Disposal Facility (OSWDF) at the Portsmouth Gaseous Diffusion Plant
The Independent technical team found that DOE was working in all of the recommended areas of public involvement and acceptance and appeared to have incorporated lessons learned from prior disposal facility design and permitting experiences.
ETR-13 Apr-08 Mitigation and Remediation of Mercury Contamination at the Y-12 Plant, Oak Ridge, TN
Recommendations were made by evaluation of four action zones: buildings and rubble, source zone soil, Outfall 200 area, and upper and lower reaches of the creek.
ETR-14 Jul-08 Disposal Practices at the Nevada Test Site
The independent review team notes that Area 5 of NTS is in an arid and remote location where ground water is very deep and found no issues that could pose immediate problems
ETR-15 Aug-08 Major Risk Factors Integrated Facility Disposition Project (IFDP) Oak Ridge, TN
Overall, the ETR Team concluded there were no severe technical issues that would need to be resolved prior to

Number, Date, Title Summary of Results
continued programmatic consideration of the IFDP.
ETR-16 Aug-08 Proposed On-Site Disposal Facility (OSDF) at the Paducah Gaseous Diffusion Plant
The team felt that the Subtitle D landfill would pose a long term risk to DOE and removal/consolidation with the OSDF should be considered.
ETR-17 Oct-08 Plutonium Preparation Project at the Savannah River Site
Due to the number of process, program, and security interfaces, DOE oversight plus the project cost and schedule planning for construction and operation should be increased. Periodic verification of planning input versus current and projected reality should be added. The time and motion study should be revisited.
ETR-18 Nov-08 System Planning for Low-Activity Waste Treatment at Hanford
The preferred option is a second LAW vitrification facility; however, if there is schedule flexibility, enhancement of the present LAW facility also is a potentially viable option.
ETR-19 Dec-08 Disposal Practices at the Savannah River Site
The Independent Technical Team found no immediate concerns with operations at SRS that could result in issues similar to those at Hanford's Environmental Restoration Disposal Facility (EDRF).
ETR-20 Dec-08 X-701B Groundwater Remedy, Portsmouth, Ohio
The ETR Team recommends implementing innovative characterization to delineate target source zones to provide focus for future source treatments, to reduce costs, and to minimize collateral damage associated with the treatment.
ETR-21 Jun-09 External Technical Review for Evaluation of System Level Modeling and Simulation Tools in Support of Savannah River Site Liquid Waste Process
There is a need for an integrated overall system planning tool; There is a lack of automatic data transfer, non-optimal software selection and some unit operations do not have models; There is a need to decouple safety, planning and operations functions; There is a need to relate system planning results with cost and impact of potential funding constraints. A further need is to include a waste acceptance tool for Saltstone similar to glass product acceptance.
ETR-22 Sep-09 External Technical Review for Evaluation of System Level Modeling and Simulation Tools in Support of Hanford Site Liquid Waste Process
There is a need for a system planning tool that is chemistry based; Incomplete alignment of G2 based models for tank farm operations (HTWOS) and WTP operation (G2 dynamic flowsheet) limits overall system analysis; There is a need for the tools supporting the system plan to incorporate uncertainties in cost, retrieval, processing, chemistry, etc; There is a need for an "overall" model that address entire plant/process reliability, availability, and maintainability (RAM).

The following are expanded discussions of the ETR team findings and recommendations.

ETR-1 Flowsheet for the Hanford Waste Treatment Plant (WTP)

What the ETR Team Found: The ETR team identified 28 issues, seventeen of which were categorized as major issues that would prevent the WTP from meeting contract rates and identified one issue, plugging, that could prevent the WTP from running consistently, and that the design approach did not minimize this risk. All of the issues are believed to be fixable without the development of new technologies and some of the fixes were already underway. The ETR team believes that the WTP project lacked a clear mission and shared vision (e.g. there was a lack of agreement about required throughput and how that translated into length of mission). Unless there is a clear mission statement, the owner and contractor cannot develop an effective shared project strategy. This includes agreement on throughput, adequacy of the basic data, and adequacy of preliminary flowsheets and piping and instrumentation diagrams.

What the ETR Team Recommended: The ETR Team recommends that the following issues be addressed to ensure throughput and reliability:

- Slurry transport piping has not been consistently designed to minimize plugging.
- Mixing systems designs were inadequate which will lead to insufficient mixing, extended mixing, vessel erosion and issues with large particles/settling.

- The WTP design has not been demonstrated to be sufficiently flexible to process all of the Hanford waste streams at design throughputs.
- Many of the process operating limits have not been completely defined making it difficult to define operating ranges for each unit operation.
- The current commissioning plans did not demonstrate long-term mission capabilities for equipment repair or remotability, especially for large and unique pieces of equipment and piping.
- The Pretreatment Facility has inadequate ultrafilter area and flux, undemonstrated leaching processes, instability in the baseline ion exchange resin, and operability and maintainability design issues.
- Adequacy of the control strategy, effect of recycle on capacity, and the decontamination factor have not been demonstrated for the evaporator design.
- Ion exchange development was inadequate including column design, cross-contamination control, valving complexity and effectiveness of cesium-137 monitoring.
- The control strategy for the LAW Vitrification Facility will likely lead to mis-batching of melter feed.
- Difficult to remove plugs will likely form in the HLW melter film cooler or the transition to the off-gas system resulting in glass production losses.
- Lack of a spare melter for both the HLW and LAW Vitrification Facilities increases the risk of loss of operation for extended periods.

ETR-2 of Tank 48 at the Savannah River Site (SRS)

What the ETR Team Found: The ETR Team's over-arching conclusion was that while TPB processing alternatives are being properly and thoroughly evaluated, the issues necessary to achieve timely Tank 48 return-to-service have not been fully addressed. In the Team's view, the critical considerations for selection of a primary treatment technology include the (1) ability to produce a treated material compatible with subsequent vitrification at the Defense Waste Processing Facility (DWPF), (2) ability for the necessary process components to physically fit within the space envelope of the 241-96H facility (to avoid construction of a new radiation compliant building), and (3) process maturity to facilitate expeditious testing, design, construction and operation that is consistent to the extent possible with overall SRS schedule constraints. The two TPB processing methods chosen by WSRC as lead candidates (Steam Reforming and Wet Air Oxidation - WAO) are technically sound, likely viable methods, and offer the best prospects for success among the approximately 80 alternatives considered. However, several areas were identified where the previous evaluations have not been sufficiently complete. Removal of residual material, tank cleanup after removal of the bulk of the material, and understanding of the form, quantities, concentrations and implications of TPB processing by-products are topics which will be very important to success.

What the ETR Team Recommended: The ETR Team recommends the following to improve the probability of timely success:

- Commit to Steam Reforming as the lead TPB processing approach immediately and carry WAO as a back up, to be developed to a point of assuring viability.
- Embark on a high priority heel management project, including development, testing and planning for tank flushing and the establishment of end point criteria for Tank 48 cleanliness.
- Incorporate process steps to improve schedule success (January 2010). Evaluate pre-concentration (e.g. filtration) to reduce the volume to be treated followed by transferring the bulk of the tank contents to another tank (existing or smaller constructed tank) to allow parallel heel processing and flushing. The team believes that these steps will greatly improve the probability of schedule success.
- Continue the development of steam reforming on the earliest practical schedule.

ETR-3 Demonstration Bulk Vitrification System (DBVS) for Low Activity Waste (LAW) at Hanford

What the ETR Team Found: The DOE requested this review in the early stages of the project which allowed for addressing issues found in the subsequent demonstration phases. No fatal flaws were identified at the current state of the project. However, 19 technical issues that could result in a failure of the DBVS to meet established performance requirements, 26 areas of concern which could result in a change to design or additional development, and 13 suggested improvements to enhance safety, cost, schedule or efficiency were identified. The DBVS Project has conducted extensive testing ranging from crucible melts of both simulants and radioactive wastes to engineering scale melts. At the time of the review, development and demonstration had focused on glass formulation and melter system testing and demonstration. The design of other major components and systems has largely relied on limited vendor testing.

What the ETR Team Recommended:

- Additional cold testing and demonstration is needed for process design and operations before radioactive testing begins (e.g. dried waste feed transfer, prevention of secondary phases, testing of prototypic waste compositions, closure of the technetium and cesium mass balance, testing and safety analysis of the melt-box containment).
- The Process Control Plan should be completed and its effectiveness tested in the full demonstration.
- The mixer-dryer and off-gas systems need special attention in the next project phase since past work has focused on In-Container VitrificationTM.
- System complexity should be reduced to enhance system operability and availability.
- A better understanding of the DBVS process chemistry is critical to success, both in ensuring reliability and in troubleshooting and recovering from process issues.
- Process sampling and monitoring plans should be improved to ensure that essential data is captured from the test runs.
- Potential nuclear safety issues, including confinement strategy, implementation of Integrated Safety Management, and response to off-normal events must be resolved before radioactive operation.
- The project needs to ensure that designs and specifications meet the required codes and standards.

ETR-4 Salt Waste Processing Facility Design at the Savannah River Site (SRS)

What the ETR Team Found:

- 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 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 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.

What the ETR Team Recommended: The ETR Team recommends that the following high priority technical risks be addressed:

- 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.

ETR-5 Remedial System Performance Improvement for the 200-ZP-1/PW-1 Operable Units at Hanford

What the ETR Team Found: The ZP-1 treatment system is well run and maintained. The operators are knowledgeable and have a strong dedication to maintaining and improving the system. The Review Team believes that additional extraction wells open to deeper portions of the aquifer are needed for future contaminant extraction and plume capture. Treated water is injected back into the aquifer at three wells. The treatment removes volatile organics, but is not adequate for removing Tc-99, nitrate, or chromium. These co-contaminants warrant that the project team verify with the stakeholders that re-injection is still acceptable. The SVE is old, but has been well maintained. Budget allocations will be needed in the future for refurbishing.

What the ETR Team Recommended:

- The Feasibility Study should include and evaluate the two identified conceptual models for Dense Non-Aqueous Phase Liquid (DNAPL) below the water table as a continuous source of contamination and should focus on expanded pump and treat as the primary remedial technology for groundwater.
- The remedial strategy should emphasize hydraulic containment for the most impacted portion of the groundwater plume, with compliance standards achieved at locations beyond the capture zone. These points of compliance (POC) should be identified and negotiated as soon as possible.
- The Feasibility Team should determine as soon as possible if treatment of co-contaminants (Tc-99, nitrate, etc.) will be required.
- Rapid action is recommended to inhibit further migration of Tc-99 to the water table in the TX Tanks Area versus the proposed prompt evaporation study for CT release at the Z-9 trench.
- Commonly applied and publicly accessible modeling tools should be used whenever possible. Detailed modeling to better interpret performance monitoring data should continue.

ETR-6 Operational Issues at the Environmental Restoration Disposal Facility (ERDF) at Hanford

What the ETR Team Found: The ETR team concluded that Washington Closure Hanford (WCH) and Stoller Corporation (Stoller) identified key issues that led to falsification of the compaction data and have proposed a management plan that will greatly reduce the probability of data falsification in the future. The level of oversight included in the management plan is sufficient to preclude requiring independent third party compaction testing. The ETR team also concluded that the plan proposed by WCH and Stoller to manage leachate pumping will minimize the likelihood of future unrecognized pumping system failures and excessive leachate depth in the ERDF. However, the long-term effectiveness of these changes hinges on permanent staff being assigned for direct oversight of these issues. Because the compaction data were falsified for an extended period, significant uncertainty exists regarding the ability of the waste to provide effective support for the final cover to be placed on the ERDF. WCH has proposed a field test that will address this issue (ERDF Placement Optimization and Settlement Monitoring Test). The outcomes of this test, along with a settlement-monitoring program on the existing filled cells, will provide insight into the ability of the existing waste to support the final cover. This field test can also be used to assess the suitability of the 3:1 soil-debris ratio and will provide the information needed to develop a performance based method for waste placement.

What the ETR Team Recommended: The ETR Team concluded that the assessments and management plan by Washington Closure Hanford and their subcontractor (Stoller Corporation) will address the issues when fully completed and implemented. The following recommendations were made to supplement the proposed management plan:

- Permanent staff be assigned to tasks associated with each operational and management change
- Install an automated system to monitor leachate depth
- The proposed ERDF Placement Optimization and Settlement Monitoring Test be given priority
- Stoller should use compaction equipment that employs GPS-based grade control and stiffness-based instruments to assess compaction directly and real time.
- The settlement monitoring program should be instituted quickly and results periodically reviewed.
- Performance based methods for waste placement should be developed and implemented. This will eliminate the need for density testing.

ETR-7 Caustic Recovery Technology

What the ETR Team Found: The technology assessment team found that this electrochemical process utilizes a novel inorganic membrane technology to recover concentrated sodium hydroxide from alkaline waste typical of decontaminated ion exchange effluents from the Hanford WTP. A successfully developed technology could be used to reduce the overall sodium demands to the LAW vitrification process at WTP by recycling the sodium hydroxide for use in aluminum leaching. The consensus was that the NaSICON electrochemical process for recovering sodium hydroxide is a viable technology at its current state of development. Additional work was identified, some of which was already in progress with the Ceramatec development program. A significant amount of work had been completed including:

- Established the tape casting/lamination manufacturing process to make large area co-fired NASICON structures.

- Using a bench-scale modular unit, completed performance evaluation with several simulant compositions and actual waste.
- NaSICON ceramic membrane processing had been scaled from 1.5 kilograms per batch up to 12 kilogram per month.
- Demonstrated greater than 2000 hours of continuous operation of NaSICON membrane-based electrolytic cells to separate sodium from a typical Hanford simulant composition
- Successfully demonstrated a 5 scaffold stacked modular bench scale cell operation at 100 mA/cm2/scaffold
- Completed initial design for a full-scale operable unit

What the ETR Team Recommended
The ETR Team recommends:
- Additional development to better understand the stability of supersaturated aluminate solutions during caustic recovery. This understanding is needed to prevent precipitation of gel aluminate and associated plugging.
- Additional production and cell life testing at 50% caustic catholyte is recommended to provide the level of confidence required for deployment. At the time of the review, a single 1000 hours test at 50% caustic had been performed. Additional testing was in progress. The ETR also recommends that a closer collaboration between Ceramatec Inc. and WTP be established to allow for more prototypic testing including expected variations in aluminum and free hydroxide concentrations. This type of testing and data would allow for an economic analysis as to the viability of caustic recovery for WTP.

ETR-8 Building C-400 Thermal Treatment 90% Remedial Design Report and Site Investigation, Paducah Kentucky
What the ETR Team Found: The ETR Team found that C-400 TCE source zone clean-up is a challenging application of the selected Electrical Resistance Heating technology in a unique and complex setting. A significant effort with extensive analysis was evident in the 90% Remedial Design Report. The team agreed that ERH is a potentially viable remedial technology to meet the remedial action objectives adjacent to C-400. The ETR Team believes that additional efforts are needed to provide an adequate basis for the planned ERH design, particularly in the highly permeable Regional Gravel Aquifer, where sustaining target temperatures will present a challenge. The following areas also should be considered and addressed before implementation of thermal treatment:
- Accurate, site-specific models to support the ERH design for fullscale implementation for this challenging hydrogeologic setting
- Flexible project implementation and operation to allow to response to observations and data collected during construction and operation
- Defensible performance metrics and monitoring, appropriate for ERH
- Comprehensive (creative and diverse) contingencies to address the potential for system underperformance, and other unforeseen conditions.

What the ETR Team Recommended
- The data provide an initial basis for design/operation; however, characterization should include expanding the target treatment zones in critical areas, sampling verification during system installation to allow for adjustments, enhanced groundwater monitoring, and future sampling downgradient of the treatment zone.
- To monitor and improve performance, the TCE in the liquid recovered should be evaluated, additional technically-based metrics should be developed, the heating target should be increased in the saturated zone beyond the co-boiling point of the TCE, and broader ERH exit strategy goals should be incorporated into the metrics.
- Based on the complex hydrogeologic setting and prior evaluations, implementation should incorporate site-specific and verified design models and sufficient flexibility and contingency.

ETR-9 ARROW-PAK Container
What the ETR Team Found: The ETR Team concluded that the current approach for the ARROW-PAK container does not have a high probability for successful certification by the NRC because the NRC concerns are significant and the DOE has not addressed concerns in key areas such as applicable design and inspection codes, cold temperature behavior of fuse joints, drop test orientations, and deflagration testing pressure and temperature. The recommendations provided by the ETR would significantly improve the potential for certification. The recommendations key on complete responsiveness to the NRC's RAI and demonstrating that a redesigned ARROW-

PAK meets regulatory requirements. A significant good practice noted by the ETR is that the revisions to the TRUPACT-II SAR over the last five years have increased the TRU inventory available for shipment in the TRUPACT-II thereby reducing the TRU inventory requiring the ARROW-PAK capability. The ARROW-PAK would address up to 160m3 of the existing inventory that is not currently shippable.

What the ETR Team Recommended
• To increase the probability of success, DOE should revise the safety analysis report addendum to include better performing materials in a redesigned ARROWPAK, consider treating ARROW-PAK as a secondary containment system instead of a payload container, and demonstrate that it has a very low probability of failure during transportation, and that even if it fails, the consequence would be minimal due to the primary container boundary of the TRUPACT-II.
• Provide sufficient testing and safety documentation to fully address the NRC's requests for additional information (RAI) and the relevant regulations.
• A redesigned ARROW-PAK made of the alternate polyethylene material would allow an additional 120m3 to be shipped, increasing the total to 160m3.

ETR-10 Idaho CERCLA Disposal Facility (ICDF) At Idaho National Laboratory (INL)
What the ETR Team Found: The independent review team found no issues of immediate concern affecting the performance of the ICDF. As noted in the recommendations, the team was concerned about void space within the waste containers and assurance of meeting the 5% requirement, void space between and under containers, compaction/density determinations of compacted mixtures of soil and debris, and that the current Compaction/Subsidence study does not consider localized differential settlements.

What the ETR Team Recommended
• Evaluate methods used to place grout within containers to ensure that the 5% maximum void space criterion is met.
• Evaluate and utilize density methods that are more reliable than nuclear density testing for compaction testing (e.g. ASTM D 4914).
• Re-evaluate the testing strategy for he leachate alarm system to ensure frequency of testing is sufficient.
• Re-evaluate the Landfill Compaction/Subsidence Study to consider the impacts of differential settlement caused by variations in stiffness, collapse of voids, and long-term creep settlement of the wastes in the ICDF.
• Consider filling voids between containers with soil to reduce moisture contact with the waste.

ETR-11 Environmental Management Waste Management Facility (EMWMF) at Oak Ridge, TN
What the ETR Team Found: The ETR Team found no issues of immediate concern affecting the performance of the EMWMF. There is a concern that the approved capacity of the EMWMF may not be sufficient for the remaining and non-baseline remedial actions at Oak Ridge.
• As noted in the recommendations, compaction assessment, waste settlement and impact on the cover should have a focused review to ensure long term objectives are met.
• Automated electronic control and record-keeping systems are being use for waste entering the disposal facility. Comprehensive technical guidance documents have been developed for delivery and disposal requirements. Similar systems should be considered for other DOE sites.
• Oak Ridge constructed a dedicated haul road for waste transport avoiding public road issues.
• A trust fund was established for perpetual long-term maintenance and monitoring after closure, alleviating public confidence issues.

What the ETR Team Recommended
• Estimate the remaining land fill volume needed to complete remedial activities at Oak Ridge, and develop landfill expansion plans, if necessary. Pre-loading wastes, substituting thinner geosynthetic cover elements, or reducing thickness of the surface layer should be considered.
• Reduce the amount of clean soil used during disposal by accelerated phasing of landfill construction to allow lined areas for queuing debris and contaminated soils for disposal.
• Evaluate and utilize density methods that are more reliable than nuclear density testing. An increase in the required minimum waste density should be considered.
• Re-evaluate the compaction criterion, void space grouting criterion, and EMWMF waste settlement due to variations in stiffness and time-dependent compression and long-term creep settlement of the soils and debris.

ETR-12 Proposed On-Site Waste Disposal Facility (OSWDF) at the Portsmouth Gaseous Diffusion Plant

What the ETR Team Found: The Independent technical team found that DOE was working in all of the recommended areas of public involvement and acceptance and appeared to have incorporated lessons learned from prior disposal facility design and permitting experiences. The recommendations were provided to enhance the current efforts. The team considered the implications of CERCLA versus RCRA, but deferred the analysis to DOE to weigh the advantages and disadvantages of both approaches. Generally CERCLA addresses inactive hazardous waste sites involving past disposal issues and RCRA addresses "cradle-to-grave" management of hazardous waste. In the area of design, logistics of construction and D&D should be considered to avoid using the landfill for clean versus contaminated materials. Operations should minimize Void space by compacting and crushing waste.

What the ETR Team Recommended

- Recognizing that public involvement is critical to acceptance, DOE will need to involve stakeholders at the beginning and create a partnership in determining siting and environmental control designs. An independently chartered organization could be created to facilitate interaction between all interested parties and DOE.
- Documentation should be electronic and paper, presented at multiple technical levels to fully address the educational and functional interests of the stakeholders.
- Fully communicate the strong operating record of the onsite disposal facilities in the DOE Complex and the positive impact stakeholders have had at other sites (e.g. Hanford).
- Consider establishing a perpetual maintenance and monitoring fund at the onset to assure stakeholders of the integrity of the OSWDF over the long term.
- The following design considerations were recommended: (a) Site selection should avoid locations with existing ground water contamination and/or buildings, (b) Sumps should be located to one side versus centrally, (c) Provide dedicated haul roads for transporting waste, and (d) use automated methods where practical.

ETR-13 Mitigation and Remediation of Mercury Contamination at the Y-12 Plant, Oak Ridge, TN

What the ETR Team Found: The review/workshop focused on mercury contamination in the East Fork Popular Creek and how to reduce mercury levels in the fish. The metrics for achieving cleanup vary according to the agency of interest; however, national data suggest a clear trend toward the use of fish tissue concentration as the ultimate basis for setting standards. A significant technical observation was that the level of Hg found in the fish in the creek at Y-12 resulted from an intricate series of chemical transformations that began with the initial release of Hg followed by a series of changes as the Hg was transported through the shallow soil, to the surface and/or shallow ground water, and then through the reach of the stream drainage. The concentration of Hg in the fish, a potential remedial action endpoint, is better correlated with the concentration of methyl mercury in the stream. The biogeochemical and microbial processes that form methyl mercury from inorganic mercury are in the basic science regime and are being actively studied. Therefore, actions that reduce the fraction of Hg converted to methyl mercury within stream water and/or sediment or actions that alter the food chain dynamics are potentially important to addressing the impact of mercury at Oak Ridge. Recommendations were made by evaluation of four action zones: buildings and rubble, source zone soil, Outfall 200 area, and upper and lower reaches of the creek. The first two zones appeared to have less direct importance than Outfall 200 and the upper and lower reaches of the creek in affecting the environmental impact of mercury contamination at the Y-12 Facility.

What the ETR Team Recommended

- The team recommended that a plan that logically integrates the prioritized list of recommendations into a coordinated technical approach be developed with the participation of affected Oak Ridge organizations, state and federal regulators and stakeholders.
- "Quick Wins" were recommended for near term improvements as follows:
    - Outfall 200- (a) use of stannous chloride in the NS Pipe to volatilize Hg, (b) addition of Hg sequestrants , and (c) use of sodium thiosulfate for dechlorination;
    - Creeks and Streams- (a) selective physical modification at areas of methylation and (b) addition of trace Se to reduce methylation and/or uptake current and projected reality should be added.

ETR-14 Disposal Practices at the Nevada Test Site

What the ETR Team Found: The independent review team notes that Area 5 of NTS is in an arid and remote location where ground water is very deep and found no issues that could pose immediate problems. NTS conditions are ideal for containment and isolation of radioactive waste. In addition, the relatively thick cover profile, the design

based on natural principles, and the local hydrology of the vadose zone at NTS make water intrusion a less important issue than at other sites. Results of the lysimeter study at Area 5 have shown that a cover system employing natural principles can limit flow into underlying waste to very small amounts. This design is more flexible than conventional covers with barrier layers and therefore is less susceptible to formation of defects in response to distortion caused by settlement or seismic events. However, a plan should be developed that includes the frequency of inspection, methods that will be used to identify defects, and procedures that will be followed to repair defects that are encountered during the institutional control period. Lessons learned in stakeholder interactions could be particularly valuable to other DOE sites. NTS's success in operating LLRW and MLLW disposal facilities with the Yucca Mountain debate in the background is a testament to the importance of this long-term relationship. Documenting or sharing in a workshop, good practices for stakeholder interactions could be a significant benefit to other sites.

What the ETR Team Recommended

- Since waste placement and disposal operations can affect the long-term stability of the final cover, previous studies should be reviewed and updated consistent with current scientific data within and external to DOE.
- Although prior analysis supports the use of unlined landfills at NTS, it would be beneficial to review the merits of both lined and unlined landfills for future applications at NTS.
- Automation of processes, monitoring and record keeping should be explored for application to waste acceptance and landfill operations to improve cost effectiveness and performance.
- Closure plans for RCRA and non-RCRA disposal facilities should consider long-term performance, sustainability with minimal maintenance and/or intervention, monitoring and long-term stewardship.
- DOE experience in maintaining Uranium Mill Tailings Remedial Action (UMTRA) facilities should be applied when designing closures and new cells to ensure the designs are congruent with the natural setting.

ETR-15 Major Risk Factors Integrated Facility Disposition Project (IFDP) Oak Ridge, TN

What the ETR Team Found: Overall, the ETR Team concluded there were no severe technical issues that would need to be resolved prior to continued programmatic consideration of the IFDP. Several observations were considered "overarching" in that they apply across the IFDP. These are (1) IFDP appears to characterize the overall level of risk in a manner appropriate for the current stage of the project (2) The strategic approach to integrate multiple DOE programs in addressing environmental management issues is commendable and (3) Addressing legacy waste and facilities issues as soon as practicable should assist in optimizing the total cost magnitude, risk reduction, and schedule duration.

What the ETR Team Recommended

- Perform characterization leading to high confidence projection of mercury contaminated debris/soil waste volumes by utilizing innovative, proven and accurate methods. This projection is critical to ensuring that treatment technologies and facilities (including existing facilities) are sufficient and available.
- Develop clear, achievable metrics for mercury remediation activities. Integrate disposition of debris with similar characteristics to improve efficiency and costs effectiveness. Presume macro encapsulation of Alpha 4 debris.
- Proceed with CERCLA commitments in a disciplined but expeditious manner balancing the need for progress with continued need for processing buildings and the need to remediate beneath D&D planned structures.
- Develop waste acceptance criteria critical for stakeholder support for on-site disposal of mercury contaminated waste.
- Increase security requirements and improve assessments of risk mitigating actions for worst case safety, security, and programmatic cost and schedule impacts.

ETR-16 Proposed On-Site Disposal Facility (OSDF) at the Paducah Gaseous Diffusion Plant

What the ETR Team Found: Since the independent review occurred prior to any design, the findings were limited. However, the team felt that the Subtitle D landfill would pose a long term risk to DOE and removal/consolidation with the OSDF should be considered. Although the use of a brownfield site is logical for the Paducah OSDF, there will be considerable regulator and possibly stakeholder hurdles to address. The team also found that at the current stage there were no evident problematic issues from a project management perspective. The ultimate public use of the closed CERCLA disposal facility should be carefully considered and be consistent with the final design and closure of the facility.

What the ETR Team Recommended

- Evaluate the stakeholder, regulatory, and cost issues associated with using the Subtitle D landfill for: (a) diversion of non-hazardous and non-radioactive wastes from the OSDF, (b) temporary storage of waste prior to disposal in the OSDF, and/or (c) consolidating the two disposal activities into the OSDF.
- The brownfield site is the most logical for the OSDF. If chosen, DOE should consider innovative monitoring Systems.
- For site selection, DOE should consider the recommendations of the US Army Corps of Engineers to include both deterministic and probabilistic approaches with sensitivity analyses versus a hybrid approach. They further suggest additional site testing.
- The public communication plan should include forming stakeholder groups that are inclusive of those affected and steps to ensure open communication paths.
- Public use should preclude access to areas with appurtenances and to the containment cap.

ETR-17 Plutonium Preparation Project at the Savannah River Site

What the ETR Team Found: A detailed review of the PuPP primary assumptions was performed with the following findings: 1. The PuPP has a sound technical basis with a limited set of technology challenges. Most of the operations are based on demonstrated technologies with recent experience within the DOE complex, except: a. The design and operation of the Pu metal furnace will require development and demonstration with a long lead time. Suitable test facilities must be identified. b. A certified Pu storage container and crimping station for transfer of in-process materials between facilities should be considered. c. Gadolinium as a poison and that maximum Pu concentrations within sludge batches are consistent with Yucca Mountain acceptance requirements must be validated. 2. The planning and scheduling process was not detailed enough to address the complexity of internal and external process, program, and facility interfaces. Since the FFTF fuel operation is likely to be the rate limiting process and multiple secure material transfers are required, the time and motion studies should be upgraded. 3. During construction, the availability and scheduling of a sufficient number of appropriately skilled and cleared craft workers will be a significant challenge.

What the ETR Team Recommended

- Due to the number of process, program, and security interfaces, DOE oversight plus the project cost and schedule planning for construction and operation should be increased. Periodic verification of planning input versus current and projected reality should be added. The time and motion study should be revisited.
- As the design matures, conservative safety assumptions should be revisited for cost improvement opportunities.
- An alternate waste disposition path that is in compliance with the current Yucca Mountain plutonium license requirements should be developed for the ~5MT proposed to be processed in H-Canyon.

ETR-18 System Planning for Low-Activity Waste Treatment at Hanford

What the ETR Team Found: A comparative schedule and cost analysis was carried out for four broad scenarios (or courses of action) to address LAW treatment needs. Each scenario was evaluated under the assumptions of treating 60,000 and 90,000 MT sodium. In addition, a minimum mission duration of 30 years was assumed to facilitate comparison with the present River Protection Program (RPP) plan; however, shorter mission durations may be possible with improvements in efficiency to operations. Each of the scenarios requires implementation of a different sequence of capital and operating expenses; therefore, each has a different cost-time profile, which is contained in the present worth analyses. The analysis indicates the following:

- A second LAW vitrification facility (Second LAW and Enhanced Second LAW) would provide the most favorable present worth while making possible attainment of the current system plan mission completion date of 2049 for the full range of potential sodium quantities assumed to be treated (i.e., 60,000 to 90,000 MT sodium). This result is possible because of the flexibility in sizing the capacity of a second LAW vitrification facility and because the selection of an immobilization method and the capacity-sizing decision would not be required until 2017, allowing time to reduce key program uncertainties.
- Inclusion of Early LAW treatment with any of the base scenarios (WTP Only, Present RPP System Plan, or Second LAW) results in an insignificant reduction in life-cycle present worth; however, non-financial benefits derived from Early LAW also warrant consideration.
- Enhancements to the present LAW facility would result in a six-year mission extension beyond the current system plan completion date of 2049 and provide a favorable present worth under the assumption that 60,000 MT sodium would be treated.

What the ETR Team Recommended: The preferred option is a second LAW vitrification facility; however, if there is schedule flexibility, enhancement of the present LAW facility also is a potentially viable option. The WTP low-activity waste, high-level waste, pretreatment, and analytical laboratory facilities under construction

ETR-19 Disposal Practices at the Savannah River Site

What the ETR Team Found: The Independent Technical Team found no immediate concerns with operations at SRS that could result in issues similar to those at Hanford's Environmental Restoration Disposal Facility (EDRF). SRS waste disposal operations are consistent with the PA and good relationships exist with the regulatory agency. The operating contractor continues to identify technical issues that may affect disposal operations and to address issues using accepted engineering methods and practices. SRS uses a performance-based approach which allows a strategy of controlled release of contaminants from the slit and engineered trenches that is fundamentally different from total containment. The SRS approach requires understanding of the interaction of the disposal system, the waste and the local environment. The PA addresses the impact of the trenches on ground water and SRS also has a vadose zone monitoring system in place to monitor radionuclides between the facility and the ground water. The limited available data was the basis for the testing recommended by the team. The SRS performance based approach has led to the good practices recommended above for application throughout the DOE complex.

What the ETR Team Recommended

- Actual or prototypical trenches should be instrumented to determine volumetric and mass fluxes. The fluxes should also be estimated by inverse modeling using plume data from legacy disposal units and compared to Performance Assessment (PA) values.
- Field testing in prototypical trenches should be conducted to determine: the adequacy of dynamic compaction in stiffening the waste and in controlling long term total and differential settlements, the potential for long-term settlements to impact the final cover, the hydrological performance of the final cover, and the liquid flux from the base of the unlined trenches with and without the final cover.
- The following SRS disposal practices should be considered for use at other DOE disposal facilities: (a) SRS's long-term stabilization strategy for managing waste settlement, including the use of temporary geomembrane covers. (b) SRS's Waste Information Tracking System (WITS) , a tool for tracking and management of LLRW disposed of on-site, should be adapted or developed for general use in the DOE complex. (c) A complex-wide program based on SRS's Groundwater Modeling Consistency Team would reduce ambiguity and increase confidence in modeling predictions made for DOE sites

ETR-20 of the X-701B Groundwater Remedy, Portsmouth, Ohio

What the ETR Team Found: The independent review team found that the mass of TCE in the middle and upper Gallia source zone significantly decreased as a result of the oxidant injection, indicating measurable progress in remediation. However, the mass of TCE in the lower Gallia (near the contact with the underlying Sunbury Shale) was unchanged overall and increased in some areas. Groundwater concentrations were unchanged or increased after each Phase II injection, and all measurements of TCE in the groundwater were 100 to 10,000 times greater than the remediation goal of 5µg/L. The team determined that the quantity of oxidant injected during the Phase I pilot and the first five Phase II injections was significantly less than the amount required to meet the measured soil oxidant demand. Rapid decomposition of the hydrogen peroxide and limited injection volumes likely hindered progress toward remediation goals. The time frame for success is expected to be decades versus a few years.

What the ETR Team Recommended: The ETR Team recommends implementing innovative characterization to delineate target source zones to provide focus for future source treatments, to reduce costs, and to minimize collateral damage associated with the treatment. An overarching recommendation was to modify the pump and treat to increase effectiveness in terms of contaminant extraction rate and to support other technologies. In addition to characterization, a combination of technologies that would work synergistically should be used, since none of the identified technologies used alone are likely to achieve remedial objectives in a timely manner. The following source remediation techniques should be considered:

- Oxidants-Consider the blending of solid oxidants, such as persulfates, beneath the former source basin (in lieu of a cap) and focusing additional injections toward the Gallia Sunbury contact using high strength long-lived oxidants. It is recommended that any oxidant method be combined with hydraulic control.
- Thermal-This technology class is potentially viable if deployment can be performed under a fixed price and guaranteed performance contract by a reliable vendor. Soil blending of oxidant, focused TCE characterization,

targeted injection of long-lived oxidant solution, and modified pump-and-treat followed by a passive technique such as wetland treatment would be an example of a simple combination of treatment technologies to be considered.

ETR-21 External Technical Review for Evaluation of System Level Modeling and Simulation Tools in Support of Savannah River Site Liquid Waste Process

What the ETR Team Found: Four main observations were noted and categorized: 1. Software tools: The current System Plan relies on a collection of software tools to organize and analyze information, and guide the processing of liquid waste. These tools currently provide "reasonable" estimates, but there is a need for an integrated overall system planning tool; 2. Capability to model facilities: The capability of current tools and their integration is limited. There is a lack of automatic data transfer, non-optimal software selection and some unit operations do not have models. This hampers process optimization and mid to long-term planning; 3. Rate at which predictions are made: There is a need to increase system planning flexibility, and turnaround time for system model predictions. There is a need to decouple safety, planning and operations functions; 4. Need for additional tools: There is a need to relate system planning results with cost and impact of potential funding constraints. A further need is to include a waste acceptance tool for Saltstone similar to glass product acceptance.

What the ETR Team Recommended: Recommendations are categorized by their execution timeline.

- Short-term (6 to 12 months): 1. Update computer resources (processor, memory and software); 2. Engage software engineers/modeling experts to integrate current tools; 3. Develop approach to calculate propagation of uncertainties through the planning process; 4. Participate in complex-wide exchanges; 5. Review current QA software design against most recent DOE policy guidelines; 6. Develop an acceptance tool for Saltstone similar to Glass; 7. Implement spreadsheet best practices to improve data input and integrity.
- Mid-term (next 2 years): 1. Determine computing environment for long-term planning needs, including optimization and what if scenarios; 2. Explore the use of software site licenses versus contractor specific; 3. Implement approach to account for uncertainty analysis, with respect to appropriate constraints (e.g., cost, glass properties, etc.) in system plan; 4. Develop tank inventory database; 5. Implement capability to compare historical model predictions with actual data; 6. Implement integrated models to run timely system planning cases.
- Long-term (3 to 4 years): 1. Implement improved planning tools for optimization and decision making; 2. Develop infrastructure tool for complex-wide inventory tracking independent of contractors; 3. Work with DOE HQ and other program offices to adopt consensus standards for material properties across all models; 4. Integrate the tank inventory and "WCS" database; 5. develop the capability to ensure assumptions and calculation consistency among Safety, Planning, Operations and Waste Acceptance tools

ETR-22 External Technical Review for Evaluation of System Level Modeling and Simulation Tools in Support of Hanford Site Liquid Waste Process

What the ETR Team Found: Four main observations were noted and categorized: 1. Software tools: The current System Plan relies on software tools that are limited to the movement of materials. These tools currently do not predict material composition, resulting in systems at high risk of not meeting waste acceptance criteria beyond the initial batches. There is a need for a system planning tool that is chemistry based; 2. Capability to model facilities: Incomplete alignment of G2 based models for tank farm operations (HTWOS) and WTP operation (G2 dynamic flowsheet) limits overall system analysis, since the current set of assumptions used by the two ORP contractors are different. HTWOS is one step behind WTP, which results in the system plan not reflecting current design/operations considerations and as a consequence timely "what if" scenarios cannot be analyzed; 3. Rate at which predictions are made: The mission is at different development stages (e.g. planning, design, construction) which require the system plan to capture uncertainties in cost, retrieval, processing, chemistry, etc. There is a need for the tools supporting the system plan to incorporate these functionalities; 4. Need for additional tools: The lack of an "overall" model that address entire plant/process reliability, availability, and maintainability (RAM) for WTP and the Tank Farm hampers life cycle analysis. There is a need to evaluate system bottlenecks and conduct "what if" scenarios to evaluate alternative pre-treatment options.

What the ETR Team Recommended: Recommendations are categorized by their execution timeline.

- Short-term (6 to 12 months): 1. Update computer resources (processor, memory and software); 2. Engage software engineers/modeling experts to integrate current tools; 3. Develop approach to calculate propagation of

uncertainties through the planning process; 4. Participate in complex-wide exchanges; 5. Determine approach to resolve differences in assumptions between HTWOS and WTP Dynamic Flowsheet Model; 6. Link to EM-30 supported activities regarding experimentation and model development for predictive chemistry, and 7. Evaluate methods to approximate tank chemistry in HTWOS and/or WTP G-2.

- Mid-term (next 2 years): 1. Determine computing environment for long-term planning needs, including optimization and what if scenarios; 2. Explore the use of software site licenses versus contractor specific; 3. Implement approach to account for uncertainty analysis, with respect to appropriate constraints (e.g., cost, glass properties, etc.) in system plan; 4. Reconcile differences among HTWOS and WTP G-2; 5. Incorporate expanded capabilities for chemical process modeling (thermo, kinetics and transient unit operations) and; 6. develop optimization, uncertainty and sensitivity analysis planning model capabilities
- Long-term (3 to 4 years): 1. Implement improved planning tools for optimization and decision making; 2. Develop infrastructure tool for complex-wide inventory tracking independent of contractors; 3. Work with DOE HQ and other program offices to adopt consensus standards for material properties across all models; 4. Consolidate G-2 based models; 5. demonstrate capability to perform sensitivity/uncertainty analysis in system plans; 6. implement unified operations research model for WTP and Tank Farms and; 7. fully implement expanded capabilities for chemical process modeling (thermo, kinetics and transient unit operations)

CONCLUSION

Through the use of ETRs, DOE-EM has put in place tools to assist in reducing the technical risks associated with its portfolio of projects. In general, the ETR process has been useful to DOE-EM senior management and/or project managers by either verifying that the issue under consideration is “on target” with respect to the desired project outcomes, or the ETR has identified technical areas that deserve further research to reduce project risk.

REFERENCES

1. Memorandum for Distribution to all DOE-EM employees from Ines R. Triay, Principal Deputy Assistant Secretary for Environmental Management; September 24, 2008.
2. DOE Order 413.3A, “Program and Project Management for the Acquisition of Capital Assets”; Approved: 7-28-06. Available at: http://directives.doe.gov
3. “External Technical Review (ETR) Process Guide” U.S. Department of Energy, Office of Environmental Management, September 2008.
4. “Technical Risk Rating for Environmental Management Projects, Criteria and Methodology,” U.S. Department of Energy, Office of Environmental Management, Revision 1 (July 2008).
5. “External Technical Review Summaries”; Prepared by Office of Engineering and Technology, Office of Environmental Management, July 2009.