

External Technical Reviews in the Environmental Management Program

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The Environmental Management (EM) program believes strongly in reducing the technical risk of its projects and has initiated External Technical Reviews (ETR) as one of several steps to ensure the timely resolution of engineering and technology issues. EM's Office of Engineering and Technology is leading the ETR process and is working closely with Federal Project Directors to review such issues as technology development, systems integration, design, operations, maintenance, and nuclear safety. EM has completed several successful reviews using expert engineers and scientists from private industry and academia over the last two years. Additional external technical reviews will be conducted to support key project decisions and will be a mainstay of the EM program.

The purpose of an ETR is to reduce technical risk and uncertainty. These independent reviews provide pertinent information for EM to assess technical risk associated with projects and develop strategies for reducing the technical risk, and provide technical information needed to support critical project decisions. Technical risk reduction increases the probability of successful implementation of technical scope. In general, an ETR assesses technical bases, technology development, and technical risk identification and handling strategies.

The three key objectives of every ETR are:

- To determine if the technology, process, system, or design under review will meet project objectives and requirements,
- To identify any issues (showstoppers) preventing successful implementation of the technology, process, system, or design under review, and
- To identify issues or data needed to support critical or other project or program decisions.

The specific objectives of ETRs may vary, but generally include:

- Determining if technical objectives are well known and defined
- Determining if alternatives have been identified and effectively evaluated
- Determining if technology development is well planned and executed
- Determining the adequacy of quality assurance and scientific investigation
- Determining if technical bases are substantial and adequately documented
- Validating the technical basis and appropriateness of the technology, process, system, or design to technical risk reduction
- Determining if the technology can be deployed and implemented.

Independent reviews are conducted to assure continuing progress, appropriate planning and development, effective use of funds, mission need, etc. A non-proponent of the project conducts an independent review. External Technical Reviews are independent reviews 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 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.

ETRs are not required by Department of Energy (DOE) Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*. 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 the ETR is different than the DOE Order 413.3A External Independent Reviews, which are focused on project management baselines (i.e., scope, cost, and schedule baselines). The ETRs are focused on technical risks and uncertainties. Furthermore, an ETR is not a contract or management review.

In the National Academies of Science (NAS) 2007 report, *Assessment of the Results of External Independent Reviews for U. S. Department of Energy Projects*, it was acknowledged that projects benefit from the effort expended in preparing for external independent reviews and independent project reviews. This benefit increases as the size, complexity, and inherent risks of the project increase. The report stated the value and cost-effectiveness of external independent reviews would be enhanced if they were (1) planned more carefully with the broader involvement of all stakeholders, (2) tailored in a more flexible manner using a collaborative process, and (3) integrated into the complete portfolio of peer reviews that are used to monitor and support DOE projects. These conclusions and recommendations resulting from the NAS 2007 report can be applied to External Technical Reviews.

EM is preparing an ETR Process Guide to provide program offices, field offices, site contractors, and ETR teams an understanding of the review process, requirements, and expectations. Existing review processes were considered during the development of this standard review process. A process flow diagram is included in the guide. This guide also provides general policy regarding initiation and approval of ETR requests, as well as the key responsibilities of the ETR team members. Three key requirements of an ETR are:

- Charter - The charter is intended to delineate the technical scope of the review, team membership, lines of inquiry, cost, and schedule. It is approved by the field and program office.

- Final ETR Report – The ETR team shall prepare a final report that documents the observations and recommendations made by the team. Observations should be categorized based on their significance, as follows:
 - Findings – Observations that would prevent the technology from being fully developed to meet mission needs. These observations should be considered fatal flaws that cannot be resolved.
 - Technical Issues – Observations requiring resolution to ensure the technology will successfully meet mission needs.
 - Areas of Concern – Observations that may require design modifications to the technology deployment or additional testing to resolve technical concerns.
 - Opportunities for Improvement – Observations that would improve the ability to meet mission needs or offer alternative solutions to technical problems.
 - Good Practices - Items that are commendable and deserve recognition.
- Issue Response Plans – Following the completion of the ETR, the responsible field office shall prepare an Issue Response Plan that provides the action planned to address each recommendation made by the ETR team.

EM has completed nine ETRs over the last two years. The reviews include ETRs of the Waste Treatment Plant (WTP) and the Demonstration Bulk Vitrification System (DBVS) at Hanford; Tank 48 and the Salt Waste Processing Facility (SWPF) at Savannah River; Caustic Recovery Technology, and the ARROW-PAK transuranic waste container. Also included are ETRs of certain groundwater remediation systems at Hanford and Paducah, as well as a review of the Environmental Restoration Disposal Facility (ERDF) at Hanford.

The scope and results of these ETRs are the following:

- The WTP ETR team was chartered to conduct a comprehensive review of the entire WTP process flowsheet and throughput. The review answered three principal questions: (1) Are there any major issues that will prevent the plant from operating? (2) Are there any major issues that will prevent meeting contract rates with commissioning and future feeds? (3) Are there any potential issues that could prevent meeting contract rates with commissioning and future feeds? The team identified line plugging as one issue that could prevent plant operation. There were 17 major issues, including line plugging, that will prevent the WTP from meeting contract rates if not fixed. There were 11 potential issues that could also prevent meeting contract rates. The WTP ETR report was issued in March 2006.

- The DBVS ETR team was chartered to review the current status of the DBVS. The team focused on the technical basis for the existing design. The consensus of the team was that bulk vitrification is a technology that requires further development and evaluation to determine its potential for meeting the Hanford waste stabilization mission. No fatal flaws that could jeopardize the overall mission were found. However, 19 technical issues were found that could significantly affect the project's ability to meet the mission. The DBVS ETR report was issued in September 2006.
- The Tank 48 ETR team was chartered to assess the technical viability of the current SR path forward for resolution of the long-standing problems posed by the tetraphenylborate (TPB) in high-level waste Tank 48. TPB is a material which can release benzene vapor to the tank head space in potentially flammable concentrations. This condition has rendered the tank unavailable for use until the condition is resolved. The team reviewed three processes to resolve the TPB problem: (1) Steam Reforming, (2) Wet-Air Oxidation, and (3) Aggregation as a backup approach. The team found that Steam Reforming and Wet-Air Oxidation are technically sound, with Steam Reforming identified as the lead approach. However, other issues, such as heel management, must be addressed in addition to TBP in order to return the tank to service on schedule. The Tank 48 ETR report was issued in August 2006.
- The SWPF ETR team was chartered to review the Preliminary Design of the SWPF, with a focus on evaluating the technical sufficiency of design to support development of a baseline cost and schedule for Critical Decision-2 per DOE Order 413.3A. The team reviewed three main areas: (1) Civil/Structural design, (2) Facility Safety, and (3) Engineering. The team also reviewed technical risks to determine if all technical risks had been identified and addressed. The team concluded that the SWPF project was technically sufficient and ready to move into final design. No fatal flaws were identified that could cause failure of the SWPF. However, technical issues were identified which could result in a failure of the SWPF if not resolved. Some major risks were identified, including geotechnical investigations. The SWPF report was issued in November 2006.
- The Caustic Recovery Technology ETR team was chartered to assess a potential sodium hydroxide recovery technology that may be deployed at WTP. This electrochemical process utilizes an inorganic membrane technology to recover concentrated sodium hydroxide from alkaline waste. The team concluded that this was a viable technology at its current state of development, but some technical issues needed to be resolved before it can be deployed. The Caustic Recovery Technology ETR report was issued in June 2007.
- The ARROW-PAK ETR team was chartered to evaluate two primary areas: (1) the technical aspects of the ARROW-PAK transuranic (TRU) waste container and its potential for certification by the Nuclear Regulatory Commission (NRC) and the Department of Transportation, and (2) the TRU waste inventory appropriate

for use in the ARROW-PAK and the programmatic need for this package. The ETR team found that ARROW-PAK container did not have a high probability of success of obtaining certification from the NRC using the current approach. No fatal flaws were identified that would prevent the ARROW-PAK from being certified by the NRC. However, there were 15 technical issues that must be successfully resolved to obtain certification. The team also identified several opportunities for improvement that would enhance EM's assessments of TRU waste inventories and transportation packages. The ARROW-PAK ETR report was issued in August 2007.

- The Hanford Remediation ETR team was chartered to perform a remediation system evaluation of the 200-ZP/PW-1 groundwater pump and treat system, as well as the vadose zone soil vapor extraction system at the Hanford site. These systems are designed to remove carbon tetrachloride from the vadose zone. The team made several recommendations to improve the current remediation strategy and modeling tools. The Hanford Remediation ETR report was issued in February 2007.
- The Paducah Remediation ETR team was chartered to review the 90% Remedial Design Report and Site Investigation for the thermal treatment of trichloroethylene (TCE) in the soil and groundwater in the vicinity of Building C-400 at the Paducah site. The team supported the remedial action objective to reduce the TCE via subsurface Electrical Resistance Heating (ERH). However, the team concluded that additional efforts were needed to provide an adequate basis for the ERH design. The team also provided recommendations to improve the design model basis and site characterization. The Paducah Remediation ETR report was issued in August 2007.
- The ERDF ETR team was chartered to review operational irregularities at ERDF. This included: (1) failure to recognize that leachate pumps were not functioning for an extended period, (2) falsification of compaction data, and (3) issues related to waste compaction. The team concluded that the management plan proposed by the contractors will address the pump operation issue. The team also concluded that a field test is needed to check the falsified data and other data associated with waste compaction. The ERDF report was issued in May 2007.

In conclusion, ETRs have proven to be a valuable tool for reducing technical risk and uncertainty in EM projects. An ETR Process Guide is currently being developed that will provide a standard review and reporting process for all EM ETRs. EM plans to conduct ETRs in the future to support key project decisions.