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## **Risk Reduction through Use of External Technical Reviews, Technology Readiness Assessments and Technical Risk Ratings - 9174**

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### **ABSTRACT**

The U.S. Department of Energy's Office of Environmental Management (DOE-EM) was established to achieve the safe and compliant disposition of legacy wastes and facilities from defense nuclear applications. A large majority of these wastes and facilities are 'one-of-a-kind' and unique to DOE. 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 DOE-EM program believes strongly in reducing the technical risk of its projects and has initiated several efforts to reduce those risks:

- Technology Readiness Assessments to reduce the risks of deployment of new technologies;
- External Technical Reviews as one of several steps to ensure the timely resolution of engineering and technology issues; and
- Technical Risk Ratings as a means to monitor and communicate information about technical risks.

This paper will present examples of how Technology Readiness Assessments, External Technical Reviews, and Technical Risk Ratings are being used by DOE-EM to reduce technical risks.

### **INTRODUCTION**

The U.S. Department of Energy Office of Environmental Management's (DOE-EM) Office of Engineering & Technology has developed a set of tools to help assure the success of environmental projects by managing the technical issues that could prevent a project's success – the "technical risks."

These issues could include:

- no technology or engineering solution currently exists to accomplish a project task;
- a technology may exist, but is not yet mature enough to be used without additional development;
- a technical project risk requires additional focus and/or external review to mitigate risk; and
- a new technology may not yet be accepted by regulators.

To assist in the management of these technical risks, and thus increase the likelihood of successful implementation of environmental projects, DOE-EM's Office of Engineering & Technology has developed the following processes: Technology Readiness Assessments (TRAs), External Technical Reviews (ETRs) and Technical Risk Rating (TRR).

## TECHNOLOGY READINESS ASSESSMENTS

Technology Readiness Assessments are performed by DOE-EM personnel or outside subject matter experts to provide a snapshot in time of the maturity of technologies and their readiness for inclusion in the project. The results of a Technology Readiness Assessment assist DOE-EM in developing plans to mature the technologies and to make decisions related to technology insertion.

Following pilot programs at the Hanford and Savannah River Sites, DOE-EM issued a guide for performing Technology Readiness Assessments in March 2008 [1]. Figure 1 provides a representation of how technology readiness levels equate to maturity and DOE's project management critical decision process. Based on DOE-EM's experience with this process, other DOE and NNSA organizations are evaluating the DOE-EM Technology Readiness Assessment process for their own use.

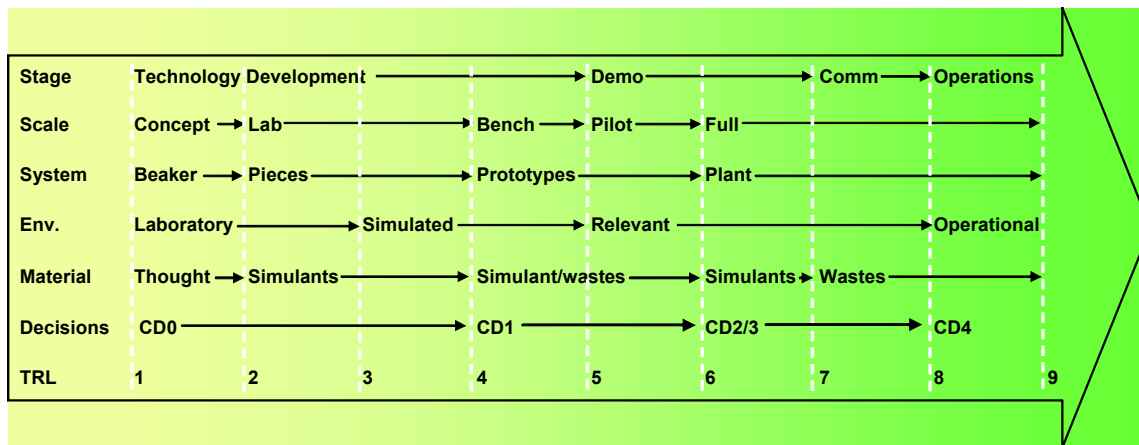


Figure 1 Technology Readiness Levels

Two examples of Technology Readiness Assessments are described briefly below:

- The Technology Readiness Assessment of the Hanford K Basins Sludge Treatment Project identified technologies that were not at the desired readiness levels. As the project team reviewed plans to mature the technologies, they decided to step back on the project execution timeline and evaluate different alternatives to meet technology gaps.
- A Technology Readiness Assessment of the U-233 Downblending and Disposition Project at Oak Ridge Site identified four critical technology elements whose current level of maturity should be further advanced prior to the start of final design efforts.

DOE-EM has conducted nine Technology Readiness Assessments:

- Hanford Waste Treatment and Immobilization Plant (WTP) Laboratory, Low Activity Waste (LAW) Facility and Balance of Facilities (BOF);
- Hanford WTP High-Level Waste (HLW) Facility;
- Hanford WTP Pre-Treatment (PT) Facility;
- Hanford Study of LAW Treatment Alternatives;
- Hanford K Basins Sludge Treatment;
- Savannah River Tank 48H Waste Treatment Technologies; and
- U233 Project at Oak Ridge.

## EXTERNAL TECHNICAL REVIEWS

The purpose of an External Technical Review is to reduce technical risk and uncertainty. External Technical Reviews use subject-matter experts from DOE-EM, the National Laboratories, academia, and industry - people who are independent of the project but knowledgeable in the subject area – to review the progress of major cleanup projects and provide pertinent information for DOE-EM to assess technical risk. The results of the reviews are used to develop strategies for reducing identified technical risks, and provide technical information needed to support critical project decisions. Technical risk reduction increases the probability of successful implementation of technical scope. DOE-EM in September 2008 issued a guide to standardize the review process. [2]

DOE-EM's Office of Engineering and Technology is leading the External Technical Review process and is working closely with Federal Project Directors to review such issues as technology development, systems integration, design, operations, maintenance, and nuclear safety. DOE-EM has completed several successful reviews using expert engineers and scientists from private industry and academia over the last three years. External Technical Reviews have been completed to

- assess if operations at some sites have the same problems incurred at others (as was done in the Review of Landfills);
- provide recommendations for technical issues (such as the mitigation and remediation of mercury contamination at the Y-12 Plant); and
- evaluate the basis for a selected technical approach prior to a key decision (as in the Review of the ARROW-Pak TRU Waste Container).

Table I is a listing of the External Technical Reviews that have been completed during the last two fiscal years. Additional external technical reviews will be conducted to support key project decisions and will be a mainstay of the DOE-EM program.

Table I Listing of External Technical Reviews Completed in FY2006, FY2007, FY2008 and FY2009

External Technical Review	Site	Completed
		FY2006
Waste Treatment Plant Process Flowsheet	Office of River Protection	3/2006
Tank 48 Technical Path Forward	Savannah River	8/2006
Demonstration Bulk Vitrification System	Office of River Protection	9/2006
		FY2007
Salt Waste Processing Facility Design	Savannah River	11/2006
Hanford Remedial System for ZP-1/PW-1 Units	Richland	2/2007
Hanford Landfill - ERDF	Richland	6/2007
Caustic Recovery Technology Process	Office of River Protection	6/2007
Paducah C-400 Thermal Treatment	Paducah	8/2007
ARROW-PAK TRU Waste Container	Waste Isolation Pilot Project	8/2007
		FY2008
Idaho Landfill	Idaho	12/2007
Oak Ridge Landfill	Oak Ridge	2/2008

External Technical Review	Site	Completed
Portsmouth Landfill	Portsmouth	2/2008
Oak Ridge Y-12 Mercury Contamination	Oak Ridge	4/2008
Hanford Columbia River Projects	Richland	7/2008
Nevada Test Site Landfill	Nevada	7/2008
Supplemental Treatment of Low Activity Waste	Office of River Protection	8/2008
Integrated Facility Disposition Project	Oak Ridge	8/2008
Paducah Landfill	Paducah	8/2008
Savannah River Landfill	Savannah River	8/2008
		FY2009
Plutonium Preparation Project	Savannah River	10/2008
Capabilities of Integrated Project Teams	All	12/2008 F
U-233 Project	Oak Ridge	6/2009 F

## TECHNICAL RISK RATING






Technical Risk Ratings combine input from risk management plans, Technology Readiness Assessments, External Technical Reviews and other information into a tool for communicating between Federal Project Directors and DOE-EM management about technical risks. The Technical Risk Rating process was developed by DOE-EM's Office of Engineering & Technology and Savannah River National Laboratory. After a pilot in the spring of 2008, guidance [3] and training were provided to all of the DOE sites during the summer, so that each Federal Project Director could prepare Technical Risk Ratings for use during the quarterly project reviews at the end of CY 2008. The Technical Risk Ratings use a stoplight-themed graphic to promote communication of technical risk. For each of four criteria - Technology Maturity, Risk Urgency, Handling Difficulty, and Resolution Path — the stoplight provides visual representation of the level of concern. Red indicates an area that warrants heightened attention. Green indicates that the technical risks are manageable as planned. The objective is to bring pressing technical risks to the forefront, keeping the team and leadership informed and engaged such that the risk impacts are fully understood and they can be effectively managed.

The criteria used to determine the Technical Risk Rating allow separate candid judgments on technical risk severity and handling that enables presentation of a more accurate status on technical risk to the project. Four criteria have been selected to comprise the Technical Risk Rating:

1. Technology Maturity: A measure of maturity/availability/existence of the technology needed to address the consequences of the risk. - "Are the needed technologies ready for deployment?"
2. Risk Urgency: A measure of the relative time in the project schedule when risk consequences are expected to occur and intervention is needed - "Are the impacts close, does the project have time to work the issues, is the critical path delayed?"
3. Handling Difficulty: A measure of the complexity and/or difficulty in developing and implementing a suitable solution to technical issues - "How difficult is it going to be to define and perform actions that will mitigate the risk(s)?"
4. Resolution Path: A measure of the progress made towards achieving expected results and reducing risk during implementation of the handling strategy - "Are the results from the risk handling actions mitigating the risk(s) as expected?"

The overall project Technical Risk Rating is determined by a qualitative assessment done by the Federal Project Director. The Federal Project Director bases this judgment on the individual criteria values and other input as appropriate. The final Rating is assigned based on Table II.

Table II Overall Technical Risk Rating

Technical Risk Rating	Management Impact
	Project technical risk(s) require heightened attention and may require Acquisition Executive decisions on direction or resources.
	Project technical risk(s) require additional focus and may require Acquisition Executive decisions on direction or resources.
	Project technical risk(s) have concerns in several areas and may require additional focus by the Integrated Project Team.
	Project technical risk(s) are manageable. Minor concern in selected areas, but additional focus not required.
	Project technical risk(s) are manageable as planned.

The initial use of the Technical Risk Rating in the latest Quarterly Project Reviews has resulted in:

- identification of specific technical risks of concern;
- increased and improved discussion of technical risks, and all risks in general;
- focused discussion on the resolution of technical risks; and
- identification of assistance for resolving the issues and roadblocks associated with mitigating the technical risk.

The technical risks identified during these reviews will be used to develop a risk “watch list” for DOE-EM management tracking. Additional technical support and independent reviews may be performed in the near future to assist resolution of the technical risks. Discussions with project managers working with DOE-EM indicate the Technical Risk Rating is applicable to government and industry projects.

## CONCLUSION

Through the use of Technology Readiness Assessments, External Technical Reviews and the Technical Risk Ratings DOE-EM has put in place tools to assist in reducing the technical risks associated with its portfolio of projects. In the short period the tools have been in place use of the tools has resulted in reductions in risks and increased attention to technical risks. Future plans include the continued use of the tools and the review of the results of the reviews to look for lessons learned that can be applied to other projects.

## REFERENCES

1. DOE-EM Guide, Technology Readiness Assessment (TRA) / Technology Maturation Plan (TMP) Process Guide, March 2008.

2. DOE-EM Guide, External Technical Review (ETR) Process Guide, September 2008.
3. DOE-EM Guide, Technical Risk Rating for Environmental Management Projects, Criteria and Methodology, July 2008, Revision 1.