

**The Role of Technical Authority
at the U.S. Department of Energy Office of Environmental Management (EM) – 9467**

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ABSTRACT

“Technical Authority” is a term used to describe a corporate framework and process that effectively manages technical and safety issues and risks in a forward-looking manner, providing a lineage of accountability in making independent technical decisions. Specific duties are delegated to designated, qualified Technical Authority personnel who facilitate the process. Technical Authority promotes engineering excellence to support improved project performance during all lifecycle phases of facilities. The Technical Authority process was successfully deployed at the U.S. Navy Naval Sea Systems (NAVSEA) Command in 1997, and is applied to all lifecycle phases of Navy combatant ships in a climate of downsizing technical resources under increasing operational requirements and budgetary pressures. The authors believe that the Department’s Office of Environmental Management (EM) can benefit from establishing a Technical Authority framework to enhance its technical decision-making. This paper provides an overview of Technical Authority, a brief history, and plans for its near-term implementation in EM.

INTRODUCTION

Technical Authority promotes engineering excellence to support improved project performance. To improve project performance, it is essential to establish the disciplines of timely identification and resolution of technical issues with the appropriate level of rigor. To do so, Technical Authority clarifies the roles, responsibilities, accountabilities, and authorities of Federal technical personnel for improved technical¹ performance. This is also accomplished through stewardship of pedigreed technical personnel and consistent technical reviews.

Having independent decision-making frameworks in each of three competencies—Headquarters policy and resources (requirements and operational needs); project authority (project cost, schedule, and scope); and Federal technical authority (safety, standards, and certification)—can help to balance decision-making. The space shuttle Columbia tragedy in 2004 and the near-loss of the USS *Dolphin* (AGSS-555) in 2002 may have been averted had technical decisions been made independently from programmatic authority. In recounting a costly but valuable lesson learned, Sean O’Keefe, the Administrator of the National Aeronautics and Space Administration (NASA), stated that “One of the most difficult Columbia Accident Investigation Board organizational recommendations is that we develop an independent technical authority to assure engineering excellence.”[1]

In its review of DOE regulatory processes for the Hanford Waste Treatment Plant (WTP), the U.S. Nuclear Regulatory Commission (NRC) suggested, in August 2008, that

¹ “Technical” includes technology, design, engineering, and safety.

DOE evaluate how these requirements are being implemented and how the transparency of its decisions and actions regarding the WTP could be improved...NRC suggests that DOE explore ways to gain and maintain more independence between regulatory oversight and project management functions. [2]

EM has crafted an initial structure and processes for Technical Authority based on Navy lessons learned tailored to the EM complex. EM is piloting a formal Technical Authority framework at the Savannah River Tank 48 Treatment Project (TTP). Lessons learned from this pilot will help to shape the resulting framework for the EM complex Technical Authority as applied to selected capital projects.

TECHNICAL AUTHORITY HISTORY

Technical Authority was successfully deployed at NAVSEA in 1997, and continues to be applied at the present time to all lifecycle phases of Navy combatant ships. Faced with a climate of downsizing technical resources and increasing operational requirements and budgetary pressures, NAVSEA used the Technical Authority framework to streamline its technical decision-making process. It created a formal network of 173 warranted Technical Authority positions that defined the breadth of technical expertise required for adequate Federal oversight of aircraft carriers, submarines, surface ships, and other types of naval platforms. These warrants were issued to technical functional area experts; ship class experts, including multifunctional Ship Design Managers; and Chief Engineers at field offices. The authors believe that EM can benefit from the application of Technical Authority to enhance its technical decision-making by establishing a similar formal framework.

NAVSEA did not fully implement the Technical Authority framework until 2002, at which time qualified personnel were issued Technical Authority warrants and the Technical Authority network was set in place. In 2002, NAVSEA joined with NASA to conduct a benchmarking exchange. This exchange was formed to compare and contrast methods of technical decision-making and certification of technical products, including certifying the readiness of the space shuttle orbiter for launch into space and certifying U.S. nuclear submarines as ready to submerge into the ocean depths. Three reports were issued between December 2002 and October 2004 by the NASA/Navy Benchmarking Exchange (NNBE), which focused on Navy submarine program safety assurance, Naval Reactors safety assurance, ongoing NNBE activities, and software safety. [3]

Use of Technical Authority Following the Columbia Accident

It was during the benchmark exchanges that the tragic accident occurred involving the space shuttle orbiter *Columbia*. The *Columbia* Accident Investigation Board Report endorsed Technical Authority by stating that “The practices noted here suggest that responsibility and authority for decisions involving technical requirements and safety should rest with an independent technical authority.”[4]

The report went on to state that

Organizations that successfully operate high-risk technologies have a major characteristic in common: they place a premium on safety and reliability by structuring their programs so that technical and safety engineering organizations own the process of determining, maintaining, and waiving technical requirements with a voice that is equal to, yet independent of, Program Managers, who are governed by cost, schedule, and mission-accomplishment goals. [5]

The report also remarked that “The Naval Reactors Program [and the] SUBSAFE program...are examples of organizations that have invested in redundant technical authorities and processes to become highly reliable.” [6]

NASA has defined Technical Authority as the authority, responsibility, and accountability to establish, approve, and maintain technical requirements, processes, and policies that “own” the decision on what is technically acceptable in matters involving safe and reliable operations. NASA further defined the basic principles of Technical Authority in supporting projects and programs as: (1) residing within an individual, not an organization; (2) being clear and unambiguous; (3) being independent of the Program Manager; (3) being credible, based on knowledge, experience, resources, and personnel; and (4) being visible and accepted as valid; i.e., has influence and prestige. [7]

While conducting public hearings to examine DOE’s methods of ensuring safety at its defense nuclear facilities, the Defense Nuclear Facilities Safety Board (DNFSB) sought to benefit from the lessons learned from the discovery of the deep corrosion in the reactor vessel head at the Davis-Besse Nuclear Power Plant as well as the *Columbia* space shuttle disaster. After the hearings, the DNFSB issued Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*. This Recommendation resulted in DOE’s establishing the Under Secretaries as Central Technical Authorities, supported by the staff of the Offices of the Chief of Nuclear Safety and the Chief of Defense Nuclear Safety, fully implemented by October 2007. [8]

In October 2008, EM committed to establishing a pilot project at the Savannah River TTP as an initial step of pioneering a much broader Technical Authority framework (described in this paper) and developing lessons learned regarding its use.

GOALS FOR ESTABLISHING TECHNICAL AUTHORITY

In establishing Technical Authority, EM seeks to develop a framework for independent, objective, and technically defensible decision-making that:

- Ensures that safety is integrated into the earliest stages of designs and projects;
- Provides safety and technical feedback early in the development of requirements and design processes that is tailored to the process;
- Identifies issues and problems early, resulting in fewer modifications, reduced cost, and reduced schedule disruption;
- Is independent of project or program authority while preserving and supporting the roles, responsibilities, and authorities of the Federal Project Director (FPD);
- Emphasizes Federal “ownership” for project technical requirements;
- Streamlines Federal technical decision-making in a formal Technical Authority network with pedigreed qualification and accountability lineage;
- Is fully integrated with the requirements and criteria in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, the Critical Decision process, and DOE-STD-1189-2008, *Integration of Safety into the Design Process*; and
- Delegates appropriate decisions to field personnel who understand the technical and safety decisions they can make.

Technical Authority provides a framework for technical decisions and assists the FPD and the Integrated Project Teams (IPTs) in identifying and resolving potential significant technical issues identified early in, and throughout, the project lifecycle. Figure 1 represents the potential for cost reduction superimposed over the cost of making design changes over the span of the initial lifecycle phases of a facility. The figure illustrates that design decisions must be made in the earliest stages of a project, where the costs of change are minimal and the potential for cost savings highest. Costly design changes during fabrication or delivery must be avoided by making sound design decisions from the beginning of a project.

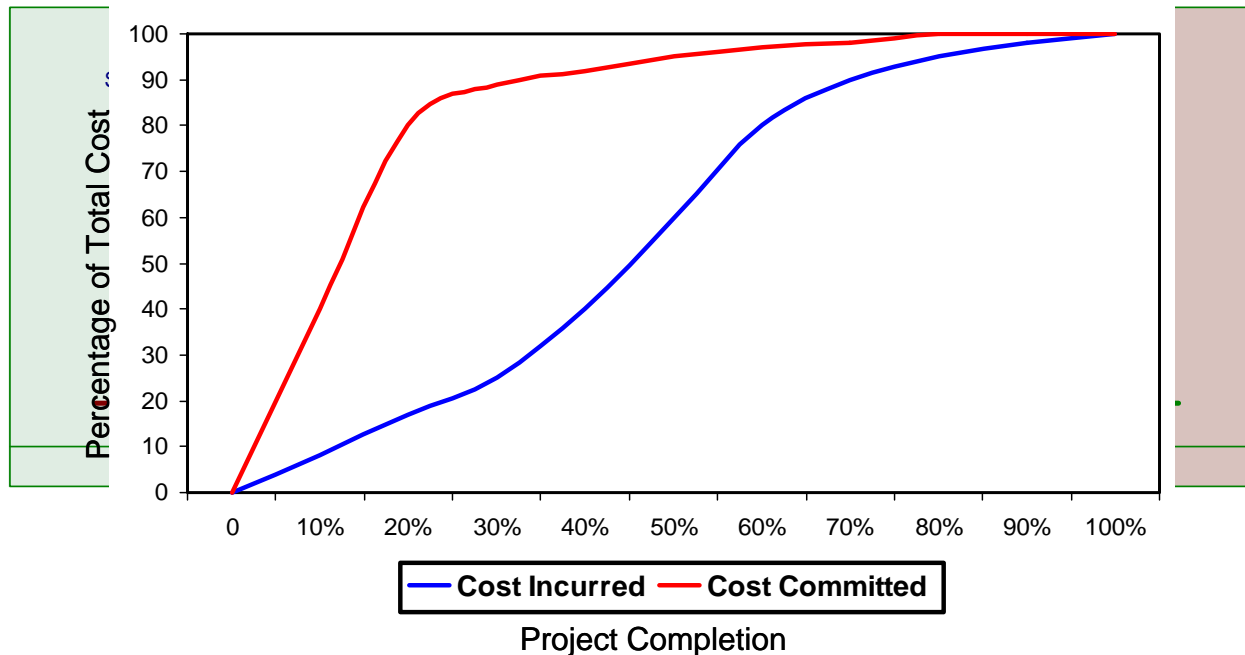


Fig. 1. The cost of design changes vs. the cost to make design changes during design and construction.

Fig. 2. Project Committed Costs versus Project Incurred Costs

Figure 2 depicts how decisions made early in a project commit costs that will be incurred later in the project. These decisions cannot be avoided and must be founded on sound business and engineering principles. Technical Authority can provide the necessary rigor and traceability for these early technical choices and decisions that affect overall project cost.

Other potential benefits of Technical Authority include:

- Complementing the IPTs and supporting the FPD in making difficult decisions. To do so, personnel with the appropriate technical expertise must be assigned to IPTs within the Technical Authority network representing the project at Headquarters and to the DNFSB;
- Availing the wealth of knowledge that exists across the EM complex, while identifying technical knowledge and expertise gaps that need to be filled;
- Helping to ensure:
 - Up-to-date standards;
 - Adequate Codes of Record;
 - Documentation of design decisions;
 - Appropriate uses of new technologies; and the
 - Stewardship of corporate EM technical and safety expertise to maintain continued adequate resources and a cadre of qualified Technical Authorities.
- Managing technical, safety, and quality issues and risks by working through the site Technical Authorities and through the IPT or Project Technical Authority, who also works for the FPD, to:
 - Support technical decisions, including development of Safety Design Strategies (SDSs), design Codes of Record, and change control;
 - Integrate advanced technology into project designs;
 - Support preparation for acquisition Critical Decisions; and

- Resolve technical issues identified during the construction, testing, and operational phases.

For the Technical Authority framework to be successful, critical functions must be appropriately integrated, from project to site to Headquarters, to:

- Ensure that the appropriate and adequate technical standards and requirements are used;
- Ensure ongoing compliance with these requirements via consistent, active involvement by site Technical Authority personnel, including participation in project design team meetings; and
- Ensure coordinated, independent compliance verification.

Therefore, expected Federal Technical Authority duties, from project to site to Headquarters, are to:

- Steward engineering and technical capabilities;
- Ensure that the appropriate technical area expertise is being used;
- Designate ownership for EM aspects of technical standards;
- Review technical input to contracts;
- Assist and participate in IPTs to establish proper technical bases, safety design strategies, and design process oversight, and to resolve technical and safety issues;
- Ensure effective systems engineering;
- Ensure that EM corporately implements integrated design and technical reviews using its Standard Review Plan; and
- Oversee Safety System Oversight (SSO) qualification and implementation.

The bottom line is that everyone involved in Technical Authority is responsible for assuring development of a safe design that complies with appropriate standards.

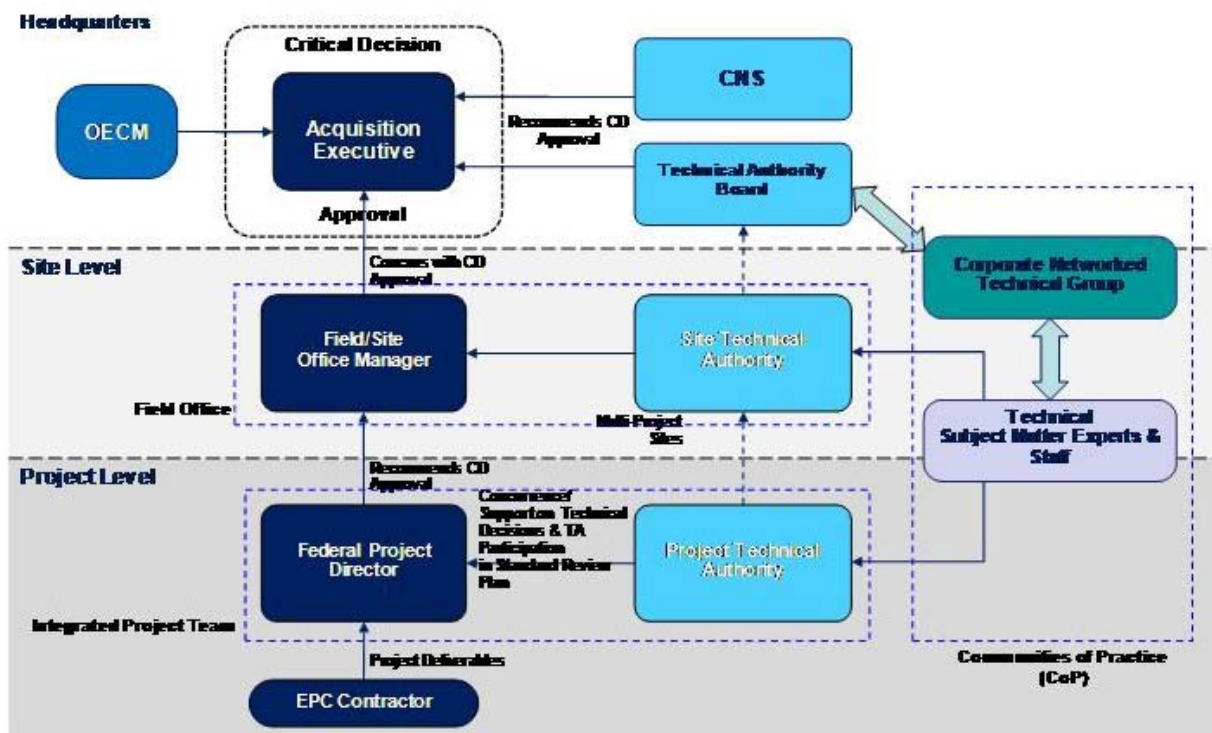
To implement Technical Authority, EM intends to use existing resources to the greatest extent possible. At Headquarters, EM will appoint senior technical personnel to its Technical Authority Board, supported by engineers and technical subject matter experts (SMEs). The Technical Authority Board is responsible for overseeing the entire Technical Authority effort and for resolving technical issues that cannot be resolved at either the project or site level. The Site Technical Authority role will be filled by a qualified senior site technical person supported by existing site engineering personnel. The Site Technical Authority is responsible for overseeing all project Technical Authority efforts at the site and for ensuring proper communication of technical issues from the projects up to the Technical Authority Board. For Technical Authority-designated projects, a Project Technical Authority (traditionally referred to as a “chief engineer”) will be assigned to the IPT under the FPD. The Project Technical Authority will be responsible for overseeing Technical Authority on the project as well as for coordinating and integrating the efforts of technical and safety discipline engineers or SMEs on the IPT. Discipline engineers and SMEs should primarily be selected from an EM corporate technical resource pool in designated technical communities of practice. The Central Technical Authority technical staff; namely, the Office of the Chief of Nuclear Safety, is also available to provide limited technical support for critical issues regarding high-hazard nuclear facilities.

Technical Authority lines of communication provide a structured means for communicating and resolving technical and safety issues from the project level to the site level to the Headquarters level, independent of project or programmatic channels. Such an approach provides a framework to support technically defensible Critical Decisions made by the Acquisition Executive, as depicted in Figure 3.

Fig. 3. Technical Authority supports technically defensible acquisition decisions.

Networked Technical Communities of Practice

EM Technical Communities of Practice are small, virtual groups that comprise a network of technical experts from across the DOE complex, including national laboratories, other contractors, academia, and Federal personnel. Such qualified personnel will be designated as Technical Area Experts in functional areas such as Chemical Engineering Processes and Flowsheets; Civil/Structural; Criticality Safety; Decontamination and Decommissioning; Electrical; Instrumentation and Control; Fire Protection;



Mechanical, including Heating, Ventilation, Air Conditioning, and Confinement; Radiation Protection; Quality Assurance; Software Quality Assurance; Safety Basis and Authorization Basis; Natural Phenomena Hazards, Seismic, and Geotechnical; and Systems Engineering. Technical Area Experts will be responsible for performing oversight to ensure that (1) technical area standards and training are adequate; (2) adequate numbers of qualified Technical Area Experts are available; and (3) that standards are interpreted and applied consistently and correctly across the EM complex.

Methods for Implementing Technical Authority

As with any important interpersonal endeavor, communication is of primary importance. Such communication is facilitated via the network established among Technical Authority personnel. Ongoing, continuous communications for technical discussions between Headquarters Technical Authorities and Site Technical Authorities, and between Site and Project Technical Authorities, is essential to the success of Technical Authority. Further, Project and Site Technical Authorities must be regularly involved in technical developments involving the project contractor as well as in project or site acceptance of selected documents or deliverables related to safety issues.

Independent functional audits, including for-cause reviews and the Exemption and Equivalency processes, remain a vital part of Technical Authority implementation. However, EM has also recently developed its Standard Review Plan (SRP), which includes Technology Readiness Assessments, to assess the acceptability of technologies and other products required to support the acquisition process and in accordance with the planned acquisition timeframe.

EM Standard Review Plan

To consistently communicate and apply EM corporate expectations to contractors and IPTs, the SRP is a strategic, mission-focused framework that EM uses for reviews of capital projects linked to lifecycle phases and Critical Decisions. The SRP is aligned with the requirements in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, the Critical Decision process, and DOE-STD-1189-2008, *Integration of Safety into the Design Process*. It is designed to provide programmatic; design and engineering; safety (nuclear, facility, and worker); quality assurance; environmental; and security bases for key deliverables and decisions associated with the Critical Decision review and approval process. The SRP is event-driven, helping EM reviewers to identify when and what areas to review. The technical and safety aspects of SRP modules and their lines of inquiry are tailored to specific review plans, such as Preliminary Design Reviews, which are implemented by the project's FPD with Technical Authority oversight or participation. SRP modules are dynamic, updated through lessons-learned feedback from FPDs as they use them and through Technical Authority Board oversight of SRP application.

Figure 4, which is taken from the EM SRP, provides a partial listing of near-term SRP review modules planned for development in FY 2009, showing the linkage of the modules with acquisition Critical Decisions.

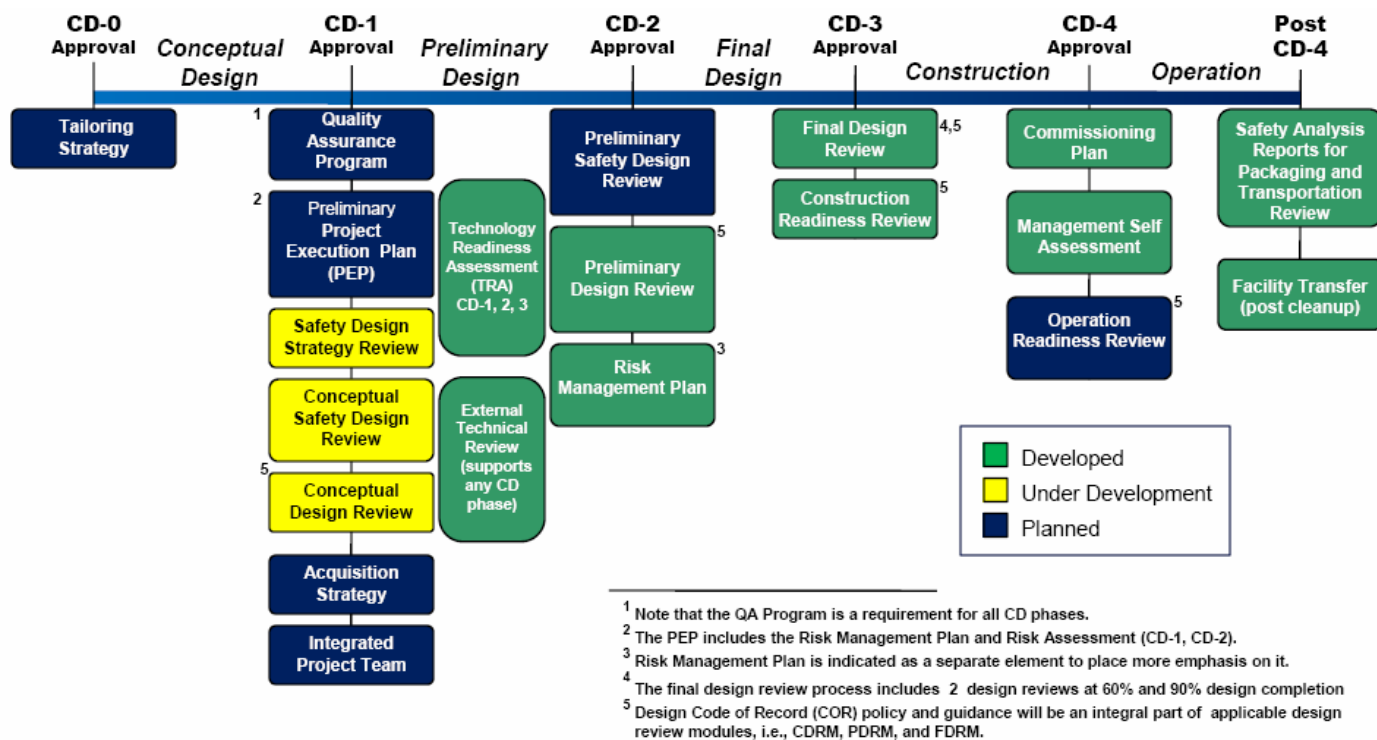


Fig. 4. Partial listing of near-term SRP review modules planned for development in FY 2009. [9]

USE OF TECHNICAL AUTHORITY AT THE SALT WASTE PROCESSING FACILITY PROJECT

Aspects of Technical Authority have been applied in the Salt Waste Processing Facility (SWPF) Project from the beginning, which has progressed through Critical Decision 3, *Start Construction*. From the start, SWPF has had access to dedicated technical staff to conduct technical reviews in the major engineering disciplines. The Technical Authority staff members were collocated with their Engineering, Procurement, and Construction (EPC) contractor counterparts, performing in-process and final reviews of all key design deliverables while being directly supervised by the FPD. Recently, however, the SWPF Project established a Chief Engineer position to act in a similar role, working directly for the FPD.

One significant challenge to implementing Technical Authority has been the availability of Federal technical staff with design experience. The Technical Authority function's effectiveness is highly dependent upon the availability of experienced engineers; however, very few Federal engineers have substantive experience in performing engineering design work. The SWPF Project addressed this challenge by sharing DOE technical experts and using contracted SMEs. This approach minimized the costs associated with full-time engineering staff, while providing the needed expertise to handle peak workloads (e.g., final design review) or to address specialized technical needs.

In-process and final reviews of design deliverables enabled the early identification of potential technical issues. Collocation of experienced Federal staff, particularly a Chief Engineer, provided an effective and efficient means of focusing resources to resolve technical issues. Lines of inquiry from the EM SRP were used on the project during the 90% design review, significantly enhancing the depth and rigor of DOE's review of design deliverables.

TECHNICAL AUTHORITY PILOT AT THE SAVANNAH RIVER TANK 48 TREATMENT PROJECT

EM is piloting a formal Technical Authority framework at the Savannah River TTP. Lessons learned from this pilot will help to shape the resulting framework for the EM complex Technical Authority as applied to selected capital projects.

Building upon the experience and lessons learned on the SWPF Project, the Technical Authority function for the TTP is being performed by a team of engineers led by a dedicated Project Technical Authority. The team members have design expertise in mechanical engineering, electrical engineering, instrumentation and controls, civil and structural engineering, nuclear safety, chemical and process engineering, fire protection, and radiation protection. Each team member's expertise has been reviewed and certified by the Site Technical Authority to ensure that his or her training and experience is commensurate with ANSI/ANS 3.1-1993, *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*.

The TTP Technical Authority team actively participates in contractor design meetings and performs in-process evaluations of select design deliverables using lines of inquiry drawn from the EM SRP.

Potential issues are brought to the attention of the FPD. The Site Technical Authority reviews the results of Technical Authority team evaluations and periodically meets with the Project Technical Authority to discuss design progress and issue resolution. The Site Technical Authority periodically reviews the status of site capital projects with the Technical Authority Board and refers issues having broad implications (e.g., new policy) to the attention of the Headquarters Technical Authority Board. Implementation of this function helps drive down potential technical risk by: (1) conducting reviews to verify the early incorporation of safety into design; (2) enhancing IPT capabilities to resolve emergent design and construction issues; and (3) establishing a means for quickly elevating technical and safety issues that require resolution at the Headquarters level.

THE PLAN AHEAD

EM formally established its Technical Authority Board to integrate the design, engineering, technology, and safety responsibilities of the Offices of Engineering and Technology (EM-20) and Safety Management and Operations (EM-60) with the coordination and cooperation of other Program Offices. The Technical Authority Board has authority across all of EM to focus on projects having significant technical issues or risks, having already proven its worth through its timely and effective action to address high-level waste tank integrity issues raised by the DNFSB. The Technical Authority Board solicits technical issues from the field that warrant its consideration, including the development of a viable cost- and risk-based Code of Record backfit policy.

Although EM has crafted the initial structure and processes for Technical Authority, it is using the TTP pilot to gather lessons learned on shaping the broader Technical Authority framework. A draft EM Technical Authority Guide has been developed; however, this Guide will be finalized only after sufficient knowledge has been captured from the TTP. EM anticipates that it will fully implement Technical Authority for key capital projects under its purview.

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