Improving Project Management

Report of the
Contract and Project Management Working Group

November 2014

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1. FOREWORD

This report was written by the Contract and Project Management Working Group, which was formed at the request of Secretary of Energy Ernest Moniz in August 2013 to analyze project management issues at the U.S. Department of Energy (DOE). The working group is chaired by a Senior Advisor to Secretary Moniz and includes a group of senior project management leaders from the following offices:

- Office of the Secretary
- Loan Programs Office
- National Nuclear Security Administration
- Office of Acquisition and Project Management
- Office of Environmental Management
- Office of Management and Performance
- Office of Science

The purpose of the Contract and Project Management Working Group is to improve project management execution. To that end, this report reflects frank analysis of a number of issues surrounding project management, and offers potential recommendations for addressing such issues. The report is not a decision memo by DOE. The observations and recommendations in it are intended for further consideration by senior departmental officials.

2. EXECUTIVE SUMMARY

At the request of Secretary of Energy Ernest Moniz, the Contract and Project Management Working Group was formed in August 2013 to analyze project management issues at the U.S. Department of Energy (DOE). The group has met biweekly to evaluate factors that contribute to projects' success or failure and develop recommendations for improvement.

The Contract and Project Management Working Group identified four key factors that contribute to project management success or failure at DOE:

- Ownership, accountability, responsibility and alignment
- Front-end planning
- Funding
- Independent oversight

Ownership, accountability, responsibility and alignment. Unclear ownership creates a culture where everyone is in charge but no one is responsible. This generates a problem for successful project execution. Instead, an owner should be established with a clear set of responsibilities, helping to ensure checks and balances by overseeing a project and the team. The concept of ownership varies across DOE. For the Office of Science, one person owns the project from start to finish. For the Office of Environmental Management and the National Nuclear Security Administration, ownership changes over the project's lifecycle. This report discusses establishing a departmental project management organization solely responsible for delivering capital construction and environmental remediation projects.

Front-end planning. Insufficient front-end planning consistently contributes to cost increases and schedule delays across DOE. Focus areas critical to the front-end planning process include ensuring that scope and technical specifications are well defined and documented, and that design is sufficiently mature before baselining. DOE projects include small projects and major system projects, and it is important to distinguish between them during the planning process.

Funding. Inadequate funding has led to projects failing to meet initial baselines. This occurs across all program offices at DOE. Adequate contingency, funding stability, and accurate project cost and schedule estimates are key considerations in the funding process. Like front-end planning, major system projects should be distinguished from smaller projects.

Independent oversight. Lack of independent oversight creates problems in successfully executing projects. Again, this occurs across all program offices at DOE. Independent oversight through peer reviews, independent reviews, and self-assessments should add value and benefit the project, the program, and DOE as a whole.

In addition to the four above-mentioned factors driving project failure or success, and embedded within each, is the need to change DOE's project management culture. DOE

strives to achieve a culture that enables successful project outcomes, and should therefore transform its culture to one of collaborative problem solving and transparency.

2.1 Summary of Recommendations

The report's key recommendations include:

- Consider establishing a departmental project management organization — with appropriate skills and staffing — that is solely responsible for delivering capital construction and environmental remediation projects for all program offices. This approach would be similar to the Department of Defense, U.S. Army Corps of Engineers and Naval Facilities Engineering Command models. *(Note:* One member of the group expressed significant concerns with this recommendation, which are described in the report's text).

- Take steps to ensure DOE follows the requirements of DOE Order 413.3B and make the provisions provided in all 413.3 guides mandatory.

- Establish clear roles, responsibilities and accountabilities among the owner, the project's line management organizational elements, and support/staff organizations. These should be codified within the Project Execution Plan.

- Have program offices analyze alternatives, independent of the contractor organization responsible for constructing the capital facility.

- Develop design management plans and preliminary performance baselines for major system projects, and report progress (in accordance with DOE Order 413.3B, in advance of Critical Decision (CD)-2).

- Similar to post CD-1 projects, conduct project peer reviews annually between CD-0 and CD-1 for active projects (projects that are supported in annual budgets and that have not been officially placed in a "hold" status), unless more frequent reviews would be appropriate per the sponsoring program or the Acquisition Executive.

- Require estimates for Project Engineering and Design (PED) funds.

- Limit PED duration to two years for projects with a total project cost under $100 million.

- Require monitoring of the expenditure of PED funds for the management design plans of all capital projects managed under DOE Order 413.3B.

- Develop an integrated priority list of capital projects. Communicate those priorities across the complex in fiscal guidance issued each February as part of the Planning, Programming, Budgeting and Execution process, and reflect them in annual budget decisions.

- Define policy for full funding authority for projects, based on need, risk, and mission. Provide full funding for all projects under $50 million.

- Require all capital asset projects, regardless of funding source, provide a Project Data Sheet with cost baseline and funding profile information/commitments.

- Reconstitute the Energy Systems Acquisition Advisory Board process (or similar) as provided for in DOE Order 413.3B. Each Acquisition Executive role should be delegated to Under Secretary-level.

- Establish a Portfolio Review Board to provide an independent assessment of the strengths, weaknesses, and risk profiles of all major capital projects.

- Implement an Independent Oversight review team to provide an independent audit function reporting to the Secretarial Acquisition Executive.

3. INTRODUCTION

Over the last two decades, the U.S. Department of Energy (DOE) has experienced significant management challenges associated with past and ongoing DOE projects. It has consistently faced problems managing projects and programs, leading to cost increases and schedule delays. DOE has been criticized by stakeholders, including Congress and the U.S. Government Accountability Office (GAO), which has placed DOE on its High-Risk List since 1990. The High-Risk List includes agencies and program areas that are high risk because of their vulnerabilities to fraud, waste, abuse, and mismanagement, or are in need of transformation. This list is updated every two years, or at the start of a new Congress.

While DOE has made some progress in improving project management and GAO removed DOE's smaller projects from the High-Risk List, much remains to be done. To address these issues and to enhance the probability of project execution success, Secretary of Energy Ernest Moniz established a special working group in August 2013 to analyze factors that contribute to the success or failure of DOE projects and recommend changes to improve project performance. The Contract and Project Management Working Group is an internal DOE body, headed by a Senior Advisor to the Secretary, that includes project management experts from the following offices: Loan Programs Office, the National Nuclear Security Administration (NNSA), Office of Acquisition and Project Management, Office of Environmental Management, Office of Management and Performance, and Office of Science. These individuals expressed their own views, and not necessarily those of their respective offices.

This analysis of DOE projects provides a deeper understanding of DOE's project management strengths and weaknesses. This report describes successes and failures of DOE projects while highlighting primary factors for successful project completion. The essential factors that are addressed include ownership, front-end planning, funding, and independent oversight. Throughout the report, the working group provides observations of previous and ongoing projects, describes case studies for illustration, and provides recommendations for improvement.

4. BACKGROUND

4.1 PROJECT MANAGEMENT ORDERS/REQUIREMENTS

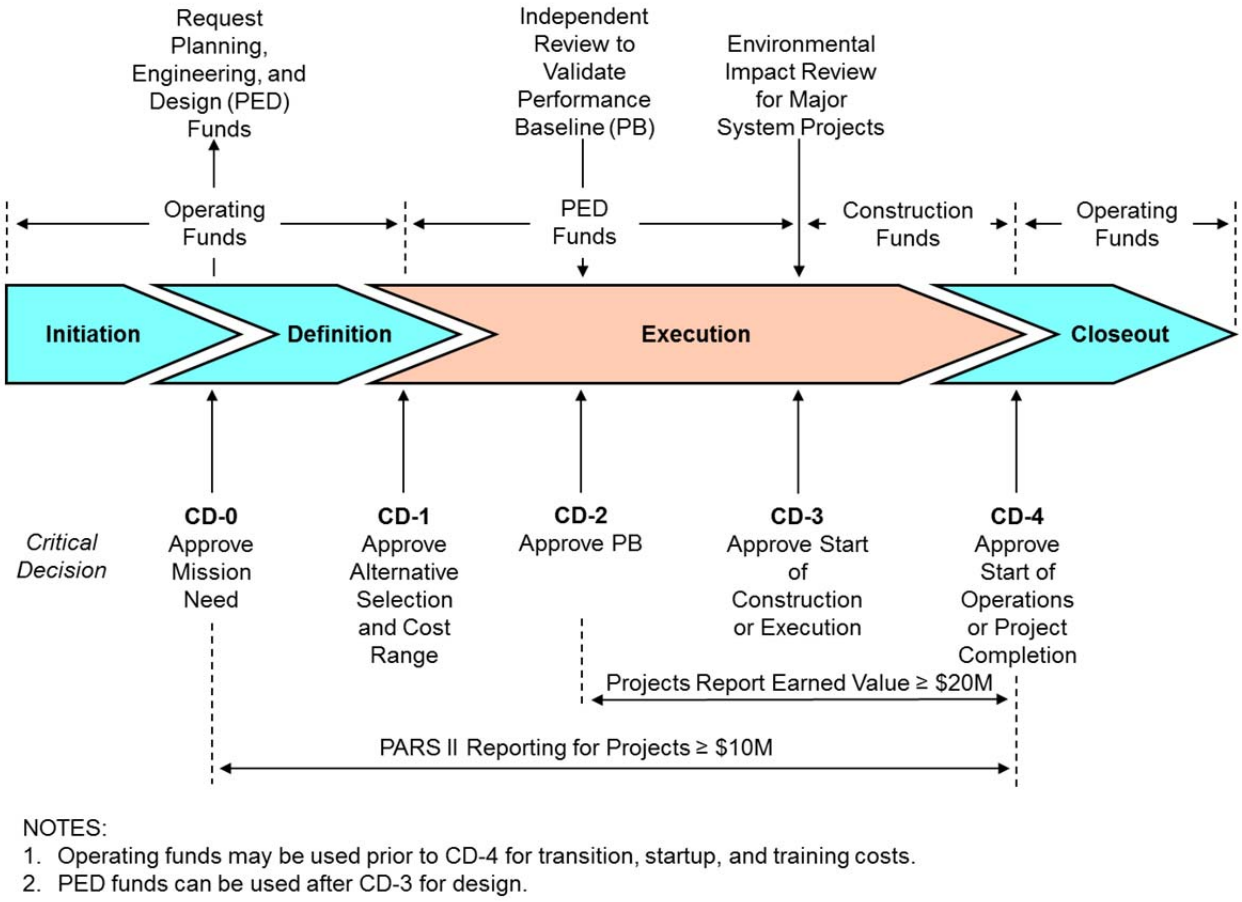
DOE's project management policy, DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, and the provisions included in the 413.3 guides, provide guidance for project management execution at DOE. However, they are often not well understood, followed, or enforced.

DOE Order 413.3B was released on November 29, 2010, by Deputy Secretary of Energy Daniel Poneman as a response to both congressional direction and criticism from the Government Accountability Office and Office of Management and Budget. The update includes improvements to contract and project management policies recommended by a review committee of DOE and NNSA federal employees and contractors. It takes into account FY 2008 Root Cause Analysis and Corrective Action Plan initiatives, 2010 Deputy Secretary Project Management Policies, and FY 2011 Contract and Project Management Improvement Executive Steering Committee policies.

DOE Order 413.3B states that DOE's ultimate project management goal is to "deliver every project at the original performance baseline, on schedule, within budget, and fully capable of meeting mission performance, safeguards and security, quality assurance, sustainability, and environmental, safety, and health requirements." The order develops a framework with requirements for different project phases to achieve this goal, and identifies roles for project teams and leaders.

Within the order, the DOE Acquisition Management System (Figure 1) "establishes principles and processes that translate user needs and technological opportunities into reliable and sustainable facilities, systems, and assets that provide a required mission capability." Within the system, project phases include initiation, definition, execution, and closeout.

These project phases are further broken down with Critical Decision (CD) points. At DOE, projects generally transition through five CDs. In CD-0, the project's mission need is approved and it is decided that there is a need that cannot be met with other material means. In CD-1, the alternative selection and cost range is decided, and in CD-2 the project's performance baseline is approved. In CD-3, the project's construction and start is accepted, and CD-4 approves the start of operations and project completion. Each Critical Decision point represents a milestone in the project's execution and includes several requirements for fulfillment.



NOTES:
1. Operating funds may be used prior to CD-4 for transition, startup, and training costs.
2. PED funds can be used after CD-3 for design.

Figure 1. Typical DOE Acquisition Management System

The order also distinguishes between major and non-major system projects, setting different rules for each. Major system projects are projects with a total project cost greater than $750 million, and non-major system projects are those below $750 million.

Supplemental guidance to DOE's acquisition and project management orders has been issued in a series of guides, which are part of the DOE Directives Program. These guides represent best practices for implementing DOE rules; however, they are not requirements, and application of the guides' processes is not uniform across the complex.

DOE guides relevant to project management and highlighted throughout this report include:

- *DOE 413.3-4A: Technology Readiness Assessment Guide:* Assists individuals and teams involved in conducting Technology Readiness Assessments and developing Technology Maturation Plans for the DOE capital asset projects subject to DOE Order 413.3B.

- *DOE 413.3-7A: Risk Management Guide*: Provides non-mandatory risk management approaches for implementing the requirements of DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets.
- *DOE 413.3-12: The U.S. Department of Energy Project Definition Rating Index Guide for Traditional Nuclear and Non-Nuclear Construction Projects:* Helps teams involved in conducting assessments of project definition (e.g., how well has front-end planning been conducted to define the project scope) using a numerical project management tool called the Project Definition Rating Index.
- *DOE 413.3-21: Cost Estimating Guide:* Provides uniform guidance and best practices describing the methods and procedures that could be used in all programs and projects at DOE for preparing cost estimates.

In addition, there are other DOE standards that impact project management, such as:

- *DOE Standard 1189-2008, Integration of Safety into the Design Process:* Provides guidance on a process of integration of Safety-in-Design intended to implement the applicable integrated safety management core functions. These core functions – defining the work, analyzing the hazards, and establishing the controls – are necessary to provide protection to the public, workers, and the environment from harmful effects of radiation and other toxic and hazardous aspects attendant to the work.

4.2 Summary of DOE Project Characteristics

DOE has some of the largest, most complex, and technically challenging projects in the public or private sector, which include unique initiatives and cutting-edge technology. DOE national laboratories and sites perform critical missions that include maintaining the nuclear weapons stockpile, cleaning up the legacy of the Manhattan project, and conducting some of the world's most sophisticated scientific research activities. The diverse project portfolio includes basic science; energy systems research and development; nuclear weapons development and stewardship; environmental restoration; contaminated and complex facility deactivation and decommissioning; and radioactive and hazardous waste management.

One of DOE's main problems has been successfully completing nuclear facilities construction projects and nuclear waste cleanup projects, since the nuclear industrial base in the U.S. has been eroding for decades. Few other government or private sector organizations are challenged by projects of this magnitude, diversity, or complexity. To complete these projects on schedule, within budget, and in scope, DOE must employ highly developed and disciplined project management capabilities, processes, and procedures.

4.3 Project Management Issues At DOE

Inadequate project management and contractor oversight have placed DOE on GAO's High-Risk List for over two decades, causing DOE to receive consistent scrutiny from Congress,

the Government Accountability Office (GAO), and the Office of Management and Budget. DOE senior management continually strives to improve project management, and while significant progress has been made, many of DOE's high-visibility, high-cost, and technically complex projects continue to encounter material cost increases and schedule delays.

To identify the systematic challenges of planning and managing projects, DOE conducted a Root Cause Analysis workshop in October 2007. The workshop helped identify the 10 most significant issues DOE faces in managing contracts and projects. These issues were published in an April 2008 DOE report, *U.S. Department of Energy Contract and Project Management Root Cause Analysis*. The workshop concluded DOE's greatest challenge was insufficient front-end planning before establishing project performance baselines. Remaining key issues included a lack of skilled personnel, funding, acquisition strategies, premature contracts, DOE's organizational structure, inconsistent adherence to project management policies, oversight, and DOE's inability to execute project ownership.

In 2008, Congress directed DOE to develop an action plan to remove it from the High-Risk List and specifically address nuclear facility safety, design, and construction issues related to technology readiness and seismic risk mitigation.

In July 2008, a DOE report, *U.S. Department of Energy Contract and Project Management Root Cause Analysis Corrective Action Plan* highlighted DOE's efforts to address significant project management issues and their root causes.

Based on DOE's progress, GAO narrowed the scope of the high-risk designation in 2009, removing the Office of Science and focusing on NNSA and Environmental Management. Major improvements were instituted in DOE Order 413.3B and documented in the *U.S. Department of Energy Contract and Project Management Root Cause Analysis and Corrective Action Plan Closure Report*. Notable developments included:

- Establishing a department-wide project success standard[1] and an independent central repository to (1) determine whether the standard had been met, and (2) monitor and maintain numerous project management metrics.

- Improving front-end planning using industry standard practices (1) requiring sufficient design maturity prior to establishing performance baselines, and (2) dividing large programs/projects into smaller, standalone projects to improve project definition, reduce time horizons and risk, and stabilize funding.

- Developing a departmental project team staffing model and guide to help determine and assess project staff size and required skill set across the project life.

- Establishing project funding stability by requiring Acquisition Executive approval of any changes to the funding profiles established at CD-2. This helps to ensure

[1] The Project Success standard is defined as a project completed within the original approved scope baseline, and within 10 percent of the original approved cost baseline at project completion, unless otherwise impacted by a directed change.

adherence to baseline funding profiles for incrementally-funded projects in annual budget requests.

- Implementing new requirements for (1) independent cost estimates and independent cost reviews for projects costing $100 million or more at CDs 1, 2, and 3, and (2) independent cost reviews at CD-0 for what are expected to be major system projects costing $750 million or greater.

- Deploying a more robust Project Assessment and Reporting System, allowing for direct upload of contractor project performance data that eliminates errors and delays inherent in the original system, thereby enhancing data reliability and informed decision-making.

- Implementing Project Peer Reviews across the complex to better monitor project development and execution and foster sharing of design, procurement and construction lessons learned. This is a successful best practice employed by the Office of Science.

Following the issuance of the Root Cause Analysis and Corrective Action Plan, the Deputy Secretary convened a DOE Contract and Project Management Summit in December 2010 to discuss further strategies for improvement to contract and project management. Participants included representatives from DOE program offices, field offices, and headquarters involved in managing large DOE projects, as well as DOE contractor representatives. Subsequently, teams members across DOE convened to address six barriers to improved performance: (1) project and contract alignment and change control; (2) contract administration and oversight; (3) program/project prioritization and funding alignment; (4) roles and responsibilities; (5) accountability; and (6) adequate project management staffing.

As a result, GAO acknowledged in February 2011 that DOE met three of its five criteria required before high-risk designations could be removed. Figure 2 shows the GAO scorecard with the five criteria for removing agencies from the High-Risk List.

Figure 2. GAO High-Risk List Scorecard

4.4 Recent Efforts To Improve Project Management

Over the last few years, DOE has devoted additional attention to improving contract and project management deficiencies cited by GAO. In various meetings and summits, the Deputy Secretary has engaged DOE senior executives responsible for contract and project management, senior managers, subject matter experts, and senior executives from the contracting community to systematically identify the root causes and implement corrective actions necessary to improve contract and project management performance.

In May 2012, the Office of Acquisition and Project Management (APM) was created. APM merged the project and contract management oversight offices of the Office of Management, the Office of Engineering and Construction Management, and the Office of Procurement and Assistance Management. However, project management responsibilities are spread out across *all* DOE's program offices and do not always fall within the Office of Acquisition and Project Management.

DOE's APM organizations work to collaboratively address improvement initiatives, such as:

- ***Emphasizing project ownership.*** Providing dedicated acquisition, project management, and independent oversight ensures projects are effectively managed within the approved contracts, project baselines, and mission requirements.

- ***Establishing in-house cost estimating capabilities.*** This strengthens alternative assessments and total project cost realism.

- ***Assisting in developing essential project requirements.*** This enables more fixed-price contracts or subcontracts.

- ***Leveraging enterprise resources.*** This allows for closer oversight of contractor performance.

- ***Improving the use of the past performance system.*** This ensures that contractor's performance is a significant factor in future contract award decisions.

- ***Integrating department-wide policies, regulations, standards, and procedures pertaining to acquisition, program and project management.***

Both the Office of Environmental Management (EM) and Office of Science (SC) project management offices fall outside the scope of DOE APM. For both program offices, project management responsibilities are spread out. Project management support offices in EM and SC:

- Provide both assistance to the project teams and independent oversight of projects on behalf of their respective programs;
- Manage the implementation of project management requirements;
- Serve as the Secretariat for Program Acquisition Advisory Board;
- Coordinate CD processes;
- Conduct quarterly reviews for projects where the program secretarial officer is the Acquisition Executive;
- Develop program-specific guidance, policies, and procedures for project management;
- Manage the lessons learned dissemination process;
- Conduct project peer reviews;
- Lead Earned Value Management System Certification reviews of contractors with projects below $100 million;
- Ensure the development of a competent, professional project management workforce; and
- Support the federal project directors in their Project Management Career Development Program certification process.

In 2011, NNSA established the Office of Acquisition and Project Management, led by a highly qualified and experienced career project manager. Consistent with the recommendations of the National Research Council, this organization is responsible for providing project management support to the NNSA program offices. This arrangement relieves the NNSA Deputy Administrators from maintaining their own project management capabilities and allows them to focus on their central responsibilities.

To assure highly credible cost estimates, NNSA issued a policy memo dated August 9, 2012, requiring nuclear projects to achieve 90 percent design completion before approving the project's CD-2 performance baseline. In GAO's February 2013 High-Risk List update, GAO acknowledged DOE's continuous improvement in contract and project management by

shifting the focus of DOE's high-risk designation to major contracts and projects executed by NNSA and EM with values of $750 million or greater.

The Contract and Project Management Working Group has identified a further opportunity for improving DOE's project management. Recent budget challenges significantly reduced DOE's project workload, and the projects are spread out across multiple program offices as discussed above. In 2008, the number of active (post-CD-2) capital asset projects in execution numbered over 120, with a total monetary value of about $65 billion. Since 2008, even with the influx of Recovery Act dollars in 2009, the capital asset workload has been in decline. Today, there are 39 active (post CD-2) projects being executed, with a total monetary value of about $27 billion. This trend is expected to continue, due to the anticipated fiscal environment in the next five years.

In that context, there may be an opportunity to consider transformational organizational changes that would concentrate the best and brightest project managers on this reduced workload. By leveraging the best practices of DOE into one construct that consolidates DOE's project management experience, DOE could significantly improve project management and project execution.

5. FACTORS CONTRIBUTING TO A PROJECT'S SUCCESS OR FAILURE

5.1 OWNERSHIP, ACCOUNTABILITY, RESPONSIBILITY, AND ALIGNMENT

5.1.1 DESCRIPTION

Clear ownership helps drive successful project management. It is imperative during the life of a project (CD-0 through CD-4) that someone has ownership, and that person is the one person responsible for the project's execution. There is a lack of accountability when ownership is unclear, and it is perceived that everyone is responsible, but no one is in charge. Project ownership must be fully transparent, both in word and in practice.

The owner ensures appropriate checks and balances. The owner (as the leader or through an effective leader) warrants that all parties involved have a clearly established set of roles, responsibilities, and accountability, and all parties as a team understand the owner's vision and objectives including constraints, timelines, and risk boundaries.

Across DOE, the owner should:

- Ensure the contractor has put in place a competent manager supported by a qualified project team.
- Ensure there is adequate skilled staff for federal oversight of the contractor.
- Establish a process for periodic independent assessment (e.g., "red team review") that would ensure the project execution, management structures, and delegated decision making processes are appropriately functioning.
- Personally visit the project site and frequently review the progress against key milestones that were approved as part of the baseline.
- Control budget authority.

Ownership varies across DOE. For example:

- In SC, the owner is a senior program official who owns the mission, establishes the project's objectives, and controls the budget. This person owns the project from start to finish (CD-0 to CD-4). In SC, the headquarters program is the owner, controls the budget, and upon completion, is the user of the facility. For SC, as well as other programs, successful execution of projects depends on the quality of its project leadership team, which typically includes the owner, the owner's technical advisors, independent project management advisors, the federal project director (FPD), and key contractor project managers.
- In EM, the Assistant Secretary is the owner, determines the requirements, controls the budget, and ensures adherence to approved scope, cost, and schedule. The Site Manager recommends a balanced utilization of funds (based on risks, regulatory requirements, and community stakeholders), oversees execution by contractors,

and is the user of the facility. When ownership changes, it occurs between CD-1 to CD-2.

- In NNSA, ownership starts with someone who knows the science and mission of the project, and is then passed to someone who can execute project management, typically the FPD. When this occurs, the FPD assumes the ownership role as the owner's representative and becomes the primary person responsible and accountable for project success. These changes during a project's lifecycle build on individuals' strengths. For NNSA, when ownership changes, it occurs between CD-1 to CD-2.

NNSA established the Office of Acquisition and Project Management (APM) in 2011 to address long-standing and significant contract and project management challenges identified by GAO and Congress. Consistent with the recommendations of the National Research Council, NNSA's APM organization is responsible for providing project management support to the program offices, which relieves the Deputy Administrators from maintaining their own project management capabilities and allows them to focus on their central mission responsibilities.

5.1.2 Observations from Previous or Ongoing Projects

The Working Group had several observations regarding project ownership at DOE:

- Diffuse ownership affects the accountability, responsibility, and alignment for DOE projects. DOE Order 413.3B and the *Contract and Project Management Improvement Corrective Action Plan* do not directly address ownership. These guides touch on leadership engagement, which has improved significantly with the Deputy Secretary as the Secretarial Acquisition Executive (SAE) undertaking corrective actions.

- Each DOE program office (e.g., EM, NNSA, SC) has a unique mission, with differing stakeholders, acquisition approaches, and challenges. Diverse program management practices yield different strategies for execution of project management roles, responsibilities, and functions, which cause the concept of a project "owner" to vary across program offices. Each program office maintains that these terms have differing meanings, which results in difficulties assigning roles, responsibilities, authority, and accountability. This unclear definition may continue to contribute to a culture of "anyone or everyone is in charge but no one is responsible."

- Given the length and duration of DOE projects, the concept of a single owner for the project's entire lifecycle may be challenging. Another option includes varying phases of ownership, such that the owner changes to an FPD or project manager after certain CD points. The owner could also be the official assigned to run or operate the facility. However, this could complicate projects being handed off from project managers assigned to complete construction and acquisition to the owner or operator of the facility. For example, the FPD may have conflicting requirements or ambiguous alignment between the facility manager, the AE, or the SAE.

- Ideas differ regarding the hierarchy of ownership flowing down from the SAE. For SC, the project owner is the program responsible for executing the acquisition or construction management of a facility. Within NNSA, FPDs are assigned a similar scope of duties as SC project managers. While this may be appropriate for horizontal execution through each CD phase, differences in opinions exist concerning the overall responsibility, accountability, and authority as it flows vertically from the SAE to FPD to contractor execution. This could be due to the SAE being assigned the overall responsibility for major system acquisitions for projects beyond a $750 million threshold, and confusion among ownership assigned to AE/Under Secretaries, site managers, oversight and review groups, the FPD, and the contractor executing the project.

- The concept of DoD's "matrix organization" could be used as a model for acquisition projects, but no common understanding exists for how this may function within DOE or how it would be applied. The concept for a functional organization supporting a matrix organization is absent along with its relationship to owners, ownership, or leadership engagement. In one part of the discussion, one working group member offered the observation that the matrix manager is the "owner's representative" accountable for delivering the finished facility. This is similar to the utility model for large megaprojects in excess of $1 billion in capital commitments.

- The project team should include federal employees and contractors with necessary experience, skills, and competence to manage every aspect of a project. The relationship between DOE and contractors cannot be contentious, and they must communicate as a team. Organization of project teams differs depending on the characteristics of the program, DOE site office, and contracted organizations.

- Capital construction projects were managed across multiple program offices in NNSA before the establishment of APM. The independent project management organization, separate from the owner requirements and fully integrated with the acquisition organization, is similar to project management agencies in other federal and private sector agencies. DOE adopted a similar construct in May 2012, merging the project and contract management oversight offices across DOE into the single DOE APM.

5.1.3 Case Study: Science Spallation Neutron Source

The Spallation Neutron Source, a neutron scattering research facility at Oak Ridge National Laboratory, exemplifies a large and complex project that evolved through several leadership teams in its early phases, until the team that ultimately delivered the project came together at the right place and time. Success stemmed from proactive and actively managed team composition changes, as well as defined and clearly executed roles. Successful team actions and interactions defined the project's ability to overcome challenges and day-to-day issues.

DOE can showcase an excellent example of the Spallation Neutron Source. In the 1990s, DOE set out to develop a powerful neutron scattering research facility with an ambitious project management strategy. Lester Price served as the project's top federal official in the field at Oak Ridge (his title became FPD after DOE issued new policy guidance on project management roles and responsibilities in 2003). Price led a small onsite federal team of just two engineers, an office manager, and a part-time health and safety officer. "From an accountability standpoint, I was the first tier of accountability on the federal side for the project," he said. "I had the authority to issue all federal technical direction regarding project matters in the field." Price noted that this small number of federal staff is consistent with the strong partnership approach that SC has with its laboratory M&O contractors.

Price kept up with work across the country through a contact person at each of the DOE site offices at the laboratories. "It was what I call a 'soft glove' approach," he said. "We wanted to make sure it was clear that the partner lab was working under the direction of Oak Ridge National Laboratory (ORNL). They were not working under the direction of the DOE site office. That was kind of tricky, but we all understood it. The guy at the site office was very careful not to direct them in any way that would conflict with the direction they were getting from ORNL, but the site rep and I would talk frequently, and he would give me his perspective and what the issues were."

Price took direction from the program sponsor, Dr. Patricia M. Dehmer, who at the time was Associate Director of the Office of Basic Energy Sciences, and Program Manager Jeff Hoy. "Jeff and I were in day-to-day contact," Price said, "and Pat was involved in all major project issues. She was the funding sponsor for the project, and if you look at it from a Project Management Body of Knowledge standpoint, she met all the criteria you would want from a project sponsor."

Each person on the team, including the AE, SC Associate Director (the owner), Program Manager, FPD, Contractor Project Manager, Laboratory Director, and the working level staff (federal and contractor) expertly executed their individual roles and worked as a cohesive unit. This coordination helped the team resolve issues that required everyone's input, allowing the team to reach consensus on decisions and unwavering support for execution. Trust, alignment, communication, accountability and common goals proved to be a successful formula for project success.

5.1.4 RECOMMENDATIONS

Recommendations regarding a project's ownership, accountability, and responsibility include:

- Consider establishing a departmental project management organization — with appropriate skills and staffing — that is solely responsible for delivering capital construction and environmental remediation projects for all program offices. This approach would be similar to the Department of Defense (DoD), U.S. Army Corps of Engineers and Naval Facilities Engineering Command models. [*Note:* One member

of the group expressed significant concerns with this recommendation. Should this recommendation be implemented, one concern cited by one member of the group is that DoD does not have a comparable contractor incumbent workforce, a key difference with DOE. DoD awards individual prime contracts, typically lasting several years for construction and cleanup activities. DoD does not have comparable DOE legacy contractor workforce issues. At DoD, the contractor workforce is typically hired and then released when the project is completed. For EM, especially cleanup work, the capital activities (e.g., facility decontamination and decommissioning, disposal cell construction) are currently performed in an integrated manner as part of ongoing operations activities (e.g., facility deactivation, waste treatment/packaging/disposal). If the capital work and operations activities were managed by different organizations, there would be separable contracts and division of the workforce which would have labor-related implications].

- Communicate across the complex, that once a capital asset project is established, SAE (or the designated representative) is the "owner" and has delegated the responsibilities and authorities through an AE to one person as the primary "person in charge" (responsible and accountable for project success) for each project, presumably the FPD in most cases. In addition, the role of all others is to support this person to the maximum extent possible to ensure project success.

- Establish clear roles, responsibilities and accountabilities among the owner, the project's line management organizational elements, and support/staff organizations. These should be codified within the Project Execution Plan.

- DOE orders, policies and guidance should be updated to directly address owners and ownership to clarify roles, responsibilities, accountability, and authorities. These updates should clarify the vertical lines of assigned roles, responsibilities, accountability, and authority. They should serve to align individual responsibilities of the FPD, AE, and SAE, to organizational responsibilities, and establish a hierarchy of reporting, controlling and managing major system acquisitions and projects.

5.2 Front-End Planning

5.2.1 Description

The purpose of front-end planning is to ensure focused attention is given to project definition from the earliest project phases and continually improved as the project matures.

Project definition starts with the project owner ensuring the project's overall scope meets the mission need. The project owner should define, as completely as possible, the entire project lifecycle, and support efforts by the project team to establish a comprehensive Work Breakdown Structure as early as possible. Using front-end planning tools described in this section, the owner and project team should work to define all project requirements, engage stakeholders and vendors early in planning processes, and establish expectations

and communications across the project enterprise. This allows all participants to have a shared understanding about individual and collective action needed to constantly respond to improvements in project definition.

DOE has recognized that higher levels of front-end planning can result in significant cost and schedule savings. However, insufficient up-front planning consistently contributes to DOE projects not finishing on budget or schedule. The *Root Cause Analysis* and *Corrective Action Plan* both determined the following focus areas as critical to the front-end planning process:

- Ensure that scope and technical specifications are well defined and documented
- Include facility system users in the planning process
- Make sure that design is sufficiently mature before baselining
- Ensure a competent and experienced project team is assembled
- Identify, evaluate, and plan for internal and external risks

To help project teams meet the principles codified in DOE Order 413.3B, several guides were developed. In accordance with departmental policies, these guides are considered best practices, but are not required. Four that are particularly relevant to front-end planning include:

- *DOE 413.3-4A: Technology Readiness Assessment Guide*
- *DOE 413.3-7A: Risk Management Guide*
- *DOE 413.3-12: The U.S. Department of Energy Project Definition Rating Index Guide for Traditional Nuclear and Non-Nuclear Construction Projects*
- *DOE 413.3-21: Cost Estimating Guide*

Front-end planning requirements should also distinguish between major system projects and smaller projects. DOE Order 413.3B's policies are sufficient for most DOE work, but lack specific guidance for large projects. DOE's major system projects are the only projects that remain on the GAO High-Risk List; the technical, scope, schedule, cost, regulatory, and political risks of these projects should be reviewed individually and in more depth than those associated with smaller projects. If a project or program spans only two-to-four years, it is likely that the associated planning and risks will be sufficiently bounded; however, for major system projects that typically span a decade or longer, there should be a codified methodology to demonstrate that the appropriate front-end planning has been accomplished. This will help build confidence in the budget and project delivery plan that will result from the planning process.

Additionally, the nuclear safety characteristics and requirements within DOE Orders 413.3B and 1189 are contradictory for CD gates, safety documentation requirements, and the 90 percent design requirement for nuclear work.

5.2.2 Observations from Previous or Ongoing Major System Projects

Front-end planning observations from previous and ongoing major system DOE projects:

- There are no rigorous reporting requirements for major system projects in advance of CD-2. Generally, periodic peer reviews are not conducted between CD-0 and CD-2. Ad hoc reviews to evaluate new alternatives have occurred on the U-233, Chemistry and Metallurgy Research Replacement Facility (CMRR), and Pit Disassembly and Conversion Facility (PDCF) projects. In many instances, hundreds of millions of dollars are expended in planning and design efforts with limited oversight. Examples include the MOX Facility, Waste Treatment & Immobilization Plant Project, Salt Waste Processing Facility, and CMRR. In addition, PDCF never reached CD-2, and expended over $700 million with little reporting requirements for this funding.

- More rigorous front-end planning and alternatives analysis would likely have resulted in the selection of different capital construction projects, as with the U-233 project, PDCF, and CMRR.

- Major system projects, such as nuclear projects, lack guidance requiring that the Project Engineering and Design funds (PED) be robustly financed and maintained throughout the project's lifecycle. PED funds are the precursor for developing the design in time for the CD points, allowing for a baseline and starting construction on the schedule envisioned in the early CD phases.

- While DOE has good front-end planning documents, they are not codified. It is unclear how various program offices require these best practices be followed, other than on an ad hoc basis. In NNSA's Business Operating Procedure, the program office developed its nuclear work's design maturity policy and codified its estimating procedures, which make it a requirement. During various audits, GAO has given NNSA credit for this measure.

5.2.3 Case Study: Mixed Oxide Fuel Fabrication Facility Project

In March 1995, the United States declared 38.2 metric tons of weapon-grade plutonium as surplus to defense needs. In January 1997, after reviewing 37 disposition options, DOE selected immobilization with high level waste, and irradiation of this material in mixed oxide (MOX) fuel.

Subsequently in 2002, a second review of options was conducted and the MOX irradiation alternative was selected as the preferred alternative. MOX fuel, albeit with non-weapon grade plutonium, had been successfully produced in two plants in France and it was believed that the technology and programmatic risks for this project were well understood. The cost for the MOX project was estimated at $1.1 billion in FY 2001. The MOX project was managed under DOE Order 413.3A. In 2006, Congress requested that DOE reanalyze its strategy for disposing of surplus plutonium, causing DOE to submit a report to Congress in 2007, entitled "Business Case Analysis of the Current U.S. Mixed Oxide Fuel Strategy for

Disposing of 34 Metric Tons of Surplus Weapon-Grade Plutonium." This report reconfirmed the MOX approach.

Prior to developing the project's baseline, DOE did not conduct peer reviews; analyze France's reference plants' construction costs or operations history that were the basis of the MOX program; or perform a rigorous technology development review, risk analysis or project definition rating. DOE and the contractors relied on the fact that similar facilities, although built decades earlier and under different regulatory, political, and industry conditions, could easily be modified and replicated in the United States. Under the DOE orders at the time, there was no requirement to ensure that design was sufficiently mature or that the project's cost estimate be performed by an independent party.

In April 2007, DOE approved a baseline for the capital construction costs for the MOX project at $4.8 billion. This approval largely relied on the cost estimate, design status, and risk program developed by the contractor. Subsequently it was determined that the design was significantly less mature than had been reported; the risks associated with meeting U.S. regulatory and building codes were not well understood; and the current state of the nuclear industry's supply chain in both labor and material procurements was significantly underestimated. Design costs continued to grow, construction and procurement bids greatly exceeded estimates, and technical staff turnover was much higher than anticipated. Insufficient research into the supply chain's ability to meet the projects rigorous Nuclear Quality Assurance-1 (NQA-1) criteria limited available sources and significantly increased oversight and procurement costs.

As construction continued, the contractors' work could not be completed within the budgeted amount. This created cash flow shortages, schedule extensions, and ultimately led to a request to rebaseline the project. During project peer reviews subsequent to CD-3, it was determined that the MOX estimate utilized production and productivity rates that were significantly higher than any other project in DOE's nuclear project portfolio; these items had not been checked by the independent reviewers when the project was baselined.

The MOX project has expended approximately $4 billion and is approximately 50 percent complete. Estimates for the capital work range from $8-12 billion depending on the funding profiles. In developing a path forward for plutonium disposition, DOE is reevaluating the options identified in the early stages of the plutonium disposition program.

5.2.4 RECOMMENDATIONS

Based on discussions between members of the Contract and Project Management Working Group, the following are recommended for front-end planning:

- Have program offices perform alternatives analysis that is independent of the contractor organization responsible for constructing the capital facility.

- Clearly codify the systems-level requirements for technology development and design maturity for each major system project.

- Develop design management plans and preliminary performance baselines for major system projects and report progress in accordance with DOE Order 413.3B, in advance of CD-2.

- Similar to post CD-1 projects, conduct project peer reviews annually between CD-0 and CD-1 for active projects (projects that are supported in annual budgets and that have not been officially placed in a "hold" status), unless more frequent reviews would be appropriate per the sponsoring Program or the Acquisition Executive.

- Align DOE Order 413.3B and DOE Standard 1189 in regards to the 90 percent design criteria for nuclear projects relative to design safety requirements and establishment of the minimum design maturity level required prior to CD-2 approval.

- Require estimates for Project Engineering and Design (PED) funds.

- Limit PED duration to two years for projects with a total project cost (TPC) under $100 million.

- Require monitoring of the expenditure of PED funds for management design plans on all capital projects managed under DOE Order 413.3B.

5.3 FUNDING

5.3.1 DESCRIPTION

5.3.1.1 Funding Requirements

Inadequate funding can lead to substantial cost growth, adversely affect the project's mission as new sources of funds must be identified, and damage DOE's reputation. An accurate and credible project estimate is vital for ensuring adequate funding, and is particularly important for major system projects.

Two areas to consider when discussing funding are (1) departmental policies compared to Administrative policies; and (2) the importance of complying with even the least rigorous DOE policies. OMB Circular A-11 provides guidance on the Administration's budget process. The Circular generally requires that capital asset projects are fully funded in advance. When upfront funding is infeasible for the entire project, funding complete and useful segments of the project is sufficient. Full funding increases the opportunity for performance-based fixed price contracts, which increases accountability and achievement of baseline goals. When full funding is not followed, the result is often poor planning, higher acquisition costs, cancellation of projects, and the resulting loss of sunk costs.

Congress also recognizes that full funding is the preferred financing methodology for capital construction projects. In the FY 2013 Military Construction and Veterans Affairs Appropriations Act, Congress stated, "In general the Committee supports full funding for military construction projects. However, it continues to be the practice of the Committee to provide incremental funding for certain large construction projects, despite administration policy to the contrary, to enable the services to more efficiently allocate military construction dollars among projects that can be executed in the year of appropriation." In this Act, the Committee identified five projects, all of which were more than $200 million for a slight reduction ($25-100 million), preserving more than 70 percent of the required full funding in the President's request in the first years appropriation.

In contrast, DOE has two conflicting policy documents regarding project funding. In his March 2010 policy memorandum, the Deputy Secretary stated, "Line item capital asset projects with a total project cost less than $50 million should be fully funded in a single budget request, if appropriate." DOE Order 413.3B states, "All capital asset line item projects (excluding Major Items of Equipment (MIE)) with a total project cost less than $20 million will request all construction funds within the same appropriation year as the start of construction. Projects with a total project cost less than $50 million should request funds within the same appropriation year, if feasible."

Both DOE policies are significantly less rigorous than the OMB Circular and Congress. While offering enormous funding flexibility, the DOE policies lead to problems that full funding would likely eliminate. Specifically, full funding would allow prioritization of requirements, improved planning, market risk mitigation, timely project execution, and the ability to utilize fixed price performance contracts.

The Department of Defense (DoD) approach has generally been to fully finance all capital asset construction, including major items of equipment, if the total construction cost is less than $100 million. Rigorously adhering to this principle, or the Deputy Secretary's guidance of fully financing projects under $50 million without the exculpatory language or "if feasible," would:

- Improve project performance;
- Lower initial capital costs by allowing our contractors to efficiently construct these small projects; and
- Bring projects on line faster to support the mission drivers that created the need for the capital project in the first place.

Internal pressure or pressure from outside stakeholders often drives a desire to "get things started," which generates an impediment to fully financing small projects up front. As limited economic resources are spread over a number of projects, project performance is often extended.

It is noted in OMB-Circular A-11 that in any budget year, funding capital projects generates tradeoffs with other capital assets or purposes outside capital assets. In 2011, DOE identified that developing an integrated priority list fashioned after the DoD's Planning

Programming, Budgeting, and Execution process ensured resources could be focused on the highest departmental priorities in an economical fashion. This initiative was coordinated among the program offices and approved by the Deputy Secretary, but never implemented largely due to the lack of a champion to drive the effort.

A related recommendation from the Contract and Project Management Improvement Summit stated that "the Department lacks a consistent, integrated process for establishing project priorities within programs and for using those priorities to drive budget decisions." A single project management entity to help enforce this type of broad departmental initiative would help DOE improve its project management execution.

5.3.1.2 Major System Projects

Major system projects cost more than $750 million and have unique requirements. Although the major system project limit is designated at $750 million, DOE's portfolio in this area is generally in the multi-billion dollar range. Examples include the $12.3 billion Waste Treatment and Immobilization Plant (WTP) project, the more than $8.0 billion MOX project, the $6.5 billion Uranium Processing Facility, and the $2.0 billion Salt Waste Processing Facility project. In considering projects of this size, DOE must consider the insufficient amount of capital to both fully finance this work and also perform our other necessary missions.

SC has traditionally exhibited the most discipline in preserving funding for large projects because it prioritizes them appropriately within the total program requirements, and has less major projects to execute. NNSA and EM have been less successful in this regard. Recently, NNSA has significantly altered project funding for the High Pressure Fire Loop project and High Explosive Pressing Facility at PANTEX, the CMRR Nuclear Facility at Los Alamos, and the UPF at Y-12.

5.3.1.3 Contingency

A critical element for project success includes control of contingencies for cost, schedule, and scope. Contingency management is an integral part of the project risk management process, providing FPDs with the tools to respond to project risks and uncertainties that are inherent in all DOE projects. Contingency is included in the overall project baseline and is available for risk uncertainty, regardless of whether the risk is internal or external to the project. The establishment of contingency is based on the level of project status, complexity, and risk. The contingency amount reflects an analysis of project risks using a typical range of 70-90 percent confidence level at the time of baseline approval. Analysis of contingency is performed continuously throughout the life of the project.

5.3.1.4 Funding Stability after CD-2

While important during the project development phase, a stable and predictable funding profile is vital after a project achieves CD-2. DOE Order 413.3B explicitly requires leadership input prior to altering the funding profile of a baselined project. Any changes to

a project's funding profile must be approved by the project's AE after being coordinated with the Chief Financial Office and DOE-APM, thus ensuring senior leadership is informed and accountable for such a decision.

5.3.2 Observations from Previous and Ongoing Projects

Underestimating contingency issues and planning problems have been and continue to be issues for previous and ongoing DOE projects.

- The project's initial estimate and funding profile should be maintained. Major system projects are financed over many years and additional estimates are largely based on the funding profile. An incentive for underestimating a project's costs often results from fear that DOE or Congress will reject the project if they know the full cost, causing major system projects to frequently be underestimated.

- DOE continuously underestimates both management reserve (contractors' contingency) and contingency (owners' contingency). In developing the *Cost Estimating Guide* and adhering to GAO best practices, DOE has significantly improved contingency allocations for small projects; however, DOE continues to underestimate total contingency needs for large complex nuclear work. EM's Integrated Waste Treatment Unit (IWTU) in Idaho, the SWPF in South Carolina, the WTP in Washington, and NNSA's MOX facility in South Carolina have all experienced multiple rebaselinings after CD-2, largely due to underestimating performance risk. Development and use of contingency is described in the *DOE Risk Management Guide*, which provides guidance that is not codified.

- Misaligned project and funding priorities have occasionally created cost and schedule increases to projects. Two examples where NNSA prioritization and funding significantly changed after baselines were established include the High Explosives Pressing Facility and the High Pressure Fire Loop. To meet PANTEX's mission, the High Explosives Pressing Facility was considered an urgent requirement. The Deputy Secretary approved the project's baseline in December 2008 at $116 million; however, NNSA defunded the project in its budget submission, and cancelled the project in April 2009. NNSA subsequently rebaselined the project, and requested funding in the 2010 budget with a new cost of $145 million and completion date two years later than originally planned. The High Pressure Fire Loop project achieved CD-2 in December 2006 with a TPC of $35 million; however, the project was underfunded by $23.1 million in FY 2008 and FY 2009. NNSA put the project on hold until funds were made available in 2010, causing a delay that led to a new baseline of $45 million.

- The instances of changing funding profiles after CD-2 have decreased across the complex since changes to a project's funding profile must be approved by the project's AE. Prior to this policy, several projects were adversely affected by changing funding after CD-2, and in some cases CD-3, including WTP in Washington;

IWTU in Idaho; the High Explosives Pressing Facility project; the High Pressure Fire Loop project; and numerous EM cleanups.

- Additional resources, including financial and personnel, were required to validate the projects and go through the baseline change process. For DOE APM, the resources required to process a typical baseline change are $500,000 for a non-major system project and $2.5 million for a major system project[2]. These costs could be avoided if accurate baselines were established at CD-2 with adequate funding available through CD-4.

5.3.3 Case Study: Corrective Actions –Canon de Valle at Los Alamos, New Mexico

The Cañon de Valle project (CdV)'s mission was to investigate the nature and extent of remediation required for 239 Solid Waste Management Units (SWMU) and Areas of Concerns (AOC) at the Los Alamos Site Office (LASO). The scope also included implementation of remedial actions for the SWMUs and AOCs as appropriate to maintain regulatory compliance with the State of New Mexico Environmental Department consent order. CD-2 was approved in April 2010, with a TPC of $52.9 million and a completion date of September 2015. Both cost and schedule contingency were included in TPC estimates and were accurate and based on assumptions known at that time.

During FY 2012, the project experienced setbacks due to regulatory and budget constraints. LASO's congressional appropriation was 52 percent ($188 million) of the EM request of $357 million. As a result, LASO assessed the allocation of this reduced funding across all its projects, and CdV received $1.5 million in FY 2012 funding against the planned $13.9 million. As the State of New Mexico identified transuranic (TRU) waste removal from LASO as its first priority under the consent order, LASO used a majority of congressional funding received for TRU waste removal. As a result of budget cutbacks, the CdV project replanned the schedule to focus on minimum tasks required to maintain regulatory compliance. The FY 2013 budget allocation for CdV was also lower than requested and the project was forced to replan tasks again to accommodate the constrained budget environment.

As the Continuing Resolution continued to be in place and TRU waste removal remained top priority for NMED and LASO, the expectation was that funding allocation for CdV would stay at lower levels than originally planned. The project was only 38 percent complete as of December 2013, and the FPD determined that the project would not achieve enough schedule progress to realistically sustain the completion date of 2015.

Even though the project had initiated discussions with NMED to extend the completion date for CdV and reprioritize the scheduled activities to comply with the consent order, the State regulators did not approve a project extension beyond 2015. Consequently, due to uncertain budget, inability to define a funding profile, and the regulatory climate, CdV

[2] These costs do not include: 1) the costs expended by the federal project team in the field or the program office at DOE/NNSA headquarters to review the contractor's baseline change proposal, or 2) what the contractor bills the government for the preparation of the baseline change.

submitted a project cancellation memo in August 2013, and cancellation was approved by the AE in December 2013 after spending $17 million. If the project were to be restarted in the future to meet DOE's required remedial options, then the TPC will likely exceed the previous baseline of $52.9 million.

The key lesson learned is that capital asset projects should be approved only if the funding can be made available. DOE should not, as policy, change a project's funding profile after approving a project baseline.

5.3.4 RECOMMENDATIONS

To build on the lessons learned in DOE project funding, recommendations include the following:

- Develop a departmental integrated priority list of capital projects. Communicate those priorities across the complex in fiscal guidance issued each February as part of the Planning, Programming, Budgeting and Execution process, and reflect them in annual budget decisions. This will allow senior leaders throughout DOE, regardless of program affiliation, to communicate those priorities with one voice.

- Define policy for full funding authority for projects, based on need, risk, and mission. Provide full funding for all projects under $50 million.

- Require all capital asset projects, regardless of funding source, to provide a Project Data Sheet with cost baseline and funding profile information/commitments. Currently, only line item capital asset projects require a project data sheet, while operating and major item of equipment projects do not.

5.4 INDEPENDENT OVERSIGHT

5.4.1 DESCRIPTION

In 1999, the National Research Council report, *Improving Project Management in the Department of Energy,* cited that "independent project reviews are an essential tool for assessing the quality of project management and transferring lessons learned from project to project." The report further stated that "DOE should formalize and institutionalize procedures for continuing independent, non-advocate reviews… to ensure the findings and recommendations of the reviewers are implemented." The report recommended that independent review results should be presented to the Energy Systems Acquisition Advisory Board and be used in decisions regarding whether programs or projects should proceed forward.

DOE Order 413.3B requires program offices to perform an annual peer review for projects past CD-2 and with a TPC of $100 million or greater. The importance of peer reviews was reemphasized at the December 2010 Contract and Project Management Summit. Peer reviews ensure checks and balances, such that a nonproponent body determines whether

the scope of programs, projects, or activities, underlying assumptions, cost and schedule estimates, contingency provisions, and management approaches are valid and credible. They ensure that DOE senior management receives a realistic assessment of the project, since there is a tendency for projects to have an optimistic bias. Moreover, when projects encounter challenges, project teams may not look outside for solutions or help. Peers from other sites/projects can suggest alternative technical and management options that may benefit the project. Independent oversight also promotes sharing of lessons learned and best practices between the review committee and the project, and vice versa — from the project to the review committee. They also confirm that projects follow the required policies and requirements throughout planning and execution.

5.4.2: Observations From Previous and Ongoing Projects

Independent-oversight observations from previous and ongoing DOE projects include the following:

- SC's peer reviews provide one process that yields success in bringing capital projects forward to completion with minimal cost escalation or schedule delays. Major functions of the project oversight office include developing and communicating policies relevant to construction projects and operation of facilities, and ensuring they are consistently and appropriately implemented. This office also serves to advise senior management on the construction and operation of facilities, and coordinates with other DOE organizations and offices, including DOE APM. In addition, the office provides assistance *and* oversight to line management organizations. SC's formalized review process includes a review committee and a review committee chair.

- SC's peer review process may not be adaptable to the construction or acquisition of facilities that involve nuclear operations or waste remediation. In the Contract and Project Management Working Group's discussions, SC expressed its need for a flexible approach that does not involve the rigors of external regulatory bodies, stakeholder settlement agreements, and complexities of adapting technologies inherent in other program offices' larger scale projects.

- DOE lacks an integrated independent oversight review to inform executive decision makers. The channels of communicating the status of major system projects have been severed because a formal process does not or no longer exists at DOE. Therefore, the early warning systems triggered by thresholds and a hierarchy of reporting results to DOE's most senior leaders responsible for the delivery of major system projects is ineffective.

- An independent oversight body is needed that advises a senior department official on a project's progress or process when major decisions are needed. This will help validate program progress reported on by the AE, thus restoring internal and external credibility. This process would return DOE to the recommendations cited

by the National Research Council in 1999 and begin to establish a culture of continuous performance improvement through continuous learning.

- The distribution of program management oversight housed within various organizations has diluted and segregated the limited number of project management personnel. In recent years, DOE's portfolio of construction projects (post CD-2) has shrunk from 121 projects valued around $65 billion in January 2008 to 39 projects valued around $27 billion in December 2013. The staff supporting these projects has also declined, while there was a shortage of qualified personnel during that time period. Consolidation to one integrated oversight function could yield efficiency and improve oversight effectiveness. The responsible AEs (Under Secretaries) are best suited in their role as the most qualified and knowledgeable about project management to become members in a reconstituted Energy Systems Acquisition Advisory Board.

5.4.3 Case Study: Bevatron Demolition Project

The mission of the Bevatron Demolition Project, located at Lawrence Berkeley National Laboratory (LBNL), was to deactivate, demolish, and dispose of the Bevatron accelerator, ancillary Buildings 51 and 51A, and numerous supporting structures.

On October 25, 2005, the Director for Office of Laboratory Policy and Infrastructure in SC requested that the Office of Project Assessment conduct a review of the Bevatron Demolition project to ensure the project's readiness for CD-1.

An on-site review was performed from November 29 to December 1, 2005. The review was chaired by the Director, Office of Project Assessment, SC, and utilized a small but diverse review committee.

Based on the information presented, the committee judged:

> *The project is not ready for CD-1. The project management team does not have experience in managing large projects subject to DOE project management requirements. There appears to be opportunities for cost reduction and schedule optimization. However, the Committee could not credibly evaluate these features since there is a lack of integration and consistency among project scope, schedules, and costs documents; and lack of robustness of some alternatives analyzed.*

Prior to leaving the site, the committee chair informed the project team and the LBNL senior management of the review results. After the review, the project's Acquisition Executive was provided with a two-page summary of the review and was briefed on the review results.

Within a few months, LBNL management implemented the recommendations. A new project team with more experience was placed in charge, the technical approach to demolition was modified, and the demolition work was contracted out instead of being

performed by LBNL in-house labor forces (who did not have experience with demolition of large hazardous facilities). The TPC range during the CD-1 review was $78 million to $83 million and by CD-2 the TPC was reduced to $50 million.

The project was completed on schedule in July 2008. The project's careful planning, management, and attention to lessons learned and risks, allowed it to deliver the full project scope and $2.4 million under budget.

5.4.4 Case Study: Waste Treatment and Immobilization Plant Project

The Waste Treatment and Immobilization Plant (WTP) Project is located in Richland, WA. Its mission was to design, construct, and commission facilities with the capacity to treat and immobilize, up to 56 million gallons of radioactive waste stored in 177 underground storage tanks and prepare it for disposal at a permanent national geologic repository. The WTP design was initiated in 1998 as the Tank Waste Remediation System Privatization Project, by British Nuclear Fuels Limited, Inc. In 1999, DOE awarded a contract to Bechtel National, Inc. to design, construct, and commission WTP. Construction began in 2000, with a plan to start radioactive operations by 2007. The project baseline was established in March 2003 at $5.78 billion and a completion date of July 2011. In December 2006, the project baseline was revised to $12.26 billion with a completion date of November 2019.

In 2003, to meet the demands of the Tri-Party Agreement, DOE and Bechtel adopted a fast-track, design-build approach to constructing WTP. In a conventional construction approach, technology development activities, plant design, and construction occur sequentially, but they occur simultaneously with this unconventional design-build approach. The use of a fast track approach for first of a kind nuclear plant consisting of multiple nuclear facilities was a bad acquisition approach. It is the primary factor for the significant cost increases and schedule delays that have ensued over the years. There continues to be significant performance risk associated with this project.

Over the last decade, the project has undergone regular project peer reviews and several independent reviews to inform the project team and the SAE on the project progress and resolution status of technical issues. These reviews include:

- Annual Construction Project Reviews – to date
- After-Action Fact Finding Report – January 2006 to identify root causes of projected cost/schedule increases
- External Technical Flow sheet Review – March 2006
- US Army Corps of Engineer Validation of contractor May 2006 Estimate at Completion
- External Independent Review – October 2006, chartered by OECM
- Secretary of Energy Chu Review of WTP, 2013 (Webinar series)

In spite of these reviews, serious technical issues remain unresolved. While some of these reviews may have had warnings, it takes courage to correct the decision making process and change course after spending billions of dollars.

In the view of the Contract and Project Management Working Group, EM is again at these crossroads. The issuance of the framework document, *Hanford Tank Waste Retrieval, Treatment, and Disposition Framework* on September 24, 2013 generated the consideration of an alternative phased completion approach using Direct Feed to the Low Activity Waste Facility. This alternative approach will be a major shift in how to bring the facility on line. It will allow waste immobilization to begin as early as June 2020 while proceeding simultaneously on resolving the remaining technical challenges with the Pre-Treatment and High Level Waste facilities.

5.4.5 RECOMMENDATIONS

Independent oversight through peer reviews, independent reviews, and self-assessments should add value, which benefits the project, the program, and DOE as a whole. As a near-term objective, it is recommended that DOE focus on a few specific areas listed below:

- Reconstitute the Energy Systems Acquisition Advisory Board (ESAAB) process (or similar) as provided for in DOE Order 413.3B. Delegate ESAAB members with responsibility and accountability for major system acquisitions/capital projects. Each AE role should be delegated to Under Secretary-level.

- Conduct regular periodic ESAAB meetings for AEs to update the SAE on progress or decisions that are needed at the corporate level. Strengthen dashboard metrics and watch lists to alert executive leadership of major issues, interdepartmental priorities, successes and corporate lessons learned.

- Recreate the hierarchy of reporting. Establish a systematic process of reporting various control levels from the FPD to the ESAAB.

- Establish a Portfolio Review Board to provide an independent assessment of the strengths, weaknesses, and risk profiles of all major capital projects. The board would advise the AE whether investment decisions, resource commitments, and priorities are meeting their expected outcomes and DOE's goals. It would be modeled after "governance boards" that provide checks and balances between the most senior executive (SAE) responsible for the portfolio of DOE activities and the ESAAB members who report on their areas of responsibility.

- Implement an Independent Oversight review team to provide an independent audit function reporting to the SAE. The team must be firewalled from both program and project management organizations and the AEs (DOE Under Secretaries/Program Secretarial Officers) and must be purely independent. The AE must support and understand the purpose of the review, be briefed and aware of the review recommendations, and ensure that the recommendations are implemented or resolved in a timely manner.

- Require that independent peer reviews and SAE Independent Oversight reviews occur during the lifecycle of a project from CD-1 to CD-4. Establish a "graded risk-

based" approach to the implementation of reviews. Therefore, from the onset, higher technical risks associated with first-of-a-kind engineering would require greater scrutiny. In contrast, programs with lower risk profiles (e.g., build to print projects) would require less scrutiny.

6. Achieving a Culture that Enables Consistently Acceptable Project Outcomes

After decades of studies, evaluations, analyses, and dozens of action plans, DOE's project delivery performance has improved, but performance issues remain. In addition, these improvements are inconsistent across program offices. Expertise within the Contract and Project Management Working Group helped identify four factors for continuous project management success at DOE. Efforts to address these four factors can result in the improvements DOE needs and its stakeholders demand.

A fifth factor – culture – helps address the longevity of improved performance, and is overarching and supportive of the four factors already described. While other studies have indicated changes in organizational and individual culture are needed to support project management improvements, more should be done to make long lasting improvements.

Currently, weaknesses in the organization of DOE's projects create barriers to successful project delivery. In some cases, insufficient line management, ownership and authority, routine decision making at the wrong levels, and focus on reporting projects as "green" rather than on sustained performance improvements are all emblematic of the deep cultural issues underlying project performance. In other cases, there appears to be a lack of strategic prioritization for project funding, as well as a lack of a transparent funding allocation process. Often for government agencies, an internal prioritization list of programs and projects does not exist, or if it does exist, the agency does not adhere to it. This causes projects to fall victim to their budget allocations. Project managers also develop an optimism bias in delivering the project on cost and schedule despite the changes to a project's funding profile.

In many instances, the Contract and Project Management Working Group provided anecdotes of an "informal culture" within DOE with regards to project and acquisition management, which is misaligned with the formal structure that includes policies, orders and guidance. In some respects, because of this misalignment, the informal culture overtakes recognized systems, processes, and procedures resulting in less than acceptable outcomes from project and acquisition management.

EM's 2011 *Report on the Office of Environmental Management Program and Project Organizations* highlights the impact of culture change on project performance, and can be extrapolated across DOE. The report's findings focus on a strategic change that embraces a commitment to a new culture, and provides recommendations to achieve this goal.

One key recommendation from this report states:

> *Transform the culture of EM to one of more open sharing, collaborative problem solving, and transparency so that open and honest results are communicated and acted upon, resulting in continuous improvements being made to EM. This culture*

should be proactive in its approach to managing programs and projects, rather than reactive.

Another applicable recommendation focuses on the need for accountability, responsibility, and authorities to be formally documented, effectively communicated, and executed at the right level, which is related to the recommendations identified throughout this report. The Contract and Project Management Working Group wishes to reemphasize the need for culture change and endorses the recommendations included in the EM report.

The group believes, however, that the EM recommendations should embrace additional elements to change DOE culture. For example, DOE should work to overcome natural defensive routines in use throughout the project delivery system and ensure that all project teams understand the need to solicit appropriate outside views in all project phases.

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