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Test Capabilities Revitalization Phase 2 Project

Lessons Learned Report

May 2014
Revision 0

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Change Log

Rev	By	Date	Type	Change Description	Pages
0	Paul Schlavin	5/14/14	New	Original Issue.	All

1.0 Introduction

1.1 Purpose, Scope, and Background

This lessons learned report presents Sandia National Laboratories Test Capabilities Revitalization (TCR) Phase 2 Project lessons learned. The purpose of lessons learned is to share information to (1) promote the recurrence of desirable activities, and (2) preclude the recurrence of undesirable activities. The scope of this report includes project lessons learned obtained from design refresh (post-critical decision [CD]2B/3) through project construction and startup.

This report has been prepared by the Project Team to support the lessons learned requirements of DOE Order (O) 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. The revision of the order in effect at the onset of the project (DOE O 413.3A, July 28, 2006) required a post CD-4 project requirement to prepare and submit a lessons learned report to the DOE Office of Engineering and Construction Management for broader sharing among the DOE project management community. The revision of the order that is currently in effect (DOE O 413.3B, November 29, 2010) requires that the Project Team submit lessons learned to the Program Secretarial Officer and the Office of Engineering and Construction Management as follows:

- Within 90 days of CD-3 regarding upfront project planning and design
- Within 90 days of CD-4 regarding project execution and facility startup

Note: DOE Guide (G) 413.3-11, *Project Management Lessons Learned*, was cancelled on November 9, 2011.

1.2 Lessons Learned Methodology

The method used to develop this report was based on DOE G 413.3-11, *Project Management Lessons Learned*, which was cancelled on November 9, 2011, but it offers some best management practices for lessons learned. The method may be summarized in the following four steps: Capture, Check, Learn, and Close.

1. Develop a lessons learned form and tip sheet.
2. Issue lessons learned form and tip sheet to stakeholders with a request for lessons learned.
3. Conduct stakeholder meetings to solicit/discuss lessons learned.
4. Summarize findings in a lessons learned report.

The lessons learned form and tip sheet used for this effort are presented in Appendix A. Stakeholders included those involved in all phases of the project from initial planning through startup and occupancy and included DOE, user groups, Sandia project personnel, and Sandia project support personnel and subcontractors.

2.0 Lessons Learned Summary

The project's lessons learned are summarized in tabular format in Appendix B. As shown, the summary includes a lessons learned number, issues/comments, a lessons learned summary description, and the associated project phase. For lessons learned that were considered to be beneficial for all phases of the project, "all" is indicated. The lessons learned summary statement is structured to emphasize the following:

- What actions need to be taken
- What the general problem is that the actions address
- What consequences were experienced or avoided

A total of 51 lessons learned were identified for the project. These lessons learned were estimated to help save several months of time on the project schedule and several million dollars in project costs.

3.0 References

- DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets* (DOE O 413.3A, November 17, 2008; DOE O 413.3B, November 29, 2010)
- DOE G 413.3-11, *Project Management Lessons Learned* (August 5, 2008)
- Office of Health Safety and Security website (<http://www.hss.doe.gov/csa/analysis/ll/>)

Appendix A: Lessons Learned Form and Tip Sheets

Lesson Learned Format

This format is provided as a means to capture issues and observations and to identify potential lessons learned. Once all the sheets are gathered and compiled, a single edited list of lessons learned will be published for this phase of the project.

Name: _____

Page: _____ of _____

Issue/Observation	Lesson Learned

Lessons Learned Form and Tip Sheet

This is the general document format for collecting TCR Phase 2 Construction Lessons Learned.

Do not worry about formatting issues on this document; just identify items to be captured. The final information will be formatted at a later date.

This format is provided as a means to capture issues and observations and to identify potential lessons learned. Once all the sheets are gathered and compiled, a single edited list of lessons learned will be published for this phase of the project.

Name: _____

Page: _____ of _____

Issue/Comment	Lesson Learned

Other issues (cut and paste from emails, etc.)

Appendix B: TCR Phase 2 Project Lessons Learned Summary

Item No.	Issue/Comment	Lessons Learned	Phase
1	Maintain frequent open and honest communication among Project Team.	Maintain frequent open and honest communication among the Project Team for changes and/or potential issues. Several changes to the project scope were required during the execution of the project that could have imparted significant schedule delays and/or introduced adverse safety conditions. The Project Team's open and honest communication regarding these changes, both from SNL project management and the construction contractor and subcontractors, allowed the project to address the changes without imparting delays and/or affecting the safe execution of the project.	Development, Design, Construction, and Closeout
2	Involve user representative in design and construction meetings.	Involve a user representative in day-to-day project design and construction meetings. User preferences may change and/or not be clearly understood by the Project Team. Heavy involvement of a user representative in the day-to-day design and construction meetings/activities minimized possible rework and resulted in meeting the project schedule and performance criteria.	Design and Construction
3	Due to the long timeframe from initiation to completion, several functional and operating requirements (F&OR) were found to be out of date at the end of the project and required much effort in a short timeframe to gain concurrence on the path forward.	Schedule time to review project F&ORs and higher-level key performance parameters (KPPs) quarterly to identify as early as possible if project expectations or performance requirements/parameters may become an issue. Allow time to negotiate changes to the project plan, if required.	Development, Design, Construction, and Closeout
4	Personnel stability on the Project Team was an issue. Due to the length of time between original F&OR development and final construction completion, the project spanned over 10 years.	While good documentation is always key to good project delivery, maintaining continuity of personnel on the Project Team is another factor that must be considered to ensure project success. The TCR Phase 2 project was originally developed in calendar year 2002 (CD-1 approved). It was shelved due to funding constraints and revalidated in 2005. CD-2B/3 was approved in 2008. Funding was not made available, and the project floundered during 2008-2011, with minimal funding to purchase long lead equipment and to report on the status. During this time, the Contractor Project Manager was able to maintain some continuity, but all other team members changed (often multiple times).	Development, Design, Construction, and Closeout
5	Ensure project documentation quality and version control.	While Project Team stability allows for good project delivery, maintaining a strong focus on project documentation and document version control is another factor that must be managed to ensure project success. The TCR Phase 2 project was originally developed in calendar year 2002 (CD-1 approved). It was shelved due to funding constraints and revalidated in 2005. CD-2B/3 was approved in 2008. Funding was not made available, and the project floundered during 2008-2011. It finally gained traction to be completed in fiscal year 2012. The original document	Development, Design, Construction, and Closeout

Item No.	Issue/Comment	Lessons Learned	Phase
		control/tech writer could not be kept on the team, and with various staff members creating documentation, the quality suffered.	
6	Return to operations/transition to operations – With the change in management from the design phase to construction phase, different expectations on restart became apparent between the Project Team and the operations staff.	<p>During the length of time between project initiation/design and construction/restart of operations, all of the individuals in line management changed. Therefore, those who participated in the design decisions were not available to understand and accept the modifications. The line management had not gone through this exercise previously and had questions on how to accept the work that was provided during the project.</p> <p>The project plan called for the restart of operations to conform to the established corporate safety basis process for restart. To facilitate the transition to operations, the Project Team sponsored a workshop to educate the Line Team on corporate requirements and to plan the restart activities (the workshop was termed a “phase schedule workshop,” following the Lean Construction Institute’s scheduling principles [i.e. “pull scheduling”). During this “phased schedule” workshop, all activities necessary for performing and documenting the restart after construction modifications were listed and interconnected in a workflow document. This workflow document indicated relationships to other work and responsible parties for the work. The status of the workflow was reported each week via a call-in to the project Deputy Project Manager. This activity proved to be valuable to the Manager and Operations Teams as it allowed for accountability and predictability towards completing the required effort.</p>	Construction transitioning to Operations
7	Due to the extended length of the time between design and construction, it was difficult to recreate events that led to current design requirements.	<ol style="list-style-type: none"> 1. The original requirement was to provide a project that targeted specific items deemed of highest value to NNSA/SNL. This led to a “targeted revitalization” effort. The performance was measured on addressing specific scope items that were chosen at a point in time when the Design Team had just recently completed its condition assessment. Therefore, the project was set up to address specific scope items; it did not have a performance-based contract approach. As the project delayed, it became increasingly difficult to recall all the specific drivers that led to the specific decisions on what was in the scope versus not. 2. A more solidified consolidated documentation process could have helped these issues. 	Design
8	Submit electrical equipment and coordination studies.	<ol style="list-style-type: none"> 1. The commissioning plan required receipt inspection sheets to be delivered by the contractor. These were not always provided in a timely fashion. 2. Due to the phased approach to acceptance (required to meet mission goals) the design engineer provided “panel board” coordination studies based on submittal information to set breakers, but they were not always accurate with respect to field-installed equipment. There were times when the receipt 	Construction and commissioning

Item No.	Issue/Comment	Lessons Learned	Phase
		<p>inspection checklist provided by the contractor (commissioning requirement) did not make it back to the engineer in a timely manner. This time lag meant that differences were not always caught by the Commissioning Agent during phased startups. This was a particular problem with an electrical equipment supplier as manufacturers changed product lines during the extended course of the project. This issue, coupled with the scale of the project, made coordination studies an issue that needed to be readdressed between design and the facilities operations engineers.</p> <p>3. The design and operations engineers met to discuss improvement opportunities. The Sandia System Engineers are working on tightening the specification for delivery and records to minimize this issue in the future.</p>	
9	Design criteria and design documents were not clearly understood by the customer.	The line organization had difficulty understanding how the provided documentation (design criteria, design narratives, and design drawings) satisfied its basic requirements. The line suggests that the Project Team list the expectations and correlate this with the design deliverables to illuminate any differences and then discuss ways to reduce the delta prior to any work.	Design
10	Ensure communication between line and the Project Team.	Weekly meetings with the line organization, Facilities (Project Management Team), and the contractors is a great practice to keep everyone in the loop on issues and progress.	All
11	Transfer equipment manuals and project information.	The Project Team provided information that was helpful in the long-term stewardship of the facility. The line organization would have preferred to receive this earlier in the process. The Project Team needs to find a way to get the commissioning information quicker.	Closeout
12	Project Controls – Provide better insight into what is going on through earned value (i.e., “task starts”).	A better definition is required on the task line and in the Work Breakdown Structure dictionary to understand “what” is being done.	Project Controls
13	Project Scope Creep – The baseline change proposal (BCP) 12-12 impact on A/E was not adequately addressed. The increased workload added more complexity on top of an already complex revitalization project.	BCP impacts on all project components need to be addressed. The added scope ultimately led to an increase in the schedule, which likely led to more change orders in the field than were originally outlined in the BCP 12-12.	Project Controls

Item No.	Issue/Comment	Lessons Learned	Phase
14	There were project funding delays between CD-3 and the actual start of construction, coupled with a “restrained” design refresh phase in an attempt to limit scope creep (push by DOE – no new scope).	This issue most likely forced a reduction in upfront planning that could have saved time and effort in the field.	Construction
15	Configuration Management by Management and Operations – As-builts were not in the state they should have been. This applied both to line and maintenance organizations.	<ol style="list-style-type: none"> 1. Work harder to maintain as-builts of process equipment, buildings, and utilities. These facilities are over 60 years old and as-built drawings have been poorly maintained over this long period. A more thorough set of as-built drawings could have helped, but many issues were buried and undiscoverable until uncovered by actual construction. 2. Better as-builts were also noted in the restart process lessons learned as needing greater emphasis and speed. 3. Better as-builts was also noted by the contractor as an issue to be resolved to minimize field meetings and potential change orders. 4. Consider the use of new technologies to locate hidden utilities such as Light Detection And Ranging (LIDAR). 	Construction
16	BCPs need to be approved by Federal Project Directors before work is completed.	The issue of contractor management reserve vs. DOE/NNSA cost and schedule contingency ownership and the authority for the performance measurement baseline (PMB) contract budget base vs. the total performance baseline shall be established early in the project development cycle. This will/could offer better insight into earned value performance reporting (i.e., cost and schedule variances). This will allow BCPs to be processed quicker, perhaps without federal review. It will also allow more flexibility for the Contractor Project Manager and will clarify roles/responsibilities and accountabilities in the Project Execution Plan (PEP).	Project Controls
17	Project restart requirements were not sufficiently understood, documented, and agreed upon prior to the restart phase.	<ol style="list-style-type: none"> 1. Review restart requirements and set up project files to facilitate all phases of the project, not just execution of physical work. 2. Commissioning reports should be designed to facilitate startup and restart activities. 3. Show schedule logic in master schedule to indicate when people, procedures, and equipment reviews should occur in support of restart activities and how it should be documented. The PEP should avoid any “nuclear” language when implying downstream commitments (e.g., CD-4) referencing the “change management” role when determining the appropriate startup review. 4. Keep the line organization apprised of new technology requirements being provided to minimize the learning curve at the end of the installation and transition to actual user operations. (This applied primarily to the new 	Restart and Project Closeout

Item No.	Issue/Comment	Lessons Learned	Phase
		research and development electrical equipment in the Aerosciences Facility).	
18	Spreading the project out over multiple years with starts and restarts made project coordination difficult.	<ol style="list-style-type: none"> 1. Delays in project execution invariably led to additional cost and duplication of efforts and should be avoided if possible. 2. The depth and details of decisions that were made early in the project life had to be carried throughout the project lifecycle. Even though many details were written down, the later interpretation of previous decisions were often questioned by new project members. 3. Project personnel shifted over time. Constant effort was required to keep a common level of understanding throughout the Project Team. 4. Keeping track of the work to coordinate outages and as-builts was made more complex by the number of buildings, geographical separation, and number of individuals attempting to maintain mission-related work during restoration efforts. 5. It became difficult to set up a contracting strategy to place the burden of risk on the contractor performing the work because the long duration forced the Contractor Project Manager to establish many contracts to minimize the costs of maintaining a single, large contractor responsible for the entire scope of work. 	All
19	Project Team meetings were helpful in maintaining communications and coordination.	<ol style="list-style-type: none"> 1. Frequent Project Team meetings were helpful in maintaining communications and coordination. 2. Open and honest issues/solutions-oriented meetings helped maintain a trusting environment to address issues quickly and fairly. This also helped with team cooperation. 	All
20	Include project schedule specification for the contractor.	<ol style="list-style-type: none"> 1. The requirement to bill tasks at 30-60-100% created hardships on the contractor. They would prefer 30-60-90-100%, as the gap from 60-100% created a burden on the contractor's end for payment processing and probably skewed the earned value metrics. 2. Design conflicts/unidentified conditions led to many changes that were difficult to get through approval and costed in the contracting phase. A lot of time was required in preparing, submitting, reviewing, and approving baseline changes prior to being allowed to invoice new work. Fortunately, the owner and contractor worked on a high-trust basis; otherwise, this could have added more time and cost to the project. 	Construction

Item No.	Issue/Comment	Lessons Learned	Phase
21	Review project commissioning.	The contractor received the project commissioning checklists after the start of work, which made them rework some of their submittals as they gained understanding of the requirements.	Construction
22	There were inspection issues.	<ol style="list-style-type: none"> 1. Quick and frequent turnaround of project punchlists would have helped the closeout process. Consider providing hard contractual timeframes for receiving and addressing punchlist items, with payment adjusted accordingly. 2. Inspection Traveler was used to document all required inspections. This process could benefit from an independent lessons learned activity, and possibly additional training, to ensure that all inspectors are on the same page with regards to requirements. 	Construction
23	Metal building structural design details did not sufficiently describe the work.	Building structural elements with add-on metal buildings required many more iterations between the supplier and the design team than planned, which impacted the overall schedule. The supplier of the building (also the designer of the structural systems) should plan time to meet with the engineer of record to address all issues in one setting vs. the contractor's preferred method of emailing revisions and questions back and forth.	Construction
24	Sled Track Test Capability (SLED) track environmental remediation site work requirements were subsequently questioned late in the contracting process.	Hazardous Waste Operations and Emergency Response (HAZWOPER) work requirements for underground utility project work should have been determined earlier in the project lifecycle as these have a profound effect on how work is accomplished. Early documented discussions with the Emergency Response Site Team indicated that the site appeared to have been remediated to a level that allowed for safe utility work to proceed. Prior to construction commencement, the issue was revisited and a more conservative approach to construction was required. The lesson is that the Project Team should maintain close communication with support functions throughout design, review, delays, and resumption of contract work to minimize surprises.	Construction
25	Design-build specifications for fire alarm and fire protection were insufficient to fully describe the work.	Always review specifications and drawings to determine if adequate information is provided before placing the risk of execution onto the contractor.	Construction
26	Electrical change orders using National Electrical Contractors Association rates need further clarification in the contract.	This seemed like a good means to define the work and cost of work/changes; however, contractors need to become more proficient at using this tool, and a clear agreement on factors needs to be defined in the contract language to minimize debates.	Construction

Item No.	Issue/Comment	Lessons Learned	Phase
27	F&ORs and higher-level KPPs need to be periodically revalidated and kept current through a formal process.	Use the annual PEP update cycle to formally review the KPPs listed in the project documents with the line organization and DOE/NNSA to verify that the requirements are still valid as written or to formally change the requirement in both the PEP and the Construction Project Data Sheet to prevent issues at project closeout.	All
28	Minimize project ES&H concerns with respect to National Fire Protection Association (NFPA) 70E.	<ol style="list-style-type: none"> 1. Minimize special contracts with contractors unfamiliar with the requirements of NFPA 70E. Work at Sandia must meet the safety requirements as mandated in the ES&H specification. Many smaller companies do not have mature safety programs and cannot perform to the levels required. 2. Utilize the Sandia prime contractors familiar with and having approved safety plans to perform all activity-level work on site. This will minimize risk exposure to Sandia/DOE. 3. Identify complex research and development electrical equipment (i.e., Aerosciences) early. There is a need to ensure that all work practices conform to the requirements of NFPA 70E. 	Construction
29	In the Aerosciences facility, the specialty research equipment systems were not initially well understood by the design team.	The Hypersonic Wind Tunnel and Trisonic Wind Tunnel system designs required many meetings during design and construction and post-construction to get the details right. The user believes the designs were incomplete and did not provide enough details, and requested elements did not get included.	Design Construction
30	Validate F&ORs.	<ol style="list-style-type: none"> 1. Success criteria to validate the F&ORs were developed prior to CD-3 approval; however, as the project was nearing completion, it became apparent that the success criteria was not sufficiently detailed to allow for easy and mutually agreed upon acceptance. 2. User equipment acceptance tests were not fully documented in the success criteria matrix. Specific examples include the Trisonic Wind Tunnel, the Hypersonic Wind Tunnel, 20-inch actuator, and Gas Gun. 3. The commissioning report is a good place to put the success criteria matrix. It is easy to find and lends itself well to most acceptance testing. 	Closeout
31	Assess Project Controls cycle.	<p>The Project Controls Team developed a checklist approach to accomplishing the monthly reporting cycle. This made for repeatable results and also provided an easy tool to verify progress or where difficulties were in any given month.</p> <p>The checklist clearly identified the steps required for Baseline Maintenance; Performance, Forecast, and Cost Update; Cost and Schedule Reports; and Project Management Reports.</p>	Project Controls

Item No.	Issue/Comment	Lessons Learned	Phase
32	PC – The accrual process, which is important to properly account for costs incurred in the correct time period, is managed outside of the project team. This lack of direct control can sometimes make it difficult to properly account for project costs.	Established a “draft pay app” process with construction contractors to generate data for worksheet provided to Org. 10500 for processing monthly accruals. Defined roles between Finance/Accounting, Accounts Payable, Procurement, and Project Controls, leading to increased accountability among entire team.	Project Controls
33	PC – Assess contractor progress by monitoring trending for key project parameters.	Developed a color-coded spreadsheet for reviewing contractor progress that tracked key scheduling components (e.g., activities on the critical path, activities not finished by baseline date) with respect to how they compared to the previous reporting period. Trending was identified by green (better than previous), orange (same as previous), or red (worse than previous).	Project Controls
34	PC – Estimated actuals may be required to maintain accurate monthly actual cost (AC) values.	In the instances when the accrual process did not occur as designed, it was necessary to apply estimated actuals. The Earned Value Management System (EVMS) System Description does not address estimated actuals and we recommend including an estimated actuals narrative be included in the next revision to the system description.	Project Controls
35	PC – Engage Project Controls members assigned to Org. 4000 for line-item projects in training provided by Org 10000.	As upgrades to the Oracle E-Business suite toolset were implemented, the TCR Project Controls personnel under Facilities (Org. 4800) required training as if they were under the Financial Organization (Org. 10000). This maximized their value to the Project Team due to their continual interconnection with the Labs financial system to accurately produce monthly reports. Familiarity with customer reporting systems, such as DOE Standard Accounting and Reporting System (STARS) and internal systems, like Nuclear Weapon’s Plan, Authorize, Track and Report (PLATR) system for projects, would improve programmatic understanding. Similarly, training Project Controls personnel on more project-oriented systems, like the Cost Estimating Tool, Oracle’s analytical reporting capabilities, or IBM’s soon-to-be-implemented project module, would increase their value. Of equal importance would be to include Project Controls personnel in training relative to Corporate Cost Estimating Tools (e.g., Project Estimating Template and Cost Estimating Template) along with general budget and finance courses.	Project Controls
36	PC – Develop a business process to address how initial efforts approved by the Construction Manager for constructability changes can be incorporated into the integrated	This issue addresses differing site conditions that occur in the field. Per the PEP, these types of changes will be submitted through the Construction Manager to the SCR (aka, “the buyer”) and are typically generated from a Request for Information submitted by the contractor to Sandia. The next step is a CR; however, CRs often include multiple RFIs that accumulate over the course of a month or more. This	Project Controls Contracts

Item No.	Issue/Comment	Lessons Learned	Phase
	project schedule (IPS) PMB prior to a contract revision (CR) being implemented by the Sandia Contracting Representative (SCR).	may result in a timing delay before the constructability change, which is usually allowed with a partial budget only to get the work started, and is included in a CR to change the contractor's Statement of Work. In order to practice sound baseline management, Sandia's EVMS mandates that the IPS PMB can only be changed based on approved CRs. This situation is not unique to the TCR project; however, developing a business process to quickly capture differing field conditions in the PMB that does not impact production would be valuable to the entire project management effort. Without an approved system in place to rapidly address field issues, the potential for contractor delay claims goes up dramatically.	
37	PC – Enforce idea that the time-phased budget (monthly planned value [PV]) in the PMB is based on early dates in the project schedule.	Contractor schedules must contain a low amount of free and total float to avoid having time-phased budgets (PV) at mid-point between early and late dates in the IPS. This proved to be an issue during the later phases of the construction effort. Recommend requiring that the contractor provide a "time-phased budget" that reflects the early dates produced by P6. If the contractor insists that late dates drive their true PV cost spread, then the restriction on "float" values identified in the schedule specification must be enforced. Typically PV is based on early dates in P6.	
38	PC – Require non-contractor (i.e., Sandia organizations) project participants to follow an in-house resource "schedule specification."	Establish a formal process with project line organizations (i.e., Org. 1500 in TCR's case) that issues POs to procure equipment to provide subordinate schedules as subsequent monthly cost and schedule status updates occur. Recommend requiring a schedule specification (scalable to the agreed to project scope) to be followed by line organizations just to provide project cost and schedule data similar to what is required by primary construction contractors.	Project Controls
39	PC – Establish monthly Baseline Change Control Board (BCCB) meeting for BCP process related to baseline maintenance of PMB.	Convene a full BCCB each month to allow Control Account Managers to present entire case for BCPs. Once BCPs are approved by the BCCB, the Project Controls Team will need ample time to process the change in time for the next reporting cycle. Although establishing a routine BCCB meeting will add rigor to this process and potentially delay production, it will allow the technical staff to prepare and present their positions to the board. This structure will ensure that both project and programmatic concerns are considered when reviewing/approving BCPs.	Project Controls
40	PC – Design and develop a web-based control account plan/control account/work package generator as "cost book" to support the PMB during EVMS Audit/Surveillance Reviews.	Design and develop a control account plan authorization form and control account/work package generator to provide a single repository for cost, scope, and schedule baseline and change source information (i.e., cost estimates with basis of estimate from A&E with Sandia loads and escalation to formulate PMB values) to quickly generate a project "cost book." Additionally, this tool could produce a CAP as a backup for PMB in the Integrated Project Management System.	Project Controls

Item No.	Issue/Comment	Lessons Learned	Phase
41	PC – Document desktop project controls instructions.	Document desktop instructions for project controls procedures. Use the business mapping tool for all EVMS processes conducted during the project controls cycle.	Project Controls
42	PC – Ensure proper earned value measurement techniques are applied to various types of schedule activities.	Plan earned value measurement techniques for work packages/activities that relate to labor, equipment, services and material in a manner that correlates with how performance will be earned during the execution phase.	Project Controls
43	PC – Ensure the proposing contractors are able to provide a project scheduler that can meet EVMS flow-down requirements for line-item projects.	Engage Project Controls staff when reviewing the contractor’s proposals for requirement to provide a project scheduler to ensure all requirements in the schedule specification can be met by the proposing contractor. Also, allow Project Controls staff to review the schedule specification at the pre-construction meeting or schedule a separate meeting with the contractor’s scheduler immediately after contract award and prior to Notice to Proceed, even if a partial Notice to Proceed is conditionally granted.	Project Controls; Construction
44	PC – Implement EVM rolling wave concept during execution phase of the project.	Consider incorporating the rolling wave concept for planning packages, work packages, and summary-level planning packages in the development of a solid PMB. Sandia used work packages like planning packages in the past, but should differentiate and apply them in a more conventional EVM methodology.	Project Controls
45	PC – Reconcile cumulative actual costs (ACs) between SNL Accounting and project reporting values every month to ensure the two values match.	Project AC values are reported as values for the month and may include overhead or other cost adjustments from previous reporting periods. It is critical to monitor cumulative values to ensure that the project reporting values always match the SNL accounting values.	Project Controls
46	PC – The following successes were realized during the project.	<ul style="list-style-type: none"> • Established charge code (chart of accounts) structure that crosswalks to the appropriate level of the WBS (i.e., control account-level) throughout the project lifecycle. • Completed data conversion from P3 to P6 (BCP 11-01). Ensure the P3 schedule is an hourly schedule (not daily) to avoid dividing the units by 8 when completing the conversion. The Primavera utility defaults to hourly and will take a daily schedule (in P3) and divide all units by 8. • Implemented Oracle Primavera Earned Value Management (PEVM) cost and 	Project Controls

Item No.	Issue/Comment	Lessons Learned	Phase
		<p>schedule integrator for management reporting purposes (Contract Performance Reports and Variance Analysis Reports [VARs]).</p> <ul style="list-style-type: none"> • Established database production, development, and quality environments with the database administrator to ensure EVMS monthly deliverables were met. • Processed EVMS data from PEVM to populate external Access 2003 extractor tool for upload into DOE web-based PARS II reporting system. • Working processes implemented (reference the project controls cycle) include: <ul style="list-style-type: none"> - Monthly pay app process with major construction contractors - Monthly accrual process with Sandia Accounting to generate ACs - Mid-month and month-end schedule review process with major construction contractors to facilitate quality of status information - BCP review and approval process for major construction contractor's PMB - Extraction of AC table from Oracle with SQL as input for upload into PEVM actuals basis - Estimate-to-complete data collection using P6 status schedule as input into PEVM forecast basis - Variance analysis reporting at the control account level • Developed roles and responsibilities for Project Controls staff, and development of repeatable processes established accountability and confidence among team • Designed and implemented VARs (e.g., VAR Narrative Editor) with Development Team • PV for equipment 100% upon receipt = earned value measurement technique at-finish curve in P6 • Integrated contract management and baseline management concepts to produce valid PMB • Demonstrated EVMS tools during EVM audit • Prepared earned value monthly information in support of DOE NNSA/Acquisition Project Management customer reporting requirements to Headquarters 	

Item No.	Issue/Comment	Lessons Learned	Phase
47	Establish contracting strategies to minimize project risk.	Consider utilizing fixed-price design contracts for the A/E on a project. With the TCR Team's current contracting strategy, there is little or no accountability for the A/E to issue correct information in a timely manner. This would result in a time and cost savings to SNL, but it would also require the project scope to be accurately defined.	Construction Title-III
48	Perform project cost accounting of contract work.	For projects with multiple work packages, a thorough review of the WBS elements and how to define the cost accounting for the associated work packages should be reviewed. For the TCR Project, the team had 9 different line items in the PO that required extensive time to associate change order costs and CRs to modify an individual line item. While this was an early requirement levied by NNSA, fewer WBS elements and cost associates would improve the time needed to correctly categorize the associated costs for each change.	Project Controls
49	Review change control process.	The change control process needs to be reviewed and updated to allow for more flexibility and speed. The current system is okay for large, well thought-out changes, but trying to take this process to the field during construction where time is more closely related to cost is difficult. Consider a streamlined process for acceptance of changes.	Project Controls
50	Consider design management during design and construction.	The AE Title III (Design) Team must maintain a person in a strong leadership position during construction (i.e., Design Manager) without direct design responsibility to assist in accurate, timely, and coordinated information flow.	Design and Construction
51	Use partnership construction firms during construction.	Using pre-established partner construction firms that have a demonstrated track record of working with Sandia on scheduling resources to match availability of construction sites was a good decision by the Project Team. Due to the constant adjustments required to minimize mission impact while performing targeted revitalizations in multiple facilities on Sandia's low hazard and moderate hazard facilities, the risk for delay claims was high. The Project Manager negotiated with the Purchasing organization to allow, as a best value criteria, local contractors with a proven track record at Sandia for supporting the needs of the labs.	Contracting Construction