Department of Energy
Office of Science
Office of Project Assessment

Acceptance Review

of the

Princeton University Earned Value Management System (EVMS)

Princeton Plasma Physics Laboratory

October 2011

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1. SUMMARY

During the week of October 3, 2011, the Department of Energy (DOE)/Office of Science (SC) conducted an Earned Value Management System (EVMS) acceptance review of Princeton University (PU) in Princeton, New Jersey. The review was led by the Office of Project Assessment (OPA) with committee members from the Office of Engineering and Construction Management (OECM), the Argonne National Laboratory (ANL), and the Brookhaven National Laboratory (BNL).

The focus of the review was to ensure that PU implements its contract-wide certified EVMS in accordance with the ANSI/EIA-748B guidelines across all applicable DOE Order 413.3B capital asset projects.

The review was conducted in accordance with the OPA EVMS Surveillance Guide.

The review committee and the guidelines that they were responsible for are identified in Appendix A.

The Committee identified four Corrective Action Requests (CARs) and seven Continuous Improvement Opportunities (CIOs). One CAR was corrected during the review resulting in a downgrade to a CIO; several CIOs were addressed by the project team during the review and are considered closed. Summaries of the CARs and CIOs are listed below with the supporting documentation appended to the report (Appendices C and D):

1.1 Corrective Action Requests (CARs)

CAR-01—Acceleration of schedule and added scope without formal baseline change authorization.

CAR-02—Variance Analysis Reports (VAR) are not written at the Control Account Level (at least) for adequate management control.

CAR-03—Schedule Integrity.

CAR-04—Control Account Managers (CAM) are not claiming their time in a consistent documented manner for Level of Effort (LOE) versus Discrete Effort.

1.2 Continuous Improvement Opportunities (CIOs)

CIO-01—Estimate at Completion (EAC) Tracking and Maintenance should be improved.

CIO-02—The Chief Financial Officer (CFO) should validate actual costs from accounting system to COBRA.

CIO-03—Provide additional Earned Value (EV) Management training.

CIO-04—Documentation requires corrections and clarifications.

CIO-05—Documentation of EV technique for each Control Account to ensure objective performance measurement is consistent and documented.

CIO-06—Eliminate inconsistencies in change control processes and procedures.

CIO-07—The Project Execution Plan (PEP) and Responsibility Assignment Matrix (RAM) have Work Breakdown Structure (WBS) listings with one control account against four WBS elements. **(This CIO was downgraded from a CAR.)**

2. OVERVIEW

Prior to the review, a suite of PU EVMS documents, as well as project specific documents for the National Spherical Torus Experiment (NSTX) Upgrade project were made available to the Committee and were reviewed by the committee members prior to arrival at the Princeton Plasmas Physics Laboratory (PPPL). On the morning of October 4, 2011, the Committee attended a series of presentations that included overviews of the PPPL EVMS, the NSTX Upgrade project, and how EVMS is applied to the project. The Committee spent the following one and a half days interviewing the Project Managers (PM), CAMs, Project Control Staff (PCS), and the project finance staff members.

Some of the documents reviewed included:

- PPPL Laboratory Overview Presentation, September 29, 2011
- NSTX Upgrade Overview Presentation, September 29, 2011
- NSTX Upgrade EVMS Implementation Presentation, September 29, 2011
- NSTX Upgrade Work Authorization Documentation (WAD) [1000 through 8250], September 26, 2011
- NSTX Upgrade Contract Performance Reports (CPR) – Format 1 (April through September, 2011)
- NSTX Upgrade Project Execution Plan (PEP), (Rev 01 June 22, 2011 draft as of October 6, 2011
- NSTX Upgrade Organizational Breakdown Structure (OBS), September 1, 2011
- NSTX Upgrade WBS, March 23, 2011
- NSTX Upgrade WBS Dictionary, draft as of October 6, 2011
- NSTX Upgrade Schedule – XER file, August 31, 2011
- NSTX Upgrade RAM, status as of October 5, 2011
- PPPL (PMSD), Revision 1, June 2011
- Appendix E PMSD Supporting Procedures, Procedure 8 Monthly Reporting
- NSTX Cost Performance Reports, June-August 2011
- NST Upgrade Performance Trends Report

Personnel interviewed included:

- Adam Cohen, Deputy Director Lab Operations
- Mike Williams, Associate Director for Engineering and Infrastructure
- Ron Strykowsky, NSTX Upgrade Project Manager;
- Steve Langish, NSTX Project Controls;
- Erik Perry, NSTX Control Account Manager;
- Martin Denault, NSTX Control Account Manager;
- Jim Chrzanowski, NSTX Control Account Manager;

- Mark Cropper, NSTX Control Account Manager,
- Subrahmanya Ramakrishnan, NSTX Control Account Manager.

Consistent with the ANSI/EIA-748B Standard the report narrative is divided into the five major EVMS sections: 1) Organization; 2) Planning, Scheduling, and Budgeting; 3) Accounting Considerations; 4) Analysis and Management Reports; and 5) Revisions and Data Maintenance.

2.1 Organization

2.1.1 Findings

The ANSI Guidelines (GL) #1–5, Organization, is concerned principally with ensuring that each part of the EVMS is properly established including: defining the work required to be performed; assigning the tasks to organizations responsible for performing the work including major subcontractors; facilitating the collection and developing of information for management purposes; and identifying organizational resources that facilitate the preparation of accurate and timely estimates of project cost and schedule completion. During the review, the Committee performed detailed analysis of the documentation for the NSTX Upgrade project Control Accounts validated during corresponding project interviews.

The analysis for project's WBS included the WBS, WBS Dictionary, and Scope of Work (SOW) for both projects and their component Control Accounts. The Committee observed an adequate knowledge of PPPL standard policies and procedures for the CAM and Project Control Managers (PCM) that relied heavily on individual expertise rather than documentation or tools. Further, the splitting of time between CAM duties and other PPPL work, although common when technical professionals are also used to manage a project, was perceived to have project execution be more reliant on individual expertise than the consistent CAM and PCM knowledge. However, this was not considered to be a non-compliant issue and was more properly dealt with as a training issue. (See GL #3 below).

The analysis for the project's OBS included: how the OBS is integrated with the WBS, how subcontractors are effectively managed to compliment the overall project team, and how the subcontractors are integrated into the overall project structure. The Committee observed competent understanding of how the subcontractors and overall Federal team are working to move the NSTX Upgrade project forward.

The analysis for integration of the WBS and OBS into the RAM included: how and where the Control Accounts were established and defined through their respective WADs and

Control Account Plan (CAP); and an analysis of how EV performance is taken per EVMS policy and procedures and the projects appropriate Schedule of Values (SOV). The Committee observed that the CAMs appropriately load the SOVs originating from the subcontractors into P6 before performing validation via onsite analysis and review. However, there is a greater reliance on individual CAM expertise for claiming performance than for any documented percent complete procedure. The project team maintains close and documented communication within the team and with prior team members for the projects. The WADs and CAPs include an appropriate level of detail and are linked to the WBS Dictionary, yet often they are they are incomplete in terms of clarifying percent complete or how to calculate it in a consistent manner.

The Committee observed that current project delivery team training is on-going; however, it is often conducted informally between the CAM and the PCM, as needed, and at various levels of rigor, depending upon the specific experience of the CAM and tailored for each project need. This approach appeared to be too susceptible to CAM and PCM expertise rather than a more rigorous and consistent message of content and needed policies and procedures. This was especially true during interviews where such critical subjects as how a change should be processed, how an EAC should be computed (and whether to even have—and use a Control Account plan to enforce project management effectiveness) were discussed.

Through the interviews the Committee found this approach to EVMS training, although well intended, allowed gaps to occur by CAMs and PCMs against the written policies within PPPL. Often it appeared there was a lack of understanding and awareness or only an 'occasional' application of any PPPL-wide EVMS policies or procedure. This permitted the potential for differences in EVMS understanding and/or execution across Control Accounts and within CAM/PCM teams operating on the NSTX Upgrade project. Although not significant enough to warrant an ANSI violation of non compliance with any particular guideline, the Committee judged this approach to training clearly fostered an inconsistent application of the EVMS across NSTX Upgrade project staff. This approach could also indirectly encourage individual project team approaches that, although well-intentioned, could lead to gaps that could produce inaccuracies in data or loss of reporting reliability across an entire project timeline and budget.

The analyses for project Control Account development and management included: monthly Performance Reports (i.e., CPR); handling of any LOE; and other status reporting documentation and logs reflecting management of project Control Account. The Committee observed high reliance on the electronic, web-based CAM "notebook" sourcing of documents in conjunction with some CAMs who also utilized paper-based notebooks. This duality is not

uncommon and should remain helpful as long as the web-based source remains current and in sync with any paper records.

2.1.2 Conclusions and Recommendations

The Committee recommended:

1. That PPPL continue EVMS training so that it becomes a part of the normal work process of functioning as a CAM or a PCM. Continued training should include change control, EAC, and the development and usage of a comprehensive CAP.

The following CARs and/or CIOs are submitted for disposition:

- CIO-03—Provide additional EVMS training.
- CIO-07—The PEP and RAM have WBS listings with one Control Account against four WBS elements.

2.2 Planning, Scheduling, and Budgeting

2.2.1 Findings

A project schedule was developed with some short duration activities that are logically linked. Based on the interviews, the CAMs stated they developed the schedule and indicated that it is their schedule. The schedule contained deliverables, milestones, and each CAM interviewed could identify their EV technique. In most cases, the EV technique is percent complete and the CAMs were able to identify the means of assessing objective performance measurement using pre-defined “peg-points” or milestones to assess objective performance measurement. The project schedule is organized by Job Number Control Account with activities and milestones in place to measure project performance. Schedule status is taken on a monthly basis, and objective performance measurement techniques have been identified in the schedule for taking EV performance.

The NSTX project schedule should be reviewed for schedule integrity. Schedule integrity is necessary in order to ensure the schedule accurately represents the project activity sequence, the correct forecast of schedule start and finish dates for all authorized work activities, milestones, and project early start finish dates. The schedule is not logically-linked and is artificially constrained limiting the scheduling tool from correctly calculating the project critical

path (see CAR-03). The schedule is highly constrained with a relatively large number of activities that are not logically linked (activities either without predecessors and successors), will not calculate total schedule contingency accurately, and will not provide an accurate critical path. The lack of a horizontally integrated schedule degrades schedule effectiveness as a tool for analyzing the critical path and the near critical paths and schedule contingency values.

The Committee observed in the pre-document review that the PPPL PMSD and supporting policies provide a good basic explanation of the EV performance measurement techniques CAMs are to use and specify when the "percent complete" technique is appropriate. The inconsistency and reliance on the individual expertise only, is subjective, and results in a question as to the accuracy of the performance claim for EV.

During the CAM interviews, the Committee found that some activities contained weighted steps or milestones but others did not. The method for determining percent complete was too focused on the relative expertise of the CAM and/or PCM and their relationship with the contractor performing the execution.

The project has established a time-phased performance measurement baseline (PMB) using the Primavera P3 tool to resource load the activities in the schedule and the Cobra database maintains the monthly time-phased cost/schedule baseline. The assignment to the activities in Primavera and the pricing of the resources based on the schedule dates in Cobra results in the PMB, which is used for taking monthly EV performance on the work scope. The schedule provided to the team was organized by Job Number (or Control Account). The Control Account plans reflect the work planned in the baseline but did not reflect the work/schedule currently authorized by the project. The PMB should represent the formal plan for each CAM to accomplish the work. The project authorized the CAMs to begin working on an accelerated schedule including added scope (i.e., CA 2440-the NBI refurbishment—approved via email by DOE November 2010) and outlined in the schedule (CAR-01-Attachment B). As a result, the PMB does not reflect the formal plan (as authorized by the customer and the project manager) for each CAM to accomplish the authorized work assigned within the time and budget defined.

The budget and schedule for all authorized work scope including the subcontracted work should be documented formally through the Work Authorization process prior to the start of work. This includes identification of all resources, budget, and subcontracted effort. The project authorized new scope and acceleration of procurements ahead of CD-3 via e-mail to the CAMs based on direction from the customer. During the CAM interviews, several CAMs indicated they had started new scope work (see CAR-01) ahead of the baseline schedule based on e-mail

authorization. A subcontractor was authorized to begin work ahead of the baseline schedule without the Work Authorization and Change Control process being initiated, which would have formally updated the baseline plan and updated the work authorization documents required to initiate work scope changes to the formal PMB. The CAPs were generated and requested during the CAM interviews. The CAPs are developed based on detailed cost estimates delineated by cost element (labor, material, subcontract, travel, other). The CAMs indicated that they developed the cost estimates and they were based on their estimates of work effort, activities, and duration as a result of expert prior experience in their respective areas. The CAMs were very knowledgeable regarding their particular work scope, cost estimates, and schedule. The CAMs stated that the WADs had not been updated to reflect the revised work scope and schedule in the NSTX Upgrade project baseline plan. The project did not initiate change control to revise project baseline schedule to reflect the customer driven changes. As a result, the CAMs executed the work, inconsistent with the baseline, by placing procurements ahead of Critical Decision (CD) 3, Approve Start of Construction that were not formally authorized in the schedule baseline (see CAR-01).

The NSTX Upgrade project Control Accounts are established and are planned with work packages or planning packages. The work packages/activities were detailed with resources assigned. The work package descriptions were clearly distinguishable. A few CAMs identify planning packages for long-term effort that they will detail plan into work packages in the future. The planning packages were coded as such in both Primavera and Cobra.

Budgets, established at the work package level identifying specific resource requirements in dollars, hours, or other measureable units, provides the detail for effective execution of the baseline plan. The resources are to be time-phased consistent with the way the detail work is to be accomplished." In the case of several Control Accounts, see CAR-01, the time-phased plan (baseline plan) did not reflect the authorized work/schedule that the CAMs were directed to execute against. As a result, the baseline plan does not provide the detail schedule and work scope that the CAMs have been informally authorized to perform and execute against. The resources in the detail cost/schedule baseline must reflect the time-phasing in the way the work will be executed.

The Committee determined that the sum of all work packages and planning packages equals the total budget for the Control Accounts. However, the work packages and planning packages in the Control Accounts that comprise the project cost/schedule baseline are not currently reflecting the all the authorized work scope that is being executed. The project's current authorized work scope, budget, and schedule baseline do not reflect the authorized work

as documented in several project e-mail correspondence. The project cost/schedule performance measurement baseline does not reflect a realistic baseline schedule. The project developed a separate "New Scope" schedule that the CAMs are authorized to follow but the new work scope and schedule have not been added to the PMB.

During the CAM interviews, it was clear that method of handing EV measurement for project management related work was inconsistently handled between the CAMs. Some CAMs identified the EV measurement technique for project management tasks as LOE and others did not. Some CAMs combined LOE related work into discrete work for the project management tasks planned in their control accounts.

It is the Committee's position that the inconsistent application of the CAMs project management activities as LOE has the potential to negatively impact the accuracy of performance claims for discrete work resulting in misrepresentation of the actual project management impact on a Control Account. LOE work packages/activities should be limited to project management or support related activities where objective measurement is not readily assessed. Project Management tasks are clearly LOE as defined in the PPPL PMSD and in the ANSI Standard. LOE related tasks should be identified separately from discrete work. This practice will avoid the risk of masking performance from discretely measured effort.

The amount of LOE within the project budget is 26 percent based on a report provided to the Committee. The LOE percentage is somewhat high and should be reviewed for accuracy.

The NSTX Upgrade project has identified $17 million of "Reserve Contingency" based on a risk assessment. The PPPL PMSD does not distinguish between Management Reserve and Contingency. In addition, the PPPL PMSD does not discuss the use of Undistributed Budget. The NSTX Upgrade project does not use undistributed budget. The PPPL PMSD does not currently address undistributed budget because, per Project Controls, "the project does not use Undistributed Budget". Without a provision for Undistributed Budget in the PPPL PMSD, the projects have no process for segregation and managing budgets into a temporary holding account if the detail plans for the budget have been authorized but not yet fully detailed.

Additionally, the PMSD is unclear on the use and definition of Management Reserve and Contingency. The PPPL PMSD currently describes (in sections 1.3.8, 4.1.3.5, and 4.3) the use of "Contingency Reserve" but Figure 1.2 depicts a distinction between Contingency and Management Reserve. The Committee found the use of this combined term confusing. Further, the NSTX Upgrade PEP references Contingency and states that the PPPL EVMS description

provides a formal process for: “Controlling Management Reserve and authorized allocated contingency via the change control process.”

After reviewing the NSTX Upgrade project documentation, including the CRPs and the RAM and Cobra CAPs, the Committee found that the NSTX Upgrade Project Target Cost does reconcile with the sum of the PMB plus the NSTX Upgrade project contingency. The Total Project Cost for the NSTX Upgrade project is $94.3 million comprised of $77.3 million of internal work scope budget comprising the performance measurement baseline plus $17 million in contingency:

Performance Measurement Baseline	$77.3 million
Contingency Reserve	$17.0 million
Total Project Cost	$94.3 million

The NSTX Upgrade project CPR for August 2011 indicated the PMB is currently at $77.3 million. The RAM also illustrates that the sum of all the Control Account budgets (which make up the PMB) total $77.3 million.

2.2.2 Conclusion and Recommendations

2. The project should ensure all authorized work is documented through the change control process and that all project documentation is updated to reflect the authorized work scope, schedule, and budget.

3. The project should initiate a change request to implement the authorized changes into the project PMB and WAD to correct the fact that the CAMs are executing work not currently authorized in the formal EVMS.

4. The project should review their determination of LOE on the project Control Accounts and make changes where reasonable per the ANSI Guideline.

5. PPPL should establish the correct terminology and usage of Undistributed Budget, Management Reserve, and Contingency in the PPPL PMSD. The project should also ensure that a log is maintained to track the Contingency, Management Reserve and Undistributed Budget. The project should revise their PPPL PMSD to include undistributed budget even though the NSTX Upgrade project, “does not currently use undistributed budget”.

The following CARs and/or CIOs are submitted for disposition:

- CAR-01—Acceleration of schedule and added scope without formal baseline change authorization.
- CAR-03—Schedule Integrity.
- CAR-04—CAMs are not claiming their time in a consistent documented manner for LOE versus Discrete Effort.
- CIO-05—Documentation of EV technique for each Control Account to ensure objective performance measurement is consistent and documented.

2.3 Accounting Considerations

2.3.1 Findings

The project is documenting, approving, and recording financial transactions in a consistent and timely manner, and in accordance with Generally Accepted Accounting Principles (GAAP) and applicable Cost Accounting Standards (CAS) Disclosure Statements. A Project Account number is established via an approved Request for Baseline Adjustment (RFBA) to enable cost to be recorded in the PPPL financial accounting system. The Project Account numbers identify the correct cost collection account (Control Account) for specific items of work. Direct costs are charged directly to the Project Account (Control Account) numbers in the appropriate expense class that are assigned at the job or task level, as appropriate. A trace from P3 to Cobra, Job Costs Report, Timesheets, and Invoices was performed on both labor and material charges to confirm compliance.

There were inconsistencies regarding the PEP, RAM, and WBS Dictionary. The WBS listing in the PEP has one Control Account (5,000) against four WBS elements (1.5.1, 1.5.2, 1.5.3, 1.5.5). The RAM only showed one of these WBS elements. The intent of GL #17 states "A work order/job order/task code charge number structure must exist that uniquely identifies costs at the Control Account Level allowing for accumulation and summarization of costs to higher levels of the WBS. Through the use of this coding structure, allowable costs collected within the Control Account by element of expense roll-up from the Control Account Level through the WBS to the top-level without being divided among two or more higher-level WBS elements. Cost collection accounts map to the WBS, and the WBS roll-up structure contains no division/allocation of lower-level cost to multiple higher-level WBS elements. When common

costs are collected in separate control accounts for like items or services they are allocated to appropriate control accounts in each project."

With the structure as listed, traceability of costs into various WBS rollups and in CPR reporting showed discrepancies. Upon disclosure of this finding, PPPL's project team provided Engineering Change Proposal (ECP) documentation to correct this allowing the Committee to confirm traceability of costs to the appropriate WBS rollups and in CPR reporting.

PPPL's CAS Board Disclosure Statement identifies all indirect and allocated cost pools and the methodologies used to distribute these costs to cost objectives. The budget manual also identifies and explains rates and allocations as they pertain to the specific cost objectives. The basis of each cost allocation is reviewed annually by the Budget Office to assure that each indirect/allocated cost pool is appropriately identified with the correct set of beneficiaries. Any changes are formally reviewed and approved by Laboratory management before being filed and approved by the DOE contracting officer. The PPPL EVMS Description accurately documents this process.

A traceability exercise was done on labor and four jobs (Control Accounts 1307, 1302, 1310, and 5501) to determine if indirect costs were being applied appropriately. This exercise confirmed indirect costs are being applied as defined in PPPL's CAS Board Disclosure Statement.

PPPL is considered an R&D facility and does not currently need to implement procedures for unit cost (equivalent cost or lot costs), because they do not have projects that produce identical products for multiple customers. The NSTX Upgrade project and PPPL are not involved in the manufacturing process to warrant application of GL #20.

An accounting trace was performed to verify performance for material purchases are not claimed prior to actual receipt. A complete trace from planned value to accrual to actual invoice was performed with success. This guideline, as it pertains to residual inventory, does not apply to PPPL. A trace on high dollar value material was not possible as this project has not yet purchased items of this size.

The GAAP internal controls guideline "Segregation of Duties" states that no person will hold more than one role amongst the following business critical roles: authorization, recording, asset custody, and reconciliation. One person in Project Controls is responsible for validating the Actual Cost file, which comes from the accounting system. The same person in Project Controls

is also responsible for creating the final version of the file from data in the accounting system which is entered into their EV system. Even though the individual has others in the Project Controls group review the final version, having one person and/or group create the final version and perform the reconciliation/validation function for actual cost data violates the "Segregation of Duties" internal controls guideline.

A trace was performed on the actuals from the accounting system cost reports to Cobra and the project EVMS reports.

2.3.2 Conclusions and Recommendations

The following CARs and/or CIOs are submitted for disposition:

- CIO-02—The CFO should validate actual costs from accounting system to COBRA.

2.4 Analysis and Management Reports

2.4.1 Findings

The NSTX Upgrade project currently prepares a monthly cost performance report summarizing cost and schedule performance at the Control Account Level. The document summarizes the monthly Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), Actual Cost of Work Performed (ACWP), Schedule Variance (SV), and Cost Variance (CV) for the current period and the performance to date. This document is updated monthly and reviewed by the CAMs. Review of the accounting system by the Committee indicated that cost data is reconcilable between COBRA and the PPPL accounting system.

The NSTX Upgrade project currently prepares a monthly performance report summarizing cost and schedule performance at the Control Account Level. The document summarizes the monthly BCWS, BCWP, ACWP, SV, and CV for the current period and the performance to date. This document is updated monthly and reviewed by the CAMs. The monthly performance report is used as the basis for evaluating all Control Accounts and identifying those performing outside the acceptable range (.90-1.25) for both the Schedule Performance Index (SPI) and the Cost Performance Index (CPI). VARs are being prepared by the CAMs using CPR Form 5. The Control Account Level has been linked, through the RAM, to WBS Levels 2-5 and corresponds to previous PPPL Job Numbers. Because the Control Accounts (PPPL Job Numbers) correspond to various WBS levels, the VARs are not prepared at a consistent level; some are prepared at WBS Level 2; some are prepared at WBS Level 4 or 5.

Variance reporting to the DOE/Princeton Site Office (PSO) is at WBS Level 2 and includes a roll-up of lower level variance analyses.

Overall, the Committee concurred with much of the PPPL documentation concerning how variances should be handled at the project level. The Project Managers, Project Directors, CAMs, and PCS meet on a monthly basis to evaluate the performance of the projects. During these meetings, the project variances are evaluated and an analysis is prepared. The quality of the VARs varies greatly and the level of detail ranges from acceptable to incomplete. This prevents the project from effectively communicating the cause and proposed solution. In some instances, the VARs are not prepared by the CAM. For the NSTX Upgrade project, the VARs are not consistently prepared at the Control Account Level. The VARs represent a roll-up of Control Accounts and provide a summary of the analyses. Because the VARs reference former PPPL Job Numbers and Control Accounts are based on these rather than the WBS, there are concerns regarding consistency and traceability.

The Associate Director for Engineering and Infrastructure and the NSTX Upgrade Project Manager meet weekly and monthly with the NSTX Project Controls Manager, lead project scheduler, and CAMs to discuss the performance of the project at the Control Account Level. Multiple reports detailing the performance of the project are prepared on a monthly basis and reviewed. The reports are developed at the Control Account Level and summarized appropriately to support management needs. The NSTX Upgrade Project Manager meets weekly and monthly with senior PPPL management officials to discuss project performance. The level of reporting is sufficient to support compliance with this guideline.

The Deputy Director for Operations, Associate Director for Engineering and Infrastructure, and the NSTX Upgrade Project Manager provide management direction to the CAMs based on the project's EV information. Management communication and direction occurs at the monthly status meetings, weekly rollover meetings, and plan-of-the-day meetings. However, there is no official log of the direction provided by PPPL management. The CAMs maintain a daily log of status and direction and much of the project communication is by e-mail. Interviews with the CAMs indicate that records are inconsistent and that e-mail correspondence is sometimes deleted.

The project would benefit by implementing a formal record of management direction maintained at the Project Manager level.

The project is updating the EAC at the Control Account Level on a monthly basis and has recently completed the six-month "bottoms-up" EAC for the entire project. The process used to calculate the EAC on a monthly basis varies with the CAM; some rely on PPPL cost reporting software to calculate the EAC while others will hand-calculate the EAC based on control account performance issues. The project would benefit from additional CAM training regarding EAC development as the project continues implementation of the EVMS.

2.4.2 Conclusions and Recommendations

6. PPPL should establish a consistent Control Account Level based on the WBS (Level 4 or lower) and ensure that analysis is prepared at that level, with reference to the appropriate WBS element on CPR Form 5, such that their managers and others impacted by the Control Account can understand the variance root cause, associated impacts on project scope, schedule, and budget, and the corrective action plan.

7. The EVMS Description and other necessary documentation should include VAR examples that show a well-written VAR that describes variance root-cause associated impacts on scope, schedule, budget, and corrective action plan.

8. PPPL should develop a procedure for preparing variance analyses to ensure consistency across the project.

9. The upper WBS Level 2 SV/CV variance analysis thresholds should be lowered to +15 percent and that the thresholds be rewritten to change "and" to "or", i.e., SV +15 percent or -10 percent OR >$50K and >10 percent of BAC or any impact on a DOE Level 1 or 2 Milestone and CV +15 percent or -10 percent OR >$50K and >10 percent of BAC.

The following CARs and/or CIOs are submitted for disposition:

- CAR-02—VARs not written at least at the Control Account Level for adequate management control.

2.5 Revisions and Data Maintenance

2.5.1 Findings

The project authorized the CAMs to begin working on an accelerated schedule, which includes added scope (i.e., CA 2440-the NBI refurbishment) approved via e-mail by DOE in November 2010. The CAM interviews found seven Control Accounts authorized to either begin work on new scope or authorized to accelerate work ahead of the baseline schedule. These include:

WBS-Control Account	Control Account Description
1.1.2-1200	Vacuum Vessel and Support Structure
1.1.3.3.2-1305	Heating Coil
1.1.3.3.3-1306	Inner PF Coils
1.2.4.4-2425	BL relocation
1.2.4.4-2440	NSTX Beamline2 Refurbishments
1.2.4.7-2475	NBI Controls and Instrumentation
WBS-NA -5200	Control and Protection System

CAMs initiated work without formal change control and without the formal update to the WAD. There were six requests for change authorization from DOE going back to August 2010 without any formal change control documentation prepared or processed for approval to capture any of the authorized changes. The project did not follow-up with an authorized change request for formal approval per the PPPL change control procedure. The PMB should reflect current program and project management plans for accomplishment of program objectives. If the maintenance of the baseline plan is compromised, the information on the management reports will be degraded.

The CAMs could not consistently describe the formal change control process and could not consistently determine when a change request should be initiated. All CAMs interviewed relied heavily on one individual from Project Controls to initiate the change request for them and follow it through to implementation.

The PEP for the NSTX Upgrade project states that an updated list of all approved, disapproved, and pending changes will be maintained electronically by Project Engineering on the NSTX Upgrade project website. However, only approved changes were listed on the change control log. The Committee gave the NSTX Upgrade project time to revise their change control log to conform to the PEP. At the conclusion of the review, a revised change control log was produced that included one pending change. However, during CAM interviews, discussions

alluded to at least four other pending changes that did not appear on the change control log. The pending change that was added to the log (ECP-004) also did not reflect the estimated impact to cost, scope or schedule. While these options were included on the log, they were not populated for the pending change.

Currently the NSTX Project Systems Engineer determines on a case-by-case basis whether changes that are administrative or editorial in nature should be documented through the formal change proposal system. This is an informal process not consistently documented and may not produce an effective mechanism to track the change.

The project baseline change control procedure was not followed, and the WADs for each Control Account were not updated to reflect the new authorization. Therefore, the CAMs were executing work without formal authorization based on the PEP and PPPL change control procedures. Since the baseline and project documentation was not updated to reflect this change in schedule and new scope additions to the project, the maintenance of the baseline plan is compromised.

Budget changes must be controlled and understood in terms of scope, resources, and schedule. Budgets must reflect current authorized work. The PMB must be up-to-date and should include all authorized changes from DOE.

The Committee found that a correction was made in August in two WBS elements (1200 and 7100). The project provided evidence that labor adjustments occurred in the month of August 2011 on RFBA form. The Committee verified this through the various systems and found the adjustment occurred in the month of the request and that no prior month's actuals were changed as a result. Retroactive changes are recorded in the Laboratory's project accounts and General Ledger in the month the revision is implemented, and these costs are then accurately recorded in the actual cost of the project management report. This was confirmed in interviews with Accounting and Budget.

The CAMs acknowledged that the PM had authorized new work scope and the acceleration of their work via email. The project did not follow-up with an authorized change request for formal approval per the PPPL change control procedure. The change control process would formalize the authorization by DOE, require a revision to the cost/schedule baseline, and WAD formalizing the authorized change. Since there was no formal change authorization, the baseline was not revised and the project was measuring performance against a baseline that does not represent the work that is currently being executed. Changes outside the authorized baseline

compromise the integrity of the performance data and reduce visibility of overall project variance from the plan, thus reducing the alternatives available to managers for project redirection or revisions.

By ensuring that budget and schedule revisions are documented and traceable, the integrity of the PMB is maintained and can be verified. This provides the CAMs with valid Control Account plans against which to execute and measure performance. The PMB should always reflect the most current plan for accomplishing the effort. Authorized changes must be promptly recorded in the system and incorporated into all relevant planning. Planning and authorization documents must be updated accordingly, prior to the commencement of new work.

The PEP outlines a change control process and EVMS provides the mechanism via Change Procedure 9 to initiate a change request from DOE through the project and DOE to request authorization of this change. Once the change is authorized, the documentation is updated (WAD, Schedule and Budget Baseline). Change Control Procedure 9 indicates that "the Job Managers must work with Project Controls to update all affected CAs and Work Authorization Forms (WAF) and Project documents that reflect scope, schedule and budget information. This must be accomplished in a timely manner, typically within 30 days" and preferably within the same time period. Once the approval is processed and approved through change control, the project can begin to perform work to the authorized new work scope and schedule. The project elected to eliminate the change control procedure requiring updated project documentation that would have required the WAFs to be updated authorizing the change to begin execution of the work.

The NSTX Upgrade project received authorization to perform and accelerate work and procurements from DOE and elected to authorize the CAMs to execute the work without formal change control, which is intended to provide a mechanism to document baseline changes, authorize the execution of the work and provide for a PMB for the NSTX Upgrade project to accurately measure performance and forecast project trends.

2.5.2 Conclusions and Recommendations

The following CARs and/or CIOs are submitted for disposition:

- CIO-01—EAC Tracking and Maintenance should be improved.
- CIO-04—Documentation requires corrections and clarifications.
- CIO-06—Eliminate inconsistencies in change control processes and procedures.

APPENDIX A

REVIEW PARTICIPANTS

Department of Energy Certification Acceptance Review for the
Princeton University-Princeton Plasma Physics Laboratory
Earned Value Management System (EVMS)
October 4-6, 2011

Department of Energy

Ethan Merrill, SC/OPA

Review Team (per ANSI Guidelines)

Organization and Analysis & Management Reports

Jim Fountain, OECM (GL #1-5)
Ethan Merrill, SC/OPA (GL #22-27)

Planning, Scheduling and Budgeting

Cathy Lavelle, BNL (GL #6-15)

Accounting Considerations

Christine Madonia, BNL (GL #16-21)
Jennifer Fortner, ANL (GL #16-21)

Revisions & Data Maintenance

Jennifer O'Connor, BNL (GL #28-32)

APPENDIX B

REVIEW AGENDA

Department of Energy Certification Acceptance Review for the
Princeton University-Princeton Plasma Physics Laboratory
Earned Value Management System (EVMS)
October 4-6, 2011

REVIEW AGENDA

Tuesday, October 4, 2011

8:00 a.m.	DOE Executive Session
8:30 a.m.	Welcome/Opening Remarks
8:35 a.m.	PPPL Laboratory Overview
8:55 a.m.	PPPL PMSD Overview
9:25 a.m.	NSTX Upgrade Project Overview
9:55 a.m.	EVMS Implementation on NSTX
10:55 a.m.	Lunch
11:55 a.m.	Tour of NSTX
12:55 p.m.	CAM Interview #1/Accounting Interview
2:40 p.m.	CAM Interview #2/Budget Office Interview
4:25 p.m.	DOE Executive Session
5:25 p.m.	Adjourn

Wednesday, October 5, 2011

8:30 a.m.	CAM Interview #3/Laboratory Management Interview
10:15 a.m.	CAM Interview #4/CAM Interview #5
12:00 p.m.	Lunch
1:00 p.m.	CAM Interview #5/CAM Interview #6
2:45 p.m.	Project Manager Interview/Project Controls Interview
4:30 p.m.	DOE Executive Session
5:30 p.m.	Adjourn

Thursday, October 6, 2011

8:00 a.m.	DOE Executive Session and Final Out-Brief Preparation
11:00 a.m.	Review Out-Briefing
12:00 p.m.	Adjourn

APPENDIX C

CORRECTIVE ACTION REQUESTS (CAR)

1. Subject: Accelerated schedule and added scope without formal baseline change.	2. Guideline Ref (if applicable): **6, 8, 9, 10, 11, 28, 29, 31, 32**	3. Control Number: **CAR-01**
4. CA#, WBS#, or Functional Area: Planning, Scheduling, Budgeting and Revision for CA# 1200, 1305,1306,2425,2440,2475,5200		

5. REQUIREMENT:

Guideline 6 – (ANSI/EIA-748B) requires the following:
– Schedule the authorized work in a manner that describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program.

Guideline 8 – (ANSI/EIA-748B) requires the following:
Establish time-phased budget baseline at Control Account Level where performance is measured.

Guideline 9 – (ANSI/EIA-748B) requires the following:
Establish budgets for authorized work with cost elements defined for internal management and control of subcontractors.

Guideline 10 – (ANSI/EIA-748B) requires the following:
Identify authorized work in discrete work packages; establish budgets for this work in dollars, hours, etc. where the CA is not divided into work packages, identify far term work in planning packages.

Guideline 11 – (ANSI/EIA-748B) requires the following:
Sum of all work packages and planning packages equals the control account budgets.

Guideline 28 – (ANSI/EIA-748B) requires the following:

Incorporate authorized changes in a timely manner, recording the effects of such changes in budgets and schedules. In the directed effort prior to negotiation of a change, base such revisions on the amount estimated and budgeted to the program organization.

Guideline 29 – (ANSI/EIA-748B) requires the following:
Reconcile current budgets to prior budgets in terms of changes to the authorized work and internal planning in the detail needed by management for effective control.

The budget needs to reflect the current authorized work.

Guideline 31 – (ANSI/EIA-748B) requires the following:

Prevent revisions to the program budget except for authorized changes. Changes outside the authorized baseline compromises the integrity of the performance data and reduces visibility of overall project variance from the plan.

Guideline 32 – (ANSI/EIA-748B) requires the following:
Document changes to the performance measurement baseline.

The PPPL Project Management System Description states the following:

1. Subject: Accelerated schedule and added scope without formal baseline change.	2. Guideline Ref (if applicable): **6, 8, 9, 10, 11, 28, 29, 31, 32**	3. Control Number: **CAR-01**
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PPPL PMSD – Section 1.3.2 page 13 The performance measurement baseline is a representation of the project execution plan (PEP). Proper maintenance of the baseline will prevent performance measurement against an outdated or unauthorized plan.

PPPL PMSD – Section 1.4.1 Work authorization ensures that all work performed on the project has been contractually authorized and properly planned prior to its execution.

PPPL PMSD Change Control Procedure 9 states: " The Job Managers must work with Project Controls to update all affected Control Account Plans/ Work Authorization Forms and Project documents that reflect scope, schedule and budget information and assure that these updates are consistent with the approved ECP." This must be accomplished in a timely manner, typically within 30days and preferably within the same time period.

6. DISCUSSION:

ANSI EIA -748-B Intent Guide states:

Intent Guideline 6 –"Scheduling authorized work facilitates effective planning, statusing and forecasting, all of which are critical to the success of projects. The integration of the technical, schedule, and cost aspects of the project results in the time-phasing of authorized discrete work for use as a performance measurement baseline." The schedule must agree with the project objectives, include all key events, and reflect a logical sequence of events. Ensuring that all team members are working toward the same project schedule is essential for monitoring progress, analyzing variances, and tracking corrective actions. The schedule must be reasonable as a baseline for achieving project requirements as defined by the customer and the PEP.

Intent Guideline 8 – "The time phased PMB (Performance Measurement Baseline) that represents the planned scope of all authorized work and schedule provides the program manger a reference to assess project performance. The establishment, maintenance and use of the PMB are indispensible for effective performance measurement. Since control account budgets and schedules also establish the constraints required for baseline control, care must be exercised in the establishment of control account budgets to ensure a viable scope/effort correlation. The maintenance of realistic budgets, directly tied to an established scope of work, is essential for each organization responsible for performing project effort. The PMB represents the formal plan for each control account manager to accomplish the authorized work assigned within the time defined by the authorized schedule and within the budget authorized."

Intent Guideline 9 – "An essential part of project planning and establishing a performance measurement baseline is the establishment of budgets for all the authorized work. No work should begin before all work is authorized by an initial work authorization document. As budgets and schedules are established and approved for all the authorized work at the Control Account Level, the work authorization is updated as required." The control accounts identify the appropriate cost elements associated with the work scope. It is important to include all resources required to accomplish the work scope. Each control account should contain resources necessary to complete the assigned effort and budgets reflecting these resources.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
C. Lavelle	**10/2011**				

1. Subject: Accelerated schedule and added scope without formal baseline change.	2. Guideline Ref (if applicable): **6, 8, 9, 10, 11, 28, 29, 31, 32**	3. Control Number: **CAR-01**
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Intent Guideline 11- "All control accounts must contain budget, schedule and scope of work and should realistically represent the scope of work assigned and budgeted to each control account. The control account manager should not have authorized scope without associated budget. A control account manager should not have authorized scope without associated budget."

Intent Guideline 28 – "A properly maintained performance measurement baseline is crucial to effective program management. The timely and accurate incorporation of contractual changes ensures that the information generated from the execution of the baseline plan provides an accurate picture of progress and facilitates correct management actions and decisions. Incorporate the work scope for authorized changes into the performance measurement baseline in a documented, disciplined, and timely manner. The timely and accurate incorporation of authorized and negotiated changes into the performance measurement baseline ensures that valid performance measurement information is generated for the new scope being executed. Adherence to this guideline helps to ensure that budget, schedule, and work remain coupled.

Intent Guideline 29 – "Budgets changes are controlled and understood in terms of scope, resources, and schedule. Budgets reflect current authorized work."
Intent Guideline 31 – "Changes made outside the authorized baseline control processes compromise the integrity of performance trend data and delay visibility into overall project variance from plan, this reducing the alternatives available to managers for project redirection or revisions."
Intent Guideline 32 – "By ensuring that budget and schedule revisions are documented and traceable, the integrity of the performance measurement baseline is maintained and can be verified. This provides control account managers with valid control account plans against which to execute and measure performance. The performance measurement baseline should always reflect the most current plan for accomplishing the effort. Authorized changes must be promptly recorded in the system and incorporated into all relevant planning. Planning and authorization documents must be updated accordingly, prior to the commencement of new work."

The PMB should reflect current program and project management plans for accomplishment of program objectives. If the maintenance of the baseline plan is compromised, the information on the management reports will be degraded.

PPPL PMSD Change Control Procedure 9 states: " The Job Managers must work with Project Controls to update all affected Control Account Plans/ Work Authorization Forms and Project documents that reflect scope, schedule and budget information and assure that these updates are consistent with the approved ECP." This must be accomplished in a timely manner, typically within 30days and preferably within the same time period.

7. OBSERVATION/FINDING:
The Centerstack failed resulting in a premature shutdown of the NSTX. As a result, the project requested from DOE (via email) authorization to accelerate work and add "new" scope to the project. The customer authorized the accelerated work (Attachment A) and added scope per Primavera schedule document titled "Pre-CD3 *New* Scope

Prepared By: **C. Lavelle**	Date: **10/2011**	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Accelerated schedule and added scope without formal baseline change.	2. Guideline Ref (if applicable): 6, 8, 9, 10, 11, 28, 29, 31, 32	3. Control Number: CAR-01
4. CA#, WBS#, or Functional Area: Planning, Scheduling, Budgeting and Revision for CA# 1200, 1305,1306,2425,2440,2475,5200		

request for approval" via email (Attachment B). The project authorized the CAMs (Control Account Managers) to begin working on the accelerated schedule which includes added scope (i.e. CA 2440-the NBI refurbishment - approved via email by DOE November 2010) and outlined in the schedule (Attachment B).

The CAM Interviews revealed five CAMs representing seven Control Accounts/Job numbers were authorized to either begin work on "new scope" or were authorized to accelerate work ahead of the baseline schedule:

WBS-Control Account-CA Description
1.1.2-1200 Vacuum Vessel and Support Structure
1.1.3.3.2-1305/ - Heating Coil,
1.1.3.3.3-1306 Inner PF Coils,
1.2.4.4-2425 BL relocation,
1.2.4.4-2440 NSTX Beamline2 Refurbishments,
1.2.4.7-2475 NBI Controls and Instrumentation,
WBS-NA -5200 – Control and Protection System,

During the Control Account Manager interviews, the CAMs acknowledged that the project manager had authorized new work scope and the acceleration of their work via email. The project did not follow-up with an authorized change request for formal approval per the PPPL change control procedure. The change control process would formalize the authorization by DOE and require a revision to the cost/schedule baseline and work authorization documentation formalizing the authorized change. This is a violation of Guideline 6, 8, and 10. These guidelines require that the integration of technical, schedule, and cost aspects of the project should result in the time-phasing of authorized discrete work in the cost/schedule baseline for use during performance measurement. These CAMS had revised their current schedule to reflect the acceleration of activities and the added scope and were directed via email to begin work (Attachment B) without any additional budget. Guideline 11 indicates a control account manager should not have authorized scope without associated budget."

All four CAMs had begun the work without initiation of the formal change control process and without the formal update to the work authorization documentation. This is a violation of Guideline 28 and 32. Guideline 28 requires that projects incorporate work scope for authorized changes into the performance baseline in a documented, disciplined manner. There were six requests for changes authorization from DOE going back to August of 2010 without any formal change control documentation prepared and processed for approval to capture any of the authorized changes. Guideline 32 states that planning and authorization documents must be updated prior to the commencement of new work. The work authorization documents were not updated (Guideline 31) because the baseline change process was not initiated to document the change. Guideline 31 indicates the work authorization documents must reflect authorized changes. Therefore, since there was no formal change authorization, the baseline was not revised and the project was measuring performance against a baseline which does not represent the work that is currently being executed.

In addition, several procurements were placed, in advance of CD3, based on email direction from the customer (Attachment C) to the project manager to accelerate work and add additional scope to the project baseline.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
C. Lavelle	**10/2011**				

1. Subject: Accelerated schedule and added scope without formal baseline change.	2. Guideline Ref (if applicable): 6, 8, 9, 10, 11, 28, 29, 31, 32	3. Control Number: CAR-01
4. CA#, WBS#, or Functional Area: Planning, Scheduling, Budgeting and Revision for CA# 1200, 1305,1306,2425,2440,2475,5200		

The PEP outlines a change control process and EVMS provides the mechanism via Change Procedure 9 to initiate a change request from DOE through the Project and DOE to request authorization of this change. Once the change is authorized, the documentation is updated (Work Authorization, Schedule and budget baseline) Change Control Procedure 9 indicates that "the Job Managers must work with Project Controls to update all affected CAs and WAF and Project documents that reflect scope, schedule and budget information. This must be accomplished in a timely manner, typically within 30days" and preferably within the same time period. Once the approval is processed and approved through change control, the project can begin to perform work to the authorized new work scope and schedule. The project elected eliminate the change control procedure requiring updated project documentation which would have required the Work Authorization Forms (WAF) to be updated authorizing the change to begin execution of the work. This is a violation of Guideline 32.

The Performance Measurement Baseline must be up to date and should include all authorized changes from DOE. The NSTX project received authorization via email from DOE to accelerate work ahead of the baseline plan. Certain procurements and new scope (see attachment A) were authorized by DOE program to the Federal Project Director and site office for early placement ahead of CD3 approval for Fabrication and Construction. This DOE authorization should be included in the project baseline via the project change control procedure to ensure the control account managers have formal authorization to proceed with early placement of new procurements and the addition of "new scope" to the project. One example is the procurement of TF conductor Assemblies as a fixed price subcontract which was authorized for award based on email authorization without a change to the baseline cost/schedule or formal change control documentation. This contact value included Fabrication, test of 54 TF conductor assemblies to be delivered in 2012. The value of this contract is $1.1M. (See Attachment D). Per the schedule, a portion of this contract was awarded on March 31, 2011. The authorization to place this procurement was via email from DOE to the project and from the project to the control account manager. The change control process/procedures, work authorization documentation and revision to the cost/schedule baseline was not initiated or implemented.

The project baseline change control procedure was not followed, the work authorization documents for each control account were not updated to reflect the new authorization. Therefore, the Control Account Managers were executing work without formal authorization based on the Project PEP, and PPPL Change control procedures. Since the baseline and project documentation was not updated to reflect this change in schedule and new scope additions to the project, the maintenance of the baseline plan is compromised, the information on the management reports will be degraded and the variance analysis is being written against an out of date baseline rendering the variances analysis process ineffective.

Summary, the NSTX project received authorization to perform and accelerate work and procurements from DOE and elected to authorize the CAMs to execute the work without formal change control which is intended to provide a mechanism to document baseline changes, authorize the execution of the work and provide for a performance measurement baseline for the NSTX project to accurately measure performance and forecast project trends.

Prepared By: **C. Lavelle**	Date: **10/2011**	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Variance Analysis Reporting must be at the Control Account Level as a Minimum	2. Guideline Ref (if applicable): 22, 23, 25, 26	3. Control Number: CAR-02
4. CA#, WBS#, or Functional Area: Analysis and Management Reporting -(ANSI GL #22-27)		

5. REQUIREMENT:

Guideline 22 (ANSI/EIA-748) requires the following: "At least on a monthly basis, generate the following information at the control account and other levels as necessary for management control using actual cost data from, or reconcilable with, the accounting system: 1) Comparison of the amount of planned budget and the amount of budget earned for work accomplished. This comparison provides the schedule variance. 2) Comparison of the amount of the budget earned and the actual (applied where appropriate) direct costs for the same work. This comparison provides the cost variance."

Guideline 23 (ANSI/EIA-748) requires the following: "Identify, at least monthly, the significant differences between both planned and actual schedule performance and planned and actual cost performance, and provide the reasons for the variances in the detail needed by program management."

Guideline 25 (ANSI/EIA-748) requires the following: "Summarize the data elements and associated variances through the program organization and/or work breakdown structure to support management needs and any customer reporting specified in the contract."

Guideline 26 (ANSI/EIA-748) requires the following: "Implement managerial action taken as the result of earned value information."

6. DISCUSSION:

The NDIA EVMS Intent Guide states the following regarding GL # 22: "On at least a monthly basis, generate schedule variance and cost variance data that supports management control needs by allowing the project manager to focus on those areas in need of attention. This ensures a generation of valid variances for analysis purposes."

The NDIA EVMS Intent Guide states the following regarding GL # 23: "The purpose of this guideline is to ensure both significant schedule and cost variances are analyzed, at least monthly, at a level of detail required to manage the effort; i.e., to enable management decision-making and corrective action. "

The NDIA EVMS Intent Guide states the following regarding GL # 25: "Use the same data for internal management needs and for reporting to the customer. Summarizing performance information assists senior levels of management to focus on the significant problems that require their intervention."

The NDIA EVMS Intent Guide states the following regarding GL # 26: "Identify and implement corrective actions based on earned value variance analysis to achieve project objectives. Regular monitoring of the performance data helps keep the program within its cost and schedule baseline objectives. Performance measurement data should be utilized by all levels of management to promote effective project execution."

7. OBSERVATION/FINDING:

Observations:

The Team reviewed the PPPL Project Management System Description, Revision 1, June 2011 as the basis for the Control Account Manager (CAM) and the overall project team direction within EVMS execution and ensuring ANSI compliance. The Team notes:

> Section 2.3, Performance Analysis, Section 2.3.2, Variance Analysis states: Variance analyses provide the means for the control account manager to derive and communicate cost, schedule, and EAC divergences from the performance measurement baseline. The control account structure is integral with the WBS and

Prepared By: E. Merrill	Date: 10/2011	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

will accurately summarize budgets, earned value, actual costs and the associated variances up through the WBS and the project organization. Variance analysis above the control account is performed in support of internal management needs and external customer requirements. Section 2.3.3, Variance Thresholds, states: Variance analysis is conducted at thresholds identified in the specific project's Project Execution Plan. The Project Manager may establish thresholds to respond to specific project or PPPL needs. Section 2.3.5, Control Account Performance Analysis, states: The control account managers prepare variance analysis statements or explanations for each control account exceeding established variance thresholds. Control account managers are responsible for determining the cause of the variance and its impact on the control account and the related activities and milestones, developing a corrective action plan (as appropriate), and including this information in the pertinent sections of the monthly report.

The Team reviewed the Project Management System Description, Revision 1, June 2011, Appendix E, PMSD Reporting Procedures, Procedure 8 Monthly Status Reporting and notes the following:

Section 4.3, Variance Reporting and Corrective Action, states: If variances exceed the defined thresholds, then the CAM evaluates the variances, ascertaining the cause and impact, and if required, proposes a corrective action to minimize any negative impact to the project. The CAM prepares a Variance Report (Figure 2) and submits the report to Project Controls and the Project Manager for review and acceptance.

The Team reviewed the National Spherical Torus Experiment (NSTX) Upgrade Project Execution Plan, Revision 1, September 22, 2011 and notes the following:

Section 8.4, Reporting, Explanations of variance to plan will be submitted to the FPD and into PARSII on a monthly basis when any WBS Level 2 cumulative to date variance exceeds the following thresholds:

SV +25% or -10% and >$50K and >10% of BAC or any impact on any DOE Level 1 or 2 Milestone;

CV +25% or -10% and >$50K and >10% of BAC

If a WBS Level 2 VAR is required, the VAR will be prepared at the Control Account Level for those control accounts that drive the WBS Level 2 variance. The project manager may also selectively, at his/her discretion, request VARs for control accounts that he/she feels requires further explanation even if the WBS Level 2 threshold has not been exceeded.

The Team reviewed the Control Account Variance Analysis reports supporting the NSTX Upgrade Project for the months June – August 2011.

Findings:

Overall, the team was in concurrence with much of the PPPL documentation reviewed concerning how variances should be handled at the project level. The Project Managers, Project Directors, CAMs, and Project Controls Staff meet on a monthly basis to evaluate the performance of the projects. During these meetings the project variances are evaluated and an analysis is prepared. The quality of the Variance Analysis Reports (VARs) varies greatly and the level of detail ranges from acceptable to incomplete. This prevents the project from effectively communicating the cause and proposed solution. In some instances the VARs are not prepared by the CAM. For the NSTX Upgrade Project, the VARs are not consistently prepared at the Control Account Level. The VARs represent a

1. Subject: Variance Analysis Reporting must be at the Control Account Level as a Minimum	2. Guideline Ref (if applicable): 22, 23, 25, 26	3. Control Number: CAR-02
4. CA#, WBS#, or Functional Area: Analysis and Management Reporting -(ANSI GL #22-27)		

rollup of Control Accounts and provide a summary of the analyses. Because the VARs reference former PPPL job numbers and control accounts are based on these rather than the WBS, there are concerns regarding consistency and traceability.

One of the main expectations of ANSI Guideline # 23 is to provide visibility into root causes, and take actions to achieve better project completion. Accurate and reliable EVMS data supports management control needs by allowing the project manager to focus on those areas in need of attention. Another expectation is to foster analyses and identification of root causes of the variances and their resulting impacts at the Control Account Level. In order for control account managers to have full management control responsibility, they must be able to analyze the work performance and associated costs against the performance measurement baseline. Such did not seem possible for the project given the single sentence structure for cause and corrective action displayed in the monthly variance reports.

Summary: This CAR is issued because the review team believes VARs are not consistently documented or analyzed at the Control Account Level with sufficient information to permit proper and timely corrective action on the NSTX Upgrade Project.

As stated in the Out briefing by the Office of Science Review (SC-28) team on 10/6/11:
Variance Analysis Reporting must be at the Control Account Level as a minimum.

8. RECOMMENDATION:
The Review Team recommends:

- That PPPL establish a consistent Control Account Level based on the WBS (Level 4 or Lower) and ensure that analysis is prepared at that level, with reference to the appropriate WBS element on CPR Form 5, such that their managers and others impacted by the control account can understand the variance root cause, associated impacts on project scope, schedule, and budget, and the corrective action plan.
- That the EVMS System Description and other necessary documentation include VAR examples that show a well written VAR that describes variance root cause, associated impacts on scope, schedule, and budget and corrective action plan.
- That PPPL develop a procedure for preparing variance analyses to ensure consistency across the project.
- That the upper WBS Level 2 SV/CV variance analysis thresholds be lowered to +15% and that the thresholds be rewritten to change “and” to “or”, i.e., SV +15% or -10% OR >$50K and >10% of BAC or any impact on a DOE Level 1 or 2 Milestone and CV +15% or -10% OR >$50K and >10% of BAC.

Prepared By: E. Merrill	Date: 10/2011	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Schedule Integrity	2. Guideline Ref (if applicable): 6	3. Control Number: CAR-03
4. CA#, WBS#, or Functional Area: Scheduling - All Control Account activities -(ANSI GL #6)		

5. REQUIREMENT:
Guideline 6 – (ANSI/EIA-748B) requires the following:

" Schedule the authorized work in a manner that describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program."

6. DISCUSSION:

The NDIA EVMS Intent Guide states the following regarding GL #6:

"Establishment of significant interdependencies between work packages and planning packages (or lower-level tasks/activities) that determine total work time and critical path through the project.

"There must be horizontal and vertical integration of the schedule through the framework of the WBS." Vertical integration is critical to the accurate forecasting of start and finish dates for the activities in the schedule. Accurate calculation of dates is based on accurate definition of activity predecessor and successor relationship.

"Significant interdependencies should be defined at a consistent level of detail to support development of a critical path. The schedule should be designed for effective management purposes and contain a critical path for the entire contractual period of performance. "

"The schedule network relationships support the development of a critical path for development projects."

"Discrete activities/tasks along the critical path have the least amount of float." The critical path is an important part of the monthly schedule analysis and management assessment. In order to have an accurate critical path, the logic ties must be accurate, the schedule must not be artificially constrained to ensure the schedule float is accurate. Accurate schedule float will correctly determine the project critical path and near critical activities.

7. OBSERVATION/FINDING:

The NSTX Upgrade Project Schedule has been developed as a network of logically linked tasks organized by WBS and Control Account. The integrity of the project schedule is necessary in order to perform effective schedule analysis, critical path analysis and identification of near critical path activities. The accurate and thorough integration of the schedule activities ensures that the schedule tool can adequately calculate total float values to provide project management with an accurate assessment of the activities that are nearing or on the critical path. The calculation of the critical path is a valuable management tool for analyzing and forecasting project schedule progress. Incorrectly linking the schedule (or missing schedule linkages) that may impact on the project scheduling process providing accurate projection of the critical path, near critical items, inaccurate assessment of the completion of milestones or possibly an inaccurate projection of the early project completion date.

The NSTX Upgrade project schedule is in Primavera version 3.0. The review team requested a copy of the project schedule in P6 to run the schedule diagnostics report to access the integrity of the project schedule. The Schedule Log Report was run from the XER file provided to the review team in P6 (See Attachment A). The schedule log

Prepared By: C. Lavelle	Date: 10/2011	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Schedule Integrity	2. Guideline Ref (if applicable): 6	3. Control Number: CAR-03
4. CA#, WBS#, or Functional Area: Scheduling - All Control Account activities -(ANSI GL #6)		

report indicates the NSTX upgrade project schedule currently has 2126 activities and 2669 relationships with a total of 608 open ends and 401 constraints. Based on the number of activities in the project schedule there are a relatively large number of logic errors in the project schedule. The number of activities in the schedule without predecessors is 432, the number of activities in the schedule without successors is 176. A schedule that is highly constrained with a relatively large number of activities are not logically linked (activities either without predecessors and successors) will not calculate total float accurately and also will not provide an accurate critical path. The lack of a horizontally integrated schedule (GL6) degrades schedule effectiveness as a tool for analyzing the critical path and the near critical paths and float values.

When the Critical Path was run by the project team using the XER file provided by the project and setting the criteria for Total Float <= 0, two activities are listed. (See Attachment B) The critical path presented to the Review team had approximately 100 activities (See Attachment C). This is an example of how the schedule is not logically linked and is artificially constrained limiting the scheduling tool from correctly calculating the project critical path.

When the Critical Path is run setting the criteria as Total Float <= 1, approximately 50 activities are listed. (See Attachment D) The 50 activities were related in part to Control Accounts 8200, 2450, 6100 and 8250. Activities on the critical path provided by the project were from control accounts 1304, 1305, 1302, 8250 and 7900. .There is very little commonality between the critical path run by the review team and the critical path run by the project. This is another example of how the schedule is not correctly calculating the critical path because not all the activities in the schedule are logically linked and too many activities are artificially constrained limiting the scheduling tool from correctly calculating the project critical path and near critical activities.

In summary, the NSTX project schedule needs to be reviewed for schedule integrity. Schedule integrity is necessary in order to ensure the schedule accurately represents the project activity sequence, the correct forecast of schedule start and finish dates for all activities , milestones, and project early start finish dates. A review of all activities and logic will ensure that the project schedule provides an effective and valuable management tool for assessing and analyzing schedule progress; and will ensure that the project schedule represents the true critical path and near critical activities to assist project management in effectively managing the project schedule.

Prepared By: C. Lavelle	Date: 10/2011	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Inconsistent LOE vs Discrete	2. Guideline Ref (if applicable): 12	3. Control Number: CAR-04
4. CA#, WBS#, or Functional Area: Planning, Scheduling and Budgeting		

5. REQUIREMENT:

ANSI/EIA-748 (ANSI) GL # 12 state: "Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is not measurable or for which measurement is impracticable may be classified as level of effort."

PPPL PMSD (EVMS) – Rev 01, June 2011: The PPPL Project Management System Description (PMSD) states under section 2.1.1. Requirements for Employing Earned Value Methodology: "Non-discrete work packages, such as for project management and general support—work that cannot be readily measured—is tracked using the Level-of-Effort (LOE) technique:. The PMSD goes on to state under section 2.1.2.3 Level of Effort: "Some project activities do not produce tangible outcomes that can be measured objectively. An example is project management. This activity consumes project resources and should be included in EVMS planning and measurement. In these cases, the LOE technique is used for determining earned value. A planned value is assigned to each LOE task for each measurement period. This planned value is automatically credited as the earned value at the end of the measurement period."

6. DISCUSSION:

DOE O 413.3B (Order) provides additional project team guidance under (Appendix B, Responsibilities) Federal Project Director: "Ensure timely, reliable and accurate integration of *contractor performance data* into the project's scheduling, accounting, and performance measurement systems, to include PARS II."

NDIA EVMS Intent Guide (NDIA) relative to ANSI GL # 12 states, in part: "Level of effort work packages should be separately identified from discrete effort work packages and apportioned effort work packages. Budgets for level of effort activity must have a sound basis of estimate and be time-phased to properly reflect when work will be accomplished. LOE budgets may be planned at either the Control Account Level or at the same level as discrete or apportioned work packages."

7. OBSERVATION/FINDING:

As stated in the OPA out briefing to PPPL on 10/6/2011, the committee's findings for CAR # 4 were: "Inconsistent identification and application of Level of Effort (LOE) and Discrete across Control Accounts".

During the committee's discussions with the NSTX CAMs and review of there working relationship with their controls support it was clear that their accounting for project management time was inconsistently recognized as LOE at best, and at worst, simply lumped into discrete accounting for all PM hours worked, even though admittedly for what appeared to be LOE work.

It is the committee's position that the inconsistent reorganization of the CAM's project management activities as LOE or even as LOE in different measurements, has the potential to negatively impact the accuracy of performance claims for discrete work as well as misrepresent the actual project management impact on a control account. Granted that LOE work packages/activities should be limited, project management activities are clearly LOE as defined in the PPPL PMSD and as well as in ANSI and should be accounted for so as to avoid the risk of masking performance that results from the other discrete measured effort.

Prepared By: **Jim Fountain**	Date: **10/20/2011**	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:

1. Subject: Inconsistent LOE vs Discrete	2. Guideline Ref (if applicable): 12	3. Control Number: CAR-04
4. CA#, WBS#, or Functional Area: Planning, Scheduling and Budgeting		

Additionally, during a few of the NSTX CAM interviews it was admitted that many project management activities were not felt to be PM at all, such as developing an EAC and producing reports, but rather were simply "part of the job" and assumed to be discrete work. These admissions, albeit well intended, speak to an inconsistent measurement of discrete work and produce a non-compliance result to ANSI. Also, when taken in the broader context of how project management activities were found inconsistently measured across so many of the CAMs it was felt to be systemic to the NSTX project. This was largely the result of extrapolating result against the large number of CAM's that exist in the NSTX upgrade project (16) across the high number of control accounts (42) and projecting the opportunity for potentially a gross distorting of the accuracy of discrete work measurement. It was simply too great to ignore.

As such, the committee felt this spoke of a clear ANSI violation that was systemic to the NSTX project and warranted the issuance of CAR # 4 for non-compliance with ANSI guideline # 12.

8. RECOMMENDATION:

The Committee recommends that policies and procedures be documented and enforced to require ALL CAMs to use the LOE EV method for their Project Management non-measurable activities and not simply let PM be absorbed in the overall discrete method used – or not accounted for at all. The issue is not one of too much LOE or not defining LOE accurately; it is that lack of consistency across the CAM's in either using LOE or not and how it is measured. The recommendation of this CAR is to have PPPL focus on a consistent and documented approach that is enforced across all control accounts by all CAMs.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
Jim Fountain	**10/20/2011**				

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APPENDIX D

CONTINUOUS IMPROVEMENT OPPORTUNITIES (CIO)

1. Subject:	2. Guideline Ref (if applicable):	3. Control Number:
Establish Proper EAC Tracking and Maintenance	27	CIO-01

4. CA#, WBS#, or Functional Area:
All WBS elements

5. REQUIREMENT:
Guideline 27 - Develop revised estimates of cost at completion based on performance to date, commitment values for material, and estimates of future conditions. Compare this information with the performance measurement baseline to identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.

6. DISCUSSION:
Intent Guideline 27 - On a monthly basis, the control account manager should review the status of the expended effort and the achievability of the forecast and significant changes briefed to program management. This analysis should focus on performance to date within the control account, an assessment of the effort to complete the remaining work, and an evaluation of the type and quantity of resources required to complete the effort. When updates are made to existing forecasts of cost to complete, significant changes are briefed to program management. Prudent maintenance of the control account-level EAC by the control account manager ensures that the EAC reflects a valid projection of project costs.

Comparisons of this estimate to budgets for the associated effort must be made frequently enough for management to ensure project performance and resource availability will not be adversely impacted. Prudent maintenance of the control account-level EAC by the control account manager ensures that the EAC reflects a valid projection of project costs.

A properly established and maintained estimate at completion will ensure continuing visibility into resource needs (people, funding, etc) and lead to project success for both the customer and the contractor. Accurate estimates support the customer's ability to provide sufficient funding to the project and enhance internal management's visibility into critical resource requirements.

7. OBSERVATION/FINDING:
Not all CAMs were able to explain their EAC value. From conversations during CAM interviews, it became clear that most CAMs rely heavily on Project Controls to perform the EAC analysis and update process for them. Some CAMs interviewed expressed surprise at their EAC growth and were not able to defend where the value came from. An example of this can be found in control account 1200 where the EAC value was approximately $500K higher than the BAC. The CAM was not able to explain what that value was comprised of and was surprised to see his EAC had been adjusted. One CAM stated that he has nothing to do with his EAC and relies on Project Controls to update his EAC for him. Examples of this were evident in control account 1304 where the EAC showed a $762K delta, and control account 1305 where the EAC showed a $443K delta. The CAM stated he had no documentation to support those EAC values and assumed Project Controls entered the adjustment for him. Another EAC value did not reflect the CAM's statement of explanation that his over-runs would be absorbed by his under-runs. Examples of this were found in control accounts 2490, 8200 and 8250.

8. RECOMMENDATION:
It is recommended that further training on EAC analysis and maintenance be conducted with the CAMs, and the CAMs should take on a more active role in maintaining their EAC. The training should include the value a properly maintained EAC adds to the project, as well as how to determine what justifies an EAC update. It is also recommended that documentation be kept on file to reflect the basis of the adjustment, and that both additions and subtractions be maintained in the EAC in order to reflect a valid projection of project costs.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
Jennifer O'Connor	10/12/11				

1. Subject: Actual Coast Reconciliation	2. Guideline Ref (if applicable):	3. Control Number: CIO-02
4. CA#, WBS#, or Functional Area: All WBS elements		

5. Description:

GAAP internal controls guideline "Segregation of Duties" states: no person will hold no more than one role amongst the following business critical roles: authorization, recording, asset custody, and reconciliation.

OBSERVATION / FINDING:

One person in Project Controls is responsible for validating the Actual Cost file which comes from the accounting system. The same person in Project Controls is also responsible for creating the final version of the file from data in the accounting system which is entered into their EV system. Even though the individual has others in the Project Controls group review the final version, having one person and/or group create the final version and perform the reconciliation/validation function for Actual cost data violates the "Segregation of Duties" internal controls guideline.

In the October 5, 2011, daily out brief, Ron Strykowsky, Steve Languish and Ron Egebo commented they will separate the roles by engaging PPPL's accounting office to validate the Actual Cost File and have Project Controls as the recording role. However, it is currently being handled by the same person.

RECOMMENDATION:

It is recommended that the Actual Cost file be validated by the accounting offices and entered into the EV system by Project Controls to ensure the integrity of the Actual Cost data reported on a monthly basis.

Prepared By: **C. Madonia**	Date: 10/6/2011	Reviewed By:	Date:	Supplier:	PMO:

1. Subject:	2. Guideline Ref (if applicable):	3. Control Number:
EVMS Training Not Adequate	All	CIO-03

4. CA#, WBS#, or Functional Area:
PPPL Policies and Procedures for EVMS training; encompassing all 5 ANSI process areas.

5. REQUIREMENT:
ANSI/EIA-748 (ANSI) defines guidance for CAMs, Project Managers, Project Controls support and other project / program leadership personnel. Within ANSI it states in part: The primary purpose of the [EVMS] system is to support program management. The system is owned by the organization and is governed by the organization's policies and procedures… This EVMS standard does not require or suggest that an organization should create a descriptive document that is outside of normal requirements or restrict an organization's ability to effectively implement desired system changes. At the same time, it is duly noted that it is good business practice to provide adequate policies and procedures where the subject processes are expected to be implemented and *applied effectively enterprise wide*.

PPPL PMSD (EVMS) – Rev 01, June 2011: The PPPL Project Management System Description (PMSD) states, in part: [Introduction] "For each PPPL project, the responsible PPPL Department Head or Program Manager shall review the overall project requirements, complexity, visibility, cost, safety, security, and schedule and identify the specific training/qualification requirements for the Project Manager." The PMSD goes on to state under section 1.3.4 Control Account Planning: "Control account planning consists of those efforts needed to establish time-phased budgets for each control account identified for project execution." Under section 1.4.3 Work Authorization Document: With the completion of the control account planning process for each control account, the total authorized work is released to the responsible organizations based on the approved control accounts." The PMSD goes on to state under section 6.4 Responsibilities of the PPPL Project Management Officer and Cognizant Project Management: "Ensuring compliance with applicable portions of PPPL's PMSD; Ensuring project managers are properly trained and qualified".

6. DISCUSSION:
DOE O 413.3B (Order) states under (Appendix B) Responsibilities: " Key roles and responsibilities of line managers are: [Program Managers and Heads of Field Organizations] Oversee the project line management organization and ensure the line project teams have the necessary experience, expertise, and training…"

NDIA EVMS Intent Guide (NDIA) relative to training in policy and procedures states that the goal of an EVMS is twofold: *First, to ensure that organization processes and procedures are being followed. Second, it confirms that organization processes and procedures satisfy the guidelines in the ANSI/EIA 748.* Deploying and maintaining an effective implementation of a compliant Earned Value Management System requires a documented EVMS training program, including refresher training for project personnel, that is consistent, accurate and aligned with overall organizational and project and program goals and objectives.

7. OBSERVATION/FINDING:
As stated in the OPA out briefing to PPPL on 10/6/2011, the committee's findings for CIO # 3 were:
"Recommend additional EV training, some examples include: a) PPPL change control processes, procedures and responsibilities (when and how); b) EAC; and c) understanding of Control Account Plans".

The committee observed that current project delivery team training is on-going but provided in an as-needed or at a project high-level across the organization. It is often conducted informally between the Controls Account Manager (CAM) and the Project Controls Manager (PCM), as needed, and at various levels of rigor, depending upon the

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
Jim Fountain	**10/20/2011**				

specific experience of the CAM and tailored for each project need. This approach appeared to the committee to be too susceptible to CAM and PCM expertise rather than a more rigorous and consistent message of content and needed policies and procedures. This appeared especially true during interviews where such critical subjects as how a change should be processed, how an estimate at completion should be computed and whether to even have – and use, a control account plan to enforce project management effectiveness. The result appeared to be an overall lack of any defined, consistent and standardized rigor driven from the from the PPPL project leadership to those working at the Control Account Level.

Through the interviews the Committee found this approach to EVMS training, although well intended, allowed gaps to occur by CAMs and PCMs against the written policies within PPPL. Often it appeared there was a lack of understanding and awareness or only an 'occasional' application of any PPPL-wide EVMS policies or procedure. This permitted the potential for differences in EVMS understanding and/or execution across Control Accounts and within CAM/PCM teams operating on the NSTX upgrade project. Although not significant enough to warrant an ANSI violation of non compliance with any particular guideline, the Committee felt this approach to training clearly fostered an inconsistent application of the EVMS across NSTX project staff. This approach could also indirectly encourage individual project team approaches that, again well-intentioned, could lead to gaps that could produce inaccuracies in data or loss of reporting reliability across an entire project timeline and budget.

8. RECOMMENDATION:

The Committee recommends that PPPL deploy EVMS training that is consistently and rigorously applied so that the message becomes a part of the normal work process of functioning as a CAM or a PCM. A training venue, especially in the areas of change control, EAC and the development and usage of a comprehensive Control Account Plan should deliver results that show CAMs and PCMs have integrated the teaching into their everyday work methods and not just 'taken' a class or reviewed an online assignment; then "went back to work". The intent of the Committee's recommendation is not so much to request training is "conducted" but that a training program is focused on the CAMs and PCMs "using" the training and ensuring the consistent and continuous application of the EVMS policies and procedures across all Control Accounts.

1. Subject: Documentation Clarifications and Corrections	2. Guideline Ref (if applicable): All	3. Control Number: CIO-04
4. CA#, WBS#, or Functional Area: All Areas		

5. Description:
A variety of inconsistencies and clarifications were discovered when the team reviewed PPPL and NSTXU documentation. Four major areas of improvement are outlined below.

A. UB, Management Reserve, and Contingency:
The EVMS description does not address provisions for undistributed budget or processes/procedures for managing such. The team could find no process that addresses the tracking, use, distribution, and accounting for undistributed budget. The FAR has provisions for contract letters of authorization to proceed which authorize additions/deletions of scope and budget. Should DOE issue a letter of authorization to proceed pending the preparation, review, and approval of a baseline change proposal, the PPPL projects currently have no process for managing such budget until the baseline change proposal is approved. Contract authorizations to proceed could direct additional scope and budget or the removal of scope and budget. Without a provision for UB, the projects have no process for segregation and management of such budget into a temporary holding account. The EVMS description should have a provision for UB and a process for the managing a UB holding account.

Additionally, the EVMS description is unclear on the use and definition of Management Reserve and Contingency. The PPPL EVMS description currently describes in sections 1.3.8, 4.1.3.5, and 4.3 the use of "Contingency Reserve" but Figure 1.2 depicts a distinct Contingency and Management Reserve. The review team found the use of this combined term confusing. Further, the NSTXU PEP references Contingency and states that the PPPL EVMS description provides a formal process for: "Controlling management reserve and authorized allocated contingency via the change control process."
The team recommends that PPPL establish the correct terminology and usage of UB, Management Reserve, and Contingency in the PPPL EVMS description.

B. EVMS Responsibility within Organizations:
The PPPL EVMS description currently outlines the responsibilities for oversight and implementation of the EVM and project management processes and systems as "delegated by the Deputy Director for Operations to the Project Management Officer who will be supervised by the Associate Laboratory Director for Engineering and Infrastructure." This relationship is further clarified in the EVMS description as it relates to various project size and type. While this matrix relationship is very well explained, the system description makes no reference to the involvement of PPPL CFO. Based on team observations and interviews, it is recommended that the matrix relationship between engineering and infrastructure and CFO be clarified in the EVMS description.

C. Inconsistencies between Project Documents:
Inconsistencies were found while reviewing project documentation. For example, the WBS Dictionary, Project Execution Plan (PEP), and Responsibility Assignment Matrix (RAM) all contained errors in outlining the current WBS, CA, and descriptions. These documents should be subjected to a detailed quality review and all errors corrected prior to CD-3 review. Many issues regarding the WBS Dictionary and RAM were corrected prior to the review's conclusion (see CIO07 for example) but other corrections remain in addition to a detailed quality check. Each document should be placed under configuration control (version control) for these changes.

Prepared By:	Date:	Reviewed By:	Date:	Supplier:	PMO:
J. Fortner	10/2011				

1. Subject:	2. Guideline Ref (if applicable):	3. Control Number:
Documentation Clarifications and Corrections	All	CIO-04
4. CA#, WBS#, or Functional Area: All Areas		

D. Formal Documentation versus Verbal:

It was evident to the review team that PPPL has a culture of open communication. This proves beneficial when discussing project issues and managing strategies. However, this can become a downfall if formal documentation of decisions does not take place as follow-up to verbal communication. Instances regarding authorization of work scope ahead of schedule, for example, should not be handled only via verbal communication or email. The team recommends that the already existing culture of communication be enhanced by adding the element of formal documentation.

Prepared By:	Date:	Reviewed By:	Date:	Supplier:	PMO:
J. Fortner	10/2011				

1. Subject: No EVMS documentation of procedure for how to establish consistent % complete across CAM's	2. Guideline Ref (if applicable): 7	3. Control Number: CIO-05
4. CA#, WBS#, or Functional Area: Planning, Scheduling and Budgeting		

5. REQUIREMENT:
ANSI/EIA-748 (ANSI) GL # 7 states: "Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress."

PPPL PMSD (EVMS) – Rev 01, June 2011: The PPPL Project Management System Description (PMSD) states under section 2.1.2.1 Discrete Work: [Expert Opinion]: "Employed at each measurement period, when the responsible worker or manager makes an assessment of the percentage of work complete…The CAM determines percent complete, preferably based on some sort of objective measurement of work completed and remaining..." The PMSD goes on to state in section 2.2.3 Evaluation of Planned Value: "…To avoid unrealistic variances, the PV is established according to the control account manager's decision on how the work is to be accomplished, and the earned value method is chosen to ensure that EV is claimed in the same manner as the PV was planned… Accuracy of determining actual performance is directly related to the ability to accurately determine progress and earned value within a given work package or control account..."

6. DISCUSSION:
DOE O 413.3B (Order) states under (Appendix C, Topical Areas) Design Maturity: "The appropriate completion percentage is dependent upon the type of project…" Additional guidance is found under Key Performance Parameters: "A Key Performance Parameter is defined by CD 2 and is a characteristic, function, requirement or design basis that if changed would have [an impact] on the system or facility performance, schedule, cost and/or risk."

NDIA EVMS Intent Guide (NDIA) for ANSI GL # 7 states in part: "Identify objective interim performance measures within control accounts (or lower-level tasks/activities) to enable accurate performance assessment each month. The master schedule includes key program and contractual requirements." The Intent Guide identifies the following typical attributes of guideline 7:

- "Objective completion criteria are determined in advance and used to measure progress to determine achievement of milestones or other indicators. "
- "Interim milestones and lower-tier tasks serve as indicators of progress against which the control account manager monitors progress. "

7. OBSERVATION/FINDING:
As stated in the OPA out briefing to PPPL on 10/6/2011, the committee's findings for CIO # 5 were: "Recommend including documentation of Earned Value technique (e.g. percent complete) in each Work Authorization Form".

The committee observed in pre-document review that the PPPL Project Management System Description (PMSD) and supporting policies provide a good basic explanation of the EVM performance measurement techniques CAMs are to use and specify that when the "percent complete" technique is appropriate. But nowhere did it say 'how' the percent complete was to be computed. The committee admits that computing percent complete is, as defined in the above section, the matter for the CAM to decide; but what happens if CAM's changed during execution of a Work Package? The inconsistency and reliance on the individual expertise only, of the CAM is the core issue that calls the resulting accuracy of the performance claim for EV into question.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
Jim Fountain	**10/20/2011**				

1. Subject:	2. Guideline Ref (if applicable):	3. Control Number:
No EVMS documentation of procedure for how to establish consistent % complete across CAM's	7	CIO-05
4. CA#, WBS#, or Functional Area: Planning, Scheduling and Budgeting		

More specifically, during the detailed interviews of the NSTX upgrade project CAMs and PCMs the committee found that some activities contained weighted steps or milestones but others did not. Also, some measurements contained observational basis from actual assessments while others were based upon merely printed data outputs. In many cases, the method for determining percent complete was too focused on the relative expertise of the CAM and/or PCM and their relationship with the contractor performing the execution. It was felt that this could lend itself to potential variances over time as personnel are changed. Further, observational methods are subject to differences in how the individual project work package is being assessed due to personal preferences.

In the final assessment the committee felt there existed a well-intentioned approach to leveraging CAM and PCM expertise but too much allowance for inconsistency of performance claims over time, especially given a potential for personnel changes. Clearly the approach taken, although not warranting an ANSI violation for non-compliance, calls for greater documented guidance on how to consistently and continuously take percent complete across ALL CAM's and PCM's and control accounts.

8. RECOMMENDATION:

The Committee recommends that across all Control Accounts the Work Authorization Forms have both the specific method for claiming performance clearly spelled out but also the "process" by which this performance is to be claimed. The intent of this CIO is to raise the level of 'consistency' in the implementation of a percent complete approach to claiming performance across all CAMs for that CA, both current and future, and not just to state in the WAF that the method is percent complete.

Prepared By:	Date:	Reviewed By:	Date:	Contractor Reviewed:	Outbrief Date:
Jim Fountain	**10/20/2011**				

1. Subject: Establish Consistent Change Control	2. Guideline Ref (if applicable): 7	3. Control Number: CIO-06
4. CA#, WBS#, or Functional Area: All WBS Elements		

5. REQUIREMENT:

Guideline 28 - Incorporate authorized changes in a timely manner, recording the effects of such changes in the budgets and schedules. In the directed effort prior to negotiation of a change, base such revisions on the amount estimated and budgeted to the program organizations.

Guideline 32 - Document changes to the performance measurement baseline.

6. DISCUSSION:

Intent Guideline 28 - Incorporate the work scope for authorized changes into the performance measurement baseline in a documented, disciplined, and timely manner. The timely and accurate incorporation of authorized and negotiated changes into the performance measurement baseline ensures that valid performance measurement information is generated for the new scope being executed. Adherence to this guideline helps to ensure that budget, schedule, and work remain coupled. For unpriced change orders, the contractor will develop its best estimate for planning and budgeting purposes for incorporation into the performance measurement baseline. Near term effort should be planned and have budget in control accounts. Far term effort that cannot be reasonably planned in the near term may be planned in summary level planning packages or maintained in Undistributed Budget (UB). Until contractual definitization, the near-term work is continually planned. After definitization, any budget remaining in undistributed budget will be planned and budgeted within control accounts, summary level planning package packages or management reserve as soon as practical. Incorporating changes must not arbitrarily eliminate existing cost and schedule variances. Rate changes and economic price adjustments may be made as appropriate.

Intent Guideline 32 - The performance measurement baseline should always reflect the most current plan for accomplishing the effort. Authorized changes must be promptly recorded in the system and incorporated into all relevant planning. Planning and authorization documents must be updated accordingly, prior to the commencement of new work.

By ensuring that budget and schedule revisions are documented and traceable, the integrity of the performance measurement baseline is maintained and can be verified. This provides control account managers with valid control account plans against which to execute and measure performance. Some typical attributes include:

- Change control logs (management reserve, undistributed budget, performance measurement baseline, and contract budget base) reflect changes from the original contract budget base.
- Time-phased budget run reflects authorized changes to the budget.
- Statement of Work, WBS, and WBS dictionary reflect incorporation of all authorized changes.
- Management reports (contract performance reports or other applicable management reports) reflect incorporation of all authorized changes.

1. Subject: Establish Consistent Change Control	2. Guideline Ref (if applicable): 7	3. Control Number: CIO-06
4. CA#, WBS#, or Functional Area: All WBS Elements		

7. OBSERVATION/FINDING:

The CAMs were not able to describe the formal change control process and were not able to determine when a change request should be initiated. One CAM stated during his interview that he was allowed to change the time phasing of a control account without initiating an ECP as long as scope or budget did not change in the process. All CAMs interviewed relied heavily on one individual from Project Controls to initiate the change request for them and follow it through to implementation.

1. Subject: Multiple WBS Elements To A Single Control Account	2. Guideline Ref (if applicable): ANSI #5	3. Control Number: CIO-07
4. CA#, WBS#, or Functional Area: WBS 1.5.1, 1.5.2, 1.5.3, 1.5.5 and Control Account 5000		

5. Description:

The NDIA EVMS Intent Guide for ANSI GL #5 states the following:

"The integration of the WBS and OBS creates control accounts that facilitate schedule and cost performance measurement. The control account is the point where the WBS tasks and OBS responsibility intersect. It is defined as the point where a single functional organization or integrated product team has responsibility for work defined to a single WBS element."

"One or more control accounts are visible at the intersection of the WBS and responsible OBS"

"The control account clearly identifies any supporting activities."

It was observed by the review team that a single Control Account (CA) was assigned to multiple Work Breakdown Structure (WBS) elements. Specifically, WBS elements 1.5.1, 1.5.2, 1.5.3, 1.5.5 were all assigned to CA 5000. This was evident in the PEP, RAM, and WBS Dictionary. For this reason, the PPPL system was found not compliant with the ANSI GL #5. This issue was discussed with the PPPL team and corrections were made to the PEP, RAM, and WBS Dictionary prior to the review's completion. Since evidence was presented of the correction, this violation was downgraded to a CIO. However, follow-up reviews should confirm that this is no longer a compliance issue.

6. Attachments:

Example of the RAM before (1) and after (2) correction.

Prepared By:	Date:	Reviewed By:	Date:	Supplier:	PMO:
J. Fortner	10/2011				

APPENDIX E

ACRONYM LIST

ACRONYM LIST

ACWP – Actual Coast of Work Performed
ANL – Argonne National Laboratory
BCWP – Budgeted Cost of Work Performed
BCWS – Budgeted Cost of Work Scheduled
BNL – Brookhaven National Laboratory
CAM – Control Account Manager
CAP – Control Account Plan
CAR – Corrective Action Request
CAS – Cost Accounting Standards
CFO – Chief Financial Officer
CIO – Continuous Improvement Opportunities
CPI – Cost Performance Index
CPR – Contract Performance Reports
CV – Cost Variance
DOE – Department of Energy
EAC – Estimate at Completion
ECP – Engineering Change Proposal
EVMS – Earned Value Management System
EV – Earned Value
GAAP – Generally Accepted Accounting Principles
LOE – Level of Effort
NSTX – National Spherical Torus Experiment
OECM – Office of Engineering and Construction Management
OPA – Office of Project Assessment
OBS – Organizational Breakdown Structure
PCS – Project Control Staff
PCM – Project Control Manager
PEP – Project Execution Plan
PM – Project Manager
PMB – Performance Measurement Baseline
PMSD - Project Management System Description
PPPL – Princeton Plasma Physics Laboratory
PSO – Princeton Site Office
PU – Princeton University
RAM – Responsibility Assignment Matrix
RFBA – Request for Baseline Adjustment
SC – Science
SOV – Schedule of Values
SOW- Scope of Work
SPI – Schedule Performance Index
SV – Schedule Variance
VAR – Variance Analysis Report
WAD – Work Authorization Documentation
WAF – Work Authorization Form
WBS – Work Breakdown Structure