Project Management System Description (PMSD)

Revision 1 June 2011

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NOTE: Throughout this description document, cross reference is made to the ANSI/EIA-748-B (2007) standard EVMS guidelines by both the reference section and the guideline number as indicated in the National Defense Industrial Association (NDIA) Program Management Systems Committee (PMSC) ANSI/EIA-748-A Intent Guide Revision 9a. For Example, Intent Guideline 12 corresponds to ANSI/EIA-748-A section 2.2g. This will be referred to in this description as Guide 12 {2.2g}.

RECORD OF REVISIONS

Revision	Date	Description of Changes
0	July 2009	Initial issue.
1	June 2011	Deleted "Program" from document title "Project Management System Program Description". Revised to incorporate corrective actions to resolve findings in Audit #1004, Project Management July 13, 2010 (pages 5, 6 and 9). Revised to incorporate suggestions from PPPL Project Management Advisory Committee Report September 30, 2010 (pages 9, 16 and 31). Update references from DOE O 413.3A to DOE O 413.3B. Added new requirement of DOE 413.3B to perform monthly cost performance uploads (including earned value) to the DOE's Project and Assessment and Reporting System (PARS II). Incorporated PMSD supporting procedures as sub-procedures in a new Appendix E.

Table of Contents

Introduction

The U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) is a collaborative national center for plasma and fusion science. Its primary mission is to develop the scientific understanding and the key innovations which will lead to an attractive fusion energy source. Associated missions include conducting world-class research along the broad frontier of plasma science and technology, and providing the highest quality of scientific education.

PPPL uses standardized and proven project management systems to plan, implement, and measure projects being designed and constructed/fabricated at PPPL or for other DOE fusion organizations. These systems and approaches are described in this Project Management Systems Description (PMSD). Within the PPPL organizational structure, the Deputy Director for Operations has the ultimate responsibility for overall oversight and implementation of the project management systems processes and systems described herein. Direct responsibility for the development and management of the PPPL Project Management System – including oversight of individual project management plans, processes, training, and procedures – has been 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.

For Projects with a Total Project Cost of less than $20 million PPPL shall utilize a graded (tailored) approach which considers a project's risk, complexity, visibility, cost, safety, security, and schedule to appropriately select the project management systems, processes, and procedures to be applied. For example, major DOE-funded and work for others shall be executed under the specific requirements of DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets,* and its implementing guides and procedures. For projects covered by DOE Order 413.3B, the DOE Acquisition Executive, the Associate Laboratory Director for Engineering and Infrastructure, and the Deputy Director for Operations must approve all applications of the graded approach, which must be described at project initiation.

For smaller projects/experiments and GPP projects that are not covered by DOE Order 413.3B, the overall principles of DOE Order 413.3B shall be applied, but to a lesser degree of rigor. A Project Execution Plan is not required. Utilizing the laboratory Work Planning Process (reference ENG-032) the Laboratory Project Management Officer will consult with the Project Manager, Responsible Line Manager and the Engineering & Infrastructure Associate Director to establish the project management processes to be used while complying with the Project Status and Oversight Procedure (reference ENG-049) as required.

For each new project, a specific Project Execution Plan (PEP) or memo and this PMSD shall establish the overall project management systems and approaches for that project. The PEP focuses on organizational structure and an overview of the engineering management and control systems to be used on a particular project. Additional topics that shall be described in the PEP include: project reporting, ES&H, value engineering, records management & document control, Quality Assurance, and communication management plans.

Selection of a qualified Project Manager is an important part of an effective project management system. 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. Based on this review, and in consultation with the Project Management Officer, the responsible PPPL Department Head or Program Manager will select an individual to serve as the Project Manager. For projects covered by Order 413.3B, the one or more candidates may be selected and proposed to the Associate Laboratory Director for Engineering and Infrastructure and Deputy Director for Operations. As appropriate, the Deputy Director for Operations will consult with the Deputy Director for Research prior to naming the Project Manager**.**

Appendix A of this manual presents a roadmap of how the PPPL project management systems will meet the requirements of DOE Order 413.3B and the subset of effective Project Management Body of Knowledge (PMBOK) generally recognized as best practices. The PMBOK is as a joint national standard by the American National Standards (ANSI) and the Project Management Institute (PMI) as standard ANSI/PMI 99-001, dated 2004.

This manual also addresses the Earned Value Management System (EVMS) approaches and processes that integrate each project's management elements required to effectively plan, organize, and control complex projects. The EVMS processes described in this manual provide an overview of PPPL's earned value management system approaches for cost, schedule, and technical performance management and reporting. More comprehensive information is contained in a series of PPPL Project Management and/or other PPPL procedures. These will be referenced in each section to provide a roadmap to the details of implementing the principles outlined in this Manual.

For Projects with a Total Project Cost of less than $20 million PPPL implementation of the PPPL-EVMS varies based on specific customer requirements and project graded-approach risk analyses. PPPL project managers are permitted to adapt the EVMS to their project, while maintaining the necessary management controls to meet project cost, schedule, and technical requirements.

The PPPL-EVMS complies with the ANSI/Electronic Industries Alliance (EIA) Standard 748-A (1998), Earned Value Management Systems, approved May 19, 1998, and reaffirmed on August 28, 2002. ANSI/EIA-748-A standard is industry best practice, and DOE's standard for EVMS. The PPPL-EVMS meets the requirements of Office of Management and Budget Circular No. A–11 (2003), Part 7, Section 300—Planning, Budgeting, Acquisition, and Management of Capital Assets. The PPPL-EVMS is a key component of the organization, methods, and procedures adopted by PPPL to ensure that its mission and functions are properly executed. **Appendix B** presents a crosswalk between the 32 ANSI/EIA-748-A guidelines and the PPPL-EVMS.

The PPPL-EVMS addresses the seven principles of EVMS, as defined by the ANSI/EIA standard:

- Plan all work scope for the project to completion.
- Break down the project work scope into finite pieces that can be assigned to a responsible person or organization for control of the technical, schedule, and cost objectives.

- Integrate the project work scope, schedule, and cost objectives into a performance measurement baseline against which accomplishments may be measured. Control changes to the baseline.
- Use actual costs incurred and recorded to accomplish the work performed.
- Objectively assess accomplishments at the work performance level.
- Analyze significant variances from the plans, forecast impacts, and prepare an estimate at completion based on performance to date and work to be performed.
- Use EVMS information in management processes.

The PPPL-EVMS is designed to provide project managers with a comprehensive system that develops and maintains the baseline; tracks project cost, schedule, and scope; and allows for the generation of timely performance measurement data and reports. Performance measurement reports provide management with objective project information critical to monitoring progress, identifying significant issues, and implementing corrective actions as needed.

In addition to this overview section, this document is organized into seven (7) sections and five (5) appendices:

- Section 1: Project Organization and Baseline Planning
- Section 2: Earned Value Analysis and Progress Reporting
- Section 3: Accounting
- Section 4: Subcontract Management
- Section 5: Change Control
- Section 6: Surveillance and Maintenance
- Section 7: Risk Management
- Appendix A: DOE Order 413.3B and PMBOK Roadmap – describes how PPPL project management systems will satisfy the requirements and best practices outlined in these two documents
- Appendix B: ANSI/EIA-748-A Guideline Crosswalk including reference to PPPL Procedures
- Appendix C: Acronyms, Abbreviations, and Terms
- Appendix D: Roles and Responsibilities of PPPL project team members
- Appendix E: PMSD Supporting Procedures

The Office of Project Management owns the PMSD. Proposed revisions to this Manual are submitted to the Head of the Planning and Control Division to ensure the proper coordination, review, and incorporation of appropriate changes. Annually, the PPPL Head of the Planning and Control Division will coordinate the review of this PMSD in collaboration with the PPPL Project Management Officer to 1) assess the need for revisions to this document and 2) assess project compliance with the PPPL PMSD. The PPPL Project Management Officer is responsible for ensuring projects comply with the PPPL PMSD.

Section 1 Project Organization and Baseline Planning

1.1 PROJECT STRUCTURE

1.1.1 Objective [Guide 1, 2, 3 {2.1a, b, c}]

Every project that falls within the criteria established in DOE O 413.3B (i.e., TPC greater than or equal to $20Million) will develop Project Execution Plan (PEP). Key project organization components of the PEP associated with EVMS are the Work Breakdown Structure (WBS), the Organizational Breakdown Structure (OBS), and the Responsibility Assignment Matrix (RAM). Using a graded approach the Project Management Officer may determine that a project with a TPC < $20M requires a PEP and will document that determination in a memorandum to the assigned Project Manager.

1.1.2 Project Execution Plan [Guide 3 {2.1c}]

The Project Execution Plan (PEP) is the primary vehicle that correlates project objectives with a plan for accomplishment. It also serves as the agreement between DOE (or another PPPL customer) and the PPPL project manager on how the project will proceed.

A PEP provides a general overview of the project, restates the mission need, defines the roles and responsibilities of PPPL, DOE and other customer organizations involved in the project, defines the project scope, schedule and cost baselines, and outlines cost and schedule data. The major elements required in a DOE project's PEP are stated in DOE Order 413.3B and DOE Manual 413.3-1. Department of Energy Guide 413.3-15 provides approaches for implementing PEP requirements of DOE O 413.3B.

The PPPL project manager normally develops the PEP, with input from the DOE Federal Project Director. For DOE projects covered by DOE Order 413.3B, after obtaining concurrence from the Princeton Site Office (PSO), the DOE Acquisition Executive (usually DOE headquarters) approves the PEP. For non-DOE funded projects, PEP approvals must also follow the funding agency's specific requirements. The PEP is under configuration control.

1.1.3 Work Breakdown Structure [Guide 1 {2.1a}] [Appendix E Procedure 2 of this document]

The Work Breakdown Structure (WBS) is a product-oriented, hierarchical outline of all work elements required to accomplish the entire work scope of the project. Each descending level is a subdivision of the work above, with increasingly detailed definition/division of the work. The WBS is the structure for integrating the scope, schedule, and budget for all project work. It is used as a framework for assigning and defining work, schedule development, estimating and budgeting, managing funds, and controlling changes. The WBS is used by management throughout the lifecycle of a project to identify, assign, and track the project's total work scope. Each element is assigned a unique code to identify it in all project documents. The WBS is detailed in the PEP, or attached as an appendix.

1.1.4 Work Breakdown Structure Dictionary [Guide 1 {2.1a}]

The WBS dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. It defines each element to at least the control account level in terms of the content of the work to be performed. A WBS dictionary is required for all projects with a TPC > $2M. For projects with a TPC < $2M if a WBS dictionary is not used, the project must demonstrate to the satisfaction of the Laboratory Project Management Officer that the Scope of Work (SOW) and the WBS are fully reconciled.

1.1.5 Organizational Breakdown Structure [Guide 2 {2.1b}]

The Organizational Breakdown Structure (OBS) is a project organization framework for identification of accountability, responsibility, management, and approvals of all authorized work scope. It is a direct representation and description of the hierarchy and relationships of organizations that will provide resources to plan and perform work identified in the WBS. The OBS helps management focus on establishing the most efficient organization, by taking into consideration availability and capability of management and technical staff, including subcontractors, to achieve project objectives. The organizational breakdown structure for each project is found in the PEP.

1.1.6 Responsibility Assignment Matrix [Guide 3, 5 {2.1c, e}]

The Responsibility Assignment Matrix (RAM) is an element of the project documentation that integrates the organizational breakdown structure with the work breakdown structure. This integration identifies key control points at the intersections of the WBS and OBS. Control accounts are then created at these key control points and they facilitate the linkage between the planning, scheduling, budgeting, work authorization, cost accumulation, and performance measurement processes. A single control account manager (CAM) is assigned to one or more these control accounts and is responsible for the planning and control within their control account(s) and the identification, analysis, and reporting of significant variances that may occur during project execution. With a complete RAM and OBS, one should be able to identify the person/organization responsible and accountable for every element of the WBS and SOW.

1.2 PROJECT SCHEDULE

1.2.1 Objective [Guide 6, 7 {2.2a, b}]

The project schedule is used to plan project time durations and control the interdependencies of all the activities needed to execute the project. The project manager employs a scheduling tool that maintains the target schedule, supporting control milestones in the baseline, and the current schedule used to accumulate and report current schedule status.

1.2.2 Schedule Development [Guide 6, 7 {2.2a, b}]

The development of the project schedule will require input from the entire project team and may involve multiple iterations in order to reach a workable plan for accomplishing the work scope. CAMs and Technical leads from the various disciplines participate in these early iterations to identify the constraints and interfaces. The control account managers expand these schedules into the detail

needed to identify the activities that will be performed in executing their assigned scope of work. The Project Schedule is structured and numbered consistent with the project Work Breakdown Structure. At the project outset, the details of the future schedule are generalized and the associated activities are of longer durations. As the project moves through time and as activities are more clearly defined, new activities with shorter durations are added. The PPPL scheduling system consists of baseline, current, and supplemental schedules.

BASELINE SCHEDULE

The Baseline Schedule is used to measure performance. It contains the list of control milestones that are generally negotiated with the customer and are identified in the Project Execution Plan. The project manager may supplement these milestones with other events deemed sufficiently important to be in the baseline. The activity logic and relationships are established in the Baseline Schedule such that they support the timely accomplishment of the control milestones.

The project management team assembles the baseline schedule. The project manager has the responsibility to ensure that all parts of the baseline schedule are properly integrated and phase with each other. The baseline schedule should be consistent with constraints imposed externally, internally, by resource limitations or by other projects at PPPL.

The baseline schedule is approved and fixed consistent with DOE Order 413.3B. For non-DOE projects, the baseline schedule will be reviewed by the customer to obtain approval. The baseline schedule constitutes the official plan against which schedule performance (e.g., the budgeted cost of work scheduled [BCWS]) is measured and reported to the customer and to PPPL management. The baseline schedule is maintained under configuration management and may not be revised without proper authorization as detailed in the Baseline Change Control Thresholds table documented in the PEP.

CURRENT SCHEDULE

The Current Schedule shows current project status. It is used to manage all project activities and is an integrated, network-logic-based schedule. This network approach provides the ability to relate the project's time-phased activities in their logical sequence using predecessor-successor relationships and timing. The Current Schedule also enables the determination of the critical path and an evaluation of the effects of the current schedule performance status on activities and milestones scheduled to be accomplished in the future. The Current Schedule includes detailed input from all Control Account Managers, and provides the ability to relate activities and milestones between different levels of schedules. The Current Schedule includes all project milestones identified in the baseline schedule.

The Current Schedule employs the approved baseline schedule to relate progress. The Current Schedule shows the actual status of the project or program at the current point in time by reflecting the work performed and the milestones accomplished. It is used by the local project management team for analysis, including issue identification and resolution.

SUPPLEMENTAL SCHEDULES

The project team may employ Supplemental Schedules that are not part of the baseline schedule hierarchy. They are often used for day-to-day operational planning and management, and as the name suggests, supplement the baseline and current schedules, but are not under configuration control.

1.3 PLANNING AND BUDGETING

1.3.1 Objective [Guide 8, 9, 15 {2.2c, d, j}]

Planning and budgeting establish the time-phased budget used to measure project performance.

1.3.2 Performance Measurement Baseline [Guide 8, 9, 15{2.2c, d, j}]

The performance measurement baseline (PMB) is the time-phased budget plan used to measure project performance. In earned value management, the assignment or allocation of budgets to scheduled segments of work produces a plan against which actual performance is measured.

The performance measurement baseline is finalized at Critical Decision-2 (CD-2) for projects covered by DOE Order 413.3B. As part of the graded approach, other projects should establish PMBs at appropriate key decision points, typically, preliminary design or Final Design. (Figure 1-1 presents the DOE acquisition management development cycle.) The relationship of individual work tasks to the time-phased resources necessary to accomplish them is established at the control account level. All control accounts and related work packages should be planned, at least at a summary level, to the end of the project. Additional planning packages may be used, where necessary. Any control accounts that cannot be established in the initial planning effort should identify the approach by which planning packages are detailed into work packages.

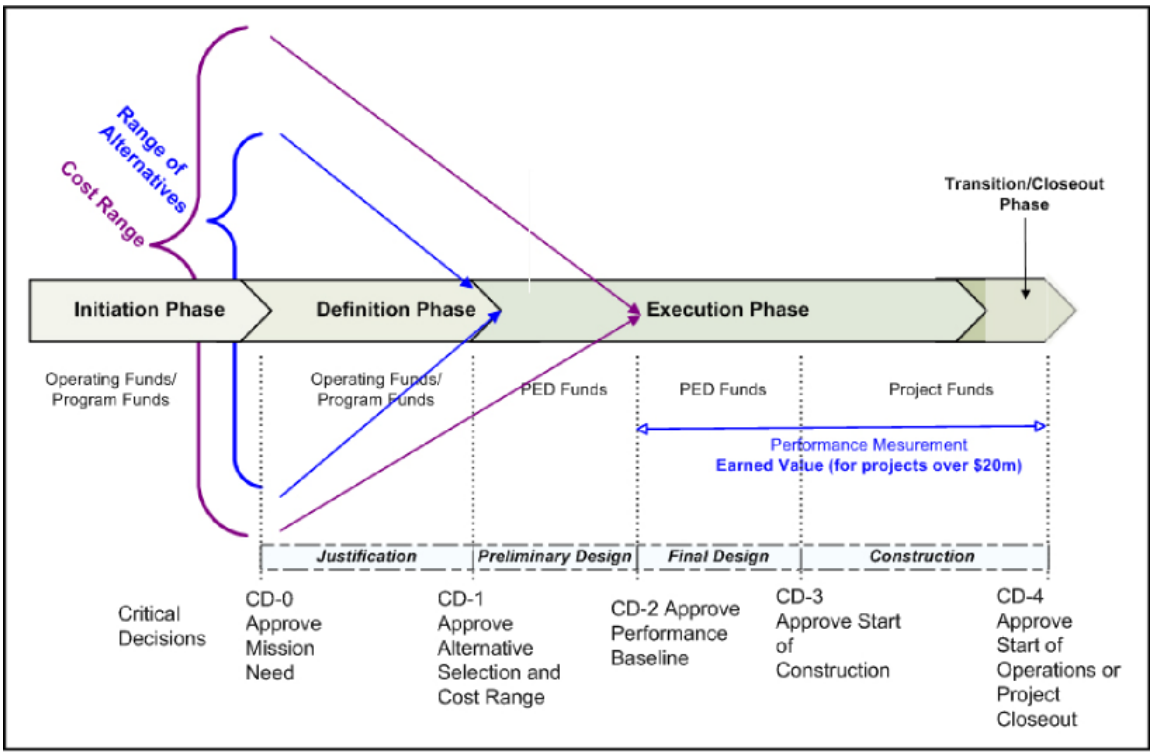


Figure 1-1. DOE Acquisition Management System

The performance measurement baseline is the summation of the time-phased budgets for all of the control accounts and summary-level planning packages. The relationship of the performance measurement baseline (PMB) to the total project cost (TPC) is depicted in Figure 1-2. 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.

1.3.3 Control Accounts [Guide 3, 5, 18 {2.1c, e, 2.3c}]

A control account is a management control mechanism where budgets (resource plans) and actual costs are accumulated and compared to earned value. A control account represents the work assigned to one responsible individual representing one responsible organization on one project's WBS element. A control account manager maintains "single point responsibility" for an individual control account.

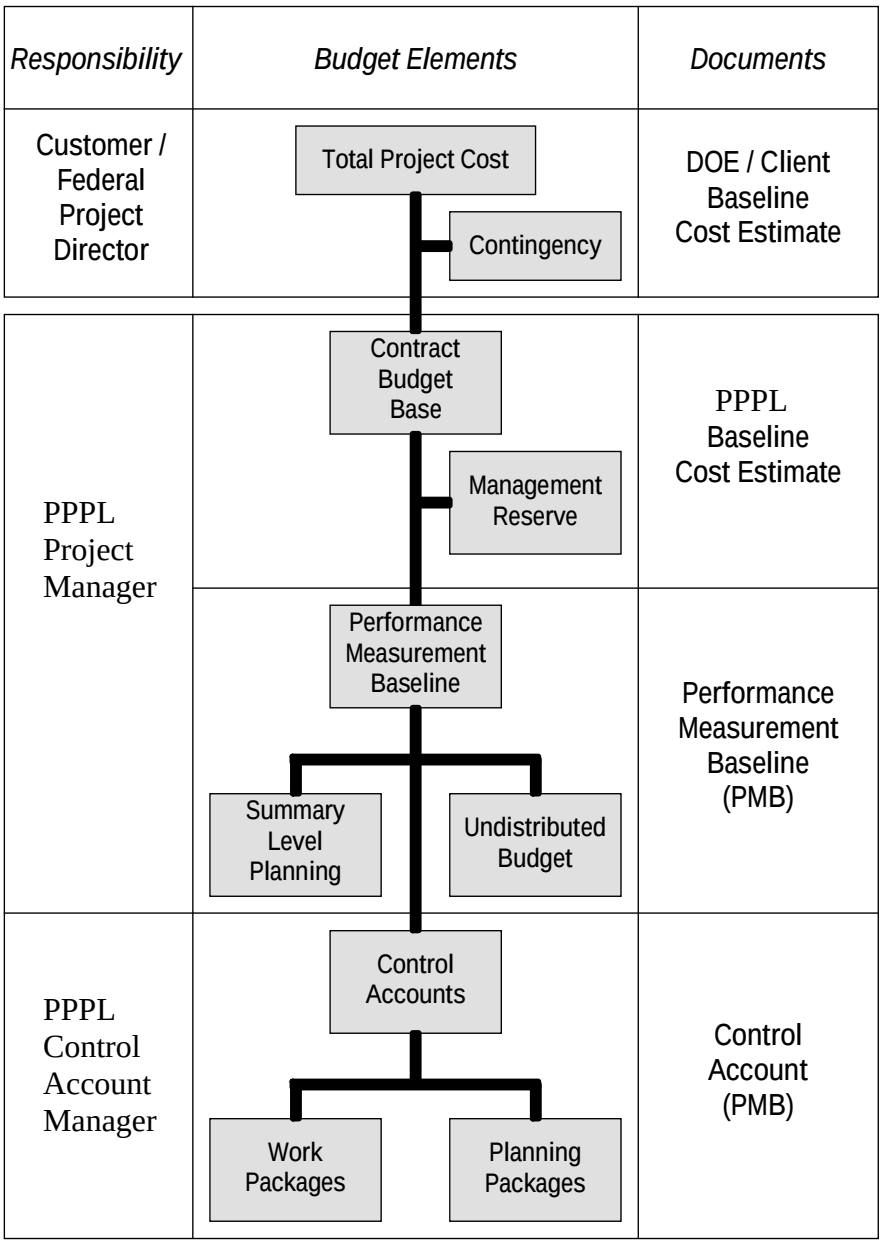


Figure 1.2 Project Baseline Budget Hierarchy

Within PPPL's Financial Accounting System, cost collection is performed through Project Code numbers at the Control Account level. No charges are directly charged or recorded at any summary level above the Project Code number.

1.3.4 Control Account Planning [Guide: 3, 5, 8, 9, 10, 11, 30 {2.1c, e, 2.2c, d, e, f, 2.5c}]

Control account planning consists of those efforts needed to establish time-phased budgets for each control account identified for project execution. The control account managers have the primary responsibility for developing and managing the control account budgets. The project provides

control account managers with budget guidance and a common planning capability to perform resource costing, indirect rate applications, and other calculations.

Control accounts are generally budgeted in dollars. The project manager and the control account manager come to agreement on the work scope to be accomplished, and the accompanying budget and schedule necessary to support the required effort. Once these budgets have been developed, the amount of budget associated with each monthly accounting period is referred to as the Planned Value (PV). The total budget with respect to any given grouping of work is called Budget at Completion (BAC).

The PV and the BAC must be maintained at the work package level. Records can be kept at lower levels, if necessary.

Control account budgets are further subdivided into work packages and planning packages in the project schedule. The control account manager selects the EV measurement technique (one technique per work package)—the method for measuring the work performed for each task within a control account. Planning packages have no associated earned value technique, as they always represent future work that remains to have detailed planning and estimation.

Control account budgets in the EVMS are governed by the following guidelines:

- The sum of budgets for work packages and planning packages equals the control account BAC value.
- The control account manager must be able to provide the basis for the budgets of all planned work packages and planning packages.
- The start and completion dates for all tasks, including planning packages, are to fall within the scheduled start and completion dates of the control account.
- Retroactive changes to budgets for completed efforts are prohibited except for the explicit correction of accounting errors.
- Re-planning future portions of open and unopened work packages and planning packages requires formal change approval, consistent with the PEP change management requirements.

1.3.5 Work Packages [Guide 2, 3, 5, 7, 9, 10, 11, 12 {2.1c, 2.2b, d, e, f, g}]

Work packages are a subdivision of a control account and consist of a discrete, apportioned, or level-of-effort task that have been planned and budgeted in detail. The budget for each is segregated into elements of cost. Work packages constitute the basic building blocks used in planning, measuring accomplishment, and controlling project work. A work package has the following characteristics:

- Represents units of work at levels where work is performed.
- Is clearly distinguishable from all other work packages by a descriptive title.
- Is assignable to a single organizational element responsible for performing the work.
- Has scheduled start and completion dates and, as applicable, interim milestones—all of which represent physical accomplishment.
- Has a budget or an assigned value expressed in terms of dollars. Indirect costs are allocated based on the applicable base per the PPPL CAS Disclosure Statement.
- Has a defined earned value methodology.

- Has a limited duration within a reasonably short time span (less than four reporting periods unless they are LOE or long lead procurements).
- Can be integrated with project schedules.
- Reflects the way in which work is planned and has meaningful products, or is a management-oriented subdivision of a higher-level element of work.
- Uses objective indicators/milestones as much as possible to minimize in-process work evaluation and provides accurate assessment of progress.
- Contains time-phased budgets that are used for planning, reporting, and control. When learning curves are used, time-phased budgets and schedules reflect this learning.
- Level-of-Effort should only be used on a work package where no definable deliverable or work products exist as a consequence of the work package.

1.3.6 Planning Packages [Guide 3, 5, 7, 9, 10, 11 {2.1c, 2.2b, d, e, f}]

Planning packages are created to describe work within a control account that will occur in the future. Planning packages must have a work scope, schedule, and time-phased budget. Planning packages are normally larger (scope, schedule, and budget) than individual detailed work packages, but planning packages must still relate to a specific work scope. Individual planning packages do not require the detail found in work packages. When planning packages are converted into work packages, they are defined in greater detail.

1.3.7 Acquisition Planning [Guide 2, 9, 10, {2.1b, 2.2d, e}]

PPPL often subcontracts with external suppliers, contractors, and collaborators for much of the work associated with large and complex projects. Examples include architecture/engineering (A/E) firms, general and specialty contractors, other national laboratories, research institutions, and consultants. Typically, these subcontracts are executed through Firm-Fixed Price (FFP), Time and Material, or Level-of-Effort (LOE) support-type contracts.

The contracting vehicle type is determined based on the nature of the work to be subcontracted: its complexity, risk, and cost. All acquisitions (for DOE-funded projects) are made in accordance with the requirements of PPPL's prime contract with DOE. Uniform policies and procedures for Federal project acquisitions provide for a fair and competitive environment.

1.3.8 Contingency Reserve [Guide14 {2.2i}]

The contingency is an amount of money within the approved Total Project Cost (TPC) that is set aside at the start of the project. The contingency is established to provide budget coverage for future uncertainties (risks) that are within the scope of the project but are not funded in the control account budgets. The contingency is not assigned to specific segments of work.

The PM baseline change control procedure provides the process for control of contingency. The project manager establishes the contingency based on a risk analysis of the project work scope. The factors affecting the amount of contingency established are: technical risk, schedule issues, and/or possible shortages in a critical resource area (i.e., labor, material, timely appropriations, or support services), direct and indirect rate changes, etc. Contingency is normally developed "bottoms-up" from a risk assessment of individual work elements within the project WBS. This

contingency is then extracted from the individual WBS elements and summed into a project contingency account. As the level of risk is reassessed on the project, the budget for contingency can change.

The DOE on DOE projects (or as described in the Project Execution Plan for non-DOE projects), has the responsibility for controlling project contingency. Contingency is released to provide a budget for risk mitigation within the project work scope.

The Performance Measurement Baseline (PMB) change control procedure (described in the Project Execution Plan) provides the process for control and release of contingency. Contingency transactions are documented in the project baseline change control log. These transactions are addressed in the EVMS monthly progress reports to the customer.

1.4 WORK AUTHORIZATION

1.4.1 Objective [Guide 3 {2.1c}]

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

1.4.2 Contractual Authorization [Guide 3 {2.1c}]

A work authorization cannot be officially initiated until the formal work authorization and funding is received from DOE or other funding agency. The project manager will request and the PPPL Budget Office will authorize the allocation of Project Codes in the PPPL accounting system. The opening of these Project Codes allows project setup to begin.

1.4.3 Work Authorization Document [Guide 3 {2.1c}]

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 project manager delegates work to the control account managers within the authority provided in the work authorization statement. The work authorization provided for each control account includes the relationship to the WBS element or elements, responsible organization identification, control account task description, schedule, and time-phased budget in dollars. The work authorization document can only be changed with appropriate change approval.

The approved control account is the project manager's vehicle to delegate responsibility for budget, schedule, and scope requirements to the control account manager at the work package level. The signing of a work authorization document by all parties represents a multilateral commitment to authorize and manage the work within the budget and agreed-upon schedule.

Section 2 Earned Value Analysis and Progress Reporting

2.1 EARNED VALUE

PPPL will ensure that earned value is an objective measure of performance. Comparisons of actual costs, and the work accomplished, with baseline plans generated during the planning and budgeting phase, are included in internal and external reports. Forecasts of future costs and schedule dates are made, and corrective actions will be initiated when problems are identified.

2.1.1 Requirements for Employing Earned Value Methodology [Guide 7, 12 {2.2b, g}]

Work packages are established and opened when the Planned Value (PV), or Budgeted Cost of Work Scheduled (BCWS), is planned and authorized. Each work package uses one earned value methodology to track work progress. Discrete work packages (i.e., tangible/measurable work) use techniques such as discrete effort and apportioned effort. 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 earned value technique is selected consistent with the following:

- ***Stability*** – One earned value technique is chosen for each work package. The selected technique and milestone(s) will not be changed after the work package is opened.
- ***Objectivity*** – Completion of an event (for discrete work) is based upon predetermined criteria or tangible product.
- ***Ability to audit*** – The procedure and criteria for evaluation will facilitate audit of the Earned Value (EV), or Budgeted Cost of Work Performed (BCWP) or reported.

2.1.2 EV Measurement Techniques [Guide 7, 12 {2.2b, g}]

(Excerpted from the Project Management Institute Practice Standard for Earned Value Management, 2005.)

Earned Value is a measure of work performed. Techniques for measuring work performed are selected by the Control Account Manager (CAM) during project planning and are the basis for performance measurement during project execution and control. Earned value techniques are selected based on key attributes of the work, primarily the duration of the effort and the tangibility of its product.

The performance of work that results in distinct, tangible products can be measured directly. This work is called ***discrete effort (e.g., "install widget, fabricate widget")***. Other work is measured indirectly as a function of either discrete efforts or elapsed time. Work that is linked to discrete effort is called ***apportioned effort (e.g., "field supervision, crane support")***, while that based on elapsed time is referred to as ***level of effort (e.g., "project management")***.

Earned Value Measurement Techniques (EVMTs) on already started activities cannot be changed. For unopened work packages, EVMTs can be changed only through the change control process.

2.1.2.1 Discrete Effort

Work performance is measured and reported monthly. The EV measurement techniques (EVMT) selected for measuring the performance include the weighted milestone, 50-50, 0-100 methods, percent complete, units complete, and user defined percent.

The above guidelines for selection of EV measurement techniques are outlined in Figure 2-1 below, and examples of the most common techniques are described in the paragraphs that follow.

Product of Work	
Tangible	• *Weighted Milestone* • *Fixed formula (e.g. 50-50,0-100)* • *Expert Opinion (e.g. Percent Complete, Units Complete, User Defined Percent)*
Intangible	• *Apportioned Effort* • *Level of Effort (LoE)*

Figure 2-1. EV Measurement Techniques

- ***Weighted Milestone.*** The weighted milestone technique divides the task work to be completed into segments ending with observable milestones and then assigns a value to the achievement of each milestone. The weighted milestone technique is more suitable for longer duration tasks having intermediate products such as procurement tasks where the milestone may represent the delivery of an item or progress payment milestones as spelled out in the contract.
- ***Fixed Formula.*** Predetermined percent complete values are assigned for starting and completing an activity based on the time-phasing of the budget for the activity. Examples of these techniques are as follows, but are not limited to:
    - **50-50.** 50% of the value is earned as soon as the activity is started, and the rest is earned when the activity is completed. This EVMT should be used only for activities that span a maximum of two financial accounting periods since value cannot be earned in any intervening periods.
    - **0-100.** No value is earned until the activity is completed; at which point, the entire budget is earned. This method should be used only if the activity is scheduled to start and finish in the same accounting period.
- ***Expert Opinion.*** Employed at each measurement period, when the responsible worker or manager makes an assessment of the percentage of work complete. These estimates are usually for the cumulative progress made against the plan for each task. If there are objective indicators that can be used to arrive at the percent complete (for example, number of units of product completed divided by the total number of units to be completed), then they should be used.

- **Units Complete.** This EVMT is applicable to any work package that comprises a predefined number of similar tasks. The value earned at any point in time is simply the work package budget multiplied by the number of these tasks completed and divided by the total number to be done. Use of the EVMT assumes that budgets are based on the units being measured or a physical quantity count. This technique is typically suitable for fabrication and installation tasks.
- **Percent Complete.** The CAM determines percent complete, preferably based on some sort of objective measurement of work completed and remaining.
- **User-Defined Percent.** A subjective variation of the 50-50 EVMT. The percentage earned at the start of the work package (1 to 90%) is defined in advance by the user. The remaining percentage is earned when the work package is completed. This method should be used only for work packages whose schedule dates span a maximum of two fiscal accounting periods. This technique is least desirable and only allowed with Project Manager approval.

2.1.2.2 Apportioned Effort

If a task has a direct, supportive relationship to another task that has its own *earned value,* the value for the support task may be determined based on (or apportioned to) the *earned value* for the reference activity. Examples of proportional tasks include field supervision or inspection activities. For instance, a project task may have a field supervision function associated with it. Using the apportioned effort technique, the project manager may determine that the *planned value* for the field supervision task is 10 percent of the value of the main task. The total apportioned *planned value* for the field supervision effort related to the main task would then be a constant 10 percent of the main task's *earned value,* regardless of the actual work accomplished. *Earned value* for each measurement period would be assigned for the field supervision component in direct proportion to the *earned value* assigned to the main task.

2.1.2.3 Level of Effort (LOE)

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.

LOE activities will never show a schedule variance. Consequently, the technique always biases the project data toward an on-schedule condition. LOE should be used conservatively and should be considered *only* when the task does not lend itself to a more objective measurement technique.

2.2 STATUS AND EARNED VALUE CALCULATION

2.2.1 Objective

The objective of measuring schedule progress and calculating earned value is to accumulate and report the EVMS data needed to assess the project's performance for the current period and the cumulative-to-date costs based on the amount of work performed.

2.2.2 Performance Measurement Data [Guide 22, 23 {2.4a, b}]

The cost/schedule performance measurement data provides visibility concerning the project cost/schedule status as it relates to completed work and forecasted work remaining. These data elements are accumulated monthly, at a minimum, for each control account and are summarized directly through the various elements of the WBS to obtain the cost/schedule status at any level of the structure. The primary data elements that are used to supply this information are:

- ***Planned Value (PV)***. The time-phased budget plan approved as a result of the control account process. The PV may be developed at a lower level of detail. The lowest level should be at least the work package or planning package level of detail within each control account. The PV is also referred to as the Budgeted Cost of Work Scheduled (BCWS).
- ***Earned Value (EV)***. A measurement of the work completed. The EV is also referred to as the Budgeted Cost of Work Performed (BCWP), and is derived by applying predetermined earned value calculations to assess the work completed for each in-process work package.
- ***Schedule Variance (SV).*** When the PV is subtracted from the EV, a measure of the SV is obtained (EV – PV = SV). Care must be exercised in drawing inferences from either favorable or unfavorable SVs because of the influence of high-value work performed out of sequence. Crosschecks must be made using the scheduling system to determine the true status of the schedule.
- ***Actual Cost (AC).*** The AC is the cost for work that has been completed or partially completed (actual cost plus accruals). The AC is compiled in the PPPL financial management system by control account. Accruals are routinely added through the PPPL accounting system when the CAM determines some accomplished work is not shown as paid in the month earned, has consulted with affected parties (usually subcontractors/vendors), and communicated with the PPPL accounting Division. If errors are discovered later, necessary corrections are made in the current month. The AC is also referred to as Actual Cost of Work Performed (ACWP).
- ***Cost Variance (CV)***. When the AC is subtracted from the EV, a measure of the CV is obtained (EV – AC = CV). A positive CV indicates that work is being performed for fewer dollars than planned, whereas a negative variance indicates that work is being performed for more dollars than planned.
- ***Budget at Completion (BAC)***. The BAC is the total budget for a given work scope. The BAC for the total project plus contingency equals the TPC. The BAC for lower-level WBS elements, control accounts, and work packages equals the cumulative PV up to and including the last period to which it is assigned.
- ***Estimate to Complete (ETC).*** The ETC is the latest revised estimate for the remaining work scope.
- ***Estimate at Completion (EAC).*** The latest revised cost estimate for a given work scope (EAC = cumulative AC + ETC).
- ***Variance at Completion (VAC).*** When the EAC is subtracted from the BAC, a measure of the VAC is obtained (BAC – EAC = VAC). The VAC is the amount of under run or overrun forecast for the work scope being considered, without regard to the use of contingency.

2.2.3 Evaluation of Planned Value [Guide 7, 12, 22, 23 {2.2b, g, 2.4a, b}]

The time-phased budget Planned Value (PV) represents the plan against which performance is measured. PV is also called the Budgeted Cost of Work Scheduled (BCWS). At the control account level, the baseline is the result of assigning the necessary resources to the scheduled tasks (work packages and planning packages) as part of the process of detail planning for the control account (a.k.a. resource loaded scheduled). The process includes identifying the tasks, scheduling the tasks, identifying the resources, and determining the earned value method. Work to be accomplished in a control account must be performed in a logical, consistent manner to help provide consistency in determining the baseline and accomplishing the work. 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. Consequently, LOE tasks should only be used in those work packages where no deliverables or other material means of determining actual progress exists. The earned value of LOE only documents the passage of time and not actual project progress. Consequently, within a discrete or apportioned control account, the inclusion of the LOE activity should be avoided and is kept to a minimum in order to prevent any distortion of the performance measurement data. When unavoidable, and LOE work is combined with discrete and/or apportioned work within the same control account, then segregated work packages are established for the discrete, apportioned, and LOE portions, as appropriate.

2.2.4 Current Schedule Progress Evaluation [Guide 22, 23 {2.4a, b}]

The baseline schedule maintains original agreed-upon milestone dates, unless altered in accordance with the Change Control Procedure. Current status of the project is compared to the baseline for progress measurement and analysis. Actual project progress and status are maintained on the current schedule, which also reflects the current forecast of activity durations, activity start and finish dates, and milestone dates.

The current schedule also maintains an "as-built" project history and will be archived periodically.

- The current schedules are used for internal project management and customer reporting purposes. A comparison of the current and baseline schedules indicates the extent to which the project is ahead of or behind schedule. This comparison also identifies the specific activities and events that are the source of current SVs or impending problems.
- At the end of each accounting month, as a minimum, each control account manager will determine the status of each open activity in the current schedule for which they are responsible and update the current schedule accordingly. Various methods are used to assess the status for different kinds of activities to ensure that progress is being determined objectively.
- The status of material and equipment procurement activities is tracked through the procurement system. The procurement system tracks material purchases from receipt of a purchase request, to receipt of the material, until invoicing and payment are completed.

- Earned value flow-down subcontracts will have provisions in their contracts that require the subcontractors to submit an earned value report at least monthly. Such subcontractors are required to provide quantitative data that can be used to assess the status of their work activities. Earned value flow-down subcontracts are required on all projects where the total project cost exceeds $20 million dollars.
- Non-earned value flow-down subcontractors have provisions in their contracts that require them to develop a schedule that supports the details in the project schedule. The control account managers are responsible for ensuring that the methods used to status these schedules result in an objective measurement of progress.

The status for current schedules is developed to provide the following information:

- Progress to the customer and to PPPL management, focusing particularly on those areas of greatest impact on, or potential risk to, key milestones and project completion.
- Progress as compared against the baseline schedule.
- Basis for forecasts of future events, milestones, activities, and project completion.

Status information, which is collected at the lowest level of the schedule, includes the following information:

- Actual start dates for activities begun during the status period.
- Actual finish dates for activities completed during the status period.
- Actual occurrence dates for milestones accomplished during the status period.
- Percentage complete and/or remaining duration of activities started but not complete.
- Forecast completion dates for activities previously started but not yet completed.
- Forecast duration, start, and finish dates for activities—and occurrence dates for milestones—that are currently scheduled in the future and for which a change is foreseen.

The control account manager updates the schedule to reflect the current status. Status from updated current control account schedules is reflected in the current project schedule.

2.3 PERFORMANCE ANALYSIS

2.3.1 Objective

Analysis of performance measurement data will identify and document the cost, schedule, and work scope conditions that may require management attention, assess the impact of these conditions on the baseline and future work, and develop and implement corrective actions as necessary. This subsection establishes guidance for performance analysis for PPPL projects, specifically: variance analysis, corrective action, and updating EACs.

2.3.2 Variance Analysis [Guide 22, 23, 25 {2.4a, b, d}]

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 will accurately summarize budgets, earned value, actual costs and the associated variances up through both the WBS and the project organization. Variance analysis at levels above the control account is performed in support of internal management needs and external customer requirements.

2.3.3 Variance Thresholds [Guide 22, 23, 25 {2.4a, b, d}]

Variance analysis is conducted at the thresholds identified in the specific project's Project Execution Plan. The Project Manager may establish lower thresholds to respond to specific project or PPPL needs.

2.3.4 Performance Indices [Guide 22, 23, 25 {2.4a, b, d}]

The control account manager(s) will apply various metrics to assess the performance of their assigned control accounts. These performance metrics will provide additional insight and a basis for the CV and SV analysis. All metrics will be updated at least monthly. The metrics employed should be both time-phased and "snapshot" in nature. Time-phased metrics include a ***Cost Performance Index*** (CPI=BCWP/ACWP) and a ***Schedule Performance Index*** (SPI=BCWP/BCWS). The control account manager will assess the time-phased metrics to look for control account performance trends. "Snapshot" metrics include CVs and SVs. Graphics are used to aid in displaying trends associated with project performance. Performance graphs are useful in communicating project performance objectives and in displaying progress toward meeting those objectives.

Figure 2-2 shows an example of a commonly used graphic for PPPL projects that illustrates EVMS metrics. The **middle** (solid) line is the PV, the planned work as defined in the current Earned Value Management Baseline. The **top** (dotted) line, the AC, shows a higher than estimated project cost. The **bottom** (dashed) line, the EV, or the actual work accomplished for the given time period. As illustrated on the graph, the SV is the difference between EV and PV; the CV is the difference between EV and AC.

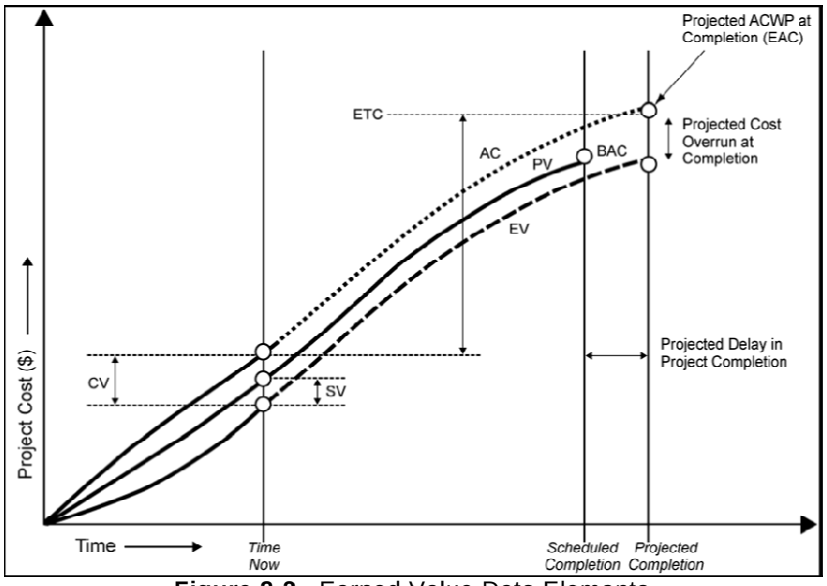


Figure 2-2. Earned Value Data Elements

2.3.5 Control Account Performance Analysis [Guide 22, 23, 25, 26, 27 {2.4a, b, d, e, f}]

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.

Control account managers periodically (at least annually) develop a comprehensive (bottoms-up) EAC at the control account level using all available information to arrive at the best possible estimate.

2.3.6 Project Performance Analysis [Guide 22, 23, 25, 26, 27 {2.4a, b, d, e, f}]

Project performance analysis is an ongoing process that includes routine and ad hoc analyses of problem causes, corrective actions, risk analysis, and cost savings opportunities. The process is formalized via the monthly report, which includes a review of cost and schedule performance information, identification of significant problem areas, and the status of corrective actions.

2.3.7 Monthly Project Status Calculations and Forecasts [Guide 22, 23, 25, 27 {2.4a, b, d, f}]

On a monthly basis, the control account manager updates the ETC at the control account level to account for all changes from the baseline that have been identified (approved, pending or anticipated). The ETC update reflects a current analysis of control account risks. The EAC is then calculated (EAC=AC+ETC) at each control account and summarized for the total project.

2.4 REPORTING

2.4.1 Objective

The objective of the reporting process is to provide accurate and timely reports needed by both PPPL and the customer to manage the cost, schedule, and work scope on the project. The project manager shall define a project-specific reporting calendar that is consistent with the PPPL monthly reporting cycle.

2.4.2 General Reporting [Guide 25, 26 {2.4d, e}]

The project manager will provide regular reports to PPPL management on project status. The reporting cycle will be determined by using a risk-based approach that will consider such factors as project size, complexity, the number and volume of tasks, as well as the point in the project's life-cycle. The level of reporting will be defined in the Project Execution Plan (PEP). Once the project has obtained Critical Decision-2 approval, the reporting cycle will be at least monthly. Reports will be sent to the appropriate management levels as defined in the PEP.

PPPL project managers regularly review the project status and develop corrective actions as required. Management review may include review of any or all of the following:

- Project cost/schedule performance rolled-up to a level appropriate to the overall risks of the project (this document is commonly referred to as a cost performance report (CPR).
- Variance analysis and suggested corrective actions.
- Critical Path activity performance.
- Project personnel and staffing.
- Project Baseline change performance.
- Contingency (used and remaining).
- Risk strategies.

Project management will address variances and corrective actions that are outside the threshold ranges. Once the project has received an approved performance measurement baseline (at Critical Decision-2), monthly customer (DOE) reports are generated by the project manager as specified in DOE Order 413.3B or as determined by the DOE Federal Project Director. In addition, the project manager supports the Federal Project Director in preparing quarterly reports and presentations to the DOE Acquisition Executive.

2.4.3 Monthly Reporting Cycle [Guide 22, 23, 25 {2.4a, b, d}]

After Critical Decision-2, reports generated from the EVMS are updated and published monthly in the CPR. The large amount of data, number of people providing input, processing time, and other considerations require that an orderly process is used to collect, review, report, and use the data generated by the system. For projects with a total project cost greater than $20 million monthly uploads of cost performance (including earned value data) is required to the DOE's Project Assessment and Reporting System (PARS II) for projects at CD2 and beyond.

The monthly reporting cycle is based on the accounting month. The PPPL accounting calendar ends on the last day of each calendar month. Each project must develop its own reporting calendar in order to support the contract-specific due dates for the required internal and external reports and to ensure timely and accurate reporting.

Earned value reports are generated monthly after Critical Decision-2 (CD2) is achieved. The purpose of the monthly report is to provide the PPPL project manager, PPPL senior management, and DOE (or other customer) a periodic assessment of each project by which to monitor and manage the project. These project status reports contain the following information:

- Budget summary
- Status of key milestones
- Progress narrative
- Baseline change control log actions
- Project manager comments
- EVMS data
- Variance explanations (if required)

Section 3 Accounting

3.1 ACCOUNTING PROCESSES

The comparison of actual costs (ACWP) and the work accomplished (BCWP) is included in the cost performance reports (CPRs). Additionally, costs are reported electronically to DOE via the Standard Accounting & Reporting System (STARS).

3.1.1 Objective

The objective of the accounting process is to provide accurate and timely recording and reporting of the actual costs associated with all project work.

3.1.2 Cost Accounting Policy [Guide 16 {2.3a}]

All financial transactions are documented, approved, and recorded properly in the PPPL accounting system on a consistent and timely basis in accordance with Generally Accepted Accounting Principles (GAAP) and applicable Cost Accounting Standards. Any change in the Laboratory's cost accounting practice that may have a material impact on the reporting of costs to final cost objectives must be approved by the PPPL Chief Financial Officer and incorporated into PPPL's Federal Cost Accounting Standards (CAS) Disclosure Statement by the Budget Officer for submission to DOE for approval. In accordance with Laboratory practice, the PPPL Accounting Division is delegated the authority to define, direct, and ensure compliance with Generally Accepted Accounting Principles and all applicable DOE regulations with respect to the laboratory's financial reporting.

3.1.3 Cost Code Structure [Guide 16, 17, 18, 19 {2.3a, b, c, d}]

The cost code structure for each project is developed in conjunction with the development and integration of planning, scheduling, and assignment of work scope/task to the responsible organization. Subsequently, these planning tasks lead to the creation of Project Account numbers in the PPPL financial accounting system that identify the correct cost collection account, and control account, for specific items of work.

An approved Request for Baseline Adjustment (RFBA) is the required documentation to open a Project Account number to enable costs to be recorded in the PPPL financial accounting system. Project Account numbers will be closed when the work is complete and all costs are recorded.

All direct labor, material, subcontracts, and other direct costs (ODC) are charged directly to the Project Account numbers that are assigned at the job or task level as appropriate for the specific control account. Indirect charges and allocated charges, if applicable, also accumulate in the Project Account number, applied as rates to the appropriate direct charges or distributed based upon percentage tables. The established cost account structure will ensure that actual costs are collected so that direct comparison with associated budgets can be made at the appropriate WBS level(s). The selected account assignment scheme will assure that:

- Direct and indirect/allocated costs are recorded in a manner consistent with how budgets are developed, consistent with applicable CAS.
- Direct and indirect/allocated costs can be summarized from Project Account numbers into the WBS without allocation of a single Project Account number to more than one WBS element.

3.1.4 Cost Accumulation [Guide 16 {2.3a}]

The actual costs are accumulated and processed by the PPPL financial system. The direct costs are identified by Project Account cost elements, and the indirect costs and allocated costs are distributed via pre-approved indirect rates and percentage tables (provisional rates/tables during the fiscal year retroactively changed to actual rates/tables at year end for all rates and most allocated costs). All costs reported in the accounting system are transferred into the earned value management system as the AC.

3.1.5 Direct Labor Cost [Guide 16 {2.3a}]

Each direct labor employee records direct labor charges in a uniform manner via an institutional time reporting system. The reporting frequency is typically bi-weekly, for “non-exempt” and hourly employees, or monthly for “exempt” professional staff although individual staff are requested to maintain daily logs of their activities, as appropriate. The hours are recorded and costs are charged to the project control accounts by the application of standard labor rates to actual hours charged and are available monthly from the PPPL financial system. Subcontract personnel under the direct supervision of PPPL also submit time reports on a biweekly basis.

3.1.6 Material Cost and Accounting [Guide 16, 21 {2.3a, f}]

Equipment and material costs are generally recorded in project accounts through the accounts payable system. Material will not appear as actual cost (AC) until it has been received on-site or an accrual (estimate of cost) is entered for vendor performance to date. Once the receiving department has recorded receipt in the procurement system, and after the control account manager acknowledges physical receipt and acceptance of materials by signing the invoice or sending electronic approval, invoices are approved for payment and paid by the Accounting Division.

3.1.7 Subcontract Cost [Guide 16 {2.3a}]

Subcontract costs are entered into the PPPL project accounts via the accounts payable system when an accrual (estimate of cost incurred) is entered for vendor performance to date or after receipt of an invoice is approved by the Princeton Technical Representative (PTR). The actual cost (AC) reported for these subcontracts generally consist of an accrual for costs estimated to have been incurred in addition to actual invoice costs recorded. Accruals are recorded in accordance with Generally Accepted Accounting Principles and PPPL accounting policy.

3.1.8 Other Direct Cost (ODC) [Guide 16 {2.3a}]

ODCs are costs other than direct labor and material. Principal items included in this category are travel, electricity, stockroom and telephone expenses.

3.1.9 Indirect Cost Accumulation [Guide 13, 19 {2.2h, 2.3d}]

Indirect and allocated costs are distributed at least monthly to project control accounts. Indirect and allocated costs are applied to each project at the current approved fiscal year rates or allocation tables. PPPL's indirect rates are processed during the course of a fiscal year, but are set to "actual" at the year-end closing. The PPPL CAS Disclosure Statement explains in detail the process concerning the collection and reporting of indirect and allocated costs. See Section 3.2.1 for more information regarding the CAS Disclosure Statement.

3.2 INDIRECT COST PLANNING AND CONTROL

3.2.1 Objective

PPPL maintains a cost accounting system that distributes indirect and allocated costs to final cost objectives (i.e., Project Accounts at PPPL). Indirect Costs are collected in discrete cost pools and distributed to the individual project beneficiaries via published rates and allocation tables that are formally reviewed and approved by the Laboratory management. PPPL files a *"Cost Accounting Standards (CAS) Board Disclosure Statement"* as required by Public Law 100-679 and approved by the DOE contracting officer. This Disclosure Statement identifies all indirect and allocated cost pools and the methodologies used to distribute these costs to cost objectives

3.2.2 Indirect Cost Pools [Guide 4, 13, 19, 24 {2.1d, 2.2h, 2.3d, 2.4c}]

As described in 3.2.1 above, PPPL's CAS disclosure statement identifies all indirect and allocated cost pools, and defines how these cost pools are distributed to the final or benefiting cost objectives. The current CAS Disclosure Statement may be obtained from the Budget Office at PPPL.

3.2.3 Allocation of Indirect Costs to Projects [Guide 4, 13, 19, 24 {2.1d, 2.2h, 2.3d, 2.4c}]

Indirect and allocated cost pools are distributed in proportion to the relative benefit incurred by each cost objective (i.e., Project Account). Indirect costs are distributed using individual rates that are applied to the base cost of discrete and specified resources (labor, procurements, travel costs, etc.) or using percentage tables for allocated cost pools. 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. As explained in 3.2.1 and 3.2.2, the complete composition of each indirect/allocated cost pool and the beneficiaries associated with each indirect /allocated cost pool are fully disclosed within the CAS Disclosure Statement. In addition to the annual review and disclosure of current year indirect cost pools, beneficiaries, and rates, the Budget Office at PPPL issues forward-pricing rates used to estimate the full cost of future-year program and project activity. Provisional indirect rates in effect at the time costs are incurred are charged. All indirect rates are changed to actual at fiscal year end.

3.2.4 Revisions to Indirect Rates [Guide 4, 13, 19, 24 {2.1d, 2.2h, 2.3d, 2.4c}]

On a few occasions, new program, project, or business requirements present themselves in the current year that could not be anticipated in prior years. Accordingly, revisions to provisional current-year rates or liquidation methodologies and out-year rate projections may be necessary. PPPL strives to conduct current-year operations to reduce or eliminate revisions to current year rates during the course of the fiscal year. Typically, revisions to current-year pricing structures are reviewed for compliance with Federal Cost Accounting Standards (CAS) and are fully disclosed by the Budget Office. Rates are effective for a given fiscal year. Therefore, rate and allocation table changes implemented during the year are retroactive to the beginning of the fiscal year. Retroactive rate revisions 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 (AC) of the project management report. PPPL's indirect rates are provisional and are reset to "actuals" at the end of each fiscal year. Material impacts to the project baseline are addressed through the use of the formal project management change-control process.

3.3 MATERIAL ACCOUNTING [Guide 20, 21 {2.3 e, f}]

EVMS Guideline 20 applies to manufacturing processes. PPPL is a research and development facility, and we normally do not need to implement procedures for unit cost, equivalent unit cost, or lot costs, because we do not normally have projects that produce identical products for multiple customers. EVMS Guideline 21 also applies to manufacturing processes. We seldom bulk order material for project work, and therefore have not implemented procedures for residual inventory tracking.

3.3.1 Systems and Procedures

PPPL has established systems and procedures for material control and procurement. These systems and procedures provide a basis for integrating material performance into our EVMS and for tracking materials through the life of the project. However, most PPPL projects require little or no material procurement and control. On some projects, "government-furnished" equipment and material is installed on a project. These instances are handled in accordance with PPPL policies and procedures.

The budget for material and equipment supplied by PPPL is initially estimated in gross terms and carried in appropriate work packages.

3.3.2 Objective

The objective of the material handling process is to provide effective methods for identifying the project's material requirements and for requisitioning, purchasing, receiving, inspecting, accepting, inventorying, and disbursing materials. The systems and procedures provide appropriate information and accountability for such materials at each stage of the material's life cycle. The following sections provide the minimum requirements and guidance for managing materials on PPPL projects.

3.3.3 Material Costing

3.3.3.1 BCWS

Equipment and materials can be grouped into one or more WPs for each applicable CA using any appropriate EV method. The BCWS time phasing is based on a planned receipt date or need date. The planning for this category is based on the effort that it supports. If the equipment or material supports a primarily discrete labor effort, then the planning should be either discretely planned or should be an apportioned effort based on construction capital asset acquisition and operations and maintenance (O&M) labor in the CA. If it supports primarily LOE work, it is planned as LOE.

3.3.3.2 BCWP

BCWP is earned using the method in accordance with the EV methods explained in Section 2.1.2.

3.3.3.3 ACWP

The ACWP enters PPPL through the accounts payable system. As invoices are approved for payment and entered into accounts payable, the material costs are recorded in PPPL's accounting system. For external procurements, using the accounts payable system rather than an actual payment (check issued) to a vendor, the ACWP is recognized earlier, i.e., the cost is recorded as an accrual when materials are received or services are provided. PPPL's actual costs are used directly as the ACWP. Any accrual is reversed when the actual payment is made to the vendor and is entered into PPPL's accounting system. This approach ensures that ACWP is recognized in the same period as BCWP is taken.

3.3.4 Material Cost and Schedule Performance Measurement

Control Account Managers are responsible for controlling the schedule and budget performance for all material within their assigned control accounts.

3.3.4.1 Material Cost Variances

By monitoring all material items, the EVMS provides a comparison of the planned requirements with actual receipt or usage in terms of quantity and cost. This information alerts the CAMs and project management to any significant cost increases that could affect the project funding or EAC or that could require actions to reduce future material cost growth.

3.3.4.2 Material Schedule Variances

Schedule variances for material are caused when materials are not received according to the planned receipts indicated by the budget spread used for the BCWS.

Section 4 Subcontract Management

When substantial effort associated with large and complex projects is obtained through subcontracts, the subcontracts must be written in such a way that information required for earned value management may be readily obtained from the subcontractor. The scope, complexity (risk), criticality, and cost of the subcontracted work may warrant inclusion in the subcontract of an EV flow-down provision. The project manager will establish reporting requirements for all subcontracts.

4.1 SUBCONTRACTS WITH EV FLOW-DOWN
[Guide 9, 10, 16, 22, 23 {2.2d, e, 2.3a, 2.4a, b}]

The earned value flow-down subcontracts are generally high dollar value (required on projects greater than $20 million), high-risk subcontracts. These subcontracts require careful planning prior to solicitation and award. The solicitation (RFP) or Memorandum of Understanding (MOU) must include the proper language and the subcontract the appropriate contract clauses, including full description of the reporting requirements. The reporting requirements include monthly earned value, and performance reporting from the subcontractor to PPPL. Requirements for reporting are described in the Request for Proposal (RFP) and formalized in the contract.

4.2 SUBCONTRACTS WITHOUT EV FLOW-DOWN
[Guide 9, 10, 16, 22, 23 {2.2d, e, 2.3a, 2.4a, b}]

The method of payment to non-EV flow-down subcontractors will generally drive the planning for receipt of cost and schedule information required to perform EVM. For most subcontracts, payment will be made based either on the achievement of planned milestones or, for design and construction, the percentage of completion of milestones or project component parts; or on the basis of cost reimbursement for labor hours expended and materials consumed. Information provided by the subcontractor with requests for payment must be sufficiently detailed that accurate cost information can be incorporated in the earned value reporting.

An EV flow-down requirement is not mandatory for any one of the following types of subcontracts:

- Time and material
- Support subcontracts that are primarily LOE

Section 5 Change Control

Change control ensures that any project changes are identified, evaluated, coordinated, controlled, reviewed, approved, and documented in a manner that best serves the project. This process is discussed in the Project Management (PM) Change Control Procedure.

5.1 CHANGE CONTROL PROCESSES

5.1.1 Objectives [Guide 28, 29, 31, 32 {2.5a, b, d, e}]

Change control has the following objectives:

- Provides the methods used to ensure the integrity of the project's cost, schedule, and work scope baseline.
- Enables the implementation of timely and auditable changes to the baseline.
- Ensures that changes to the project cost, schedule, and technical baseline are properly documented, evaluated, approved, and implemented.

DOE Manual 413.3B, and other DOE guidance documents, establish change-control requirements for DOE projects. PPPL project managers implement DOE requirements in project procedures for change control in accordance with the principles and processes described in this EVMS Manual and its implementing procedures.

5.1.2 Change Documentation [Guide 28, 29, 31, 32 {2.5a, b, d, e}]

The project budget base and the performance measurement baseline are two important budget entities for which full control and accountability must be maintained. A detailed change log is maintained to record all changes to authorized work and to reconcile original budgets and schedules and all changes for the WBS elements.

All changes to the performance measurement baseline made as a result of contractual changes, formal reprogramming, internal re-planning, or the use of the contingency are documented and reported to the customer, as required. Changes that have an impact on the performance measurement baseline are formally controlled, and are documented through the formal change-control process.

5.1.3 Change Request [Guide 28, 29, 31, 32 {2.5a, b, d, e}]

Change control thresholds are defined in the Project Execution Plan (PEP). All changes are recorded and tracked through the change-control process. Each change type is identified and numbered sequentially.

The Engineering Change Proposal (ECP) will be the vehicle for controlling and documenting these changes, be they external or directed changes ([see 5.1.4] or internal changes [see 5.1.5]). In all instances an ECP shall be prepared and processed to document the external or directed change within the PPPL change control systems.

5.1.4 External and Directed Changes [Guide 28, 29, 31, 32 {2.5a, b, d, e}]

An external change is one that is imposed on the project, generally by DOE (or other customer), with direction to implement. Such a change affects one or more baseline elements (scope, cost, or schedule) and may include, but is not limited to:

- DOE approved funding changes
- Program Secretarial Officer direction
- New or revised DOE policy directives

Typically, for projects covered by O413.3B, the DOE (or customer's) Federal Project Director will provide a written notice of the external or directed changes to the project manager. Unless specifically authorized in the written instruction, the change will be acted upon in accordance with the Project Execution Plan change-control process. An ECP will then be processed.

5.1.5 Internal Changes [Guide 28, 29, 31, {2.5a, b, d}]

The objective of internal change is to reflect a more accurate, realistic project plan. It is sometimes necessary to perform re-planning actions that are within the scope of the authorized contract. These re-planning actions may be appropriate to compensate for cost, schedule, and technical problems that:

- Have caused the original plan to become unrealistic resulting from design evolution and/or technical issues.
- Require a reorganization of work or personnel in order to increase the efficiency for accomplishing the effort.
- Require different engineering or construction approaches.

Internal re-planning is intended for in-scope changes that relate to future budgets. Changes that result in a change to the CA Budget, Milestones, and/or Scope must be documented in an ECP and retained in project files. Approved changes are incorporated into the performance measurement baseline in a timely manner, usually before the end of the next reporting period.

5.1.5.1 Internal Replanning Restrictions [Guide 28, 29, 30, 31 {2.5a, b, c, d}]

The following restrictions apply to any type of internal re-planning:

- Retroactive changes to the previously reported performance measurement baseline (PMB), earned value (EV), and actual costs (AC) are prohibited, except for the correction of errors.
- The time phasing of the BCWS may be changed in future portion of open WPs, but will require Customer approval.
- Changes to open WPs will be limited to Customer directed changes or formal reprogramming. Additionally, the following two conditions apply: (1) the changes only affect future budgets/efforts; and (2) the WPs continue to support key milestones in the schedule after the changes are implemented.`
- An ECP must be approved before a budget revision can be formally incorporated into the performance measurement baseline and its associated work executed.

- Internal changes and plans are reviewed to ensure that re-planning or the conversion of planning packages does not result in the application of a budget intended for future work to a near-term effort.

5.1.5.2 Changes within Control Accounts [Guide 28, 29 {2.5a, b}]

Re-planning within the established control account/job scope, schedule, and budget at completion (BAC) parameters are considered "internal to the control account/job" in that they do not affect the control-account/job scope or BAC, nor do they violate the control milestones. Review and approval of the revised plan by the project manager or designee, and the control account/job manager, are required to ensure that the planning procedures are followed, and that resources are available to support the revised plan. Two internal changes are typical in this class:

- Rolling-wave planning (converting planning packages to work packages).
- Change to the work approach within the control-account scope and BAC.

Changes made within a control account that alter the "shape" of the PMB must be incorporated into the PMB in a timely manner (usually with one month). In no instance shall changes within control accounts be allowed that impact the PMB without an official approved change request.

5.1.5.3 Other Internal Re-planning [Guide 28, 29, 31 {2.5a, b, d}]

Due to unplanned cost, schedule, and/or technical problems (realized risks), the existing plan might become unrealistic, and revisions could be necessary. These plan revisions would result in reorganizing future work or changing the methods and approaches from those originally planned. These revisions could be identified as a result of the normal variance-analysis process or while developing a comprehensive estimate at completion (EAC). Internal re-planning may cover a single control account or multiple control accounts. The thresholds established in the PEP govern all changes. Impact and justification for all budget changes are documented in the change request, and all internal changes used to authorize internal re-planning are recorded in the change log.

Typical internal changes are:

- Scope and budget transfers between control accounts/jobs (e.g., make vs. buy).
- Changes to the work approach that change the control account/job scope or the BAC.
- Future rate changes significant enough to warrant re-planning.
- Funding revisions that affect resource availability.
- Adjusting subcontract budget values to reflect negotiated values.
- Adjusting material budgets to reflect modifications to material lists after design phases.

5.1.5.4 Changes to Actual Direct and Indirect Costs [Guide 29, 30 {2.5b, c}]

Changes to actual costs incurred, whether direct or indirect, are considered retroactive changes and are not permitted, except for the correction of errors or routine accounting adjustments. Accounting adjustments must be made in the current month, in accordance with PPPL accounting procedures.

5.1.5.5 Changes to Budgeted Direct and Indirect Rates [Guide 29 {2.5b}]

An indirect-rate analysis is often prepared at least annually, usually near the end of the PPPL fiscal year, in conjunction with the release of the revised indirect rates by the Budget Office. Salary rate revisions generally occur in the first quarter of the fiscal year. The project must determine whether rate changes are significant enough to warrant internal control-account/job changes.

5.1.5.6 Changes in Scope or Nature of Work [Guide 28, 29, 31 {2.5a, b, d}]

Additions to, or deletions from, the scope or nature of work performed by a control account/job are an allowable reason for making changes to the budget for that specific control account. For example, internal or customer-directed design reviews might yield results that make it necessary to revise the technical scope, schedule, or organizational plans. Whether such changes result from an internal decision, or from a decision directed by the customer, changes to control-account budgets are controlled in the same manner. Pertinent control account managers review changes to determine the impacts. Authorized work packages that are directly affected are re-planned using one of the two following methods:

1. Close the open work package by setting the cumulative PMB equal to the cumulative EV, and make this value the BAC for the closed work package (the AC always remains unchanged). The remaining budget from the former work package (i.e., old BAC – cumulative EV) plus unopened work packages and planning packages become the BAC value for the new re-planning effort.
2. Leave the affected work package open, and re-plan the future budget and scope if the earned value method that is used can accommodate this type of re-planning.

5.1.5.7 Changes in Make-or-Buy Determination [Guide 28, 29, 31 {2.5a, b, d}]

When warranted, the make-or-buy (self-performed vs. subcontracted) decision made during the proposal phase and implemented at the contract-award phase might need to be revised. When this happens, affected control account/job managers must re-plan when the resulting dollar amounts are significant (typically annotated in the PEP).

5.1.5.8 Changes in Funding Profiles [Guide 28, 29, 31 {2.5a, b, d}]

If significant changes in contract funding occur, the existing schedules may need to be revised. Under this circumstance, there needs to be agreement between PPPL and the client regarding the scope, schedule, and budget revisions to the remaining contractual effort, and the normal change-control process is followed.

5.2 SCHEDULING CHANGES [Guide 28, 29, 31 {2.5a, b, d}]

After the baseline schedule is established, changes are made in accordance with the PM Change Control Procedure. Historical change records provide an audit trail for all revisions to the baseline schedules. The project manager maintains a baseline change-control log. The log identifies and records each baseline schedule revision, the date and purpose of its incorporation, and the authority for the revision action. Electronic file copies of the baseline schedules, along with all updated schedules, are kept in addition to the log.

Section 6 Surveillance and Maintenance

6.1 SURVEILLANCE AND MAINTENANCE PROCESSES

System surveillance and maintenance (called self-assessment and corrective action at) are the processes of reviewing the health of our earned value management system (EVMS) and making changes to actual implementation practices and procedures to ensure continued compliance with ANSI/EIA-748-A guidelines, and our approved EVMS description. Surveillance is monitoring and assessing, and maintenance is the effective administration of improvements and corrective actions identified through surveillance.

6.1.1 Objectives

Through effective surveillance and maintenance, we anticipate two types of changes: (1) changes that result from a need to correct shortcomings, and (2) changes that represent opportunities for improvement. Surveillance and maintenance will be accomplished primarily through self-assessment and implementation

6.1.2 System Surveillance

The objective of system surveillance is to provide a process for assessing the implementation of the PPPL-EVMS on required projects. Surveillance ensures that the system continues to fulfill the following functions:

- Provide valid, timely information that depicts actual conditions and trends.
- Provide timely indications of actual or potential project issues.
- Maintain baseline integrity.

6.1.3 System Maintenance

The objectives of system maintenance are to provide a process that will continuously improve the operation of the EVMS, to ensure that all changes to the system are in conformance with PPPL and customer requirements, and to update all system documentation impacted by system changes.

6.2 SELF-ASSESSMENT FOR SYSTEM SURVEILLANCE AND MAINTENANCE

Self-assessment is a continuous quality control monitoring process and thorough periodic surveillance by carried out by knowledgeable individuals. Project managers and project-controls personnel, who are trained in the correct use of the PPPL EVMS, and are held accountable for proper implementation on their projects, can perform self-assessment. Issues identified by project personnel will be brought to the attention of, at least, the next level of management on the project, plus the project manager and the PPPL Planning & Control Division (P&CD). Issue resolution will be coordinated by the P&CD if the issue involves changes to the EVMS or supporting PPPL procedures. Project-specific issue resolution is the responsibility of the project manager. The self-assessment and surveillance process will include the following:

- Project baselines will be reviewed during Critical Decision-2 reviews.
- The EVMS system will be periodically, but not less than annually reviewed against the ANSI/EIA-748-A Guidelines and PPPL requirements.
- Recommendations to improve systems will be evaluated and implemented as appropriate.

The P&CD will periodically prepare an EVMS self-assessment report for each project required to use earned value management. The self-assessment report is submitted to the PPPL's Laboratory Director's Office, Associate Laboratory Director Engineering and Infrastructure, the Project Management Officer and Head Business Operations. Based on a review of actual implementation practices in the field, determined by review of project documentation and interviews with project managers and CAMs, the report will document: prior project-specific issues and resolutions; current areas of non-compliance with PPPL's EVMS and ANSI/EIA-748-A; areas of potential improvement; and areas requiring corrective actions, plus an implementation and tracking plan for those actions. The self-assessment is conducted under the ownership and direction of the P&CD, potentially with the participation of other knowledgeable individuals from DOE PSO.

6.3 RESPONSIBILITIES OF THE P&CD

The Laboratory Project Control Office is the steward of earned value management system policy, and has authority delegated by the Laboratory Director to ensure that projects follow established Laboratory policy, and by extension, applicable industry standard. Through a series of ongoing project updates the P&CD provides guidance and recommends improvements to procedures or practices to improve and ensure the quality and completeness of the EVMS.

The P&CD will provide initial PPPL certification of any project that requires a certifiable or certified EVMS. As part of its annual report on project management status, the P&CD will provide an annual statement regarding compliance with the EVMS for all projects that require a certifiable or certified system.

6.3.1 Special Circumstances

When the situation arises where independence of the P&CD cannot be assured with respect to a specific project, the P&CD recommends someone with adequate credentials and independence to provide both the initial certification, and/or annual attestation. The Laboratory Director approves the recommendation. This project-specific surveillance authority is for a specific project and is to be used only when the appearance of independence cannot be assured. Otherwise the P&CD retains both the authority and responsibility for surveillance and certification. The P&CD provides a review of the PPPL-EVMS description, policy, and procedures on an annual basis.

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

Section 7 Risk Management

7.1 BACKGROUND

PPPL will manage risks, where “risk” refers to factors within the Project’s control that both threaten and provide opportunities to improve project cost and schedule performance and the achievement of project technical objectives. During all phases of a project, priority is placed on identifying and mitigating risks. Risk mitigation activities are incorporated into the project’s cost and schedule baselines, as appropriate. Contingency Reserve is used to address realized risks. A quantitative, probabilistic analysis of outstanding risks and estimating uncertainties is used to estimate the amount of reserve required.

Control of the environment, safety, and health hazards, while part of risk management in a broader sense, are not unique to PPPL and are enveloped by the Princeton Plasma Physics Laboratory (PPPL) Integrated Safety Management (ISM) program that is applicable to all PPPL projects and operations. The PPPL ISM clearly indicates that risk management is line management responsibility and will be factored into every project decision at all levels throughout the life of the PPPL Project.

7.2 REFERENCES

The DOE Order on Project Management (DOE Order 413.3) emphasizes the importance of risk management. As outlined in each project's Project Execution Plan (PEP) and its accompanying Risk Management Plan. Risk management is the driving force in establishing and for maintaining the technical, cost, and schedule baselines for PPPL. In addition, PPPL Engineering Procedure, ENG-032, “Work Planning,” provides the lab’s overall guidance in establishing project requirements based on risk management approaches and consequences.

7.3 BOUNDING CONDITIONS

The following key assumptions form the basis for project plans and the Performance Baseline for the project. Project contingency allowances are not intended to address or cover conditions that differ from this planning basis or events that occur in violation of these assumptions. In such cases a Baseline Change will be requested.

- Funding will be made available by DOE and the Congressional budget process in accordance with the profile which forms the basis for the baseline resource loaded schedule, as presented in the Project Execution Plan.
- There will be no changes to PPPL funding or programs that would have a major impact on the overhead rates upon which the baseline is based
- There will be no extraordinary ESH incident or other event that causes an extended shutdown of the Laboratory or a stand down of laboratory activities.
- Certain risks with very significant potential consequences but a very low likelihood of occurrence are not covered by the contingency allowance for the project. Although these risks will be tracked and managed within the project, the project contingency allowances are not intended to cover the impacts of these risks if they are realized.

Examples of risks that fall in this category, and which are assumed will not occur for baseline planning purposes, are:

- Major technical events requiring disassembly of the machine or a field period
- Damage requiring re-fabrication of a component (but damage requiring re-work in accessible areas, e.g. cooling tubes and leads, is covered.)
- Failure of a key component or system during integrated system testing.

- CD-4 Project Completion criteria and requirements will not change from those described in the Project Execution Plan.

7.4 RESPONSIBILITIES

While any member of the PPPL Project Team is expected to identify risks that become apparent, the responsibility for risk management for the PPPL Project rests with the PPPL Project Manager.

7.4.1 Control Account Managers

Identify risks that can impact their work packages; assess the likelihood and potential cost and schedule impacts of the risk; identify and execute risk mitigation activities, and report on the status of both risks and mitigation activities.

7.4.2 Project Risk Manager

By default the Project Manager is responsible for managing project risk. However, the Project Manager may delegate this responsibility to other project team member.

7.5 RISK

7.5.1 Risk Definition

A risk is typically a negative outcome that, if it occurs, would adversely affect the project's ability to achieve overall project objectives within defined cost, schedule, and technical constraints. Risk can be categorized in two broad classes – Management and Organization Risks involving financial factors (e.g., funding profiles, escalation, labor and overhead rates, etc.) or loss of key personnel; and Technical Risks that have the potential to impact the performance of the machine (e.g., Assembly – both generic and specific, systems and components, startup, and systems). In PPPL, the definition is broadened to include opportunities, i.e. positive outcomes that, if they occur, would improve the project's ability to achieve overall project objectives. Hereafter, we use "risk" to cover both negative and positive outcomes.

Terms associated with risk and its management are:

Risk Management – the act or practice of dealing with risk. It involves assessments and planning for risk, implementing workable risk mitigation strategies and plans, monitoring risks to determine how they have changed, and updating risk documentation to assist in the overall project's ability to manage its risks.

Risk Identification – the process of examining project areas and associated technical areas to identify and document risk items.

Risk Analysis – the process of examining each identified risk item to refine the description of the risk, isolate the root causes of the risk item, and determine the effects and consequences should the risk item become a reality. It involves an assessment of each risk item in terms of the probability/likelihood of occurrence, severity of the consequence/impact in terms of cost and schedule, and any relationships to other risk items.

Risk Handling – the process that describes the actions and/or plans to handle and/or control an identified risk by risk avoidance, risk transfer, risk mitigation, and or risk acceptance.

7.5.2 Risk Management Processes

7.5.2.1 Risk Identification

Risk identification begins by compiling the project's risk items. CAMs identify potential risk items for their Control Accounts at a level of detail that permits an evaluator to understand the significance of any risk, identify its causes, and estimate potential consequences.

7.5.2.2 Risk Analysis

Risk analysis is a systematic evaluation of identified risk events by determining the probability of occurrence and consequences, assigning a risk rating based on established criteria, and prioritizing the risks. The first step in the risk analysis process is to determine for each risk event the probability that the risk item will actually occur.

The next step in the risk analysis process is to determine for each risk item the magnitude of the consequences should the event occur. For the PPPL Project, consequences will be assessed in terms of cost and schedule impacts, and classified.

Once the risk likelihood and consequences are established, a risk ranking is assigned to each risk item. This rating is a qualitative measure of the severity of the risk item and provides a starting point for development of risk management priorities. The risk ranking is assessed based on likelihood and consequences, and classified as high, medium, or low.

7.5.2.3 Risk Handling

There are four approaches to handling risk: avoidance, transfer, mitigation, and acceptance.

Risk Avoidance

Risk avoidance represents change in the concept, requirements, specifications, and/or practices that reduce risk to an acceptable level. Simply stated, it eliminates the sources of high or possibly moderate risk and replaces them with a lower risk solution and may be supported by a cost/benefit analysis.

Risk Transfer

Risk transfer represents an allocation of the risk to other activities outside the PPPL MIE project, thereby reducing the overall project risk. In certain instances, risks may also be transferred to vendors through appropriate contract language and terms.

Risk Mitigation

Risk mitigation represents the implementation of activities to reduce the consequences (likelihood and/or impact) of a risk event. The goal of mitigation is to retire risks so that their consequences do not affect the project or to minimize those consequences to the project. Mitigation activities are typically budgeted and scheduled in the project baseline unless those activities are on hold pending further project development or the occurrence of certain risk triggers. Specific methodologies for Risk Mitigation are contained in individual PEPs.

Risk Acceptance

Risk acceptance is an acknowledgment of the existence of a particular risk situation and a conscious decision to accept the impact on the project's baseline. Acceptance can entail a decision not to mitigate a risk, or a decision to accept a residual risk after mitigation activities are completed. The impacts of an accepted risk must be budgeted and scheduled in the project baseline. Cost and schedule contingency allowances are included in the project baseline to cover the impacts of accepted risks.

7.5.3 Risk Documentation

The PPPL Risk Register is the vehicle for documenting identified risks, risk mitigation activities, affected jobs, ownership responsibilities, retirement deadlines, likelihood, consequences, estimated impacts and their bases, and the risk level classification.

7.5.4 The PPPL Project Risk Management Approach

The PPPL Risk Management approach consists of a three step process:

- Managing risk;
- Identifying potential areas of risk;
- Active use and maintenance of the Risk Register

Appendix A (DOE O 413.3 Chg 1/PMBOK Roadmap)

DOE O 413.3 Chg 1	PMBOK	Project Phase	How PPPL Will Satisfy
Analyze user needs vs. strategic plan that considers: Congress & DOE direction OFES initiatives Political & legal issues Develop Mission Need Statement Form basis for engineering & design budget requests Commence Conceptual Design and Obtain CD-0: Approval of Mission Need	Develop Project Charter that: • Identifies Goals and Objectives • Develops Strategies and Plans • Research Prior Experience • Develop Project Charter Develop Preliminary Project Scope Statement that: • Documents Project Costs and Benefits that form basis for engineering and design budget requests • Develop WBS • Prepare Preliminary Project Scope Statement	**Initiation Phase**	Prepare Mission Need Statement (per DOE G 413.3-17) – includes appropriate "tailoring/graded approach" for project

DOE O 413.3 Chg 1	PMBOK	Project Phase	How PPPL Will Satisfy
Analyze alternative concepts (risks, costs, constraints) that arrives at an alternative with a range of cost and schedule: • Uses Systems Engineering, alternative analyses, value management/engineering to essential functions, capability, life cycle costs that are consistent with required performance, scope, schedule, cost, security, and ES&H • Prepare a value management assessment • Develop conceptual design and undergo a CDR (per 413.3-9) • Commence confirmatory R&D • Obtain CD-1: Approve alternate selection and range of estimates for cost and schedule. DOE prepare Project Data Sheet (if line item) to request preliminary and final design funds (PED)	Set up Project Environment that includes facilities, preparation of project standards and procedures, and development of necessary project management tools Define scope, specify deliverables, define scope, and document assumptions Develop Project Schedule that: • Factors in WBS • Develops resource plans and project estimates • Defines dependencies and incorporates into the project schedule • Documents assumptions Develop Risk Management Plan that: • Identifies risks • Analyze risks • Develops mitigation plans • Identifies risk technical, cost, and schedule impacts if risk materializes Plan for Quality – prepare Quality Assurance Plan	**Definition Phase (Conceptual Design)**	Prepare General Requirements Document – defines highest level physics requirements Prepare Quality Assurance Plan per DOE G 413-2 – defines overall QA approaches Prepare preliminary JHA/NEPA documentation Start planning work tasks as per PPPL ENG-032 and ENG-033. Prepare Project Acquisition Plan (AEP) per DOE G 413.3-13 – defines Project acquisition strategies, make-buy, contract types envisioned, procurement requirements, etc. as part of preliminary design phase Start long lead procurement processes one CD-1 approval received Complete training of Project Manager and key team members

DOE O 413.3 Chg 1	PMBOK	Project Phase	How PPPL Will Satisfy
	Organize Project Resources: • Develop organization structure • Develop staffing plan	**Definition Phase (Conceptual Design) - Continued -**	
	Develop Procurement Plans that: • Define procurement requirements • Identify subcontractor scope (make-buy decisions) • Identify potential subcontractors • Identify subcontract types • Document subcontractor management plans		
	Develop financial plan, including assumptions		
	Develop Project Support Plans: • Communications plan • Configuration Management Plan • Data Management Plan		
	Develop Project Management Plan		

DOE O 413.3 Chg 1	PMBOK	Category	How PPPL Will Satisfy
<u>Preliminary Design Phase</u> • Continues system development • Considers and documents value engineering considerations • Set up preliminary EVMS (as required) to gain experience • Update JHA/NEPA documentation • Continually refined estimates, schedules, & designs • Continue confirmatory R&D • Start SOWs/Specs to foe long lead procurements • Conduct design review of the preliminary design (per 413.3-9)	Obtain resources, team orientation, and assignment of responsibilities Direct and manage project execution that manages or provides: o Data items o Configuration items o Process data o General office support o Administer project security processes Manage team performance by effective training and recognition of lessons learned Assure quality by: o Participating in walk-throughs and reviews o Conduct inspections and reviews o Facilitate continuous improvement Manage communications by periodically reviewing progress Continue procurement processes, including requisitions, bid responses, and negotiating contracts	**Execution Phases (Preliminary & Final Design)**	Prepare preliminary Project Execution Plan (PEP) per DOE G 413.3-15 - This is essentially the Project Management Plan Define how PPPL Project Management Systems will be implemented, including EVMS (DOE G 413.3-10)– ensure compliant with the PPPL Project Management Systems Program Description. Undergo a PDR in preparation for final design Finalize and approve PEP during final design Startup EVMS before CD-2 obtained and obtain EVMS certification if needed Undergo a DOE Independent Cost Estimate (ICE) review as part of the External Independent Review (EIR) process prior to CD-2.

DOE O 413.3 Chg 1	PMBOK	Category	How PPPL Will Satisfy
Final Design Phase • Continues design development into final design details • Continue value management and value engineering processes • Prepare Preliminary Safety Design Report (PSDR) • Complete JHA/NEPA documentation as needed • Perform external independent review of costs as part of the ICE or EIR processes • Culminate in obtaining CD-2 that establishes performance measurement baseline – update Project Date Sheet as required • Finalize and approve PEP • Implement EVMS following receipt of CD-2 – conduct EVMS certification if required Conduct Project FDR (per 413.3-9), ensure that all environmental and safety requirements are met, all security concerns addressed, and project is ready to start construction, implementation, procurement, and fabrication. Conduct EIR to verify ready for construction/fabrication Obtain CD-3 (per 413.3-9) that authorizes project to commit resources necessary, within funds provided, to complete the project	Monitoring and Controlling – Even before CD-2 is obtained: o Authorize work, manage action items, and manage project records o Integrate change control – by managing scope, requirements, change decisions, and changes o Verify scope o Control schedules by tracking status , maintaining and iterating schedule, and maintaining work plans o Integrate change control – by managing scope, requirements, change decisions, and changes o Verify scope o Control schedules by tracking status , maintaining and iterating schedule, and maintaining work plans o Manage finances to monitor variances of cost and schedule performance against plans, control costs, and maintaining financial plan current. o Maintain quality assurance by performing required QA checks and audits and testing o Manage team performance by effective communications and meetings, monitoring team morale, and conducting periodic team performance reviews. o Produce performance reports on required frequency. o Manage stakeholder satisfaction and issues. o Manage risks o Manage subcontracts Continue monitoring and controlling processes described in Execution Phase/CD-2	**Execution Phases (Preliminary & Final Design) - Continued -**	Prepare and implement Risk Management Plan per DOE G 413.3-7 – defines overall risk identification, mitigation, assessment processes and how risk management will be accomplished throughout life of project Update PEP and obtain approval during final design phase. Prepare and implement other project support plans/procedures for processes outlined in PEP: o Configuration Management Plan o Data Management Plan o Document Records Plan o Training Plan and Matrices Prepare SOW/Specs for procurements Undergo a FDR in preparation for construction/fabrication Obtain CD-2 to establish a performance measurement baseline (DOE G 413.3-5) Continue EVMS => obtain EVMS validation shortly after receipt of CD-2 As required, undergo a EIR for Construction Prepare PSAR Update JHA/NEPA documentation Develop drafts of project test plans for discussion as part of the CD-3 process

DOE O 413.3 Chg 1	PMBOK	Category	PPPL Reference
Complete final testing, inspection, and documentation Obtain CD-4 (per 413.3-9) to transition from construction to operations Transition to operations and commissioning		**Project Construction Closeout/Operational Readiness**	Prepare Startup and Test Plan, including specific test procedures
		Project Completion and Decommissioning	Prepare Decommissioning Plan

Appendix B ANSI/EIA-748-B

ANSI/EIA-748-A Guidelines	PMSD Implementation	Major Guideline Category	PPPL Procedure Reference
Guideline 1: Define the authorized work elements for the program. A work breakdown structure (WBS), tailored for effective internal management control, is commonly used in this process.	1.1.1, 1.1.3, 1.1.4	Organization	PMSD Appendix E Procedure 2, Project Work Breakdown Structure
Guideline 2: Identify the program organizational structure including the major subcontractors responsible for accomplishing the authorized work, and define the organizational elements in which work will be planned and controlled.	1.1.1, 1.1.5, 1.3.5, 1.3.7	Organization	PMSD Appendix E Procedure 3, Project Organizational Breakdown Structure
Guideline 3: Provide for the integration of the company's planning, scheduling, budgeting, work authorization and cost accumulation processes with each other, and as appropriate, the program work breakdown structure and the program organizational structure.	1.1.1, 1.1.2, 1.1.6, 1.3.3, 1.3.4, 1.3.5, 1.3.6, 1.4	Organization	PMSD Appendix E Procedure 1, The Project Execution Plan PMSD Appendix E Procedure 3, Project Organizational Breakdown Structure
Guideline 4: Identify the company organization or function responsible for controlling overhead (indirect costs).	3.2.2 – 3.2.4	Organization	Accounting Signature Authority List PPPL Chart of Accounts (COA) Budget Office Policy & Procedures Chapter 3
Guideline 5: Provide for integration of the program work breakdown structure and the program organizational structure in a manner that permits cost and schedule performance measurement by elements of either or both structures, as needed.	1.1.6, 1.3.3, 1.3.4, 1.3.5, 1.3.6	Organization	PMSD Appendix E Procedure 4, Control Accounts, and Planning Packages
Guideline 6: 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.	1.2.1, 1.2.2	Planning & Budgeting	PMSD Appendix E Procedure 6, Project Schedule
Guideline 7: Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.	1.2.1, 1.2.2, 1.3.5, 2.1.1, 2.1.2, 2.2,3	Planning & Budgeting	PMSD Appendix E Procedure 1, The Project Execution Plan PMSD Appendix E Procedure 6, Project Schedule PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 8: Establish and maintain a time-phased budget baseline, at the control account level, against which program performance can be measured. Budget for far-term efforts may be held in higher-level accounts until an appropriate time for allocation at the control account level. Initial budgets established for performance measurement will be based on either internal management goals or the external customer negotiated target cost including estimates for authorized but un-defined work. On government contracts, if an over target baseline is used for performance measurement reporting purposes; prior notification must be provided to the	1.3.1, 1.3.2, 1.3.4	Planning & Budgeting	PMSD Appendix E Procedure 8, Monthly Status Reporting

ANSI/EIA-748-A Guidelines	PMSD Implementation	Major Guideline Category	PPPL Procedure Reference
customer.			
Guideline 9: Establish budgets for authorized work with identification of significant cost elements (labor, material, etc.) as needed for internal management and for control of subcontractors.	1.3.1, 1.3.2, 1.3.4, 1.3.5, 1.3.7, Section 4	Planning & Budgeting	PMSD Appendix E Procedure 7, Cost Estimating Plan
Guideline 10: To the extent it is practical to identify the authorized work in discrete work packages, establish budgets for this work in terms of dollars, hours, or other measurable units. Where the entire control account is not subdivided into work packages, identify the far term effort in larger planning packages for budget and scheduling purposes.	1.3.4, 1.3.5, 1.3.7, Section 4	Planning & Budgeting	PMSD Appendix E Procedure 5, Control Account Plan/ Work Authorization Plan
Guideline 11: Provide that the sum of all work package budgets plus planning package budgets within a control account equals the control account budget.	1.3.4, 1.3.5	Planning & Budgeting	PMSD Appendix E Procedure 4, Control Accounts and Planning Packages Plan
Guideline 12: Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is immeasurable or for which measurement is impractical may be classified as level of effort.	1.3.5, 2.1.1 – 2.1.2	Planning & Budgeting	PMSD Appendix E Procedure 4, Control Accounts and Planning Packages Plan
Guideline 13: Establish overhead budgets for each significant organizational component of the company for expenses, which will become indirect costs. Reflect in the program budgets, at the appropriate level, the amounts in overhead pools that are planned to be allocated to the program as indirect costs.	3.1.9, 3.2.2 -3.2.4	Planning & Budgeting	PPPL Chart of Accounts (COA) Budget Office Policy & Procedures Chapter 3 and 4 Accounting Procedures Chapter 2
Guideline 14: Identify contingency budget.	1.3.8	Planning & Budgeting	PMSD Appendix E Procedure 7, Cost Estimating Plan PMSD Appendix E Procedure 9, Change Control
Guideline 15: Provide that the program target cost goal is reconciled with the sum of all internal program budgets and reserves.	1.3.1, 1.3.2	Planning & Budgeting	PMSD Appendix E Procedure 7, Cost Estimating Plan
Guideline 16: Record direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account.	3.1.2 – 3.1.8 Section 4	Accounting Considerations	Accounting Procedures
Guideline 17: *(When a work breakdown structure is used)* Summarize direct costs from control accounts into the work breakdown structure without allocation of a single control account to two or more work breakdown structure elements.	3.1.3	Accounting Considerations	Accounting Procedures Chapter 2
Guideline 18: Summarize direct costs from the control accounts into the contractor's organizational elements without allocation of a single control account to two or more organizational elements.	1.3.3, 3.1.3	Accounting Considerations	PMSD Appendix E Procedure 4, Control Accounts and Planning Packages
Guideline 19: Record all indirect costs, which will be allocated to the contract.	3.1.3, 3.1.9, 3.1.10, 3.2.2 – 3.2.4	Accounting Considerations	Accounting Procedures Budget Office Policies and Procedures (i.e., Chapter 4)
Guideline 20: Identify unit costs, equivalent unit costs, or lot costs when needed.	3.3	Accounting Considerations	Not Applicable

ANSI/EIA-748-A Guidelines	PMSD Implementation	Major Guideline Category	PPPL Procedure Reference
Guideline 21: For EVMS, the material accounting system will provide for: • Accurate cost accumulation and assignment of costs to control accounts in a manner consistent with the budgets using recognized, acceptable, costing techniques. • Cost performance measurement at the point in time most suitable for the category of material involved, but no earlier than the time of progress payments or actual receipt of material. • Full accountability of all material purchased for the program including the residual inventory.	3.1.6, 3.3	Accounting Considerations	Not Applicable
Guideline 22: 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: • Comparison of the amount of planned budget and the amount of budget earned for work accomplished. This comparison provides the schedule variance. • Comparison of the amount of the budget earned to the actual (applied where appropriate) direct costs for the same work. This comparison provides the cost variance.	2.2.2 – 2.2.4, 2.3.2 – 2.3.6, 2.4.3, Section 4	Analysis & Management	PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 23: Identify, at least monthly, the actual schedule performance and planned and actual cost performance, and provide the reasons for the variances in the detail needed by program management.	2.2.2 - 2.2.4, 2.3.2 - 2.3.6, 2.4.3 Section 4	Analysis & Management	PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 24: Identify budgeted and applied (or actual) Indirect costs at the level and frequency needed by management for effective control, along with the reasons for any significant variances.	3.2.2 – 3.2.4	Analysis & Management	Budget Office Policies and Procedures, chapter 3
Guideline 25: 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.	2.3.2, 2.3.4 – 2.3.7, 2.4.2, 2.4.3	Analysis & Management	PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 26: Implement managerial actions taken as the result of earned value information.	2.3.5, 2.3.6, 2.4.2	Analysis & Management	PMSD Appendix E Procedure 8, Monthly Status Reporting
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.	2.3.5 – 2.3.7	Analysis & Management	PMSD Appendix E Procedure 7, Cost Estimating PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 28: 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 organizations.	5.1.1 – 5.1.5 5.1.5.1 – 5.1.5.3 5.1.5.6 – 5.1.5.8 5.2	Revisions & Data Management	PMSD Appendix E Procedure 9, Change Control

ANSI/EIA-748-A Guidelines	PMSD Implementation	Major Guideline Category	PPPL Procedure Reference
Guideline 29: Reconcile current budgets to prior budgets in terms of changes to the authorized work and internal re-planning in the detail needed by management for effective control.	Section 5	Revisions & Data Management	PMSD Appendix E Procedure 7, Cost Estimating PMSD Appendix E Procedure 8, Monthly Status Reporting PMSD Appendix E Procedure 9, Change Control
Guideline 30: Control retroactive changes to records pertaining to work performed that would change previously reported amounts for actual costs, earned value, or budgets. Adjustments should be made only for correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.	1.3.4, 3.1.10, 5.1.5.1, 5.1.5.4	Revisions & Data Management	PMSD Appendix E Procedure 8, Monthly Status Reporting
Guideline 31: Prevent revisions to the program budget except for authorized changes.	5.1.1 – 5.1.5, 5.1.5.1, 5.1.5.3, 5.1.5.6 – 5.1.5.8	Revisions & Data Management	PMSD Appendix E Procedure 9, Change Control
Guideline 32: Document changes to the performance measurement baseline.	5.1.1 – 5.1.4	Revisions & Data Management	PMSD Appendix E Procedure 9, Change Control

Appendix C Abbreviations, Acronyms, and Glossary of Terms

AC — Actual Cost
AE — Acquisition Executive
ANSI — American National Standards Institute
BAC — Budget at Completion
BCWP – Budgeted Cost of Work Performed
BCWS – Budgeted Cost of Work Scheduled
CBB — Contract Budget Baseline
CA – Control Account (a.k.a. and job)
CAM – Control Account Manager (a.k.a job manager)
CAS – Cost Accounting Standards
CASB – Cost Accounting Standards Board
CCB — Change Control Board
CD — Critical Decision
CDR — Conceptual Design Report
CFR — Code of Federal Regulations
CO — Contracting Officer
CPM — Critical Path Method
DEAR — Department of Energy Acquisition Regulation
DOE — U.S. Department of Energy
EAC — Estimate at Completion
ECN — Engineering Change Notice
ECP — Engineering Change Proposal
EIA — Electronic Institute of America
EIR — External Independent Review
EIS — Environmental Impact Statement
EM — Environmental Management
ETC — Estimate to Complete
EV — Earned Value
EVMS — Earned Value Management System
FAR — Federal Acquisition Regulations
FY — Fiscal Year
ICE — Independent Cost Estimate
ICR — Independent Cost Review
IPR — Independent Project Review
IPT — Integrated Project Team
IR — Independent Review
ISM — Integrated Safety Management
ISMS — Integrated Safety Management System
IT — Information Technology
LOE — Level of Effort
MIE — Major Item of Equipment
MS — Major System Project
NEPA — National Environmental Policy Act
OBS — Organizational Breakdown Structure

ODC — Other Direct Cost
OECM — Office of Engineering and Construction Management
OMB — Office of Management and Budget
OPC — Other Project Costs
P3 — Primavera Project Planner
PARS — Program Assistant Reporting System
PB — Performance Baseline
P&C Officer — Planning and Control Officer
PED — Project Engineering and Design
PEP — Project Execution Plan
PMB — Performance Measurement Baseline
PM — Project Management
PV — Planned Value
RAM — Responsibility Assignment Matrix
RD — Requirements Document
RFP — Request for Proposal
RFQ — Request for Quotations
SAE — Secretarial Acquisition Executive
SOW — Scope of Work
SV — Schedule Variance
TEC — Total Estimated Cost (Capital)
TPC — Total Project Cost
WAD — Work Authorization Document
WAF — Work Authorization Form
WBS — Work Breakdown Structure

Accrual Method. An accounting method in which revenue is recognized when earned rather than when collected, and in which expenses are recognized when incurred rather than when paid. Accrual basis accounting is essential to accurate performance and progress information on contracts.

Acquisition Executive (AE). The individual designated by the Secretary of Energy to integrate and unify the management system for a program portfolio of projects, and implement prescribed policies and practices.

Acquisition Strategy. An acquisition strategy is a high-level business and technical management approach designed to achieve project objectives within specified resource constraints. It is the framework for planning, organizing, staffing, controlling, and leading a project. It provides a master schedule for activities essential for project success, and for formulating functional strategies and plans.

Actual Cost (AC). Total costs incurred (direct and indirect) in accomplishing an identified element or scope of work during a given time period. See also “Earned Value.”

Budget at Completion (BAC). The total authorized budget for accomplishing the scope of work. It is equal to the sum of all allocated budgets. Contingency Reserve is not included. The Budget at Completion will form the Performance Baseline.

Budgeting. The process of translating resource requirements into a funding profile.

Burden. Costs that cannot be attributed or assigned to a system as direct cost. An alternative term for Overhead.

Capability. A measure of the system's ability to achieve mission objectives, given the system's condition during the mission.

Change Control Board. A Laboratory or Project adjudicating board for reviewing and approving proposed changes to technical, cost, or schedule baselines.

Change Order. A bilateral or sometimes unilateral order signed by the government contracting officer that directs the contractor to make a change that the *change clause* authorizes usually with, but sometimes without, the contractor's consent.

Conceptual Design. The concept for meeting a mission need. The conceptual design process requires a mission need as an input. Concepts for meeting the need are explored and alternatives considered to determine a set of alternatives that are technically viable, affordable, and sustainable.

Configuration Management. To control changes to, and to record and report changes to, data sets, reports, and documents. The Laboratory and/or Project Configuration Management processes are described in the PEP and in more depth (using a graded approach) in the Configuration Management Plan and implementing procedures.

Contingency. The portion of a project budget that is available for unknowns and uncertainty within the project scope, but outside the scope of the contract (e.g., performance measurement baseline). Contingency is typically held by DOE on large projects. Contingency becomes part of project scope (performance measurement baseline) when released by DOE upon approval of a baseline change proposal/request, justifying its use.

Contract. A contract is a mutually binding agreement that obligates the seller to provide the specified product and obligates the buyer to pay for it.

Contractor. An individual, partnership, company, corporation, or association having a contract with a contracting agency (Federal government) for the design, development, maintenance, modification, or supply of deliverable items and services under the terms of a contract. **Subcontractor** in this document refers to contractors having a contract with BSA, as the management and operations (M&O) contractor to DOE, for work at PPPL.

Control Account. A management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes. Same as a Job.

Control Account Manager (CAM). It is expected that engineers who are assigned as job managers will manage their jobs such that they are accomplished safely and in accordance with the project's technical, cost, and schedule requirements. In particular this means that they are expected to plan the work assigned to them and provide reliable and reasonable estimates of

both cost and schedule; execute the work safely and taking into account actions to protect the environment; achieve the cost and schedule targets that they have estimated; identify needed resources and inputs and be pro-active about securing them; control the work and be accountable to the Project manager for managing and executing cost, schedule and technical plans as approved; set priorities, make decisions, including trade-offs and compromises based on sound analysis - consulting as necessary with colleagues and the Project Manager; support the project's planning and reporting requirements; preparation of monthly job progress status and ETC; and control of job costs, including reviews and controls material purchases, overtime, travel and labor personnel charges.

Cost Estimate. A documented statement of costs estimated to be incurred to complete the project or a defined portion of a project.

Cost Variance. The algebraic difference between Earned Value and Actual Cost (Cost Variance = Earned Value – Actual Cost.) A positive value indicates a favorable condition, and a negative value indicates an unfavorable condition.

Costs to Date. Costs incurred to date by the contractor and reported to DOE (or PPPL's customer), which are recorded as accrued costs. They represent all charges incurred for goods and services received and other assets required, regardless of whether payment for the charges has been made. Costs to date include all completed work and work in process chargeable to the contract; specifically, they include invoices for (1) completed work to which the prime contractor has acquired title; (2) materials delivered to which the prime contractor has acquired title; (3) services rendered; (4) costs billed under cost reimbursement, or time and material subcontracts for work to which the prime contractor has acquired title; (5) progress payments to subcontractors that have been paid or approved for current payment in the ordinary course of business (as specified in the prime contract); and (6) fee profits allocable to the contract.

Cost Performance Index (CPI). The ratio of earned value to actual costs (EV/AC). A value greater than one denotes favorable performance. CPI is often used to predict the magnitude of possible cost deviations from the baseline.

Critical Decision (CD). A formal determination made by the AE and/or designated official (Mission Need Statement) at a specific point in a project life cycle that allows the project to proceed. Critical Decisions occur in the course of a project, for example, prior to the commencement of conceptual design (CD-1), the commencement of execution (CD-3), and turnover (CD-4).

Critical Path. In a project network diagram, the series of logically linked activities that determine the earliest completion date for the project. The Critical Path might change from time to time, as activities are completed ahead of or behind schedule. Although normally calculated for the entire project, the Critical Path can also be determined for a milestone or a subproject. The Critical Path is usually defined as those activities with float less than or equal to a specified value, often zero.

Critical Path Method (CPM). A network analysis technique used to predict project duration by analyzing which sequence of activities (which path) has the least amount of scheduling flexibility (the least amount of float). Early dates are calculated by means of a forward pass using a specified start

date. Late dates are calculated by means of a backward pass starting from a specified completion date to result in zero total float for each activity.

Design Criteria. Those technical data and other project information identified during the project initiation and definition (conceptual design and/or preliminary design phases). They define the project scope, construction features and requirements, and design parameters; applicable design codes, standards, and regulations; applicable health, safety, fire protection, safeguards, security, energy conservation, and quality-assurance requirements; and other requirements. The project design criteria are normally consolidated into a document, which provides the technical base for any further design performed after the criteria are developed.

Deviation. A deviation occurs when the current estimate of a performance, technical, scope, schedule, or cost parameter is not within the threshold values of the Performance Baseline for that parameter. It is handled as a deviation, not through the normal change control system.

Directed Change. A change imposed on a project(s) that affects the project's baseline. Example of directed changes include, but are not limited to, (1) changes to approved budgets or funding and (2) changes resulting from DOE policy directives and regulatory or statutory requirements.

Duration. The number of work periods (not including holidays or other nonworking periods) required to complete an activity or other project element, and usually expressed as workdays or workweeks. Sometimes incorrectly equated with elapsed time.

Estimate at Completion (EAC). The latest revised cost estimate for a given work scope (EAC = cumulative AC + ETC).

Estimated Cost. An anticipated cost for an applied work scope.

Engineering Change Notice (ECN). Change vehicle for modifying drawings and/or creating new drawings

Engineering Change Proposal (ECP). Change vehicle for modifying technical requirements documents such as specifications and cost and schedule impacts of proposed changes. Can also be used to make editorial changes.

Estimate to Complete (ETC). Estimate of costs to complete all work from a point in time to the end of the project.

Earned Value (EV). (1) A method for measuring project performance that compares the value of work performed (EV) with the value of work scheduled (Planned Value [PV]) and the cost of performing the work (Actual Cost [AC]) for the reporting period and/or cumulative to date; (2) the budgeted cost of work performed for an activity or group of activities.

Facilities. Buildings and other structures; their functional systems and equipment, including site development features such as landscaping, roads, walks, and parking areas; outside lighting and communications systems; central utility plants; utilities supply and distribution systems; and other physical-plant features.

Final Design. Completion of the design effort and production of all the approved design documentation necessary to permit procurement. Construction, testing, checkout, and turnover to proceed. Final design occurs between Critical Decision-2 and -3.

Firm Fixed Price Contract. Fixed price contracts provide for a firm price or, under appropriate circumstances, may provide for an adjustable price for the supplies or services that are being procured. In providing for an adjustable price, the contract may fix a ceiling price, target price (including target cost), or minimum price. Unless otherwise provided in the contract, any such ceiling, target, or minimum price is subject to adjustment only if required by the operation of any contract clause that provides for equitable adjustment, escalation, or other revision of the contract price upon the occurrence of an event.

Independent Cost Estimate (ICE). A "bottoms up" documented, independent cost estimate that serves as an analytical tool to validate, crosscheck, or analyze cost estimates developed by project proponents.

Independent Cost Review (ICR). An essential project management tool used to analyze and validate an estimate of project costs. An independent cost review is typically conducted on all projects at the point of baseline approval. Such reviews may be required by the U.S. Congress, DOE management, DOE headquarters program offices, other customer's management, or field project management staff. The requiring office or agency will provide specific requirements for such reviews. An ICR may be performed by an independent internal or external organization.

Indirect Rate. Indirect rate means the percentage or dollar factor that expresses the ratio of an indirect expense incurred in a given period to a direct labor cost or another appropriate base for the same period.

Integrated Project Team (IPT). An IPT is a cross-functional group of individuals organized for the specific purpose of delivering a project to an external or internal customer.

Level of Effort (LOE). Effort of a general or supportive nature without a deliverable end product. An activity (e.g., vendor or customer liaison) that does not lend itself to the measurement of discrete accomplishment. It is generally characterized by a uniform rate of activity over a specific period of time. Value is earned at the rate that the effort is being expended.

Line Item. An appropriation by Congress for a specific effort, activity, or project. All budgets are appropriated by Congress through line items.

Major Item of Equipment (MIE). A project designated by DOE as an improvement to existing facilities – may include a new experimental device such as NCSX.

Milestone. A scheduled event marking the due date for accomplishment of a specified effort (work scope) or objective. A milestone may mark the start, an interim step, or the end of one or more activities.

Mission Need. A performance gap between current performance and what is required.

Network Schedule. A schedule format in which the activities and milestones are represented along with the interdependencies between activities. It expresses the logic (how the program will be accomplished) and the time frames (when). Network schedules are the basis for critical-path analysis, a method for identification and assessment of schedule priorities and impacts.

Organizational Breakdown Structure (OBS). A depiction of the project organization arranged to indicate the line-reporting relationships within the project context.

Other Project Costs (OPC). Costs for engineering, design, development, startup, and operations, which are essential for project execution and are operating-expense funds.

P3. Primavera Project Planner -the primary Laboratory planning and scheduling software

Performance Measurement Baseline (PMB). The collected key performance, scope, cost, and schedule parameters. The sum of the budgets for all work (work packages, planning packages, etc.) scheduled to be accomplished (including in-process work packages), plus the amount of level of effort and apportioned effort scheduled to be accomplished within a given time period. The Performance Measurement Baseline defines the threshold and boundary conditions for a project.

P&C Officer. The Planning & Control Officer (a.k.a Project Controls Manager) is responsible for the implementation, coordination and operation of PCS; generation of Work Authorization Documentation (WAFs); coordination & processing of progress status; generation of cost & schedule performance; PCS Data base and support systems maintenance and control; provide scheduling and estimating support to Project and job managers; generating specialized schedules and reports; and interface with PPPL's Budget and Accounting activities.

Planning Package. A logical aggregate of work, usually future efforts that can be identified and budgeted, but which is not yet planned in detail at the work package or task level.

Program Office. The DOE headquarters organizational element responsible for managing a program.

Project. In general, a unique effort that supports a program mission; has defined start and end points; is undertaken to create a product, facility, or system; and contains interdependent activities planned to meet a common objective or mission. A project is not constrained to any specific element of the budget structure (e.g., operating expense or plant and capital equipment). Construction, if required, is part of the total project. Projects include planning and execution of construction, renovation, modification, environmental restoration, decontamination and decommissioning efforts, and large capital equipment or technology development activities. Tasks that do not include the above elements, such as basic research, grants, ordinary repairs, maintenance of facilities, and operations, are not considered projects.

Project Execution Plan (PEP). The plan for the execution of the project, which establishes roles and responsibilities and defines how the project will be executed. Every project implementing Earned Value management will have a unique project execution plan.

Remaining Duration. The time needed to complete an activity.

Responsibility Assignment Matrix (RAM). A structure that relates the project organization structure to the work breakdown structure to help ensure that each element of the project's scope of work is assigned to a responsible individual.

Risk. A measure of the potential inability to achieve overall project objectives within defined cost, schedule, and technical constraints, and has two components: (1) the *probability/likelihood* of failing to achieve a particular outcome, and (2) the c*onsequences/impacts* of failing to achieve that outcome.

Risk Management. The act or practice of controlling risk. An organized process that reduces risk, prevents a risk from happening, or mitigates the impact if it does occur. The Laboratory approaches to Risk Management are described in the PEP and in more depth (using a graded approach) in the Configuration Management Plan and implementing procedures..

Schedule. A plan that defines when specified work is to be done to accomplish program objectives on time.

Schedule Control. Controlling changes to the project schedule and preparing workaround plans to mitigate the impact of adverse results/delays by others.

Schedule Performance Index (SPI). A schedule performance indicator relating work accomplished to the planned schedule (EV/PV). A value greater than one denotes favorable performance.

Schedule Variance (SV). A metric for the schedule performance on a program. It is the algebraic difference between Earned Value and the Budget (Schedule Variance = Earned Value – Budget). A positive value is a favorable condition while a negative value is unfavorable. The SV is calculated in dollars or work units, and is intended to complement network analysis, not to supersede or replace it.

Scope of Work (SOW). The document that defines the work-scope requirements for a project. It is a basic element of control used in the processes of work assignment (scope) and the establishment of project schedules and budgets.

System. A collection of interdependent equipment and procedures assembled and integrated to perform a well-defined purpose. It is an assembly of procedures, processes, methods, routines, or techniques united by some form of regulated interaction to form an organized whole.

Total Estimated Costs (TEC). The Total Estimated Cost of a project is the specific cost of the project, whether funded as an operating expense or construction. It includes the cost of land and land rights; engineering, design, and inspection costs; direct and indirect construction costs; and the cost of initial equipment necessary to place the plant or installation in operation, whether funded as an operating expense or construction.

Total Project Cost (TPC). Total cost for the project, including all costs regardless of sources or type of funds.

Work Authorization Form (WAF). The WAF documents the work scope to be performed, establishes a schedule, provides a cost estimate, identifies a responsible person for accomplishing the work, and provides for time phased cost & manpower profiles.

Work Breakdown Structure (WBS). A product-oriented grouping of project elements that organizes and defines the total scope of the project. The WBS is a multilevel framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. It is the structure and code that integrates and relates all project work (technical, schedule, and cost) and is used throughout the life cycle of a project to identify and track specific work scopes.

Work Breakdown Structure Dictionary. A listing of work breakdown structure elements with a short description of the work-scope content in each element.

Work Package. A task or set of tasks performed within a control account.

Workaround. A response to a specific negative schedule event. Unlike a contingency plan, a workaround is not planned in advance of the risk event.

Appendix D Roles and Responsibilities

Role	Responsibilities
Laboratory Director	(1) Has overall authority and responsibility for all activities at the Laboratory. (2) Delegates stewardship of the Earned Value Management System to the Laboratory Project Control Office.
Project Management Officer with support from the Planning and Control Division	(1) Establishes and maintains PPPL policies, procedures, and support for surveillance and maintenance of EVMS implementation on individual projects. (2) Ensures that projects comply with PPPL EVMS description. (3) Evaluates and approves EVMS deviation requests. (4) Maintains effective communication with each project implementing the EVMS to assess the lessons learned and to foster a continuous improvement process. (5) Prepares annual EVMS self-assessment report.
Project Manager	(1) Recognizes and accepts responsibility and authority for the project, including the implementation and operation of an EVMS-compliant system. (2) Establishes contingency to be held for rate changes and other project unknowns, and requests its use through the baseline-change-control process. (3) Provides overall schedule constraints, guidance, and approval to control account managers after the establishment of the baseline schedule. (4) Approves/disapproves subcontract awards in accordance with the project policies and recommendations. (5) Manages the development, execution, and maintenance of project procedures that support the EVMS description. (6) Through the development of a responsibility-assignment matrix based on a work breakdown structure and organizational breakdown structure, identifies functional managers and control account managers. (7) Identifies project variance-analysis thresholds, and negotiates and approves contract reporting-level variance thresholds, control-account budgets, and schedule planning. (8) During the baseline development phase, continually reviews and monitors the development of control-account and intermediate-level schedules and their subsequent impact on project objectives. (9) Implements a project-reporting cycle, cost code structure, Change Request, and a budget planning process. (10) Issues and approves all work authorization documents, as appropriate. (11) Approves/disapproves recommendation of the application of earned-value flow-down provisions for subcontracts in accordance with contract provisions and negotiations with the customer. (12) Reviews and analyzes monthly project-level schedules and performance measurement reports. (13) Reviews significant variances and workaround plans for approval/disapproval with appropriate levels of management following monthly process status. (14) Resolves any scheduling and/or resource conflicts that cannot be resolved at the control account manager levels. (15) Creates planning packages. (16) Reviews workaround plans, and monitors corrective actions. (17) Ensures accruals are recorded accurately.
Functional Manager	(1) Reviews workaround plans, and monitors corrective actions, if required. (2) Concurs with resource assignments from their line organizations to the project. (3) Signs the control account plans.
Control Account Manager	(1) Converts planning packages into work packages, assigns an earned-value technique to each work package, and budgets each task by element of cost. (2) Applies appropriate earned-value techniques by using the same basis used to establish the budget during initial planning, rolling-wave planning, and any other re-planning efforts. (3) Initiates the opening and closing of project IDs. (4) Negotiates and accepts the Statement of Work, budget, and schedule on work authorization documents. (5) Within a control account, identifies the tasks that must be accomplished in order for the control-account statement of work to be accomplished. Revises the control-account plan to incorporate authorized changes. (6) After baseline approval, documents the status of all in-process activities on a monthly basis, and takes actions required to develop and monitor the progress of corrective action plans to the point of resolution. (7) Plans the Planned Value (PV) and assesses the control-account status based on the performance

Role	Responsibilities
	measurement baseline using data provided by the project and project subcontractors. Identify accruals. (8) Submits a new Estimate at Completion to the functional manager and project manager, as required, based on monthly reviews. (9) Reviews and analyzes job-cost history reports, invoices, the control-account schedule, and performance measurement reports and variances. Analyzes schedule activities for slippages and impacts on the control account or other interdependent work. Develops workaround/corrective action plans for project management review/approval. (10) Serves as the primary technical interface for subcontractors. Develops and reviews the Estimate at Completion with the subcontractor management team, and either submits the value as reported or develops an independent Estimate at Completion value. Approves subcontractor invoices, verifying actual work completed. (11) Completes the variance-analysis report following the normal review-and-approval cycle. Reviews the contractor-submitted Monthly Project Performance Report. As appropriate, uses the variance analysis included in the Report to help prepare the control-account variance-analysis report. (12) By using other subcontractor information such as schedules, subcontract statement of work, and technical reports, develops control-account plans based on the best knowledge of the non-earned-value, flow-down subcontract work to be performed. (13) Develops detail schedules and networks that will depict horizontal dependency, float, and the critical path. Update control-account status. As necessary, develop supplemental schedules for use in day-to-day operational planning and management.
Procurement Division	(1) Prepares bid packages, RFPs, etc.; coordinates with prospective bidders; leads bid evaluations; and awards contracts. (2) Directs changes to subcontracted work within the general scope of awarded subcontracts. (3) Negotiates contractual changes. (4) Prepares, revises, and issues the Contract Modification.
Accounting Division	(1) Establishes and maintains PPPL accounting policy and procedures. (2) Maintains PPPL accounting system used to record all direct and indirect costs for PPPL projects.
Budget Office	(1) Establishes and maintains PPPL indirect and distributed cost application rates for projects, and notifies project management of impending changes. (2) Maintain PPPL's CAS disclosure statement, ensuring that it is in compliance with Federal cost accounting standards. (3) Ensures that PPPL's budget system and cost accounting system are compliant with the published CAS disclosure statement

Appendix E PMSD Supporting Procedures
Procedure 1 Project Execution Plan

1.0 PURPOSE

The purpose of this procedure is to ensure PMSD consistency within PPPL at the project level. A project execution plan (PEP) is the project specific baseline document that defines the project scope, schedule and cost baseline and defines how the project will be managed. DOE Order 413.3B states, "The PEP is the core document for management of a project". The PEP provides a framework that correlates project objectives with a plan for accomplishment. This framework helps to ensure projects are accomplished in a well planned, cost-effective, responsive, safe and timely manner. As such, the PEP includes Project Management and EVMS requirements.

2.0 SCOPE

Project managers will develop a PEP for each of their projects and maintain the PEP throughout the life of the project consistent with the requirements of DOE O 413.3B. The PEP describes the responsibilities of the PPPL organizations involved in the project, defines roles, restates the mission need, provides an overview of the project, and outlines cost and schedule performance parameters. It includes an accurate reflection of how the project is to be accomplished, resource requirements, technical considerations, risk management, and roles and responsibilities.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

3.2 DOE Guide 413.3-15 "Department of Energy Guide for Project Execution Plans"

4.0 RESPONSIBILITIES

4.1 Laboratory Project Management Officer (LPMO): Ensures PEPs comply with the PPPL PMSD; also reviews and approves any exceptions.

4.2 PPPL Project Manager: Develops and signs the PEP and maintains the document to PPPL PMSD standards.

4.3 Project Sponsor: Is the senior PPPL Manager who has oversight and responsibility for project success within the Laboratory. The Project Sponsor signs and approves the PEP prior to submission to the DOE.

Procedure 1 Project Execution Plan

5.0 PROCEDURES

5.1 Structure and Level of Detail

DOE Order 413.3B along with DOE Guide 413.3-15 prescribes the outline and content for Project Execution Plans. The PEP should be developed to the level of detail necessary to support a valid performance measurement baseline, and to provide the key management processes to integrate and control the project. The PEP should be concise and project specific.

5.2 Relationship to PMSD

Individual PEPs will be compliant with the PPPL PMSD and the PPPL PMSD Supporting Subprocedures. It is in this way that PPPL can assure a consistent site-wide systems approach to Project Management and earned value at the individual project level.

The PEP provides scope, schedule, resource/cost and management process information specific to an individual project. For instance, a PEP will identify the Project Manager and the Control Account Managers by name and organization. Another example is that the PEP will provide the project overall schedule and key milestones.

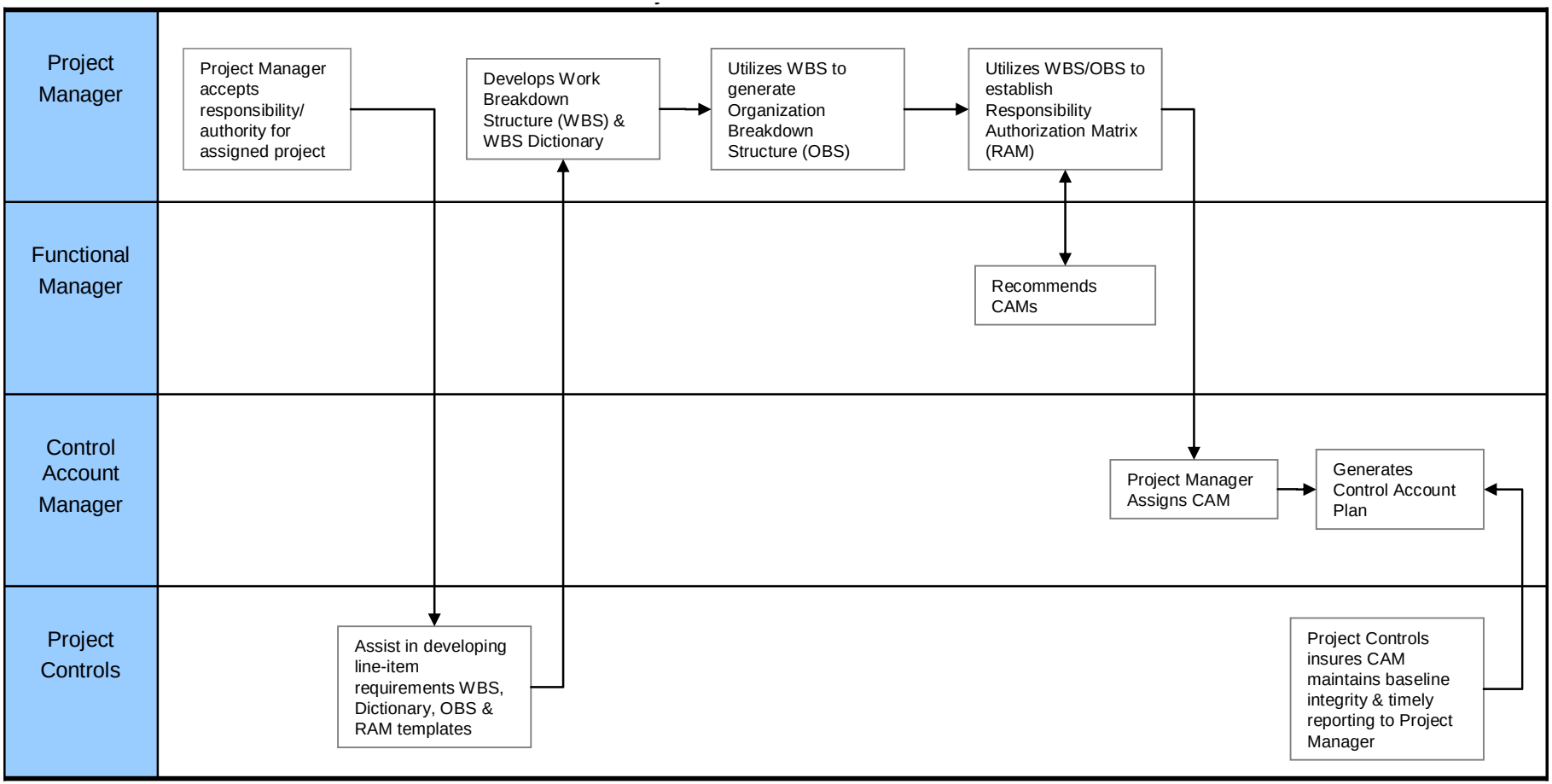
The PEP may be tailored to the needs and customer requirements. However, any exceptions to PMSD practices must be approved by the LPMO

6.0 FIGURE

6.1 Figure 1: Project Execution Plan Process

Procedure 1 Project Execution Plan

Figure 1 Project Execution Plan Process



Procedure 2 Project Work Breakdown Structure (WBS)

1.0 PURPOSE

This procedure provides guidelines and formats for the development of the project work breakdown structure (WBS). The WBS subdivides and logically organizes the entire project scope into its component elements in order to establish a framework for effective management control of the project scope, schedule and budget.

2.0 SCOPE

This procedure describes requirements for creation of a project WBS and associated WBS dictionary.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

3.2 DOE Manual 413.3-1, "Project Management for the Acquisition of Capital Assets"

4.0 RESPONSIBILITIES

The Project Managers are responsible for the creation, coding and maintenance of a WBS for his/her assigned project, with input from other members (e.g. CAMs) of the project team. The Project Manager will formally maintain the WBS and the WBS Dictionary as controlled documents.

5.0 PROCEDURES

5.1 WBS Structure

The project WBS is a product-oriented grouping of project work elements that organizes and defines the total scope of the project. The WBS is a multi-level framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition/division of a project component. The WBS is the structure that integrates and relates all project work (technical, schedule, and budget) and is used throughout the life-cycle of a project to identify, assign, and track specific work scopes.

The WBS will consist of a number of levels and be extended to the Control Account level. The WBS will be structured so that each control account is a subdivision of a unique (one) WBS element.

The WBS will be coded so that cost, schedule summarization and roll-up are possible from the activity level, through the work packages, to the control accounts, and to each

higher level WBS element such that the sum of all elements equals the total project. The total project will be referred to as level 1.

The WBS is detailed in the Project Execution Plan (PEP) or attached as an appendix to the PEP.

5.2 WBS Guidelines

The development of PPPL work breakdown structures will include consideration of the following factors:

1. The WBS provides the framework for the scope, schedules, and budgets (see Sample 1 for a sample). It includes the entire scope for the project. The WBS will not include scope outside of that authorized as part of the scope baseline.
2. Each WBS element represents an aggregation of all its subordinate elements. Valid WBS elements contain all three of the following characteristics:
   - A specific output (i.e., a product or service).
   - Discernible beginning and ending dates.
   - Resources dedicated to it.
3. A project's WBS shall not contain Organizational Breakdown Structure or Functional Breakdown Structure elements. The WBS will contain products or services, which are successively subdivided into increasingly detailed and manageable work products or elements.
4. The WBS has elements that can be assigned to individual managers who will be responsible for the planning and control of the scope represented by each of these elements.
5. At its upper levels, the WBS typically has time-phased elements to allow for the closeout of completed work (i.e., initiation, definition, execution, and transition/closeout).
6. At its upper levels, the WBS has elements designated for reporting performance data to the customer.
7. All of the items appearing on the WBS are traceable to items on the project schedule.
8. Costs that are collected and reported are summarized upward directly through the WBS without bypassing lower-level elements or allocating a Control Account (CA) to more than one higher element.
9. All required external reporting elements are included.
10. The WBS includes elements at the CA level for major subcontracted efforts, identifying subcontractors, if known.
11. The WBS does not include contingency reserve since it does not represent project work.
12. The WBS will not have upper level elements for operating or capital funds; the accounting of different fund types can be accommodated through base coding.

Procedure 2 Project Work Breakdown Structure (WBS)

5.3 WBS Dictionary

The WBS dictionary is a set of specific definitions that describe the scope of each work element identified in the WBS. It defines each element to at least the control account level in terms of the content of the work to be performed. The WBS dictionary demonstrates that the Scope of Work (SOW) and the WBS are fully reconciled. For EVMS compliant projects, the WBS will be described in a WBS dictionary (see Sample 2), in order to provide an adequate description of the work involved.

6.0 SAMPLES

6.1 Sample 1 Work Breakdown Structure (WBS) - Sample

6.2 Sample 2 WBS Dictionary (Text Format) - Sample

Procedure 2 Project Work Breakdown Structure (WBS)

Sample 1 Work Breakdown Structure (WBS) - Sample

WBS L1	L2	L3	Description
1			**NSTX UPGRADE PROJECT**
	1.1		**Torus Systems**
		1.1.0	Project Integrated Model
		1.1.1	Plasma Facing Components
		1.1.2	Vacuum Vessel and Support Structure
		1.1.3	Magnet Systems
	1.2		**Plasma Heating and Current Drive Systems**
		1.2.1	High Harmonic Fast Wave (HHFW)
		1.2.2	Coaxial Helicity Injection (CHI) Current Drive
		1.2.3	Electron Cyclotron Heating (ECH)
		1.2.4	Neutral Beam Injection (NBI)
	1.3		**Auxiliary Systems**
		1.3.1	Vacuum Pumping System
		1.3.2	Coolant Systems
		1.3.3	Bakeout Heating System
		1.3.4	Gas Delivery System
		1.3.5	Glow Discharge Cleaning System
	1.4		**Plasma Diagnostics**
		1.4.1	Plasma Diagnostics
	1.5		**Power Systems**
		1.5.1	AC Power Systems
		1.5.2	AC/DC Converters
		1.5.3	DC Systems
		1.5.4	Control and Protection System
		1.5.5	General Power Systems and Integration
	1.6		**Central Instrumentation and Controls (I&C)**
		1.6.1	Control System
		1.6.2	Data Acquisition System
	1.7		**Project Support & Integration**
		1.7.1	Project Management and Integration
		1.7.2	Project Physics
		1.7.3	Integrated Systems Tests
	1.8		**Site Preparation and Assembly**
		1.8.1	Site Preparation
		1.8.2	Torus Assembly and Construction

Procedure 2 Project Work Breakdown Structure (WBS)

Sample 2 WBS Dictionary (Text Format) - Sample

WBS Element: 1 **WBS Level: 1**
WBS Title: NSTX Upgrade Project
Definition: The replacement of the entire Center Stack Assembly (CSA) and installation of a second Neutral Beam Injection (NBI) system on NSTX is planned to allow an improved understanding of the Spherical Torus (ST) magnetic confinement configuration which is needed to establish the physics basis for next-step ST facilities, broaden the scientific understanding of plasma confinement for ITER, and maintain U.S. world leadership in ST research capabilities. In particular, operation at higher magnetic field with reduced plasma collisionality is needed to extend the plasma physics understanding of the ST toward next-step ST facilities and ITER. Controllable fully-non-inductive current-drive will also contribute to assessing the ST as a potentially cost-effective path to fusion energy.

WBS Element: 1.1 **WBS Level: 2**
WBS Title: Torus Systems
Definition: The torus systems include all the systems and related elements within the boundary of the NSTX support structure. This WBS element includes the Plasma Facing Components (WBS 1.1), Vacuum Vessel & Support Structure (WBS 1.2), and Magnet Systems (WBS 1.3). The scope of the work contains engineering design, R&D, mockups, procurement activities, and component fabrication. Assembly of the Torus System is included in WBS 1.8.

WBS Element: 1.1.0 **WBS Level: 3**
WBS Title: Project Integrated Model
Definition: This WBS element includes development of a project integrated model and the associated analysis support of the overall NSTX Upgrade Project.

As a result of the NSTX Upgrade Project, the NSTX global models and analyses will need to be updated. This WBS element includes analytical support for global models and analysis not presently identified. The global model will provide the basis for updating the analysis to qualify components and identify areas of the tokamak requiring further analysis. Identified plasma scenarios and power supply current limit analyses will be run in the global model and current sets that require further analysis will be identified. These analyses also serve to check the results of more detailed analyses.

WBS Element: 1.1.1 **WBS Level: 3**
WBS Title: Plasma Facing Components
Definition: The plasma facing components (PFCs) include all the systems and related elements that serve to protect the vacuum vessel from the charged particles and radiation flux from the plasma. These include the plasma facing tiles and mounting components, passive stabilizers, inner wall protection, divertor area strike plates, and local I&C. This element consists of the engineering design, analysis, procurement activities and component fabrication.

The NSTX Upgrade Project will require new PFCs on the new Center Stack Casing (CSC) and the new Inboard divertor (IBD). This WBS element includes the design and analysis for both the CS and IBD PFCs, design modifications to the PFC tiles to accommodate surface diagnostics, including design of the tile mounting schemes and routing plans for diagnostic wires, generation of required documentation such as checked calculations, specifications and procedures, the procurement and installation of all PFC tiles and hardware on the CSC and IBD.

In addition the NSTX Upgrade will require analysis of the passive plates for disruption and thermal loads. CDR level calculations were performed that addressed one of five disruptions. The remaining identified disruptions are to be completed during Preliminary Design. During Final design, analysis updates are expected as a result of preliminary design evolution. Modest hardware upgrades are anticipated are anticipated as part of this task. Additions of

accelerometers or other diagnostics to benchmark calculations with actual performance in NSTX are also anticipated. This analysis effort is included in this WBS element.

With the exception of the modifications identified above, no additional modifications to the PFCs are anticipated.

WBS Element: 1.1.2 **WBS Level: 3**
WBS Title: Vacuum Vessel and Support Structure
Definition: The vacuum vessel & support structure (VVSS) consists of the vacuum chamber, not including the PFCs, all ports and vacuum boundary closures and the torus support structure which provides the overall supporting mechanism for the torus components to the test cell floor. This WBS element includes the engineering design, analysis, procurement activities and component fabrication.

The NSTX Upgrade Project will require that the existing VVSS be modified to accommodate the new center stack structure, including the umbrella structure and the new center stack support structure. This WBS element includes the analytical and CAD design of the support structures associated with the Magnet upgrade activities. The scope includes; the Vacuum Vessel & Structural Support, the Outer TF Structures, the Outer PF Coil Structures, the Umbrella Structural Reinforcement, the CS Support Pedestal and miscellaneous Vacuum Vessel Structural Supports. It also includes the procurement and fabrication of these structures, but does not include installation costs. Installations costs are included in WBS 1.8.

WBS Element 1.1.3 **WBS Level: 3**
WBS Title: Magnet Systems
Definition: The magnet system consists of the outer Poloidal Field (PF) coils (PF#2-5), the outer Toroidal Field (TF) coil legs, and the Center Stack Assembly (CSA). The CSA contains the inner TF coil legs, the TF coil joint (flex bus assembly), the OH solenoid, the shaping coils, and the center stack casing. This WBS element includes the design, analysis, prototypes (as required), procurement activities and fabrication of the magnet systems up to and including the magnet system coil buswork, but does not include installation costs. Installations costs are included in WBS 1.8

The NSTX Upgrade Project will require engineering, analysis, design procurement and fabrication of a new CSA, replacement of two outer TF coil legs, and a fabrication of a new TF coil joint

This WBS element provides CAD design support for the overall assembly drawings associated with the CSA upgrade. It also includes some time for space allocation studies associated with the magnet upgrades. CAD design support for individual components is included in the specific component jobs.

WBS Element: 1.1.3.1 **WBS Level: 4**
WBS Title: Outer Poloidal Field Coils (PF #3-5)
Definition: The outer Poloidal Field coils (PF 3-5) consist of 5 poloidal field coils PF 3 upper and lower, PF 4 upper and lower and PF 5. <u>There are no changes to the outer PF coils as part of the NSTX Upgrade Project scope.</u>

Procedure 2 Project Work Breakdown Structure (WBS)

WBS Element: 1.1.3.2 **WBS Level: 4**

WBS Title: Outer Toroidal Field Coils

Definition: The outer Toroidal Field coils subsystem consists of the coil sections that make up the 12 TF outer legs. This WBS element includes the design, analysis, prototypes (as required), procurement activities and fabrication. For the NSTX Upgrade Project two (2) new Outer TF coils will be fabricated to replace existing ones. This WBS element includes the fabrication of (2) new Outer TF coils to replace the existing leaking OTF#7 and OTF#11 in NSTX. The scope includes the procurement of conductor, insulation material, aluminum castings and supports necessary to fabricate a new OTF coils. Coil fabrication will be performed in-house. This scope does not include costs associated with installation. Installations costs are included in WBS 1.8

Procedure 3 Project Organizational Breakdown Structure (OBS) & Responsibility Assignment Matrix (RAM)

1.0 PURPOSE

The Organizational Breakdown Structure (OBS) is a project organization framework for identification of accountability, responsibility, management, and approvals of all authorized scope.

2.0 SCOPE

All projects using the PPPL Project Management System Description (PMSD) will include an OBS in the Project Execution Plan (PEP). All projects will also utilize a Responsibility Assignment Matrix (RAM) to depict the OBS and WBS relationship. The RAM will also be included in the PEP.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 PROCEDURES

4.1 Structure

OBS: A project OBS is a depiction of the project organization structure arranged to indicate the responsibility and reporting relationships within the project context. The OBS identifies all responsible organizational entities and/or individuals responsible and accountable for every element of the WBS and Scope of Work (SOW). The OBS reflects the way the project is functionally organized. It is a direct representation and description of the hierarchy and organizations that will provide resources to plan and perform work identified in the Work Breakdown Structure (WBS). The OBS helps management focus on establishing the most efficient organization, by taking into consideration availability and capability of management and technical staff including subcontractors, to achieve project objectives. Each project will have an OBS unique to that project.

Responsibility Assignment Matrix (RAM): The RAM is an essential element of the project plan that integrates the organization structure with the scope of work outlined in the WBS. The RAM matrix establishes ownership of the work depicted in the WBS, by linking the WBS and the OBS. The intersection of the WBS and OBS (as shown on the RAM matrix) is the Control Account (CA). PPPL PMSD RAMs will identify the Control Account Managers (CAMs) for these intersection points by name. The intersection point will also include the budgeted planned value (PV), resulting in a "dollarized RAM". The sum of the CAs will total the total project PV. Each project will have a RAM unique to that project. A sample RAM is shown as Sample 2.

Procedure 3 Project Organizational Breakdown Structure (OBS) & Responsibility Assignment Matrix (RAM)

4.2 Responsibility

Project Managers are responsible for the creation of an OBS for their assigned projects. Line (functional) managers concur in the OBS if they provide staff and/or other resources to the project. The PPPL senior manager (sponsor approving authority) for the project concurs in the OBS and the RAM.

4.3 Development Process

The project manager will identify the sources of required staff resources and the organizations necessary to participate in the planning and execution of the project. Then, the project manager will assemble the project team and develop the project's OBS and RAM. The Project Manager will seek agreement with the management of these organizations as to their role and extent of involvement, based on initial project requirements. Project team members (such as Project Controls), and other personnel will be identified and the project OBS developed. The assignment of CAMs, as required to complete the RAM, will be with the concurrence of the line manager, unless the CAMs are assigned as dedicated staff resources to the project. For purposes of the project, all CAMs report to the Project Manager.

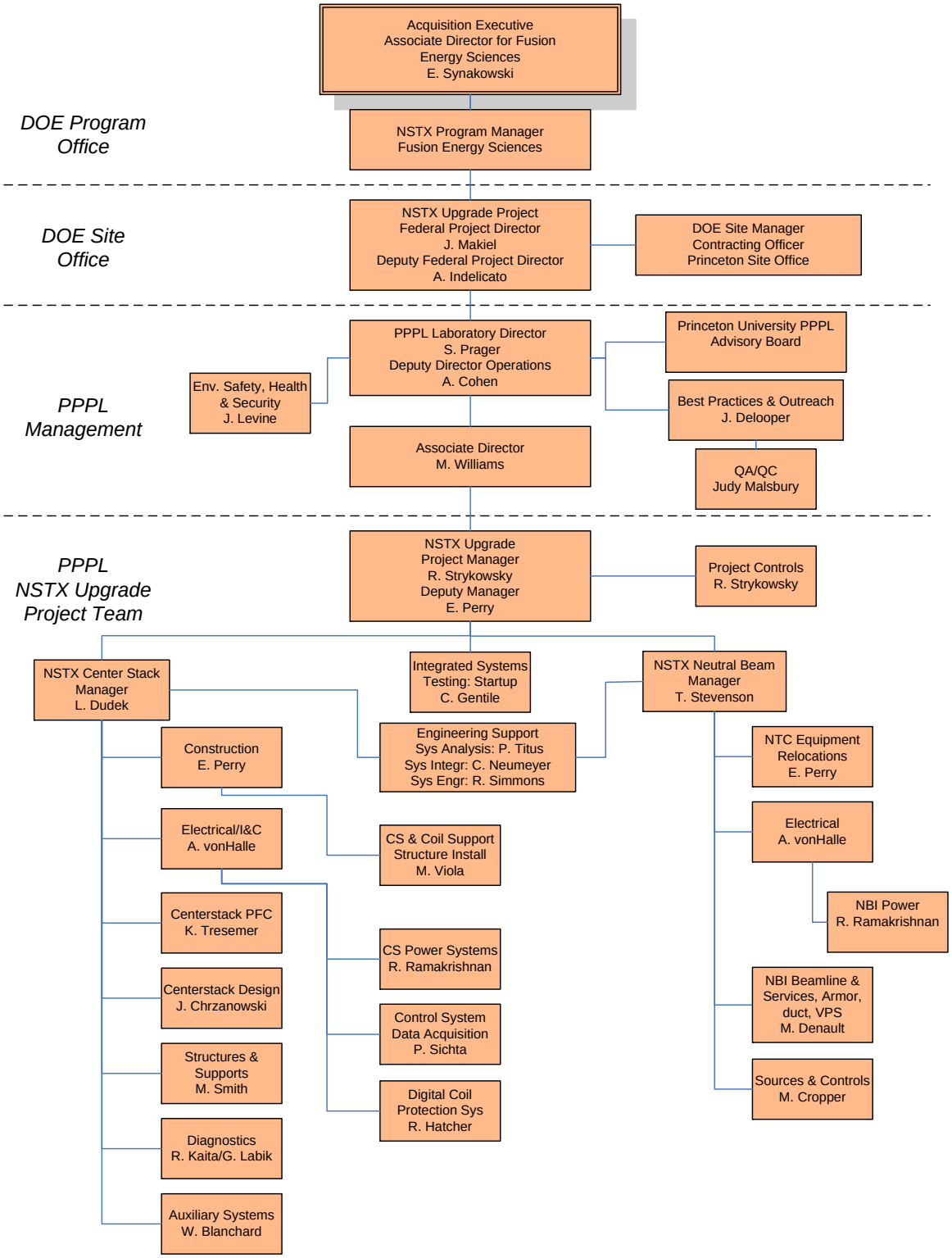
5.0 SAMPLE

5.1 SAMPLE 1: Organizational Breakdown Structure (OBS)

5.2 SAMPLE 2: Responsibility Assignment Matrix (RAM)

Procedure 3 Project Organizational Breakdown Structure (OBS) & Responsibility Assignment Matrix (RAM)

Sample 1 Organizational Breakdown Structure (OBS)



Procedure 3 Project Organizational Breakdown Structure (OBS) & Responsibility Assignment Matrix (RAM)

Sample 2 Responsibility Assignment Matrix

NSTX Upgrade Project Responsibility Assignment Matrix

WBS Element							Control Account Manager																				
L1	L2	L3	L4	L5	DESCRIPTION	Control Account	Titus	Tresemer	Smith	Chrzanowski	Kozub	Cropper	Stevenson	Denault	Raki	Perry	Blanchard	Kaita	Labik	Hatcher	Sichta	Strykowsky	Dudek	Gentile	Viola	BAC	LOE ($K)	LOE (%)
		1.1.0			Project Integrated Model (1000)	1000	X																			385	193	50
		1.1.1			Center Stack Upgrade (1001)	1001		X																		2,169	0	0
		1.1.1			Passive Plate Analysis and Upgrade Activity (1002)	1002	X																			251	0	0
		1.1.2			Vacuum Vessel and Support Structure (1200)	1200			X																	3,554	0	0
		1.1.3			Center Stack Upgrade Project Design Support (1300)	1300				X																1,063	1,019	96
			1.1.3.2		Outer Toroidal Field Coils (1301)	1301				X																338	0	0
				1.1.3.3.1	Center Stack – TF Inner Legs/Bundle(1304)	1304				X																2,595	0	0
				1.1.3.3.1	TF Joint Stand and Performance Test (1303)	1303					X															353	0	0
				1.1.3.3.2	Ohmic Heating Solenoid (1305)	1305				X																4,556	211	5
				1.1.3.3.3	Inner PF Coils (1306)	1306				X																669	0	0
				1.1.3.3.4	Center Stack Casing Job (1307)	1307				X																904	0	0
				1.1.3.3.4	Center Stack Assembly (1302)	1302				X																990	0	0
				1.1.3.3.4	Center Stack Magnets Systems	1310				X																442	0	0
		1.2.3			Electron Cyclotron Heating (ECH) (2300)	2300	X																			84	0	0
			1.2.4.2		NBI Source Refurbishment (2420)	2420						X														1,094	0	0
			1.2.4.3		NSTX Beamline 2 Decontamination (2430)	2430							X													2,057	0	0
			1.2.4.4		NSTX Beamline 2 Refurbishment (2440)	2440								X												2,590	613	24
			1.2.4.4		NSTX Beamline2 Relocation (2425)	2425								X												1,860	257	14
			1.2.4.5		NSTX Beamline 2 Services (2450)	2450								X												4,516	678	15
			1.2.4.6		NBI Armor (2460)	2460		X																		700	0	0
			1.2.4.7		NBI Power Systems (2470)	2470									X											3,335	87	3
			1.2.4.7		NBI Controls & Instrumentation (2475)	2475						X														2,089	0	0
			1.2.4.8		NSTX Beamline 2 Duct & Vacuum Vessel Mods (2480)	2480								X												2,260	0	0
			1.2.4.9		NSTX Test Cell Equipment Removals/Relocations (2490)	2490										X										3,618	424	12
		1.3.1			Vacuum Pumping System (2485)	2485											X									388	0	0
		1.3.2			Coolant Systems (3200)	3200								X												195	0	0
		1.3.3			NSTX CSU Bakeout System Mods (3300)	3300									X											79	0	0
		1.3.4			Gas Delivery System (3400)	3400											X									102	0	0
		1.4.1			Center Stack Upgrade Diagnostics (4100)	4100												X								836	0	0
		1.4.1			MPTS VV Modifications (4500)	4500													X							949	9	1
					Control and Protection System (5200)	5200														X						2,493	249	10
		1.5.5			Power Systems Integration and Testing (5000)	5000									X											5,735	412	7
				1.1.3.3.4	Coil Bus Runs (5501)	5501			X																	1,131	0	0
	1.6				Control Systems Data Acquisition (6100)	6100															X					918	28	3
			1.7.1.1		Project Management and Integration (7100)	7100																X				5,812	5,811	100
			1.7.1.2		Center Stack Upgrade Management (7200)	7200																	X			1,539	1,107	72
			1.7.1.3		Neutral Beam Upgrade Management (7300)	7300							X													1,450	943	65
			1.7.1.4		Health Physics Technical Support (7400)	7400							X													2,507	2,507	100
			1.7.1.5		Direct Allocations Jobs (7710)	7710																X				2,985	2,984	100
		1.7.3			Integrated Systems Tests (7900)	7900																		X		78	6	8
		1.8.2			Installation of the Coil Support Systems (8200)	8200																			X	6,474	3,067	47
		1.8.2			CS Removal & Reinstallation/Pumpdown/Bakeout (8250)	8250										X										1,174	0	0
						Total	720	2,869	4,685	11,557	353	3,183	6,014	11,421	9,149	4,792	490	836	949	2,493	918	8,797	1,539	78	6,474	77,317	20,605	0.2665
						LOE	193	0	0	1,230	0	0	3,450	1,548	499	424	0	0	9	249	28	8,795	1,107	6	3,067	20,605		
						% LOE	27%	0%	0%	11%	0%	0%	57%	14%	5%	9%	0%	0%	1%	10%	3%	100%	72%	8%	47%	27%		

Procedure 4 Control Accounts, Work Packages & Planning Packages

1.0 PURPOSE

This procedure describes PPPL procedures governing the development and use of control accounts, work packages and planning packages for a PMSD compliant project. A control account (CA) is a management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes. Work Packages are a subdivision of a CA and consist of discrete or Level of Effort (LOE) tasks, or sets of tasks, that have been planned and budgeted in detail. Planning packages are created to describe work within a control account that will occur in the future.

2.0 SCOPE

This procedure applies to all PPPL projects using the PPPL Project Management System Description (PMSD) for reporting.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 RESPONSIBILITIES

4.1 Project Manager (PM)

The PM shall be responsible for establishing the project controls system(s) identified in this procedure. The PM appoints the Control Account Managers (CAMs) for the project, with the concurrence of the affiliated Functional Manager(s). The PM provides the CAMs with the high-level scope, schedule and cost boundaries for the project, customer requirements, and other constraints and planning guidance, prior to the development of the CAs. The PM approves the CAs for the project.

4.2 Planning and Control (P&C Officer)

The P&C Officer is responsible for the following:

- assisting the PM and CAMs in preparation, maintenance, and control of scope, schedule, budget, and risk
- Providing guidance and ensuring compliance with EVMS procedures;
- Executing and ensuring data integrity in the PC systems referenced in, and in support of, this procedure;
- Concurring with the CAMs' development of their CA information.
-

4.3 Control Account Managers (CAMs)

The CAM is responsible for preparing detailed scope, schedules and cost estimates for the control account, and further subdividing the work into Work Packages and Planning

Packages. The CAM is also responsible for planning and budgeting assigned control accounts, analysis and management of control account performance, and revision to control accounts. The CAM is responsible for the execution of the scope of any and all Work Packages within a control account. The CAM proposes the Earned Value (EV) method to be used to track each work package.

5.0 PROCEDURES

5.1 Control Accounts (CAs)

CAs are the management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes. A control account is a natural management point for planning and control because it represents the work assigned to one responsible organizational element on one work breakdown structure element. Control accounts are made up of one or more work packages and planning packages. Control accounts are developed for each lowest-level WBS element.

CAs are accounted for in the Laboratory's General Ledger System using charge numbers ("projects"/"activities") or codes (an alphanumeric string) that represents the lowest level of data collection where all three performance measurement data elements BCWS (Planned Value), BCWP (Earned Value), and ACWP are accumulated. The control account plan itself contains the following data elements:

1. Work definition
2. Budget
3. Schedule
4. Work Authorization
5. Performance measurement method
6. Organizational Responsibility
7. Cost collection

5.2 Work Packages (WPs)

WPs are a subdivision of a CA and consist of one or more discrete or LOE tasks or activities that have been planned, estimated, and budgeted in detail. WPs constitute the basic building blocks used in planning, measuring, accomplishing, and controlling project work. A WP may contain lower level detailed activities, but has the following characteristics:

- Is distinguishable from all other WPs;
- Has responsibility assigned to a single CAM;
- Has scheduled start and completion dates;
- Has a budget expressed in dollars, labor hours, or measurable units;
- Is limited in duration to a relatively short span of time (generally four reporting

- periods or less unless they are LOE activities);
- Is integrated with detailed engineering, construction, operations, and transition
- schedules (if appropriate).

A completely planned WP is documented in the resource-loaded schedule with, at least, this information:

- A unique identifier number and title;
- A description of the scope associated with that WP;
- Resources required to perform the work;
- Estimated duration(s) of the work, with expected start and finish dates;
- Earned Value Measurement Technique (EVMT) to be used in measuring performance;
- PM and CAM approved Basis of Estimate.

All work scheduled to start in a current month has a detailed plan for the applicable WP, and is covered by a signed WAF at the CA level (see *Procedure 3 Control Account Planning/Work Authorization*).

5.3 Planning Packages

Planning packages are created to describe known scope to be performed within a CA that will occur in the future, but not sufficiently detailed. Planning packages must have a work scope, schedule, and time-phased budget. Planning packages are normally larger (scope, schedule, and budget) than individual detailed WPs, but planning packages must still relate to a specific work scope. Individual planning packages do not require the detail found in WPs and do not have an assigned PMT. When planning packages are converted into WPs, they are defined in greater detail in the schedule – as discussed in the above section. Conversion of planning packages to WPs normally occurs no later than two accounting periods before the work is scheduled to begin. These conversions must be documented using the change control process outlined in *Procedure 9 Change Control.*

Procedure 5 Control Account Plan/Work Authorization

1.0 PURPOSE

This procedure defines how project work is properly and formally authorized. The Control Account Plan/Work Authorization defines the authorized scope, budget and schedule for the control account and confirms the agreement between the Project Manager and the Control Account Manager (CAM) to accomplish this plan and provides authorization to proceed with this work. The Project Manager uses the Control Account Plan/Work Authorization form first to provide planning guidance to the CAMs, and then when planning is completed, to document and delegate work to the CAMs.

2.0 SCOPE

A Control Account Plan/Work Authorization will be prepared for all control accounts on projects using the PPPL Project Management System Description (PMSD).

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 RESPONSIBILITIES

4.1 Project Manager (PM). Authorizes all project work prior to its commencement. Authorizes work in accordance with the authorized scope, schedule and cost baselines. Approves Control Accounts (CA) and Work Packages (WP) plans/documents. Reviews CA's and work packages WP's for completion and directs CA/WP closure as appropriate. Appoints CAMs.

4.2 Control Account Managers (CAMs). Prepares and submits the Control Account Plan and the Work Packages to the PM for approval. Ensure that work is initiated and performed in accordance with the CA's and WP's. Designates the WP Managers for the CA.

5.0 PROCEDURE

The project work authorization process and documents should provide reasonable assurance that the work that is included in the project baseline, and only that work, is initiated as provided for in the project baseline. This project framework will at a minimum consist of:

5.1 Development and Assignment

The Project Manager will identify key control points at the intersections of the Work Breakdown Structure (WBS) and Organizational Breakdown Structure (OBS) through the use of the Responsibility Assignment Matrix (RAM). Control accounts will then be established at these key control points. The Project Manager will identify potential

CAMs who could be assigned to one or more of these control accounts. The Project Manager will discuss assignment of the CAMs with their functional manager(s), who will be responsible for assigning the CAMs to the project team. A single CAM is assigned to each Control Account. The Project Manager, supported by Project Controls, develops planning guidance for each control account, which may include key scope, schedule and resource parameters. The Project Manager documents this information on the Control Account Plan/Work Authorization form, and reviews planning guidance with the CAM.

5.2 Work Authorization

The first step is the DOE Project Authorization. This authorizes the Project Manager to begin work.

Upon direction of the PM, the CAM develops scope, detailed schedules and resource/cost estimates for his/her assigned Work Packages and Planning Packages. The CAMs forward these cost estimates to Project Controls for validation using the Control Account Plan (CAP)/Work Authorization form for each control account. The CAP includes the relationship to the WBS element or elements, responsible organization identification, control account task description, schedule, and time-phased budget in dollars. The Control Account Plan/Work Authorization is reviewed by the Project Controls manager and approved by the Project Manager and the CAM to document the delegation of work to the CAM. Work Packages are authorized to begin upon signature of the PM and the CAM. All work scheduled to start in a current month shall have a detailed plan for the applicable work package. Completed and signed Work Packages shall be in place before beginning work.

The approved control account and work package can only be changed with appropriate change control.

6.0 FIGURE

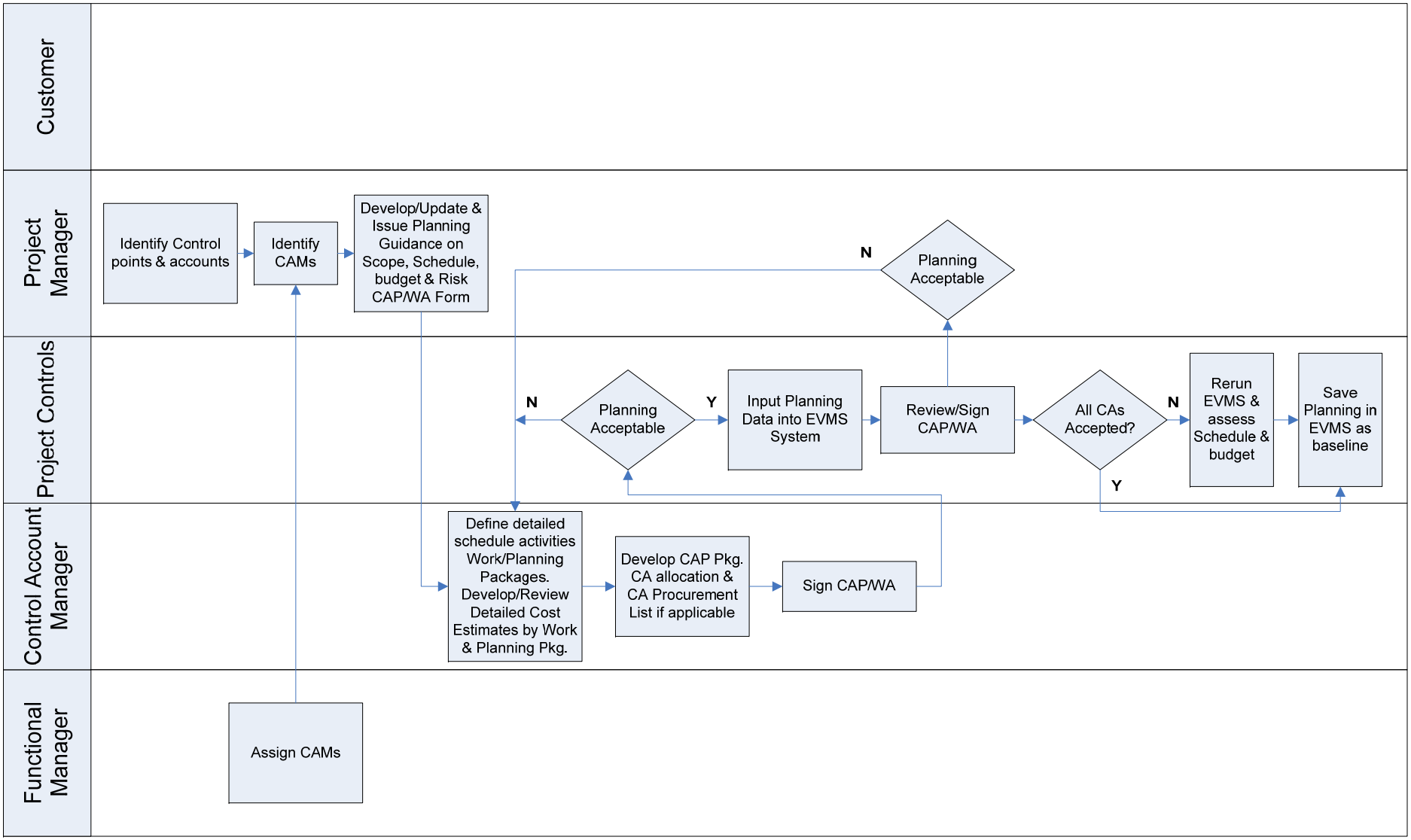
6.1 Figure 1: Control Account and Project Planning/Approval Process

7.0 SAMPLE

7.1 Sample A: Control Account Plan/Work Authorization Form - Sample

Procedure 5 Control Account Plan/Work Authorization

Figure 1: Control Account and Project Planning/Approval Process



Procedure 5 Control Account Plan/Work Authorization

Sample A Control Account Plan/Work Authorization Form - Sample

Work Authorization Document NSTX Upgrade Project			
Control Account #:	1000	**Title:**	CSU Analytical Support
WBS	1.1	**Title:**	Torus Systems
Period of Performance:	04 January 2010 to 05 October 2014		
Authorized Budget:	$385	**Control Account Manager:**	Titus
Revision #:	0	**Revision Date:**	05/04/11

Authorized Work Description:

As a result of the NSTX Upgrade Project, the NSTX global models and analyses will need to be updated. This WBS element includes analytical support for global models and analysis not presently identified. The global model will provide the basis for updating the analysis to qualify components and identify areas of the tokamak requiring further analysis. Identified plasma scenarios and power supply current limit analyses will be run in the global model and current sets that require further analysis will be identified. These analyses also serve to check the results of more detailed analyses.

Attachments:

1- WBS Dictionary sheet that defines the scope of work for this WBS element.
2- A detailed Control Accopunt schedule showing all work packages and planning packages.
3- A detailed Resource Report by WBS and Schedule acitvity.
4- Budgeted Cost by month.
5- Original Work Authorization Form (WAF)

Control Account History

ECP#	Implement Date	Prior Budget	New Budget	Signature

Approvals	Name	Signature	Date
NSTX-U Project Manager	R. Strykowsky		
Control Account Manager	P. Titus		
Functional Manager	P. Heitzenroeder		

Procedure 6 Project Schedule

1.0 PURPOSE

Project scheduling provides the basis for planning when in time work will be accomplished. The PPPL planning process emphasizes the development of schedules that are realistic, complete, logical, and reflect the way work is planned to be accomplished. The baseline schedule forms the basis for the time-phased performance measurement baseline. The schedule also fosters communication within the project team; establishes a baseline for project status monitoring, reporting, and control; facilitates effective management; and provides the basis for resource estimating, analysis and leveling, exploration of alternatives, and cost/time tradeoff studies.

2.0 SCOPE

This procedure applies to all PPPL projects required to implement the PPPL Project Management System Description (PMSD). All projects will have project schedules that are prepared and maintained by the Project Team and approved by the Project Manager, and others as required.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 REQUIRED MATERIALS, EQUIPMENT, SUPPLIES, TOOLS, AND MANPOWER

Schedules will be prepared using an appropriate scheduling software tool as approved by the project manager.

5.0 PROCEDURE

Project managers will prepare and maintain an overall baseline project schedule for their assigned projects, and ensure that all other schedules are consistent with the baseline schedule. Project schedules should contain sufficient detail to effectively manage and control the project. They should not be developed in any more detail than is necessary for cost-effective planning and management of the project.

5.1 General

Project schedules will generally consist of:

- The project activities.
- An estimated amount of time to complete the activity, known as the duration.
- The scheduled start date and completion date for each activity.
- The project initiation and completion dates (completion date milestone).
- Important deliverables (task products) as milestones.
- Milestones for Key events and major decision points.
- Predecessors and successors, interdependencies in the form of logic links.

- The critical path(s).
- Float (slack).
- Cost or resource loading.

5.2 Earned Value Management Schedule Hierarchy

As provided for in the PPPL PMSD, PPPL will develop, utilize, and keep current three categories of interrelated schedules. The PPPL PMSD schedule hierarchy provides levels of schedules that are logically consistent to maintain the integrity of the performance measurement baseline. The schedule hierarchy is shown as Figure 1. These schedules will be used as tools to facilitate and achieve project goals and schedule commitments and will generally reflect the following:

5.2.1 Baseline Schedule

The Baseline Schedule is the key control and contractual schedule for the entire project, start to finish, that includes all major control milestones, and major activities included in the project. The Baseline Schedule is the basis for project schedule performance. The project manager is responsible for developing the Baseline Schedule and subsequently executing the project in accordance with the agreed to milestones reflected in the Baseline Schedule. The Baseline Schedule is maintained under configuration management and may not be revised without proper authorization.

5.2.2 Current Schedule

The Current Schedule enables the determination of critical paths and an evaluation of the effects of the current schedule performance status on activities and milestones scheduled to be accomplished in the future. The Current Schedule includes detailed input from all Control Account Managers (CAMs) providing the ability to relate activities and milestones between different levels of schedules. The Current Schedule must be consistent with key deliverables, control and contractual milestones as reflected in the Baseline Schedule and the Project Execution Plan (PEP), when applicable.

The Current Schedule is a working-level schedule that reflects the actual status of the project at a current point in time and shows the work performed and the milestone accomplishments. The Current Schedule matches the Baseline Schedule at a re-baseline and may start to migrate as the schedule is statused. The Current Schedule in updated at least monthly, or more frequently as determined by the Project Manager, and is used by the CAM's as a key control and analysis tool to manage the work and identify areas needing corrective action.

5.2.3 Supplemental Schedules

Supplemental Schedules are prepared at the discretion of the Project Manager or CAM as an added tool to facilitate and control a certain aspect or timeframe of the project. These can be computerized or manually generated documents. Examples can include: weekly or monthly rolling or look ahead schedules, various subcontractor schedules, detailed procurement schedules, startup schedules, etc. Supplemental Schedules are not under configuration control, but they must support the Baseline Schedule milestones.

5.2.4 Control Account/Work Package Schedules

The activities necessary to accomplish the scope identified in the Control Accounts (CA) and Work Packages (WP) are identified by the Control Account and Work Package managers, respectively, and their supporting Subject Matter Experts (project team members). Activities, durations, and activity interrelationships are developed at the CA level. If the CA is subdivided into WPs, this is accomplished at the WP level. In effect, each WP will have a corresponding schedule (and corresponding scope and resource/cost estimate). WP schedules will roll-up to the CA level. CA schedules will roll-up to the respective WBS element.

5.3 Schedule Development

The development of PPPL schedules will be sequential and iterative during the planning process leading to the establishment of a formal project baseline. Schedule development will follow scope definition and precede resource estimating. The activities comprising the schedule form the basis for estimating resource requirements. Iteration is necessary during the planning stage in order to ensure all approved and defined scope is reflected in the schedule and that activities are scheduled when resources are planned to be available. Iteration is also important to ensure that durations are realistic and that all interdependencies are identified. Prior to the establishment of the baseline, initial schedule development occurs at the CA and WP levels by the CA and WP managers who will be responsible for the work. The CA and WP schedules are rolled up to the various levels of the WBS and reviewed, and if necessary, iterated to ensure they are supportive of customer and project goals. Schedules are formally baselined at CD-2. The PPPL schedule development process is shown as Figure 2.

5.4 Critical Path Method (CPM)

All PPPL PMSPD compliant projects will use critical path method scheduling as a management tool and to assess progress. The critical path will be determined using the industry standard method. After the project is baselined and work is initiated, the critical path will be re-assessed based on work accomplishment/schedule performance. At any point in time, the project will have at least one critical path that represents those linked activities that represent the longest continuous path leading to project completion. The

critical path, by definition, is comprised of activities with no float. PPPL managers will pay particular attention to the performance of activities on the critical path in that they represent a potential day-for-day delay in project completion, should their actual duration exceed their planned duration. The critical path is shown at all times in the Current Schedule and will be recalculated and analyzed based on actual performance following each reporting period.

5.5 Scheduling Guidelines

The development and management of PPPL PMSD compliant schedules will include consideration of the following:

- The level of detail and accuracy of the schedule improves as the project scope becomes better defined through the project phases.
- For the purpose of preventing informal changes in the baseline, the original schedule file is documented and saved as a point of reference.
- A status file is created from a copy of the projects “Target File” (Schedule Baseline). The analyst performing the schedule updates place percent complete, actual start and actual finish data into the status file. A comparison of the status file with the Target file indicates changes in number of activities, original duration, or other symptoms of informal alterations occurring to the schedule baseline. Such alterations should only take place using a process that leaves an audit trail.
- In conjunction with Earned Value reporting requirements, subcontractors are expected to transmit the following schedule status information (unless it is not required by their contract):
  - Actual Start dates for activities begun during the status period.
  - Actual Finish dates for activities completed during the status period.
  - Actual occurrence dates for milestones accomplished during the status period.
  - Percentage complete and/or remaining duration of activities that have started but are not yet complete.

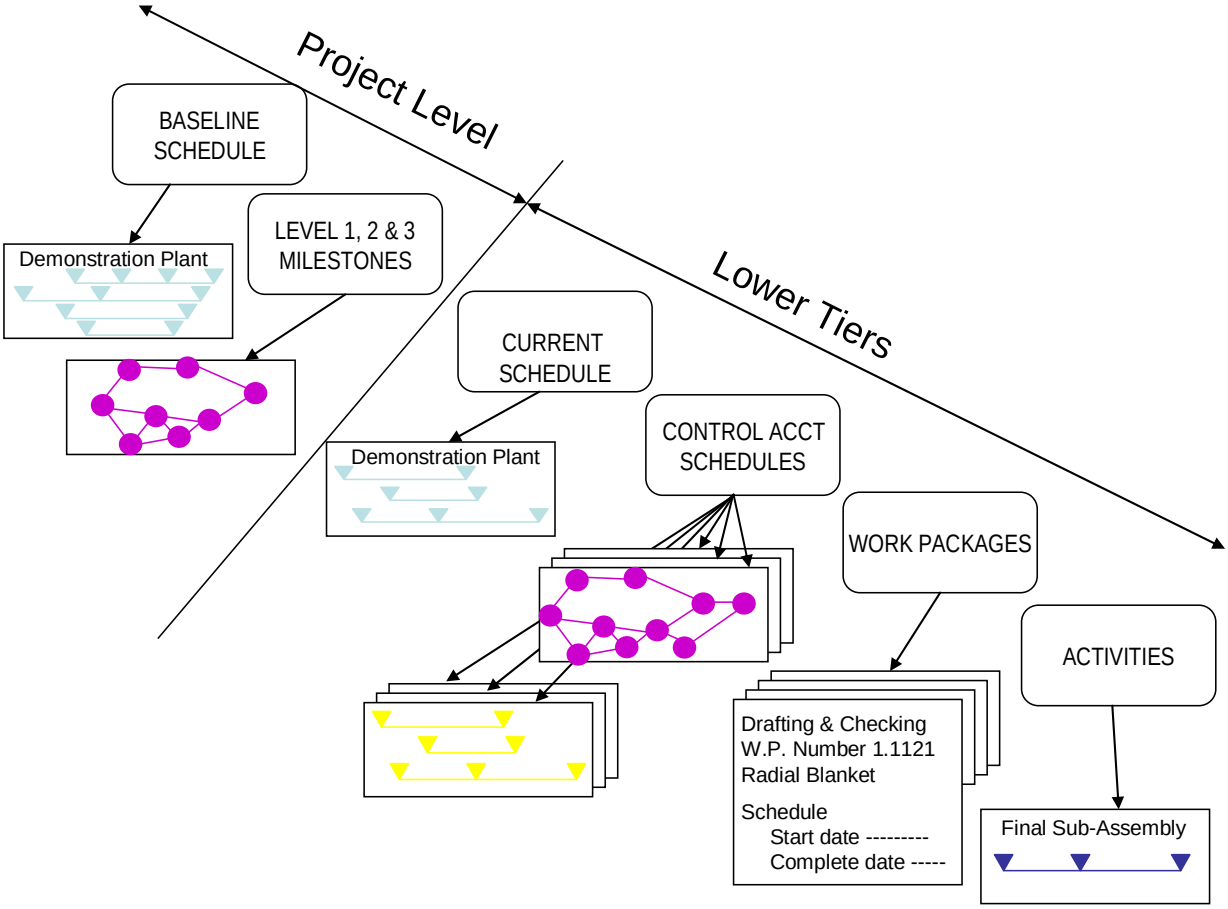
6.0 FIGURE

6.1 FIGURE 1: Schedule Hierarchy

6.2 FIGURE 2: Project Schedule Process

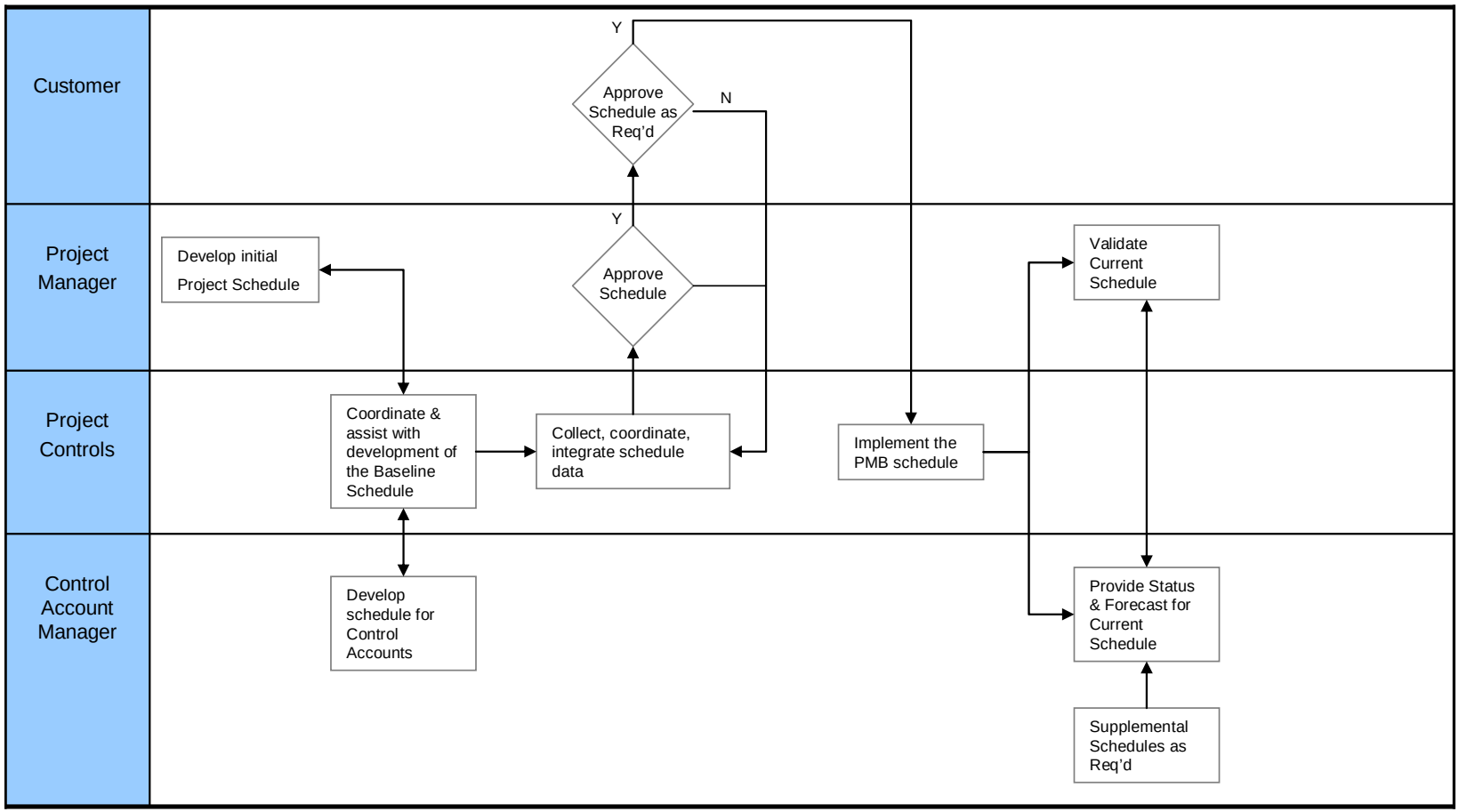
Procedure 6 Project Schedule

Figure 1 Scheduling Hierarchy



Procedure 6 Project Schedule

Figure 2 Project Schedule Process



PMB = Performance Management Baseline

Procedure 7 Cost Estimating

1.0 PURPOSE

This procedure describes the methodology for establishing cost estimates for projects at PPPL in a manner that is compliant with the standards for implementation of appropriate Project Management controls and Earned Value Management.

2.0 SCOPE

Cost estimates, including the Estimate at Completion (EAC) and Estimates to Complete (ETC), are prepared in a clear, consistent, comprehensive format that facilitates review of details and assumptions throughout the cost estimation process. Activities to be estimated are identified in sufficient detail to support the cost estimate methodology used.

The objectives of the cost estimating process are to: (1) support the establishment of the Performance Measurement Baseline (PMB); (2) serve as a basis for change control; and (3) support the establishment of the EAC and ETC. Project cost estimates shall be traceable to documented sources and based on accepted methodologies.

3.0 REFERENCES

3.1 DOE Order 413.3B, “Program and Project Management for the Acquisition of Capital Assets”

3.2 PPPL Budget Office

4.0 PROCEDURE

4.1 Estimate Preparation and Review

The estimate preparation phase begins with the issuance of guidance and instructions from the Project Manager and encompasses those activities that translate technical design and fabrication into detailed labor and procurement elements of cost. The estimate shall be organized by Work Breakdown Structure (WBS).

The level of detail and accuracy of the budget becomes more mature as the project’s scope becomes better defined. The three general levels of budget estimates are Order of Magnitude Estimates, Preliminary Budget Ranges, and Definitive Estimate.

In a project’s earliest phases, the Initiation, or Pre-Conceptual Phase (before Critical Decision [CD] -0, an Order-of-Magnitude (or Parametric) Estimate is required. When a capital asset acquisition project has completed the Conceptual Design Phase, a Preliminary Budget Range is required to establish the Budget Baseline at CD-1.

Budget refinements shall be based on a Definitive Estimate for every element in the WBS and is

required for CD-2.

The cost estimate should be analyzed for appropriate time-phasing with budget authority and budget outlay, consistent with the project appropriation profile, as directed by the Funding Agency.

4.1.1 Preparation of Detailed Estimate

The CAM shall be responsible for preparing or obtaining cost estimates for Work Packages and Planning Packages within the individual Control Accounts. The development of the cost estimate follows the definition of the Work Package/Planning Package scope, and the development of the initial schedule. The determination of the resources required to accomplish the defined scope, in the timeframes scheduled, is an iterative process that culminates in a preliminary, and then final, performance measurement baseline.

Activity based costing refers to the process of determining the resources required for each activity in the schedule within the Work Package level. The level of resource/cost estimate development will be determined by the project manager and may be at the schedule activity or work package levels in either case, a “resource loaded schedule” results.

Labor rate tables, indirect costs, and escalation rates will be provided by Project Control to assist the CAM in estimating/budget development. The Project Manager will review this information and approve all cost estimates/budget plans prior to implementation.

4.1.2 Cost Estimate Methodology

The result of the project cost estimate process shall be the CAMs most current, detailed cost estimate, commensurate with design maturity. The CAM will use one of the approved methodologies described in Figure 2.

CAMs should use Categories 1, 2, 3, and 7 when possible, especially for high-cost items, as this will provide maximum estimate support. The CAMs’ basis for all estimates will be documented for each project and retained by the Project Manager, with a copy provided to Project Controls. The documentation includes files to support project cost estimates (such as books, vendor quotes, engineering notes, memos, records of conversations with vendors, drawings, code output) with appropriate safeguards for proprietary information provided.

Cost estimates are developed for each WBS element at the Work Package level or lower as deemed necessary by the CAMs. They shall be broken down by project phase, institution, labor discipline and element of cost, as appropriate.

Items and activities in the estimate shall be of sufficient detail to support interpretation by independent reviewers.

4.2 Documentation

The Project Manager shall control supporting documentation and ensure that it is retained by WBS element. The Project Manager shall forward copies of the documentation to Project Controls. Proper care shall be given to protect business-confidential and proprietary information from unauthorized disclosure.

Documents and records generated as a result of implementing this procedure shall be generated in a manner suitable for reproduction and dated at the time of completion or approval. Official documents shall be retained by the Project Manager, with copies to Project Controls. Documents, records, and work papers shall include but not be limited to the following:

- Estimate spreadsheet.
- Work papers, including vendor quotes, telephone records, material takeoffs, basis notes, calculations, etc.
- Analysis, such as contingencies, escalation application, and quantity discounts.
- Estimating codes, such as labor disciplines and phase codes.
- Application rates and associated application methodology.

4.3 Contingency Reserve

The Project Cost Estimate (budget) shows the amount of funds set aside for in-scope, unbudgeted work, known as contingency. Because contingency reserve covers potential events only, it cannot be time-phased and cannot become part of the Performance Measurement Baseline. A contingency reserve budget is required and should be established as the result of a risk analysis. The Project Manager, CAMs, and other Stakeholders shall work together to determine a risk-based level of contingency reserve.

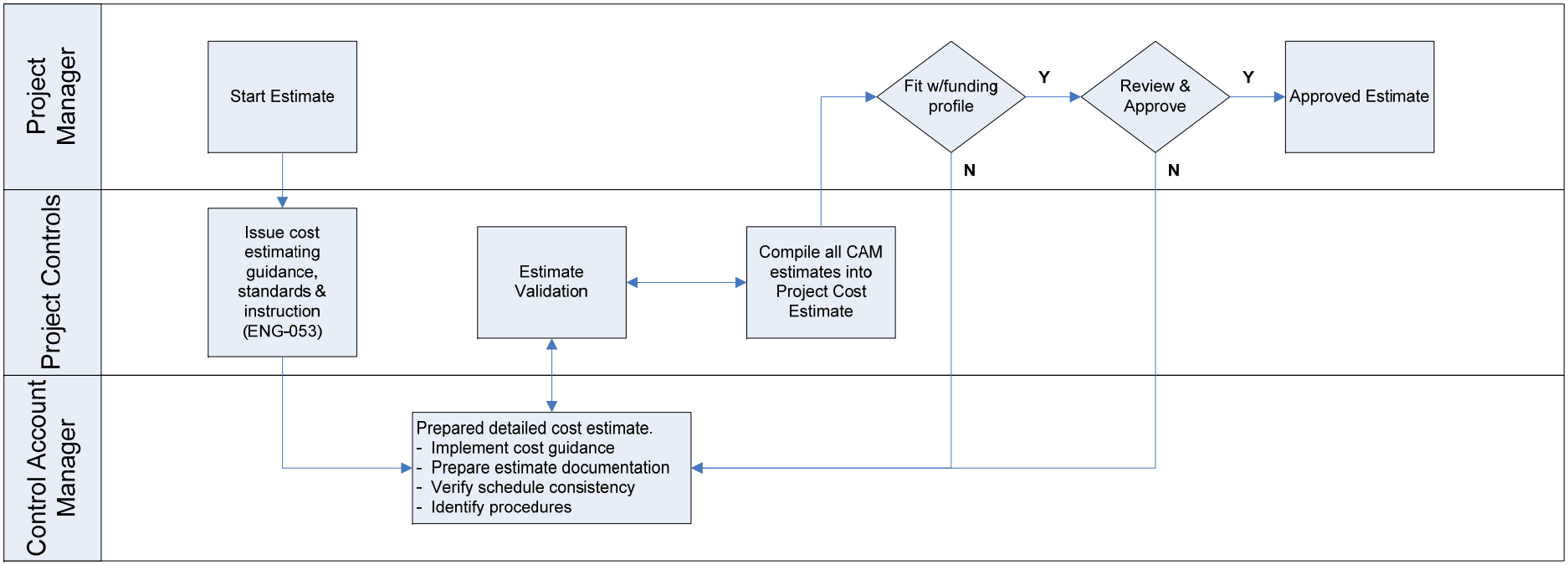
5.0 FIGURES

5.1 Figure 1 Cost Estimating Process

5.2 Figure 2 Estimate Methodologies

Procedure 7 Cost Estimating

Figure 1 Cost Estimating Process



Procedure 7 Cost Estimating

Figure 2 Estimate Methodologies*

Code	*Type of Estimate*	*Description*
1	Catalog Listing Or Industrial/ Construction Databases	This category will be used when most of the costs in an estimate can be documented from current vendor catalogs or from published or proprietary industrial or construction databases.
2	Documented Vendor Estimate Based On Drawings/ Sketches & Specifications	The estimate is primarily based on vendor estimates obtained for the specific item or activity. To the extent possible, these estimates will be written rather than oral. If the latter, they will be documented. Such quotes by a vendor indicate that a design is sufficiently mature that its cost can be independently estimated (i.e., significant detail in drawings and specifications have been prepared), although the quotes will not be taken as an offer to sell at that price.
3	Engineering Estimate Based On Drawings/Sketches & Specifications	Estimates in this category have the same level of detail available as in (2) above, but the estimates are done by an expert estimator at PPPL, or a subcontractor who is not likely to be a vendor.
4	Engineering Estimated Based On Similar Items Or Procedures	Estimates are chiefly based on items or activities that have previously been procured or undertaken. The basis for scaling up of down, or “factoring” (e.g., known cost sensitivities) should be documented in the estimate files. Given the variable degree of similarity between components of various PPPL projects, judgment must be used in selecting between (4) and (5).
5	Engineering Estimate Based On Analysis	Estimates of items or procedures that are different from previous experience, and while sketches and specifications may exist, the level of detail is not sufficient to quality for (3) above. Some labor costs, such as assembly of an item not previously built, may fall into this category. Supporting background for procured items would include, for example, standard costs for fabricating a given material and the mass of material needed.
6	Expert Opinion (Engineering Allowance)	This category should be used for items or procedures having little documented basis for the estimate. It indicates little confidence in the estimate. Its use should obviously be minimized in the final estimate. It will be used as the estimate preparation develops, however, to measure the maturity of the estimate at any given point.
7	Existing Lien	A contract has already been awarded.

* The PPPL Work Authorization Form (WAF) referenced in PPPL Procedure ENG-053 gives a similar but not inclusive list of estimating methodologies.

Procedure 8 Monthly Status Reporting

1.0 PURPOSE

This procedure defines the fundamental processes for monthly status reporting for projects managed under the PPPL Project Management System Description (PMSD) which includes the Earned Value Management System (EVMS).

2.0 SCOPE

This document describes the implementation of Earned Value Management as regards monthly status reporting and analysis. The Monthly Reporting process describes the project's method of reporting variances in cost and schedule. The comparison of actual costs and the work accomplished, and the comparison of work accomplished with the planned value, with baseline plans generated during the planning and budgeting phase, will be included in internal and external reports. Forecasts of future costs and schedule dates will be made, and corrective actions initiated when problems are identified.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 PROCEDURE

The sequence of activities involved in this procedure is illustrated in Figure 1. The sequential action steps are described in this section.

4.1 Monthly Status Report Development

The Performance Measurement Baseline (PMB) shall be "statused" by the Control Account Managers (CAM) at least monthly, using objective measures. Once the PMB is statused, the information is used to calculate the Budgeted Cost of Work Performed (BCWP). Project Controls downloads the current month's actual costs from the PPPL financial management system (i.e., Great Plains) and, along with schedule status and Estimate at Completion (EAC), creates a draft monthly report that is submitted to the Project Manager and CAMs for review and approval.

4.2 Variance Review and Analysis

The CAMs receive a report that reflects the status and shows variances of their assigned Control Accounts. Cost and schedule thresholds for reporting variances to the Department of Energy (DOE) are established in the project-specific Project Execution Plan (PEP). For tighter control, the Project Manager and Project Controls may establish cost and schedule thresholds for variance analysis that are more stringent than those imposed by DOE and use them for internal reporting of variances at the control account level. Variance analysis will occur at least one level lower than the reporting level.

Procedure 8 Monthly Status Reporting

4.3 Variance Reporting and Corrective Action

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.

4.4 Estimate to Complete

On a monthly basis, the CAM shall review the Estimate to Complete (ETC) for the elements of their control account. If, in the judgment of the CAM, the current ETC does not accurately reflect the cost for the remaining work in the control account, the CAM develops a new estimate and submits it to the Project Manager. CAMs should include in the ETC any cost variances to date as well as estimates for known pending changes and mitigation of known risks. On at least an annual basis, the Project Manager will request all CAMs review their ETCs and submit a detailed estimate for the remaining work.

4.5 Monthly Status Meetings

The CAMs shall present status information at the project's Monthly Status meetings. Participants at the meeting will consider the impact and risks of reported variances on other areas of the project.

4.6 Monthly Report Level Format

The specific EVMS reporting format will be determined on a project-by-project basis and incorporate customer specific requirements. As a minimum, it will contain the data referenced in the PPPL PMSD. Reporting will be at a level of the WBS approved by the customer. The Project Manager shall prepare and submit a Project Monthly Status Report to DOE and the PPPL project sponsor.

4.6 Documents and Records

Monthly Status Report documents and records generated as a result of implementing this procedure shall be maintained by the specific project. Project Controls has responsibility for maintaining the records of data compiled to create Monthly Status Reports.

Procedure 8 Monthly Status Reporting

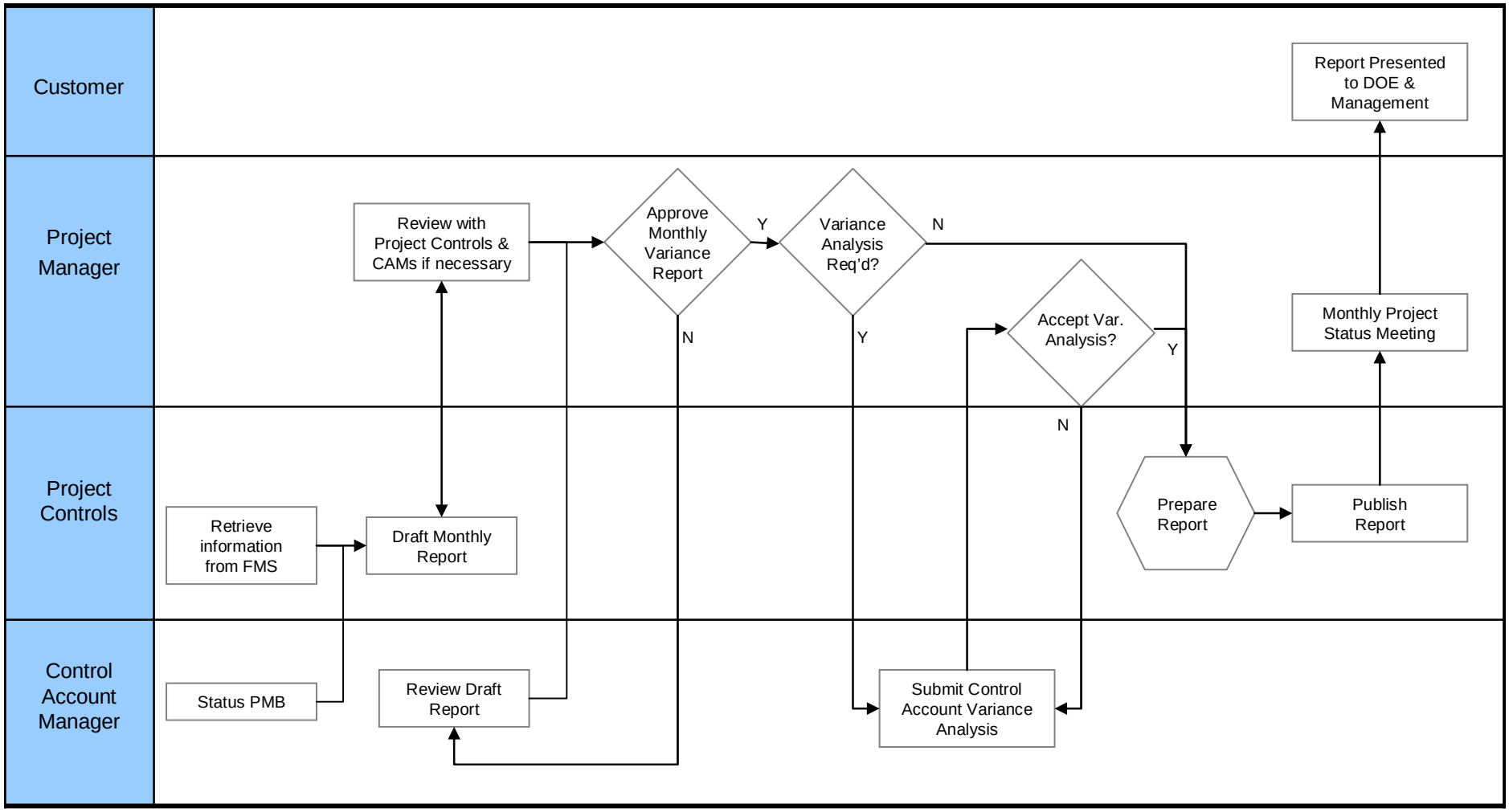
5.0 FIGURE

5.1 Figure 1 Monthly Status - Reporting Process

5.2 Figure 2 Control Account Variance Analysis Report - Sample

Procedure 8 Monthly Status Reporting

Figure 1 Monthly Status - Reporting Process



PMB = Performance Measurement Baseline
FMS = Financial Management System

Procedure 8 Monthly Status Reporting

Figure 2 Control Account Variance Analysis Report – Sample

CONTRACT PERFORMANCE REPORT FORMAT 5 - EXPLANATIONS AND PROBLEM ANALYSES				FORM APPROVED OMB No. 0704-0188
1. CONTRACTOR	2. CONTRACT		3. PROGRAM	4. REPORT PERIOD
a. NAME Princeton University-Plasma Physi	a. NAME DOE-SC-OFES-NSTX Upgrade		a. NAME NSTX Upgrade Project	a. FROM (YYYYMMDD) 2011/01/01
b. LOCATION (Address and ZIP Princeton, New Jersey	b. NUMBER DE-AC02-09CH11466		b. PHASE CD-2	b. TO (YYYYMMDD) 2011/01/31
	c. TYPE M&O	d. SHARE RATIO	c. EVMS ACCEPTANCE (YYYYMMDD NO X YES	

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	BCWS	BCWP	ACWP	SV in $	SV in %	CV in $	CV %	SPI	CPI
Current:	70	70	58	0	0%	12	17%	1.00	1.21
Cumulative:	1,671	1,671	1,605	0	0%	66	4%	1.00	1.04
	BAC	EAC	VAC in $	VAC in %	TCPI to BAC	TCPI to EAC			
At Complete:	5,812	5,746	66	1%	0.98	1.00			

Explanation of Variance/Description of Problem:

Impact:

Corrective Action:

Monthly Summary (to include technical causes of VARs, Impacts) and Corrective Action(s):

Prepared by: Date: Approved by: Date:

Procedure 9 Change Control

1.0 PURPOSE

This procedure describes change control procedures for projects managed under the PPPL Project Management System Description (PMSD). The change control procedure is documentation of changes to a project's budget and/or Performance Measurement Baseline (PMB), including scope, budget and/or schedule, and parameters. Changes are controlled to maintain the integrity of the project baseline. Changes shall not be authorized to mask cost or schedule variances.

2.0 SCOPE

The scope, schedule and cost baseline for a project is formally established in the Project Execution Plan (PEP). For EVMS projects, the PMB is of particular change control significance, in that it is the total time-phased budget plan against which project performance is measured. It depicts the time-phasing for expenditure of the resources allocated to accomplish program scope and schedule objectives and is formed by the budgets assigned to control accounts and summary-level planning packages. The PMB does not include contingency reserve. The project's budget consists of the PMB, and contingency reserve. Revisions to the PMB may affect the project's key parameters, such as the project schedule, milestones, and budget-at-completion (BAC).

The Change Control Board (CCB), as defined in the Project Execution Plan (PEP), is a committee consisting of key individuals representing the PPPL project team, PPPL management, and DOE (or other customer), who determine the merit of incorporating proposed changes to the project baseline. The CCB is responsible for approving all Engineering Change Proposals (ECPs) above the thresholds prescribed in the PEP.

3.0 REFERENCES

3.1 DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets"

4.0 PROCEDURE

The sequence of activities involved in this procedure is illustrated in Figure 1. The sequential action steps of the process are described below.

4.1 ECP Initiation

4.1.1 Change Proposed

When a PPPL CAM observes or is presented with a potential scope, schedule, or budget change the CAM will notify the Project Manager. The CAM works with Project Controls to define the impacts of the proposed change. The CAM then submits a change, using an ECP form, to the Project Manager. Project Controls maintains the project ECP Log generates an ECP number and summarizes the schedule and/or budget impact of the proposed change.

4.1.2 Subcontracted Effort

If a control account includes the oversight of a subcontract (e.g., architect/engineer services, construction effort), the Project Manager may authorize the CAM to process changes to the subcontract using contract change methodology, in addition to the formal ECP process. A log of all subcontract changes will be maintained by the Job Manager, or their designee, and made available to the Project Manager and Project Controls. The Project Manager and Project Controls will review subcontract changes with the Job manager to ensure these changes are consistent with the PPPL EVMS change control practices and that the Estimate to Complete (ETC) amount reflects all known changes.

4.1.3 ECP Package Preparation

The Job Manager works with Project Controls to prepare an accurate and complete ECP package. The ECP contains the documentation necessary to support proposed budget and/or schedule change(s). Each ECP must:

- Show the affected WBS element, the level and complexity of the change.
- Be reviewed for consistency, completeness, correctness, and appropriate routing by Project Controls before submittal to the CCB.

ECPs may be prepared using standard templates and formats created for the project.

4.1.3.1 Reason/Justification

The driver of change falls into one of the following categories:

- Scope Change: This is an addition, deletion, or transfer of work scope to/from a body of formally authorized work represented in one or more control accounts. These occur as external, contract-level changes, or internal Control Account changes.
- Budget Change: The budget of a given element of authorized work is newly estimated to be different than the budget originally associated with that work. In such as case, there have been no changes in requirements or objectives of the work. Typically, there are no activities added to or deleted from the project schedule.

- Schedule Change: Project priorities or unforeseen events may result in re-sequencing of project activities causing a change in the timing and/or definition of controlled or earned value milestones.

4.1.3.2 Consequence of Not Approving

The Job Manager shall include an impact assessment on the ECP explaining the consequence of not approving the ECP.

4.1.3.3 Budget Source Impact

The Project Manager, with the assistance of Project Controls, shall attach a cost impact statement to the ECP package when budget is requested, returned, and/or transferred. This is relevant when contingency is requested/returned or when budget (and scope) is transferred from one control account to another. This information shall be reflected on the ECP form and entered in the ECP log when a log number is obtained. When scope is moved between Jobs or in the schedule, the corresponding budget will accompany it, resulting in a scope and budget transfer.

4.1.3.4 Schedule/Contract Milestone Impact Statement

The Project Manager, with the assistance of Project Controls, shall provide a copy of the schedule to reflect the Level 1 through 4 milestones that are affected if the ECP requires a milestone revision.

Proposed schedule revisions shall be indicated in attached schedule copies provided by Project Controls to reflect the pending milestone and date changes with “before” and “after” versions. These will be entered into baseline schedule if/when the action is approved.

4.1.3.5 Contingency Reserve Requirement

The Project Manager, with support from Project Controls, shall indicate if the impact of the change will result in a request for expenditure of project contingency reserve. If contingency is requested, the Project Manager shall prepare the ECP for approval. Rules/thresholds for the use of contingency reserve are defined in the Project Execution Plan (PEP). The Budget is transferred from the contingency reserve account in the event of an in-scope, unbudgeted change.

4.1.3.6 WBS Affected

The Job Manager shall indicate the Work Breakdown Structure (WBS) elements affected as a result of the change. If the change will impact

other control accounts, the Job Manager shall notify the other affected Job Managers to insure all issues are brought forward prior to approval of the change.

4.2 Disposition of ECP

The CAM shall obtain signatures from Project Controls. Then the CAM submits the ECP to the PM and CCB with the proper authority, as defined in the PEP. The ECP can be approved, approved with changes, disapproved, or returned for revisions.

4.2.1 ECP Approval/Disapproval Processed

Once an ECP is either approved or disapproved, the ECP log shall be updated by the Project Manager and filed in numerical order, with a copy to Project Controls.

4.2.2 PMB Updates

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 30 days, and preferably within the same reporting period. Once done, Project Controls will complete the ECP log to indicate when the updates were made and by whom.

4.3 Documents and Records

Certain project documents are considered “Controlled Documents” in order to protect the integrity of the PMB and budget base, and to ensure that all project participants are aware of the latest official versions. Changes to these controlled documents will be formally approved by the Project Manager, signed and dated, and the description of the change recorded. The revision log in the front of each document will be used for this purpose. Controlled documents will be reissued to project participants and selected stakeholders within 30-days of an authorized change. When reissue of revised documents is accomplished by posting to an approved project web site, participants will be informed of the change. Controlled documents for EVMS purposes are, as a minimum: the PEP and its component sections, to include the baseline scope, schedule, performance measurement baseline, WBS (to include the listing of all control accounts and associated budgets), WBS Dictionary, Work Authorization Documents, and key milestones. The Contingency/MR Log will also be a controlled document.

Documents and records generated as a result of implementing this procedure shall be generated in a manner suitable for reproduction and shall be signed and dated at the time of completion. The Project Manager shall retain the official, signed documents. Project Controls shall retain approved electronic copies.

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The formats shown below as Appendices B and C are suggested formats. If projects elect to use other formats, as a minimum they must contain the information shown in the formats below. Whatever format is used by the project, the format must be used consistently within the project.

5.0 FIGURE

5.1 Figure 1 Change Control Flow Diagram

5.2 Figure 2 Engineering Change Proposal (ECP) Form - Sample

5.3 Figure 3 Engineering Change Proposal (ECP) Log - Sample

Procedure 9 Change Control

Figure 1 Change Control Flow Diagram

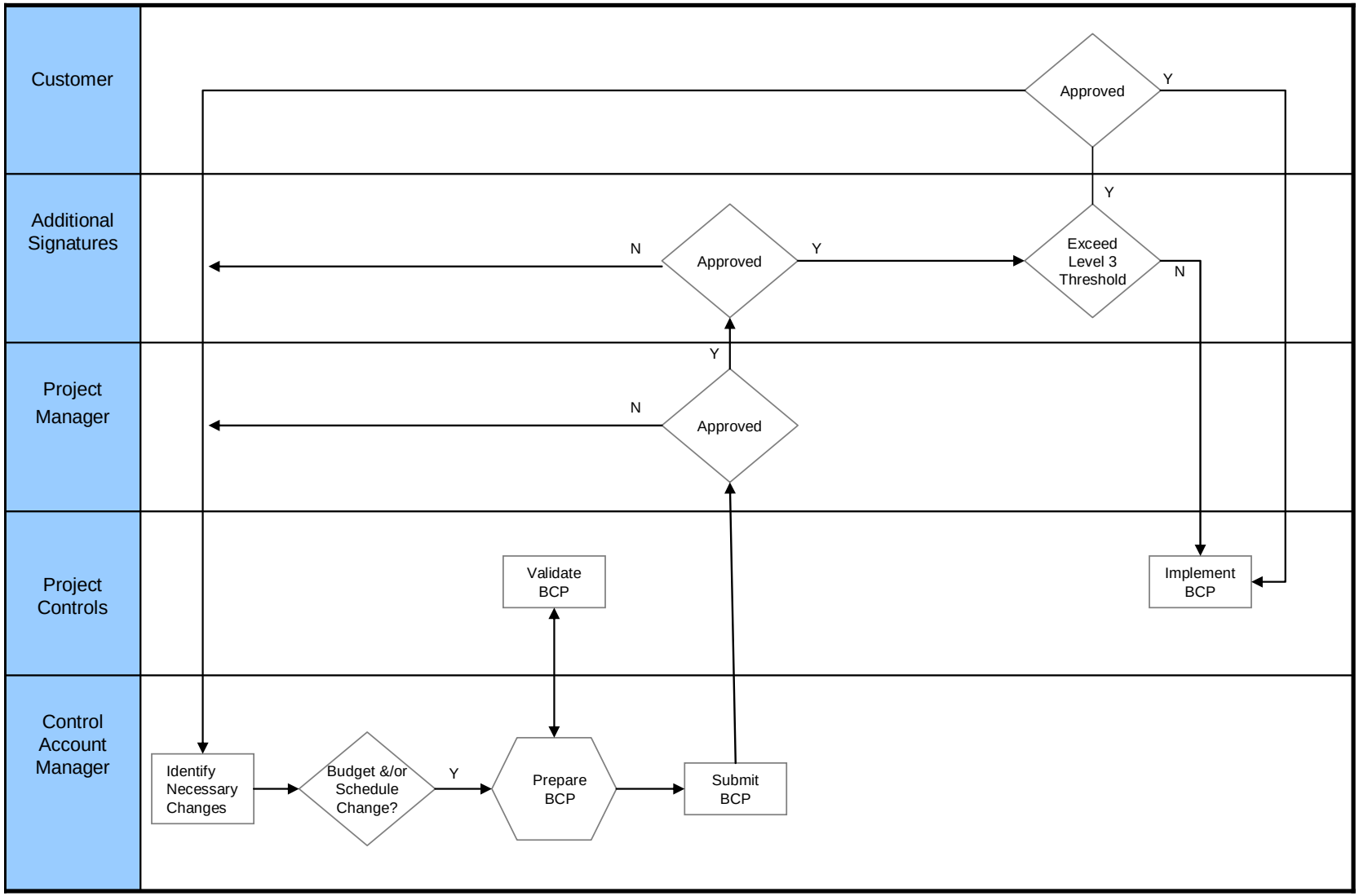

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Figure 2 Engineering Change Proposal (ECP) Form - Sample

Engineering Change Proposal (ECP) Form

Change Number: _____

Change Originated by: _____

Date Submitted: _____

Date Implemented: _____

WBS Element and Control Account Number: _____

Contingency Reserve Request ☐

Change Description: _____

Change Justification: _____

Schedule Change (current and revised milestone dates): _____

Budget Change Description: _____

Impact of Non Approval _____

ECP Level

Level 0 (DOE-SAE) ☐	Level 1 (DOE-FES) ☐	Level 2 (DOE-PSO) ☐	Level 3 (PPPL) ☐

Disposition/Description of Action Authorized by CCB: _____

Approvals:

Project Manager: _____ | _____ Date

Program Director: _____ | _____ Date

Federal Project Director: _____ | _____ Date

PSO Manager: _____ | _____ Date

Copies:

Files:

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Figure 3 Engineering Change Proposal (ECP) Log - Sample

ECP	*WBS*	*Control Account*	*Description of Change*	*Approval Date*	*Level*	*In $K*	*Contract Budget Base (CBB)*		*Contingency*		*Total Project Cost (TPC)*	
							Increase/ Decrease	Balance	Increase/ Decrease	Balance	Increase/ Decrease	Balance
001												
002												
003												
004												
005												

Procedure 10 EVMS System Surveillance and Maintenance

1.0 PURPOSE

The purpose of this procedure for system surveillance and maintenance is to ensure the PPPL site-wide Project Management System is applied consistently over time and that authorized changes to the EVMS are incorporated across all projects governed by EVMS.

2.0 SCOPE

Systems surveillance and maintenance occurs at two interrelated levels: at the overall PPPL site-wide Project Management System level and at the individual project level. A single-system Project Management System approach is the foundation for the PPPL site-wide EVMS certification; with features to ensure that the site-wide EVMS application can be flexible as may be required for individual application areas (e.g., construction, environmental, research) and/or to meet the requirements of specific external DOE customers. In all cases, the PPPL Project Management System Description (PMSD), the accompanying PMSD Procedures, and the individual project management practices described in the Project Execution Plans (PEP) will be consistent with each other and compliant with the EVMS 32 Criteria. Any exceptions must be approved in writing by the Laboratory Project Management Officer.

3.0 REFERENCES

3.1 DOE Order 413.3B, “Program and Project Management for the Acquisition of Capital Assets”

3.2 PPPL Project Management System Description (PMSD)

4.0 RESPONSIBILITIES

4.1 Laboratory Associate Director for Engineering and Infrastructure. Appoints the Laboratory Project Management Officer and receives an annual report on the health and compliance status of the PPPL PMSD.

4.2 Laboratory Project Management Officer. Reviews all PEPs to ensure compliance with the PPPL PMSD; reviews and approves any exceptions to the PMSD or PPPL PMSD Procedures; and, provides Project Management implementation guidance and advice to the projects. The Laboratory Project Management Officer adjudicates PMSD issues and is responsible for continued alignment of the PPPL PMSD, as described in the PPPL PMSD and PMSD Procedures with the 32 ANSI-748 EVMS Criteria.

4.3 PPPL Project Manager(s). Develops, signs, and maintains the PEP and conducts the project to PPPL PMSD standards.

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5.0 PROCEDURES

5.1 Annual PMSPD Self Assessment

The Laboratory Project Management Officer conducts a formal and documented EVMS compliance review against the 32 EVMS Criteria annually, and submits the report to the Laboratory Director.

5.2 PEP Relationship to PMSPD

Individual project PEPs will be compliant with the PPPL PMSD and the PPPL PMSD Procedures. It is in this way that PPPL can assure a consistent site-wide systems approach to Project Management at the individual project level.

5.3 Internal Surveillance

The Laboratory Project Management Officer, or designee, will periodically attend Project Reviews and is of sufficiently advanced expertise in PMSD and EVMS as to be able to identify system anomalies, such as invalid WBS elements, inconsistent or inadequate Earned Value or Critical Path information, or poor baseline development. When a system anomaly is identified, he/she initiates an action item to address and corrects the problem in an expeditious manner.

The self-assessment process will include the following:

- Periodically, the Laboratory Project Management Officer will select a representative project, subject to PMSD and EVMS, and will do a comprehensive assessment of the baseline and performance management systems, as implemented.
- Each capital asset acquisition project's (Line Items and major system acquisitions over $20 million TPC) baseline will be reviewed during the Critical Decision 2 review. Resolution of any PMSD and EVMS questions will occur prior to formal baseline establishment.
- The PPPL PMSD system will be reviewed against the ANSI/EIA-748-A Guidelines and PPPL requirements.
- A report to summarize PMSD self-assessment results will be sent by the Laboratory Project Management Officer to the Laboratory Associate Director for Engineering and Infrastructure, with copies to the Project Managers of PMSD projects.

5.4 External Surveillance

Once the PPPL PMSD and EVMS have been established, PPPL recognizes that DOE or its representative may execute an EVMS compliance audit/surveillance. Such audits usually entail complying with a request for documents and arranging for

Procedure 10 EVMS System Surveillance and Maintenance

personnel involved in the creation or maintenance of the EVMS to be involved in interviews. At the end of the government surveillance, the auditing agency typically releases a report that notes deficiencies observed and recommended corrective actions. The recommendations may be mandatory or voluntary, and the action items listed are tracked on a schedule for compliance. Also included in the government surveillance cycle is debriefing, as well as an opportunity for PPPL responses to the report, including those parts of the report where PPPL rejects the findings and requests that the associated action items be deleted. Final disposition of the findings and action items remains with the government customer until resolution.