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Earned Value Management System (LBNL-EVMS) Description

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The Process Owner shall specify the need for project procedure development or revisions. The Project Management Office shall assist the Process Owner with procedure coordination. The LBNL Project Management Officer will review and concur with the development of new EVMS related procedures and updates to existing procedures.

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INTRODUCTION

Lawrence Berkeley National Laboratory (LBNL), a U.S. Department of Energy (DOE) national laboratory operated by the University of California (UC), uses an Earned Value Management System (EVMS) to integrate project management elements required for effectively planning, organizing, and controlling complex projects. This LBNL Earned Value Management System (LBNL-EVMS) description document provides a comprehensive exposition of processes and guidance for cost, schedule, and technical performance management and reporting, and for effective project execution using earned value management. The UC Earned Value Management System (EVMS) Policy Statement is included as **Appendix A**.

LBNL activities are primarily conducted to support the mission needs and national security requirements of the U.S. DOE, Office of Science (SC). As a DOE Laboratory, LBNL follows the requirements in DOE Order 413.3A, Program and Project Management for the Acquisition of Capital Assets, and generally follows the accompanying guidance in DOE Guides which delineates earned value requirements. DOE-funded projects at LBNL are executed under the requirements of DOE Order 413.3A. Other major projects not funded by DOE may also use this LBNL-EVMS approach utilizing a graded approach. The LBNL-EVMS process and organization are written to comply with the American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA) Standard 748-B-2007. The ANSI/EIA-748 standard is industry best practice, and the official DOE standard for EVMS. The LBNL-EVMS fulfills the requirements of Office of Management and Budget Circular No. A–11 (2008), Part 7, Section 300—Planning, Budgeting, Acquisition, and Management of Capital Assets. The LBNL-EVMS is a key component of the organization, methods, and procedures adopted by LBNL to ensure that its mission and functions are properly executed. Appendix B presents a crosswalk between the 32 ANSI/EIA-748 guidelines and the LBNL-EVMS.

The specific implementation of the LBNL-EVMS at LBNL will vary based on specific customer planning and control requirements, and project specific graded-risk analyses. LBNL project director/managers are permitted to adapt the EVMS to their project while maintaining the necessary management controls to meet project cost, schedule, and technical requirements, with the approval of the Laboratory Project Management Officer (LPMO). The LBNL-EVMS addresses the seven principles of EVMS as defined by the ANSI 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 in accomplishing 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.

These principles are integrated into a comprehensive system that develops and maintains the baseline; tracks project cost, schedule, and scope; and provides 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.

The LBNL-EVMS is designed to provide project managers with a tool to promote optimal planning, accurate reporting, and effective control through the standardization of processes used in project scope, schedule, and budget management.

This document is organized into six (6) sections and six (6) appendices. The details of the EVMS, as it relates to the 32 ANSI/EIA-748 guidelines, are discussed in these core chapters.

The Appendices include: (A) UCOP Corporate Policy Statement, (B) ANSI/EIA-748 Guideline Crosswalk, (C) Acronyms, Abbreviations, and Terms, (D) Roles and Responsibilities of LBNL project team members, (E) References, and (F) Notes Crosswalk of EVMS document footnotes to LBNL procedures.

Configuration management of the LBNL-EVMS is the responsibility of the Laboratory Project Management Officer and is maintained through the use of institutional configuration control. Proposed revisions to the LBNL-EVMS description are submitted to the Laboratory Project Management Officer to ensure the proper coordination, review, and incorporation of appropriate changes. The Laboratory Project Management Officer is also responsible for surveillance of project compliance with the LBNL-EVMS description as described in LBID-2570, *LBNL Earned Value Management System Description* (Section 6, *Surveillance and Maintenance*) and Procedure 1-10, *LBNL Earned Value Management System Surveillance Plan.*

Throughout this description document, cross reference will be made to the ANSI/EIA-748 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 Intent Guide For Example, Intent Guideline 12

corresponds to ANSI/EIA-748 section 2.2g. This will be referred to in this description as Guide 12 {2.2g}.

Section 1

Project Organization and Preliminary Planning

1.1 PROJECT STRUCTURE

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

Every project implementing an EVMS will develop a 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).

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 and the LBNL project director/manager on how the project will proceed.

Among the principle elements, a project execution plan describes the responsibilities of the LBNL and DOE organizations involved in the project, defines roles and restates the mission need, provides a general overview of the project, and outlines cost and schedule data. The major elements required in a DOE project's Project Execution Plan are stated in DOE Order 413.3A and applicable DOE Guides.

The Project Execution Plan is developed by the LBNL project director/manager, with input from the Federal Project Director. For DOE projects, after obtaining concurrence from the Berkeley Site Office (BSO), the PEP is formally approved by DOE headquarters. For non-DOE funded projects, PEP approvals follow the funding agency's specific requirements. The Project Execution Plan is under configuration control.

1.1.3 Work Breakdown Structure [Guide 1 {2.1a}]

The Work Breakdown Structure (WBS) is a product-oriented, hierarchical depiction 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}]

Where the title of a WBS element does not provide an adequate description of the work involved, the project shall develop a 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. 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 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 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. The control accounts should be determined by the scope of the management tasks. 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 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. The project director/manager will ensure the development of a project procedure implementing the LBNL-EVMS requirements for project scheduling.

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

The development of the Project Schedule is the responsibility of the entire project team and may involve multiple iterations in order to reach a workable plan for accomplishing the work scope. 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 control account responsibilities. Project Schedule details may evolve over time in a "rolling wave." 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 LBNL scheduling system consists of baseline, current, and supplemental schedules.

BASELINE

The baseline schedule contains the list of *control milestones* that are generally negotiated with the customer and are identified in the Project Execution Plan. The project director/manager may supplement these milestones with other events deemed sufficiently important to be in the baseline. The logic and activity relationships are established in the Baseline Schedule such that they support the timely accomplishment of the control milestones. The baseline schedule is assembled by the project management team. The project director/manager has the responsibility to ensure that all parts of the baseline schedule properly mesh and phase with each other. The baseline schedule should be consistent with constraints imposed externally, internally, by resource limitations or in the context of other projects at LBNL.

The baseline schedule is approved and fixed consistent with DOE Order 413.3A. For non-DOE projects, the baseline schedule will be reviewed by the Laboratory Project Management Officer or designee to obtain approval. The baseline schedule constitutes the official plan against which schedule performance is measured and reported to the customer and to LBNL

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

The Current Schedule is used to manage all project activities and is developed by logically networking the project activities. The schedule 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

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 compared.

The performance measurement baseline is finalized with Critical Decision-2 (CD2), Approve Performance Baseline. 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. As practical and meaningful, all control accounts and related work packages should be planned, at least at a summary level, to the end of the project. It is anticipated that planning packages will be used in areas of the project 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.

The performance measurement baseline is the summation of the time-phased budgets for all of the control accounts and summary-level planning packages, plus applicable indirect budgets and any undistributed budget. The performance measurement baseline is a representation of current program plans. Proper maintenance of the baseline will prevent performance measurement against an outdated or unauthorized plan.

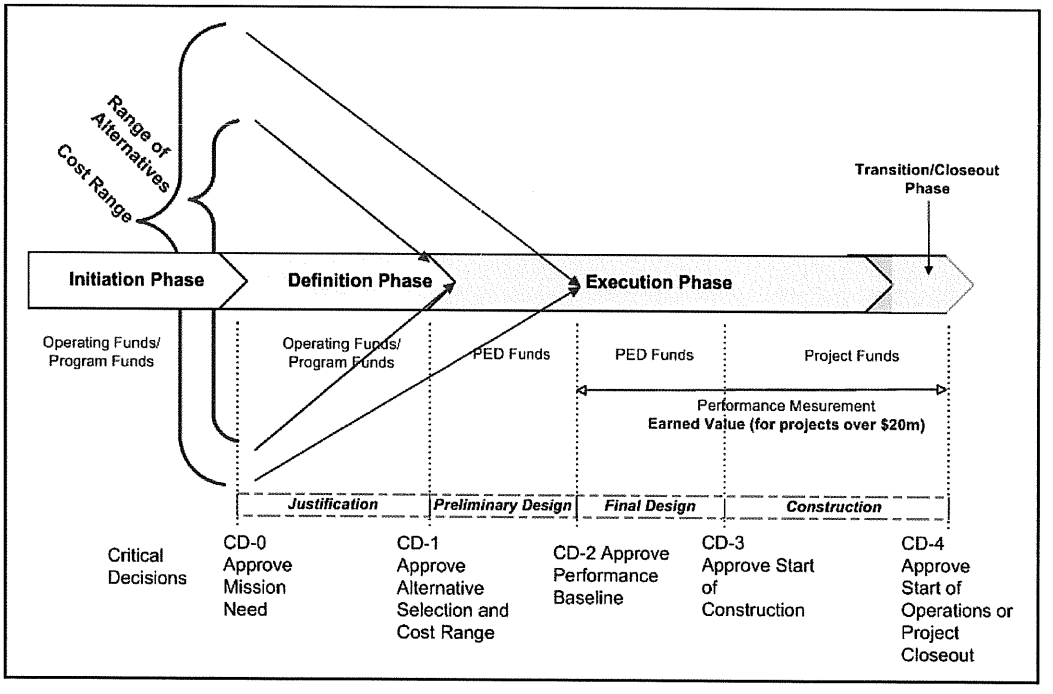

Figure 1-1. DOE Acquisition Management System

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

A control account is a 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 since it

represents the work assigned to one responsible organizational element on one project's WBS element.

Within LBNL's Financial Accounting System, cost collection is performed at the Control Account level, with Control Accounts rolling up into Summary level accounts, which in turn roll up to an overall Project Summary account. No charges are directly charged or recorded at any summary level account. At LBNL, all accounts are commonly referred to as *Project IDs*, and individual chargeable accounts are often referred to as *descendents* of the summary project IDs. There is not necessarily a one-to-one correspondence between project IDs and control accounts. Multiple project IDs, representing individual work packages, may feed into the summary project ID, which is the control account. While multiple project IDs may roll up into a summary control account project ID, **a project ID is never divided among multiple control accounts**. In all cases, the control account has a unique project ID number that matches its WBS activity identifier.

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 agree 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).

Each project is responsible for defining the specific software applications and planning procedures that will apply. However, the Laboratory Project Management Officer may recommend specific packages or configurations for uniformity and ease of integration across LBNL. Although records can be kept at lower levels of detail, the lowest required level of detail for maintaining the BCWS (or PV) and the BAC is by resource within the planning package, or work package subsets, of the control account.

Control account budgets may be further subdivided into one or more work packages and planning packages in the project schedule. The control account manager selects the EV measurement technique—the method for measuring the work performed. Only a single

technique may be used on an individual work package. 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 errors.
- Replanning 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 3, 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 LBNL financial practices disclosure.
- Uses a single earned value method.
- Has a limited duration within a reasonably short time span.
- 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, 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}]

LBNL 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 are made in accordance with the requirements of LBNL's prime contract with DOE and, where applicable, University of California policies and California state law. Uniform policies and procedures for Federal and University project acquisitions provide for a fair and competitive environment.

1.3.8 Management Reserve, Contingency and Undistributed Budget [Guide14 {2.2i}]

The management reserve, contingency or undistributed budget is an amount of the approved Project Budget Base that DOE, Project Director/Manager sets aside at the start of the project. The management reserve and/or 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 while undistributed budget is budget for work that is known but not yet assigned and not yet specifically budgeted. Management reserve, contingency and undistributed budget is not assigned to specific segments of work.

To clarify the definition and use of management reserve, contingency or undistributed budget at LBNL the following definitions apply:

Distributed Budget - Budget for work that is defined, budgeted, time-phased, and assigned to a performing organization identified in control accounts and planning packages.

Undistributed Budget - Budget (held by LBNL at the request of the client) for work that is known but not yet assigned and not yet specifically budgeted.

Management Reserve - Budget (held by LBNL) to cover any additional unplanned, unbudgeted work authorized through the change control process within LBNL approval thresholds

Contingency - Budget (held by DOE) to cover any additional unplanned, unbudgeted work authorized through the change control process

The PMO change control procedure provides the process for control of management reserve and/or contingency. DOE and/or the project director/manager establishes the management reserve and or contingency based on a risk analysis of the project work scope. The factors affecting the amount of management reserve and/or 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. As the level of risk is reassessed on the project, the budget for management reserve and/or contingency can change.

Management reserve and/or contingency is released to provide a budget for risk mitigation within the project work scope. Conversely, budget from the control accounts is returned to the management reserve and/or contingency whenever the work scope, and therefore the allocated budget, is decreased. Management reserve and/or contingency transactions are documented in the project baseline change control log. These transactions are addressed in the EVMS report to the customer.

Should a formal request for use of Undistributed Budget be made the Undistributed Budget may be used by the Project Manager for an identified and approved scope of work that has not yet been specifically allocated to a Control Account. Undistributed Budget can result from a baseline change proposal being approved or a customer/sponsor modification not yet budgeted in detail and extended to the Control Account. Undistributed Budget is included as part of the Performance Measurement Baseline (PMB).

Undistributed Budget Process

Undistributed budget or UB is budget that is applicable to specific project effort but has not yet been distributed to control accounts. UB is *not* allocated to either control accounts or to

management reserve. It represents the budgets for authorized work that has yet to be planned, as such; it will be allocated as quickly as possible. Since undistributed budgets are not time phased, UB for near term authorized work will be moved to control accounts and far term UB should be moved to summary level planning packages. Undistributed budget is a transient amount; because once it is distributed it ceases to be undistributed budget and instead is incorporated in a control account or planning package to which it has been distributed. Undistributed budget accounts are to be cleared in a reasonably timely manner. Undistributed budget accounts are to be assigned to the performance measurement baseline when the work is established in the performance measurement baseline, normally within 90 days and prior to work starting. It is recognized that some circumstances, such as delays in contract direction will impact the timely assignment of undistributed budget to work packages.

Any changes to the project and use of any management reserve, contingency and undistributed budget will be approved and implemented following the baseline change control process. These changes will be documented on a Baseline Change Proposal including the applicable supporting documents and all changes will be documented on a Change Control Log. The Change Control log will include management reserve, undistributed budget, performance measurement baseline, and contract budget base information.

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 director/manager will request and the LBNL Office of the CFO will authorize the allocation of a block of project IDs in the LBNL accounting system. The opening of this block of project IDs officially initiates the project and 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

in 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 approved control account 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. 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

The comparison of actual costs, and the work accomplished, with baseline plans generated during the planning and budgeting phase, is included in internal and external reports. Forecasts of future costs and schedule dates are made, and corrective actions are 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. 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 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*. 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*, while that based on elapsed time is referred to as *level of effort*.

2.1.2.1 Discrete Effort

Work performance is measured monthly. The EV technique selected for measuring the performance of discrete effort depends on its duration and the number of measurement periods it spans. Discrete efforts that span one to three periods are often measured with fixed formula techniques, where a fixed percentage of work performance is credited at the start of the work and the remaining percentage is credited at completion of the work. Discrete efforts of longer duration (greater than three periods) are measured with other techniques, including weighted milestone and percent complete.

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	Duration of Work Effort	
	1-3 Measurement Periods	>3 Measurement Periods
Tangible	*Fixed Formula*	*Weighted Milestone* *Percent Complete*
Intangible	*Apportioned Effort* *Level of Effort*	

Figure 2-1. EV Measurement Techniques

- **Fixed Formula.** A typical example of fixed formula is the ***50/50*** technique. With this method, 50 percent of the work is credited as complete for the measurement period in which the work begins, regardless of how much work has actually been accomplished. The remaining 50 percent is credited when the work is completed. The 50/50 technique is most effectively used on small, short-duration tasks.

- **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.

- **Expert Opinion.** The expert opinion method is 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 such as predefined earning methodology based on

detailed steps or hours necessary to complete the task or number of units of product completed divided by the total number of units to be completed), then they will be used. This method accumulates the portion of budget that is earned as it relates to the actual and/or forecasted completion dates of the detailed schedule activities. If activities are completed ahead of schedule, budget is earned in advance of the baseline time-phased plan. Conversely, if activities are completed behind schedule, a lower amount of budget is earned and an unfavorable schedule variance occurs.

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 might include quality assurance or inspection activities. For instance, a project task may have a quality assurance function associated with it. Using the apportioned effort technique, the project manager may determine that the *planned value* for the quality assurance task is 10 percent of the value of the main task. The total apportioned *planned value* for the quality assurance effort related to the main task would then be a constant 10 percent of the main tasks' *earned value*, regardless of the actual work accomplished. *Earned value* for each measurement period would be assigned for the quality assurance 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. Examples include project management, operating a project technical library, and the like. These activities consume project resources and should be included in EVMS planning and measurement. In these cases, the Level-of-Effort (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.
- 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 LBNL financial management system by control account. Accruals are routinely added through the LBNL accounting system (FMS) 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 Accounts Payable. If errors are discovered later, necessary corrections are made into the earned value processor.
- 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 management reserve and/or 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 underrun or overrun forecast for the work scope being considered, without regard to the use of management reserve and/or contingency.

When appropriate, management judgment will supplement or supplant the ETC and EAC calculated values.

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. 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 unambiguously determine progress and earned value within a given work package or control account. Consequently, level-of-effort (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 PMO Change Control Procedure. Current status of the project is compared to the baseline for progress measurement and analysis. Progress and status are maintained on the current schedule, which also reflect 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 he is 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 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.
- 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 LBNL 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 detail schedule level, 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 the minimum requirements and guidance for performance analysis for all applicable LBNL 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. Root-cause analysis is performed at least at the control account level. 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 if any cumulative SPI or CPI is less than 0.9 or greater than 1.15, unless alternate thresholds are defined in the PEP. The project director/manager may establish lower thresholds to respond to specific project or LBNL 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 LBNL projects that illustrates EVMS metrics. The orange, blue, and green trend lines are all expressed in project dollars. 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.

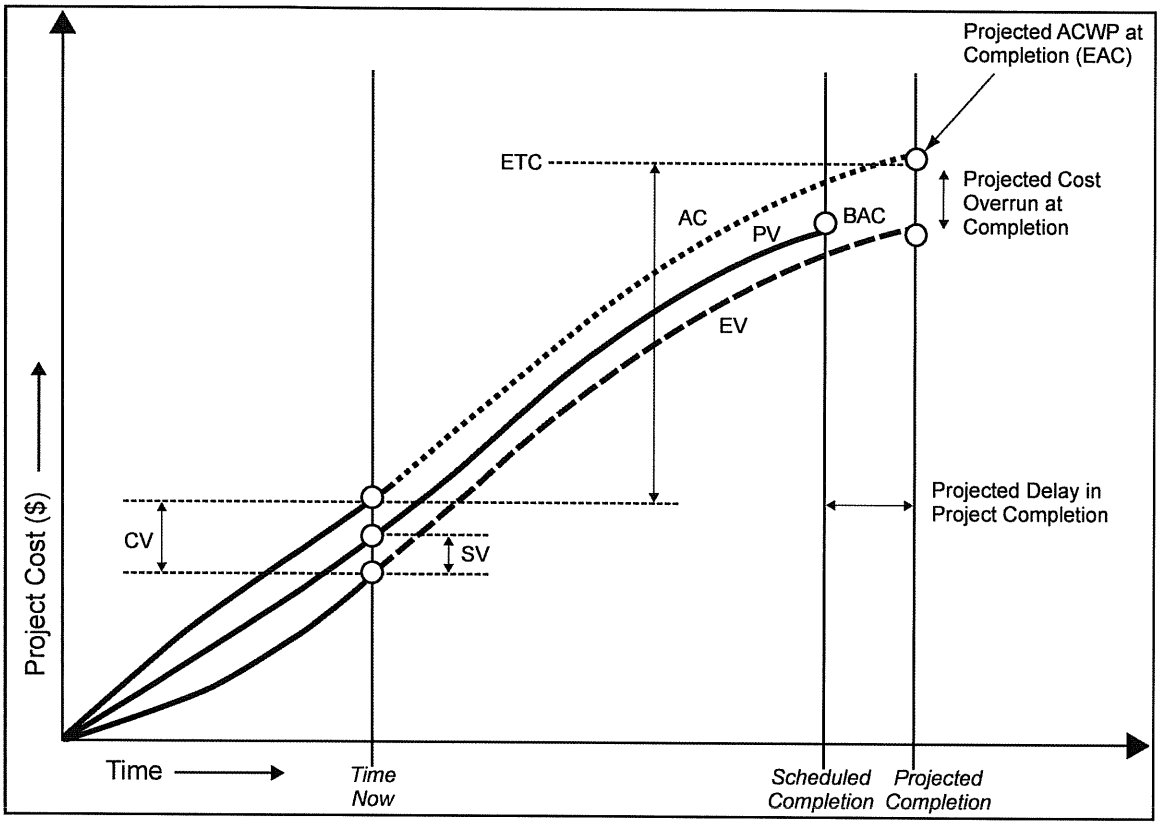

Figure 2-2. Earned Value Data Elements

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. The 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 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 calculates the cost and schedule variances and periodically also updates the ETC at the control account level to account for all changes from the baseline that have been identified. The ETC update reflects a current analysis of control account risks. The EAC is then calculated (EAC=AC+ETC) periodically 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 LBNL 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 LBNL monthly reporting cycle.

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

The project director/manager will provide regular reports to LBNL 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.

LBNL project management regularly reviews the project status and develops 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.
- Variance analysis and suggested corrective actions.
- Critical Path activity performance.
- Project personnel and staffing.
- Project Baseline change performance.
- Management reserve and/or contingency (used and remaining).
- Risk strategies.

Management addresses variances that are outside the threshold ranges, and the project manager implements appropriate corrective actions. 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 413.3A. 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. 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.

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

LBNL project managers generate earned value monthly reports after Critical Decision-2 (CD2) is achieved. The purpose of the monthly report is to provide the LBNL project manager, LBNL senior management, and DOE a periodic assessment of each project by which to monitor and manage the project. These project status reports contain the following information:

- Financial 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 and the work accomplished with baseline plans generated during the planning and budgeting phase is included in internal and external reports. Forecasts of future costs and schedule dates are made and corrective actions are initiated when problems are identified.

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 LBNL 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 accounting practice that may have a material impact on the financial data must be approved by the LBNL CFO. In accordance with Laboratory practice, the LBNL Office of the CFO is delegated the authority to define, direct, and monitor generally accepted accounting principles to ensure compliance with all applicable laws and regulations.

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 control account numbers in the LBNL financial accounting system that identify the correct cost collection account, and control account, for specific items of work.

The approved CA authorization is the required documentation to open a control account to enable costs to be recorded in the LBNL financial accounting system. Control accounts will be closed when the work is complete and all costs are recorded.

All direct labor, material, subcontracts, and other direct costs (ODC) (cf 3.1.8) are charged directly to the account numbers that are assigned at the job or task level as appropriate for the specific control account. Indirect charges also accumulate in the control account, applied as rates to the appropriate direct charges. The established project cost code 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 costs are recorded in a manner consistent with the budgets.
- Direct and indirect costs can be summarized from control accounts into the WBS without allocation of a single control account to more than one WBS element.
- Direct and indirect costs can be summarized by the project's organizational elements without allocation of a single control account to more than one organizational element.

3.1.4 Cost Accumulation [Guide 16 {2.3a}]

The actual costs are accumulated and processed by the LBNL financial system. The direct costs are identified by control account cost elements, and the indirect costs are allocated via preapproved indirect rates. 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}]

Direct labor charges are recorded by each direct labor employee in a uniform manner via an institutional time reporting system. The frequency is weekly, or monthly for "Exempt" professional staff as determined by their Federal Labor Standards Act (FLSA) category. The hours are recorded and direct labor dollars are charged to the project control accounts, and are available monthly from the LBNL financial system.

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

Liens are booked on the general ledger at the point an approved order is placed. Equipment and material costs enter the LBNL ledger through the accounts payable system. Once the receiving department has recorded receipt in the procurement system, and after the control account manager acknowledges physical receipt of materials by signing the invoice or sending electronic approval, invoices are approved for payment and paid by the accounts payable department. In situations where earned value is credited (materials are received and acknowledged) and the invoice is not yet paid, estimates may be used to accrue costs.

3.1.7 Subcontract Cost [Guide 16 {2.3a}]

Subcontract costs are entered into the LBNL ledger via the accounts payable system after receipt of an invoice approved by the CAM. The actual cost (AC) reported for these subcontracts may require that an accrual be made for costs estimated to have been incurred in addition to the actual costs recorded. This accrual is added to previously invoiced costs and then reversed in the next month's data when the new cost is added. Accruals are treated consistently with generally accepted accounting principles (GAAP).

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, electronic data processing, consultants, tooling, test equipment, and publications.

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

Indirect costs are allocated at least monthly to project control accounts. Indirect costs are applied to each project at the current approved annual rates. The LBNL CASB disclosure statement explains in detail the process concerning the collection and reporting of indirect costs. See Section 3.2.1 for more information regarding the CASB statement.

3.1.10 Accounting Adjustments [Guide 19, 30 {2.3d, 2.5c}]

Retroactive adjustments to previously reported AC are prohibited, except for the correction of errors and routine accounting adjustments such as a change to an indirect rate. Adjustments are reported monthly, consistent with GAAP.

3.2 INDIRECT COST PLANNING AND CONTROL

3.2.1 Objective

LBNL maintains a cost accounting system that allocates indirect costs to cost objectives (i.e., Project IDs at LBNL). Indirect Costs are collected in discrete cost pools and distributed to the individual project beneficiaries via published rates that are formally reviewed and approved by the Office of the CFO. Annually, LBNL files a "*Cost Accounting Standards Board Disclosure Statement*" (CASB) as required by Public Law 100-679. This disclosure statement identifies all indirect cost pools with a discrete and specific set of cost objectives or beneficiaries.

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, LBNL's CASB disclosure identifies all indirect cost pools, and defines how these cost pools are distributed to the final or benefiting cost objectives. Some of the larger cost pools (relative to the total mix of indirect cost pools) at LBNL are payroll burden, procurement burden, Institutional General Plant Projects (IGPP), Laboratory Directed Research and Development (LDRD), and the general and administrative cost (G&A). The current CASB may be obtained from the Office of the CFO at LBNL.

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

Indirect cost pools are allocated in proportion to the relative benefit incurred by each cost objective (i.e., Project ID). Indirect costs are distributed using individual rates that are applied to the base cost of discrete and specified resources (labor, procurements, physical space, etc). The basis of each cost allocation is reviewed annually by the Office of the CFO to assure that each indirect 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 cost pool and the beneficiaries associated with each indirect cost pool are fully disclosed within the CASB disclosure statement. In addition to the annual review and disclosure of current year indirect cost pools, beneficiaries, and rates, the Office of the CFO at LBNL issues forward-pricing rates used to estimate the full cost of future-year program and project activity.

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 current-year rates and out-year rate projections may be necessary. LBNL strives to conduct current-year operations to reduce or eliminate revisions to current year rates. Typically, revisions to current-year pricing structures are reviewed for compliance with Federal Cost Accounting Standards (CAS) and are fully disclosed by the Office of the CFO. Retroactive rate revisions are recorded on the Laboratory 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. 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. LBNL is a research and development facility. Accordingly, we have not implemented procedures for unit cost, equivalent unit cost, or lot costs, since we do not have projects that produce identical products for multiple customers. EVMS Guideline 21 also applies to manufacturing processes. We do not bulk order material for project work, and therefore do not need to implement procedures for residual inventory tracking.

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.

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 and 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 LBNL. 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 those milestones; or on the basis of cost reimbursement for labor hours expended and materials consumed; or based upon a payment schedule agreed upon in advance, where the payment is less than or equal to the earned value for that period. 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:

- Firm Fixed Price (FFP)
- 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 PMO Change Control Procedure.

5.1 CHANGE-CONTROL PROCESS

5.1.1 Objective [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 no work is performed without prior authorization.

DOE guidance documents, establish change-control requirements for DOE projects. LBNL project managers implement DOE requirements in project procedures for change control in accordance with the LBNL-EVMS.

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 replanning, or the use of the management reserve and/or contingency are documented and reported to the customer, as required. Changes that impact 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. All changes are recorded and tracked through the change-control process. Each change type is identified and numbered sequentially.

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, 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, the DOE 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.

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 replanning actions that are within the scope of the authorized contract. These replanning actions may be appropriate to compensate for cost, schedule, and technical problems that:

- Have caused the original plan to become unrealistic.
- Require a reorganization of work or personnel in order to increase the efficiency for accomplishing the effort.
- Require different engineering or construction approaches.

Internal replanning is intended for in-scope changes that relate to future budgets. All budget changes to the baseline are documented in a baseline change proposal 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 replanning:

- Retroactive changes to the previously reported PV, EV, and AC are prohibited, except for the correction of errors.
- Only the future portion of open work packages may be changed.

- Minor modifications to work packages are discouraged and, in most cases, should not be implemented.
- The time phasing of the PV may be changed in open work packages, as long as the following two conditions apply: (1) the changes only affect future budgets/efforts; and (2) the work packages continue to support key milestones in the schedules after the changes are implemented.
- A budget transfer from one control account to another is prohibited unless the accompanying work is also transferred. This transfer is accomplished by returning the budget to the management reserve and/or contingency, and then releasing the management reserve and/or contingency to the control account where the work will be performed.
- An internal change 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 replanning or the conversion of planning packages does not result in the application of budget intended for future work to a near-term effort.

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

Replanning within the established control-account scope, schedule, and BAC parameters are considered "internal to the control account" in that they do not affect the control-account 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 manager, are required to ensure that the planning procedures are followed, and that resources are available to support the revised plan. An internal change process is used to document the rationale and approval for all internal changes. 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.

5.1.5.3 Other Internal Replanning [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 EAC. Internal replanning may cover a single control account or multiple control accounts. All changes are governed by the threshold established in the Project Execution Plan. Impact and justification for all budget

changes are documented in the change request, and all internal changes used to authorize internal replanning are recorded in the change log. Typical internal changes are:

- Scope and budget transfers between control accounts (e.g., make vs. buy).
- Changes to the work approach that change the control account scope or the BAC.
- Management reserve and/or contingency transfers.
- Future rate changes significant enough to warrant replanning.
- 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 LBNL 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 LBNL fiscal year, in conjunction with the release of the revised indirect rates by the Office of the CFO. 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 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 is an allowable reason for making changes to the budget in that specific control account. For example, internal or customer-directed design reviews might yield results that make it necessary to revise the technical, 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. Open work packages are examined by each control account manager to determine the impact. Those open work packages that are directly affected can be replanned using one of the two following methods:

- Close the open work package by setting the cumulative PV 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 replanning effort.

- Leave the affected work package open, and replan the future budget and scope if the earned value method that is used can accommodate this type of replanning.

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 managers must replan when the resulting dollar amounts are significant. If the revised make-or-buy decision results in a budget that differs from the original budget, the delta budget is taken from (or added to) the management reserve and/or contingency, and the budget log reflects the change.

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 LBNL 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 PMO 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 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 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 LBNL-EVMS on required projects. Surveillance ensures that the system continues to fulfill the following functions:

1. Provide valid, timely information that depicts actual conditions and trends.
2. Provide timely indications of actual or potential project issues.
3. 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 LBNL 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 executed through a continuous quality control monitoring process and through periodic surveillance by knowledgeable and independent individuals. Continuous

self-assessment is performed by project directors/managers, and project-controls personnel, who are trained in the correct use of the LBNL EVMS, and are held accountable for proper implementation on their projects. 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 director/manager and the Laboratory Project Management Officer (LPMO). Issue resolution will be coordinated by the PMO if the issue involves changes to the EVMS or supporting LBNL procedures. Project-specific issue resolution is the responsibility of the project director/manager. The self-assessment and surveillance process will include the following:

1. Review will be in accordance with Procedure 1-10, *LBNL Earned Value Management System Surveillance Plan.*
2. Project baselines will be reviewed during Critical Decision-2 reviews.
3. The EVMS system will be periodically, but not less than annually, reviewed against the ANSI/EIA-748 Guidelines and LBNL requirements.
4. Recommendations to improve systems will be evaluated and implemented as appropriate.

The LPMO will prepare an EVMS self-assessment report on at least one project required to use earned value management annually. The self-assessment report is submitted to both LBNL's Project Management Officer, as well as UC's LBNL Contract Assurance Council. Based on a review of actual implementation practices in the field, determined by review of project documentation and interviews with project directors/managers and CAMs, the report will document: prior project-specific issues and resolutions; current areas of non-compliance with LBNL's EVMS and ANSI/EIA-748: 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 direction of the LPMO, potentially with the participation of other knowledgeable individuals from LBNL,

6.3 RESPONSIBILITIES OF THE LPMO

The Laboratory Project Management Officer 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 LPMO provides guidance and recommends improvements to procedures or practices to improve and ensure the quality and completeness of the EVMS.

The LPMO will provide initial LBNL certification of any project that requires a certifiable or certified EVMS. The EVMS Surveillance Officer will provide an EVMS Surveillance Report

annually regarding compliance with the EVMS for the reviewed project(s) that requires a certifiable or certified system.

6.3.1 Special Circumstances

When the situation arises where independence of the LPMO cannot be assured with respect to a specific project, the LPMO recommends someone with adequate credentials and independence to provide both the initial certification, and/or annual attestation. The Laboratory Directorate 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 LPMO retains both the authority and responsibility for surveillance and certification. The LPMO provides a review of the LBNL-EVMS description, policy, and procedures on an annual basis.

Appendix A

UC EVMS Policy Statement

Thursday September 16, 2004

Earned Value Management System (EVMS) Policy Statement

The University of California is committed to ensuring excellence in the execution and management of all projects. Those projects that are elements of our commitment to the Department of Energy under our Laboratory Management Agreements are a focus of this commitment.

Earned Value Management (EVM) is a widely recognized best business practice that includes, 1) integration of project scope, schedule, and cost objective parameters; 2) establishment of a baseline plan for accomplishment of project objectives; and 3) use of analytic techniques that measures performance against the established baseline during execution of the work and provides trending insights that can indicate the need for timely adjustments to an execution plan in order to deliver the project as committed.

A certified Earned Value Management (EVM) system conforming to OMB Circular No. A–11 (2003) Part 7 Section 300 and industry standard practice (ANSI/EIA-748) shall be maintained and utilized on all projects where directed by the university, contractually required or where indicated by the respective Laboratory Director. The individual laboratories are responsible for providing the framework, training, necessary surveillance, and maintenance of their individual EVM systems. The laboratories are also responsible for ensuring continued conformance to the industry standard. The University of California, Office of the President, Laboratory Management Office will provide coordination and oversight as may be needed to assure the continuing appropriate application and use of the EVMS.

Pursuant to this policy, the University of California assigns responsibility for EVMS to the Director of each National Laboratory.

This policy is applicable to all LBNL, LLNL, and LANL projects that require earned value management.

Appendix B

ANSI/EIA-748 Guideline Crosswalk

ANSI/EIA-748 Guidelines	EVMS Implementation	Major Guideline Category	LBNL 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	PMO Procedure 1.2, 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	Organization	PMO Procedure 1.3, 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.	1.1.2, 1.1.6, 1.3.3, 1.3.4, 1.3.6, 1.4	Organization	PMO Procedure 1.1, The Project Plan PMO Procedure 1.3, 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	CASB DS Part IV, Indirect Costs FP&P Part I, 4.08, Recharges FP&P Part I, 4.09, Organization Burden FP&P Part I, 4.10, General & Administrative CASB DS Part 4.4, Treatment of Variances from Actual Cost
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	PMO Procedure 1.4, Control Accounts, Work Packages and Planning Packages
Guideline 6: Schedule the authorized work in a manner which 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	PMO Procedure 1.6, 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, 2.1.1, 2.1.2, 2.2,3	Planning & Budgeting	PMO Procedure 1.1, The Project Plan PMO Procedure 1.6, Project Schedule PMO Procedure 1.8, Monthly Status and Reporting

ANSI/EIA-748 Guidelines	EVMS Implementation	Major Guideline Category	LBNL Procedure Reference
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 customer.	1.3.1, 1.3.2, 1.3.4	Planning & Budgeting	PMO Procedure 1.8, Monthly Status and Reporting
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, Section 4	Planning & Budgeting	PMO Procedure 1.7, Cost Estimating
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, Section 4	Planning & Budgeting	PMO Procedure. 1.5, Control Account Plan/ Work Authorization
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	Planning & Budgeting	PMO Procedure 1.4, Control Accounts, Work Packages and Planning Packages
Guideline 12: Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is not measurable or for which measurement is impractical may be classified as level of effort.	2.1.1 – 2.1.3	Planning & Budgeting	PMO Procedure 1.4, Control Accounts, Work Packages and Planning Packages
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	CASB DS Part IV, Indirect Costs FP&P Part I, 4.08, Recharges FP&P Part I, 4.09, Organization Burden FP&P Part I, 4.10, General & Administrative CASB DS Part 4.4, Treatment of Variances from Actual Cost
Guideline 14: Identify management reserves and undistributed budget.	1.3.8	Planning & Budgeting	PMO Procedure 1.7, Cost Estimating PMO Procedure 1.9, Change Control

ANSI/EIA-748 Guidelines	EVMS Implementation	Major Guideline Category	LBNL Procedure Reference
Guideline 15: Provide that the program target cost goal is reconciled with the sum of all internal program budgets and management reserves.	1.3.1, 1.3.2	Planning & Budgeting	PMO Procedure 1.7, Cost Estimating
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	CASB DS 2.5 Direct Labor RPM 3.03 Time Reporting CASB DS 2.1, 2.2, & 2.3 Direct Materials RPM 6.01 Obtaining Goods & Services UC Procurement SPs Manual - LBNL SPs Selection, Procurement Standard Practices RPM 6.02 Use of Laboratory Property and Supplies RPM 6.03 Property Management Property Guide (LBNL/PUB-3032) Property Guide CASB DS 2.7 Other Direct Costs RPM 2.25 Consultants to LBNL RPM 4.01 Travel
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	PMO Procedure 1.4, Control Accounts, Work Packages and Planning Packages
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	PMO Procedure 1.4, Control Accounts, Work Packages and Planning Packages
Guideline 19: Record all indirect costs, which will be allocated to the program consistent with the overhead budgets.	3.1.3, 3.1.9, 3.1.10 3.2.2 – 3.2.4	Accounting Considerations	CASB DS Part IV, Indirect Costs FP&P Part I, 4.08, Recharges FP&P Part I, 4.09, Organization Burden FP&P Part I, 4.10, General & Administrative CASB DS Part 4.4, Treatment of Variances from Actual Cost
Guideline 20: Identify unit costs, equivalent unit costs, or lot costs when needed.	3.3	Accounting Considerations	
Guideline 21: For EVMS, the material accounting system will provide for: • Accurate cost accumulation and assignment of costs to control accounts in a manner	3.1.6, 3.3	Accounting Considerations	CASB DS 2.1, 2.2, & 2.3 Direct Materials RPM 6.01 Obtaining Goods & Services

ANSI/EIA-748 Guidelines	EVMS Implementation	Major Guideline Category	LBNL Procedure Reference
consistent with the budgets using recognized, acceptable, costing techniques. • Cost recorded for accomplishing work performed in the same period that earned value is measured and at the point in time most suitable for the category of material involved, but no earlier than the time of actual receipt of material. • Full accountability of all material purchased for the program including the residual inventory.			UC Procurement SPs Manual - LBNL SPs Selection, Procurement Standard Practices RPM 6.02 Use of Laboratory Property and Supplies RPM 6.03 Property Management Property Guide (LBNL/PUB-3032) Property Guide
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 2.3.8, 2.4.3 Section 4	Analysis & Management	PMO Procedure 1.8, Monthly Status and Reporting
Guideline 23: Identify, at least monthly, the significant differences between both planned and actual schedule performance and planned and actual cost performance, and provide the reasons for the variances in the detail needed by program management.	2.2.2 – 2.2.4 2.3.2 - 2.3.6 2.3.8, 2.4.3 Section 4	Analysis & Management	PMO Procedure 1.8, Monthly Status and 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	CASB DS Part IV Indirect Costs FP&P, Part I, 4.08 Recharges FP&P, Part I, 4.09 Organization Burden FP&P, Part I, 4.10 General & Administrative FP&P, Part I, 4.10 General & Administrative CASB DS Part 4.4 Treatment of Variances from Actual Cost
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, 2.3.5 – 2.3.8 2.4.2	Analysis & Management	PMO Procedure 1.8, Monthly Status and 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	PMO Procedure 1.8, Monthly Status and 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	2.3.5 – 2.3.8	Analysis & Management	PMO Procedure 1.7, Cost Estimating PMO Procedure 1.8, Monthly

ANSI/EIA-748 Guidelines	EVMS Implementation	Major Guideline Category	LBNL Procedure Reference
performance measurement baseline to identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.			Status and 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.	5.1.2 – 5.1.5 5.1.5.1 – 5.1.5.3 5.1.5.6 – 5.1.5.8 5.2	Revisions & Data Management	PMO Procedure 1.9, Change Control
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	PMO Procedure 1.7, Cost Estimating PMO Procedure 1.8, Monthly Status and Reporting PMO Procedure 1.9, 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	PMO Procedure 1.8, Monthly Status and Reporting
Guideline 31: Prevent revisions to the program budget except for authorized changes.	5.1.2 – 5.1.5 5.1.5.1, 5.2 5.1.5.6 – 5.1.5.8	Revisions & Data Management	PMO Procedure 1.9, Change Control
Guideline 32: Document changes to the performance measurement baseline.	5.1.2 – 5.1.4	Revisions & Data Management	PMO Procedure 1.9, 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
BSO – Berkeley Site Office (U.S. Department of Energy)
CBB — Contract Budget Baseline
CD — Critical Decision
CDR — Conceptual Design Report
CFO — Chief Financial Officer
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
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 — Integration Safety Management
ISMS — Integrated Safety Management System
IT — Information Technology
LOE — Level of Effort
MS — Major System Project

NEPA — National Environmental Policy Act
OBS — Organizational Breakdown Structure
OECM — Office of Engineering and Construction Management
OMB — Office of Management and Budget
OPC — Other Project Costs
PARS — Program Assistant Secretaries
PB — Performance Baseline
PED — Project Engineering and Design
PEP — Project Execution Plan
PMB — Performance Measurement Baseline
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
UB — Undistributed Budget
WA — Work Authorization
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. Also referred to as Actual Cost of Work Performed (ACWP).

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.

Budget at Completion (BAC). The total authorized budget for accomplishing the scope of work. It is equal to the sum of all allocated budgets plus any undistributed budget. (Management reserve and/or contingency 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 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.

Contingency Budget (held by DOE) to cover any additional unplanned, unbudgeted work authorized through the change control process. An amount of the total allocated budget withheld by the contractor for management control purposes. Contingency is not part of the Performance Measurement Baseline.

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 UC, as the maintenance-and-operations contractor to DOE, for work at LBNL.

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.

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, 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.

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.

Distributed Budget - Budget for work that is defined, budgeted, time-phased, and assigned to a performing organization identified in control accounts and planning packages.

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.

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. Also referred to as Budgeted Cost for Work Performed (BCWP)

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

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

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

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 or a contingency.

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, 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.

Management reserve. Budget (held by LBNL) to cover any additional unplanned, unbudgeted work authorized through the change control process within LBNL approval thresholds. An amount of the total allocated budget held for management control purposes by the contractor. Management reserve is not part of the Performance Measurement Baseline.

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.

Performance Measurement Baseline (PMB). The collected key performance, scope, cost, and schedule parameters. The Performance Measurement Baseline defines the threshold and boundary conditions for a project.

Planned Value (PV). 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. Also referred to as Budgeted Cost for Work Scheduled (BCWS).

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 *consequences/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.

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.

Undistributed Budget (UB). Budget (held by LBNL at the request of the client) for work that is known but not yet assigned and not yet specifically budgeted. Budget associated with specific work scope or contract changes that have not been assigned to a control account or summary-level planning package.

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 the Earned Value Management System. (2) Delegates stewardship of the Earned Value Management System to the Laboratory Project Management Officer.
Laboratory Project Management Officer	(1) Establishes and maintains LBNL policies, procedures, and support for surveillance and maintenance of EVMS implementation on individual projects. (2) Ensures that applicable projects comply with LBNL 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) Reviews annual EVMS self-assessment report(s).
EVMS Surveillance Officer	(1) Developing and maintaining annual surveillance plan and approach; (2) Appointing a team leader for project surveillance reviews (3) Assigning resources to the surveillance reviews (4) Communicating the results of the surveillance; (5) Tracking surveillance findings to closure; (6) Prepares annual EVMS self-assessment report(s). (7) Developing and maintaining surveillance issues assess the systemic health of the process, as assessed across multiple reviews (8) Recommending or implementing EVMS processes and training changes to correct systemic findings.
Project Director	(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 authorizes 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.
Project Manager	(1) Manages the development, execution, and maintenance of project procedures that support the EVMS description. (2) 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. (3) Identifies project variance-analysis thresholds, and negotiates and approves contract reporting-level variance thresholds, control-account budgets, and schedule planning. (4) 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. (5) Implements a project-reporting cycle, cost code structure, Change Request, and a budget planning process.

Role	Responsibilities
	(6) Issues and approves all work authorization documents, as appropriate. (7) Approves/disapproves recommendation of the application of earned-value flow-down provisions for subcontracts in accordance with contract provisions and negotiations with the customer. (8) Reviews and analyzes monthly project-level schedules and performance measurement reports. (9) Reviews significant variances and workaround plans for approval/disapproval with appropriate levels of management following monthly process status. (10) Resolves any scheduling and/or resource conflicts that cannot be resolved at the control account manager levels. (11) Creates planning packages. (12) Reviews workaround plans, and monitors corrective actions. (13) Ensures accruals are recorded accurately.
Functional Manager	Reviews workaround plans, and monitors corrective actions, if required.
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 replanning 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 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.

Role	Responsibilities
	(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 nonearned-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.
Contracts Administration	(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.
Chief Financial Officer Organization	(1) Establishes and maintains LBNL accounting policy and procedures. (2) Establishes and maintains LBNL indirect and distributed cost application rates for projects, and notifies project management of impending changes. (3) Maintains LBNL accounting system used to record all direct and indirect costs for LBNL projects.

Appendix E

References

Section 2: Earned Value Analysis and Progress Reporting

1. Project Management Institute, *Practice Standard for Earned Value Management* (2005).