LIFE

CYCLE

ASSET

MANAGEMENT

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Configuration and Data Management

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1. INTRODUCTION

Successful accomplishment of a project[1] requires all participants be provided accurate information on the project and its end product(s)[2] at any point in the project life cycle. As a project proceeds through the life cycle, the number of participants grows significantly and the volume of information grows exponentially. The task of managing this information is a major challenge and essential to project success. This Guide provides methods to manage and control this information.

In the early stages of a project's life cycle, the end product(s) are defined by functions and requirements contained in mission need and conceptual design documentation. The number of participants is small. The task of managing the information is relatively easy. The focus is on controlling changes to the functions and requirements and ensuring the rapid and complete dissemination of changes to all participants. This is usually accomplished by controlling revision and distribution of the documentation containing the requirements.

As the project progresses through the life cycle, functions and requirements are expanded to develop design requirements for the functional and physical configuration of the end product(s). These design requirements, in turn, are expanded to the detail required to construct[3], operate and maintain the end product(s). The number of participants also expands to include designers, constructors and operators who often represent different organizations. The task of managing the information is now very complex. Increased volume of information, number of documents, number of participants, and requests for changes all contribute to the complexity.

The key processes to manage this information are identification, document control, change control, and data management:

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1 Although the definition of project in DOE O 430.1, LIFE-CYCLE ASSET MANAGEMENT, excludes research and development activities, the guidance herein has application to all technical efforts, including research projects, particularly where safety is a consideration.

2 As defined in *Project Execution and Engineering Management Planning*, GPG-FM-010, end product(s) is synonymous with "unique product, facility, system or environmental condition." It is also synonymous with "structures, systems and components" as used in contemporary configuration management literature.

3 Construct includes fabricate, assemble, install, and test.

- Identification - includes selection of components of the end product(s) subject to control and selection of the documents which define the project and components.

- Document control - identifies, stores and controls, tracks status, retrieves and distributes documents.

- Change control - provides a systematic method for managing changes to the project and its physical and functional configuration to ensure that all changes are properly identified, assessed, reviewed, approved, implemented, tested and documented.

- Data management - ensures that necessary information on the project and its end products(s) is systematically recorded and disseminated for decision making and other uses. As used in this Guide, data management is synonymous with "configuration status accounting" as used in contemporary configuration management literature.

Collectively the integration of these elements among all participants is referred to as configuration management. Figure 1.0-1, Configuration and Data Management in the Project Life Cycle, illustrates the relationship of these elements to the Project Life Cycle. GPG-FM-001, *Project Management Overview*, and GPG-FM-002, *Critical Decision Criteria*, provide detailed discussion and guidance on the phases of the life-cycle and the critical decision process.

This Guide provides recommendations for development and execution of a comprehensive configuration management program. It discusses establishment of baselines as reference points from which to measure and control changes to the physical and functional configuration and describes baseline maintenance and control elements, processes, factors, and management methods. It defines and classifies various data types and methods for effective management of each data type relative to purpose. The configuration management processes and controls described in this Guide are designed to meet the needs of the Department of Energy (DOE) complex, including: Strategic Systems, Line Item Projects, other projects, programs and facilities.

As illustrated in Figure 1.0-1, elements of configuration management are applicable through all phases of the Project Life Cycle. This requires that Headquarters and Field Element managers implement applicable elements of configuration management in their program and project related activities. These applicable configuration management elements interface with and are further integrated with the activities of contractors and other project participants. Collectively, these activities represent a configuration management program applicable throughout the project life cycle. This Guide includes recommendations for selecting the applicable configuration management elements for a given program and/or project and for selecting the configuration management elements that should be included in contract vehicles.

Configuration management controls should be applied in a selective and graded manner. Guidelines for increasing levels of control are based on the health, safety, environmental, regulatory, cost and programmatic importance of the components, systems and products.

Implementation of configuration management guidelines should incorporate the use of existing procedures, programs, and processes. Wherever practical, configuration management activities should be included as steps in procedures for related activities, rather than in stand-alone configuration management procedures, so the steps are integral to the process(es).

Configuration Management and Baseline Management

Within DOE, the terms "baseline management" and "configuration management" have been used with some degree of confusion. The purpose of this section is to clarify the relationship.

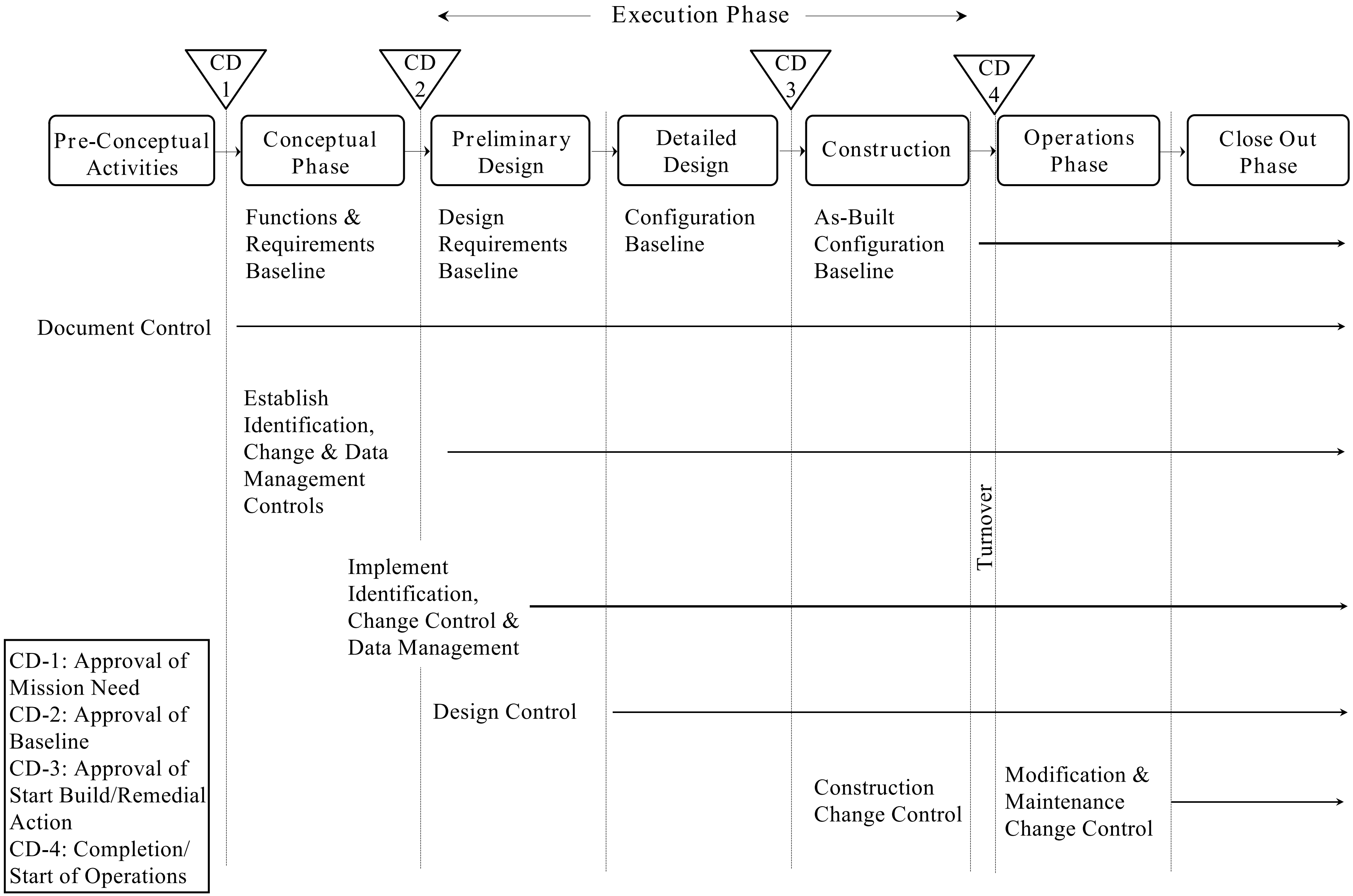
At any point in its life cycle, from inception to completion of the execution phase, a project has a configuration. Initially, its configuration is a conceptual arrangement of the parts or elements of the desired end product(s). As the project proceeds through its life cycle, the configuration is defined in greater detail through the design process and documented in specifications and drawings. At the end of the life cycle the configuration is the actual physical and functional configuration of the end product(s) and associated as-built documentation.

Configuration management is used to identify and document the configuration of the end product(s) and control changes to the configuration.

At selected points in a project’s life cycle, the current configuration is established as a reference point or technical baseline. The technical baseline is combined with other project activities (e.g., activities to construct or activities to conduct remedial action) to form a scope baseline. The scope baseline is then used as a basis to develop project cost and schedule baselines. The scope, cost, and schedule baselines serve as a basis for project authorization, management, and as a standard for measurement

Figure 1.0-1

CONFIGURATION AND DATA MANAGEMENT IN THE PROJECT LIFE-CYCLE



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during the performance of a project. As such, the scope, cost, and schedule baselines are the established plan against which the status of resources and the progress of a project are measured.

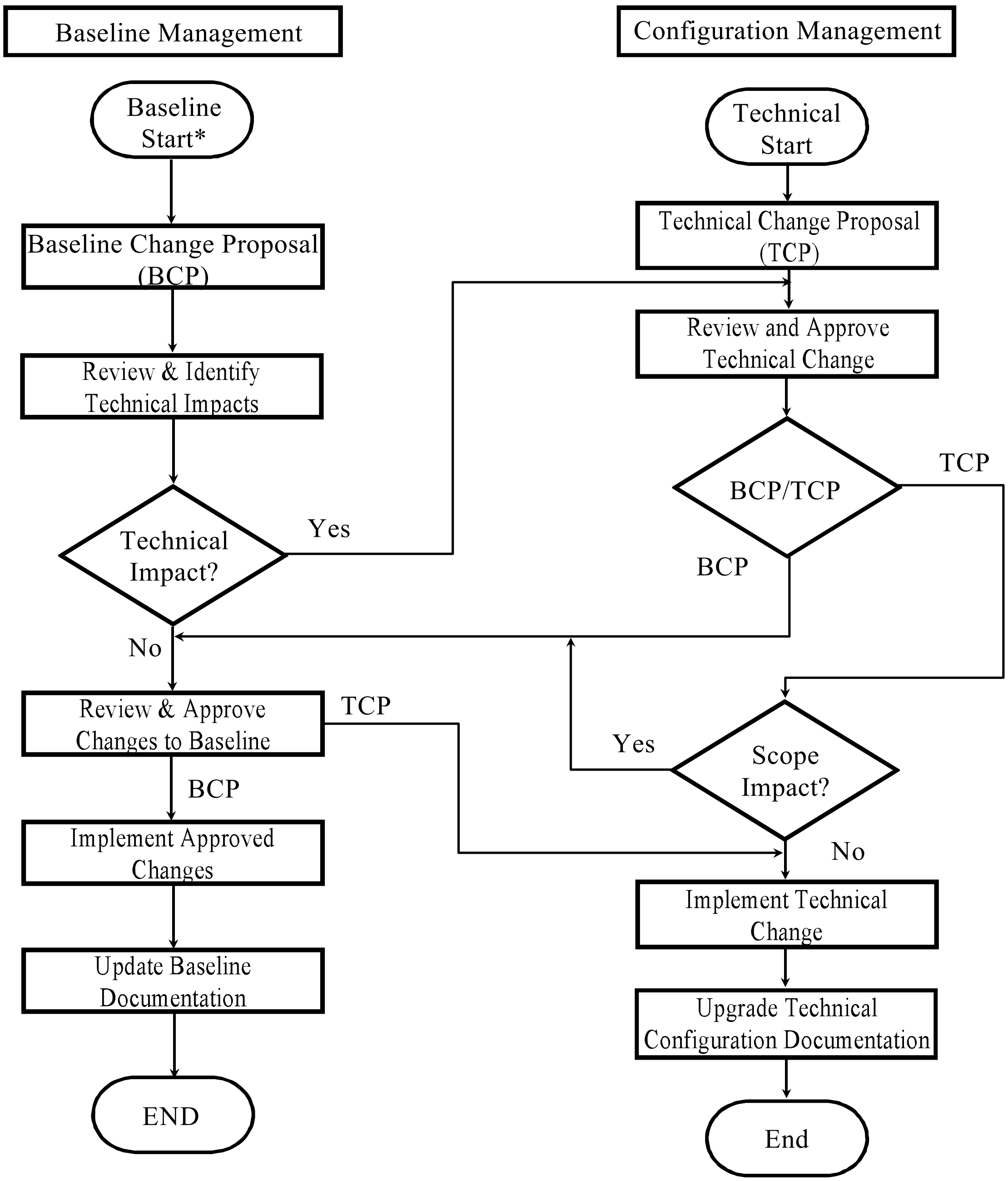
Baseline management is used to measure progress against and control changes to the scope, cost, and schedule baselines.

Configuration management and baseline management are integrated in that the baselines are derived from the configuration and they share a common change control process.

The relationship between baseline management and configuration management is illustrated in Figure 1.1-1, Overview of the Change Control Process.

Figure 1.1-1

OVERVIEW OF THE CHANGE CONTROL PROCESS



*Baseline includes scope, schedule, and cost; technical is included in scope.

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2. PRINCIPLES AND PROCESSES

The focus of this Guide is on description of the end product(s) configuration (what is controlled), methods of controlling the configuration and related information (how controlled), and on the relationship of control elements to the Project Life Cycle (when). Section 2.1 provides an overview of the configuration management process followed by guidance, in section 2.2, on roles of different project participants. Sections 2.3, 2.6, 2.7 and 2.8, provide detailed guidance applicable to programs, projects and operating facilities. Section 2.4 provides additional guidance specific to projects while section 2.5 provides additional guidance for operating facilities. Six appendices provide aids, detailed guidance and examples to the program and project manager for implementing an effective configuration management program.

Table 2.0-1, Conventions, provides a listing of key terms and their meanings as used in this Guide. The upper half of the table includes conventions for the different organizations participating in DOE work; the bottom half provides conventions for different work scope.

2.1 Process Overview

Figure 2.1-1, Configuration Management Process Flow Diagram, depicts the overall configuration management process and process elements. In addition to the four key elements of Identification, Document Control, Change Control, and Data Management; discussed in the introduction, Figure 2.1-1 includes the Change Implementation and Review process elements. Specific applicability of these processes to DOE programs, projects, and operating facilities is addressed in subsequent sections of this Guide. A general description of these process elements is provided in the following paragraphs.

Identification. The process and methods of identifying components of the end product(s) (also referred to as configuration items) subject to control and the supporting documentation which defines the project and components. The supporting documentation includes the numbers and other identifiers (e.g., document numbers, drawing numbers, equipment numbers) assigned to configuration items and documents, and the approved technical documents that identify and define configuration items' functional and physical characteristics, such as specifications, drawings, associated lists, and interface control documents.

Document Control. Provides for controlling the distribution of documents and approved changes and retains the master copy in storage for safekeeping. Document control also maintains distribution lists and a master controlled document index. The index includes information such as document title, document number, revision number or date of issue, and the document distribution list. Controlled distribution ensures that recipients of controlled documents are notified of approved changes and that superseded documents are not used for performing work.

Change Control. The process of managing proposed changes to the configuration items and technical documentation to ensure proposed changes are accurately described, systematically reviewed and evaluated for impact, properly implemented upon approval, and properly closed out. The change control process provides for technical, scope, cost, and schedule reviews of proposed changes. These reviews are documented as a change package. Upon completion of the necessary reviews, proposed changes are dispositioned by a Change Control Board (CCB). The CCB action is documented on the change proposal or a change directive which provides instructions for implementation of approved changes.

Data Management and Reporting. The process of recording and reporting the current status of configuration items, technical documentation, and all proposed and approved changes throughout the life cycle of the item. Data management satisfies two needs. The first is to track the implementation of approved change proposals to ensure that all affected documents are updated and that all change directive instructions are followed. This also permits the generation of reports providing the current approved configuration of configuration items and their documentation and pending changes to them. The second need is to create and maintain an audit trail of change proposals through the configuration change control process. Chronological records of changes and reports can be prepared for any configuration item or baseline document.

Change Implementation. The process of making changes to the configuration items, technical documentation, and technical baselines.

- For configuration items, change implementation provides for verification that the physical and functional characteristics of the configuration items conform to the technical documentation.

- For technical documentation, change implementation provides for verification that the technical documentation conforms to the technical baselines.

- For technical baseline documents, change implementation provides for verification that all technical and baseline documents impacted by the new baseline document are updated.

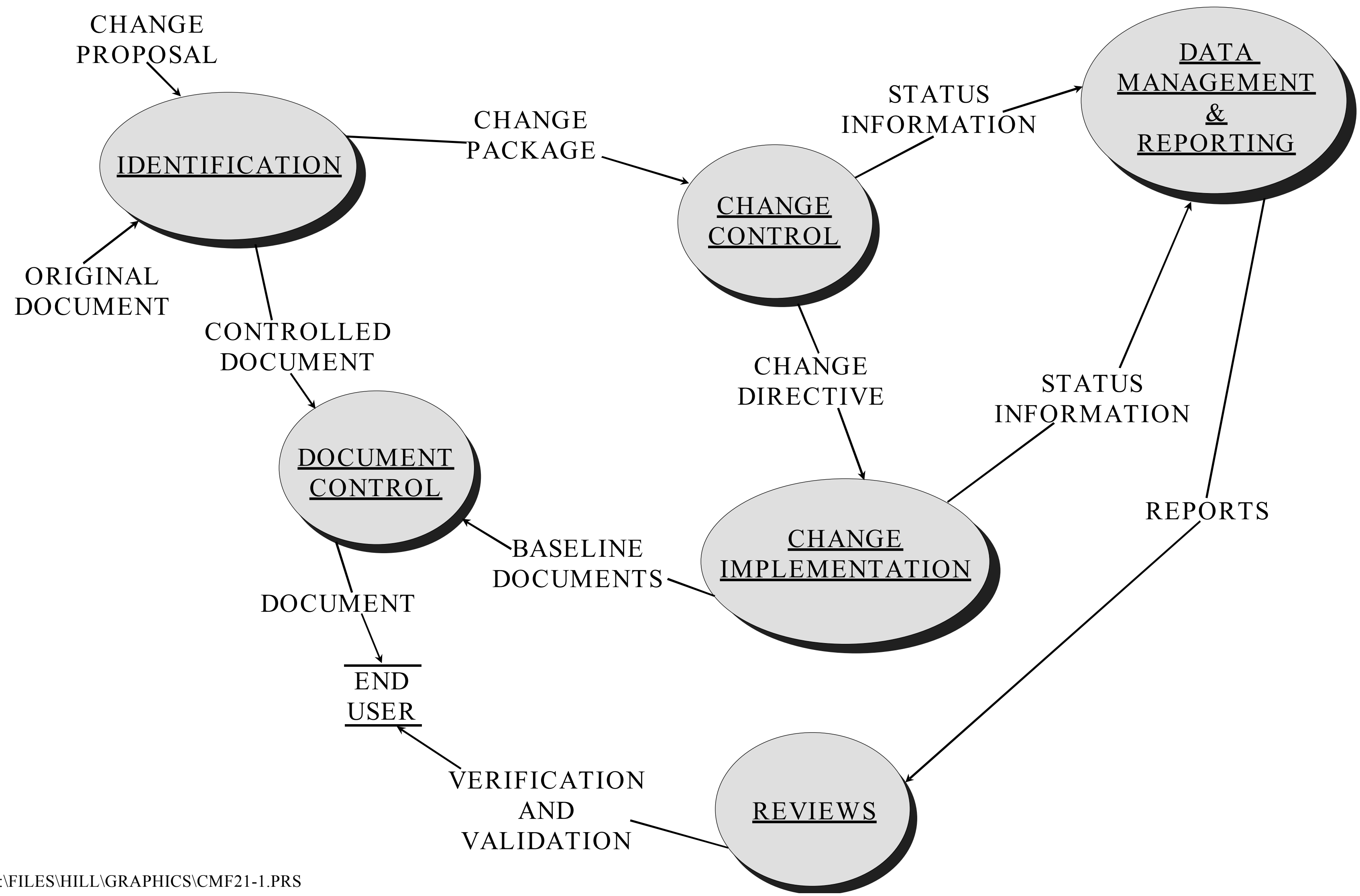
Table 2.0-1

Conventions

Consistent with DOE Order 430.1, Life-Cycle Asset Management, the following conventions are used to distinguish between participants and DOE work scope:

- DOE. A term that refers to the DOE in general and is applicable to any or all participants in accomplishing the DOE mission at Headquarters and DOE field elements.
- DOE Elements. First tier organizations at Headquarters and in the field.
- Program Office. The Headquarters organization with program and/or landlord, responsibility including contractors providing support to Headquarters.
- Landlord Program Office. (Landlord) The Program Office responsible for the support, planning, acquisition, operation, maintenance and disposition of physical assets related to infrastructure.
- Field Elements. Any non-Headquarters participants, including DOE Operations Offices, Area Offices, Site Offices, M&O Contractors, DOE installations, and support service contractors providing support to field elements.
- Programs. Organized sets of activities in direct support of a specific mission area. Programs are typically made up of technology base activities, Line Item Projects, General Plant Projects (GPPs) for DOE operating facilities, and support operations.
- Project. In general, a unique effort that supports a program mission with defined start and end points, undertaken to create a product, facility, or system with interdependent activities planned to meet a common objective/mission. Projects include planning and execution of construction/renovation/modification/environmental restoration or decontamination and decommissioning efforts, and large capital equipment or technology development activities. Tasks that do not include any of the above elements, such as basic research, grants, and operations and maintenance of facilities, are not considered projects.
- Line Item Project. Those separately identified project activities that are submitted for funding and are specifically reviewed and approved by Congress.
- Strategic System. (formerly Major Systems Acquisition) A special type of line item project(s) that is a single, stand-alone effort within a program mission area that is a primary means to advance the Department's strategic goals. Designation of a strategic system is determined by the Secretary based on cost, risk factors, international implications, stakeholder interest, and/or national security.
- Facility. The buildings, utilities, structures, and other land improvements associated with an operation or service and dedicated to a common function.
- Facilities Management. A documented process by which facilities are operated and maintained.
- Operating Facility. A facility operated and maintained for DOE.

Figure 2.1-1
CONFIGURATION MANAGEMENT PROCESS FLOW DIAGRAM



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Reviews. The process of verifying: (1) the technical baselines satisfy the design requirements, (2) the physical and functional characteristics of configuration items conform to the technical baselines, (3) approved changes have been properly incorporated into the technical baselines, (4) the as-built configurations conform to the approved technical baselines, and (5) the entire configuration management program performs in accordance with approved plans and procedures. Reviews are performed periodically to validate configuration documentation is properly updated and to verify only current controlled configuration documents are being used.

2.2 Roles

Configuration management should be an organizationally and procedurally integrated program. Typical roles of participants in DOE projects are shown in Table 2.2-1.

2.3 Guidelines for Programs, Projects, and Operating Facilities

This section includes guidelines common to programs, projects and operating facilities. Additional guidelines, specific to projects and operating facilities, are included in sections 2.4 and 2.5, respectively.

2.3.1 Plans and Procedures

The configuration management process should be controlled by a configuration management plan. For Line Item Projects, including Strategic Systems, the project should include a configuration management plan as a component of the project planning documentation. For other projects, use of a configuration management plan should be considered on a graded basis. Each non-DOE organization participating in the project should similarly be required to prepare and maintain a configuration management plan for their portion of the work that integrates with the project level plan. The project level configuration management plan may be an integrated cohesive assembly of the plans of other participants. The plan should include discussion of how configuration management will be conducted on the project and what items will be so managed. A suggested configuration management plan is provided in Appendix A.

Procedures should be established by Program Offices, DOE Field Elements, and DOE contractors for the control of changes to configuration items, baselines and supporting documents. Configuration management related procedures should incorporate existing procedures, programs, and processes. Wherever practical, configuration management activities should be included as steps in procedures for related activities, rather than in stand-alone configuration management procedures, so the steps are integral to the process(es).

Table 2.2-1. Typical Configuration Management (CM) Roles of DOE Project Participants.

Participant / Role/Activity	Office of Field Management	Program Offices and Landlords	Field Elements	Project/Facility Managers	Contractors
CM Program					
Review CM plans, procedures, processes, and training to ensure a sound CM system exists and logical interfacing with other participant CM programs.	X				
Provide general direction and guidance associated with DOE CM program implementation including resolution of conflicts.	X	X			
Interfaces with FM to obtain interpretations on the meaning and applications of CM-related DOE Orders, Notices, Regulations, SENs, etc.	X	X	X		
Develop, implement, and maintain CM plans, procedures, processes, and training consistent with DOE O 430.1, DOE 5480.19, DOE 4330.4A, and this Guide.	X	X	X	X	X
Review CM plans, procedures, processes, and training to ensure consistency with this Guide and logical interfacing with other participant CM programs.	For DOE Field Elements	For subordinate DOE Field Elements	For Project/Facility Managers	For Contractors	For Subcontractors
Oversee of CM implementation; plan and participate in CM reviews in accordance with sections 2.3.11 & 2.7.	For DOE Field Elements	For DOE Field Elements	For Project/Facility Managers	For Contractors	For Subcontractors

Table 2.2-1. Typical Configuration Management (CM) Roles of DOE Project Participants (continued).

Participant / Role/Activity	Office of Field Management	Program Offices and Landlords	Field Elements	Project/Facility Managers	Contractors
Change Control Process					
Establish and approve change control authority thresholds for scope, cost, and schedule baselines.		X	X		
Evaluate Baseline Change Proposals (BCPs) for impact on technical, scope, cost, and schedule baselines. Disposition if impacts do not exceed change control authority thresholds. Provide controlled distribution of approved change dispositions to all affected parties.		Level 1 is typical authority level[5]	Level 2 is typical authority level[4]	Level 2 is typical authority level[4]	Level 3 is typical authority level[4]
Submit a BCP to the next higher approval authority if technical, scope, cost, or schedule impact exceeds change control authority.		Submit to Level 0 authority	Submit to Level 1 authority	Submit to Level 1 authority	Submit to Level 2 authority
Other					
Issue baseline documents, including changes, and maintain the document masters.[6]		Level 1	Level 2	Level 2	Level 3
Notify the next authority level CCB that a baseline document has been issued.		Notify Level 0 authority	Notify Level 1 authority	Notify Level 1 authority	Notify Level 2 authority
Re view and approve safety system classification criteria and implementation plans for DOE operating facilities.		Landlords	X	Facility managers	Operating contractors
Prepare and coordinate work plans for CM implementation for DOE programs, projects, and operating facilities under their jurisdiction.					X
Review contractor work plans for CM implementation for DOE programs, projects, and operating facilities under their jurisdictions.		X	X	X	

2.3.2 Technical Baseline Identification

As discussed in section 1.1, the technical baseline is combined with other project activities to form the scope baseline. The scope baseline is the basis for cost and schedule baselines. The technical baseline defines the physical and functional configuration of the project's end product(s). Baseline management controls the scope, cost and schedule baselines and integrates with configuration management which controls the technical baseline. Data management controls information on the project and the configuration of its end product(s).

The technical baseline consists of a top-down set of requirements in which all subsidiary requirements flow down from the requirements above them. Typical DOE technical baselines are defined below. For identification and reference purposes, each update to the technical baseline has been given a title corresponding to its content and/or relationship in the life cycle.

The titles may vary for a particular program and project and there may be fewer or more baselines. For example the Tank Waste Remediation System, an EM Strategic System, has two program technical baselines (functional requirements and technical requirements) and five program element/project baselines: design requirements, design configuration, as-built configuration, operational, and decontamination. A minimum set of technical baselines would be those required to support scope, cost and schedule baseline submittals for Critical Decisions.

The relationship of these baselines to the Project Life Cycle is shown in Figure 1.0-1. The recommended set of documents that should be included in each baseline is shown in Figure 2.3-1, Typical Technical Baseline Documents.

Functions and Requirements Baseline. The initial baseline for projects, is developed during the conceptual phase, and supports the Approval of Baseline Critical Decision. It establishes the functions and technical requirements of DOE programs and projects. At this stage of a project, the configuration represented by the baseline is conceptual with nothing designed or built. The functions and requirements baseline is generally developed as follows:

- The DOE mission and objectives are defined.

- Functions of the DOE programs are defined.

- Functions of the DOE programs are allocated to technology base activities, facilities, and projects.

- Interfaces of the DOE activities, programs and projects with other facilities, programs and projects are identified.

- Further definition and requirements of the programs and projects are made.

Design Requirements Baseline. For complex projects, the design portion of the execution phase is often split in to Preliminary Design and Detailed Design. Through the preparation of preliminary planning and engineering studies, Preliminary Design translates the functions and requirements from the conceptual phase into preliminary drawings and outline specifications, life-cycle cost analysis, preliminary cost estimates, and scheduling for project completion. Preliminary Design identifies long lead procurement items and provides analysis of risks associated with continued project development. At this stage of a project, the configuration defined by the preliminary drawings and outline specifications is represented by the Design Requirements Baseline with the following content:

- the physical systems for each project or facility are identified;

- the boundaries and interfaces for each physical system are identified;

- the major components for the physical systems are identified and defined and

- the functions and requirements, performance criteria, and constraints established in the conceptual phase are allocated to the respective physical systems and major components.

Configuration Baseline. Represents the output of the detailed design portion of the execution phase and supports the Approval of Start Build/Remedial Action Critical Decision. The functions and requirements from the conceptual phase and the design requirements from preliminary design, as applicable, are expanded to include the detail required to construct the systems and components of the end product(s). The configuration of the project is defined by the design output documents which include procurement and construction specifications, drawings, test procedures, and operating and maintenance information.

As-Built Configuration Baseline. At completion of the construction portion of the execution phase, the detailed design documents established in the configuration baseline are used to establish the as-built configuration baseline as follows:

- All changes occurring to the configuration baseline during construction are approved and reflected in the as-built configuration baseline.

- All changes occurring to the configuration baseline during the operations phase after system turnover are approved and reflected in the as-built configuration baseline.

2.3.3 Establishment of Baselines

Development of baselines for DOE programs, projects, and operating facilities should adhere to the following management concepts set forth by DOE O 430.1:

- identification, documentation, and approval of basic requirements;

- specification of a systematic process for development;

- formal identification and approval of baselines;

- specification of allowed variances from the approved baselines;

- regular reporting and assessment of status against the approved baselines; and

- corrective management action (that may include baseline revision) in the event a variance exceeds a prescribed threshold.

GPG-FM-016, Baseline Development, provides additional guidance in this area.

2.3.4 Change Control

Technical baselines should be established and revised by submittal to the appropriate CCB. CCBs provide the coordination necessary to evaluate a change and assess its impact. Within DOE, the assignment of configuration change control responsibilities is generally based on a hierarchy of classes of changes. Change classifications are specified levels established for the control of changes affecting technical, scope, cost, and schedule baselines. To ensure the flow-down of technical requirements, a proposed change to a baseline document, which could affect a higher-level baseline document, should be referred to and acted upon by the higher level CCB first.

The CCB process is illustrated in Figures 2.3-2, Typical Change Control Authority Hierarchy, and 2.3-3, Typical Change Control Hierarchy/Overview. Table 2.3-1 provides typical technical baseline change control approval criteria for the three change classes. Summary descriptions of the CCB hierarchy and the CCB Secretariat organization are provided in this section. Change classifications, change control authority for scope, cost, and schedule baselines and the CCB Secretariat organization are described in greater detail in GPG-FM-009, *Baseline Change Control*.

2.3.4.1 Executive Baseline Change Control Board (Level 0)

The Executive Baseline Change Control Board (BCCB) is the Level 0 CCB. Membership, authority, and procedural requirements for the Executive BCCB are established by the Secretary. Membership of the Executive BCCB is the same as the Energy System Acquisition Advisory Board (ESAAB). Executive BCCB approval is normally required for all critical decision points for Strategic Systems. Additionally, changes to the Level 0 baseline exceeding established approval criteria (typical approval criteria are shown in Table 2.3-1) require Executive BCCB approval. The Level 0 scope, cost and schedule baselines for projects are defined in their individual project planning documentation developed in accordance with DOE Order 430.1. Only changes endorsed by the Program BCCB are presented to the Executive BCCB for action.

2.3.4.2 Program BCCB (Level 1)

Membership, authority, and procedural requirements for the Level 1 Program BCCB should be established in BCCB Charter for each DOE program. Membership should include representatives from the engineering, safety and health, environmental, and quality disciplines as well as management, operations, and maintenance representatives. Responsibility for chairing the Program BCCB (Level 1) is generally held by the Assistant Secretary or the Deputy Assistant Secretary for the program. The Program BCCB should have change authority over all Class 1 changes. Class 1 changes are changes that have impacts which exceed Class 2 and Class 3 approval criteria (typical approval criteria are shown in Table 2.3-1).

2.3.4.3 Field Element CCBs (Level 2)

Membership, authority, and procedural requirements for Level 2 CCBs should be established in Field Element configuration management plans and change control procedures. These documents and procedures should establish approval criteria requiring Level 2 CCB approval for changes to project scope, cost, and schedule baselines. Membership should include representatives from the engineering, safety and health, environmental, and quality disciplines as well as management, operations, and maintenance representatives. Level 2 CCBs should have change authority over all Class 2 changes. Class 2 changes are changes that impact interface control documents or that have scope, cost, or schedule impacts that exceed Class 3 approval criteria (typical approval criteria are shown in Table 2.3-1).

2.3.4.4 Contractor CCBs (Level 3)

Membership, authority, and procedural requirements for Level 3 CCBs should be established in contractor configuration management plans and change control procedures. These plans and procedures should be reviewed by the Field Element to ensure they are consistent with the Field Element configuration management planning documents and change control procedures. Membership should include representatives from the engineering, safety and health, environmental, and quality disciplines as well as management, operations, and maintenance representatives.

2.3.4.5 CCB Secretariat Organization

Typically, baseline management change control is administered at each level by a secretariat which performs its administrative functions in compliance with configuration management plans and change control procedures. A secretary is assigned to each CCB by the chairperson of the respective CCB. Level 3 CCBs should have change authority over all Class 3 changes. Class 3 changes are changes to contractor-controlled design-input or design-output documents, including software revisions to configuration identification computer codes, that do not exceed Class 3 approval criteria (typical approval criteria are shown in Table 2.3-1) or affect any other contractor.

The CCB secretariat administers the change control process, provides agendas and documents to board members prior to meetings, and documents and disseminates board direction and decisions to all affected activities. Each CCB secretary provides periodic status reports to their respective CCB chairperson.

2.3.5 Configuration Identification

The sites, facilities, structures, systems and components of DOE projects, programs and operating facilities that are important to the environment, safety and health and other structures, systems and components that are deemed critical to the DOE mission should be included in the configuration management program. The configuration items should be identified in the technical baseline documentation and should have a unique identifier (e.g., component or equipment number). The unique identifier is needed to ensure consistency, retrievability, and traceability of technical and baseline documentation for configuration items. For DOE, the configuration identification guidelines apply specifically to:

Figure 2.3-1

TYPICAL TECHNICAL BASELINE DOCUMENTS

FUNCTIONS AND REQUIREMENTS BASELINE:

Strategic Plans
Program Plans
Mission Need Justification
Conceptual Design Reports
Project Execution Plans
Interface Control Documents

DESIGN REQUIREMENTS BASELINE:

Design Criteria
Preliminary Safety Analysis Reports
System Requirements
Conceptual Design
Preliminary Design
Interface Control Documents

CONFIGURATION BASELINE:

Final Safety Analysis Reports
Definitive (Final) Design
Operational Safety Requirements
Specifications
Drawings
Quality Assurance Procedures
Test Procedures
Operating and Maintenance Procedures
Procurement Documents
Work Control Packages
Operating and Maintenance Manuals
Construction Procedures

AS-BUILT CONFIGURATION BASELINE:

Configuration Baseline documents with the approved updates incorporated to reflect the actual physical configuration.

Note: The above includes computer hardware and software subject to configuration management

- physical items (i.e., facilities, structures, systems, and components [SSCs]);
- software;
- site characteristic data and samples;
- waste package; and
- documentation (including supporting analysis and data).

The level of identification required varies depending on the importance of the configuration item and the indentured level from which documentation needs to be retrieved. Structures, systems and components important to safety require a more detailed identification than other SSCs to ensure traceability of requirements throughout the life of the project, program or operating facility. Appendix B provides additional guidelines for configuration identification and Appendix F provides an example from DOE's Yucca Mountain Project.

2.3.6 Traceability

Configuration management should require traceability of technical baseline requirements and data through all phases of DOE programs, projects and operating facilities. Technical baseline documents should establish traceability of requirements through all levels of documentation, and to the configuration items. Regulatory and other design basis requirements depicted in documents which describe configuration items should be readily traceable to their origin through design requirements documents, etc.

The baselining process allocates technical requirements to subsequent levels of detail. Throughout the design, construction and operations phases, materials and components should be traceable to their application and physical location. Traceability of technical requirements should be established by uniquely identifying configuration items and the associated documentation. Data management systems should be utilized to cross reference the appropriate documents to configuration items.

2.3.7 Software Configuration Management

The configuration management program should require that critical computer software and associated documentation be identified and controlled. Software designated to be controlled should be uniquely identified and established as part of the technical baseline. Guidance for computer software change control is provided in section 2.6 of this Guide. Software that should be included in the configuration management program includes:

Figure 2.3-2

TYPICAL CHANGE CONTROL AUTHORITY HIERARCHY

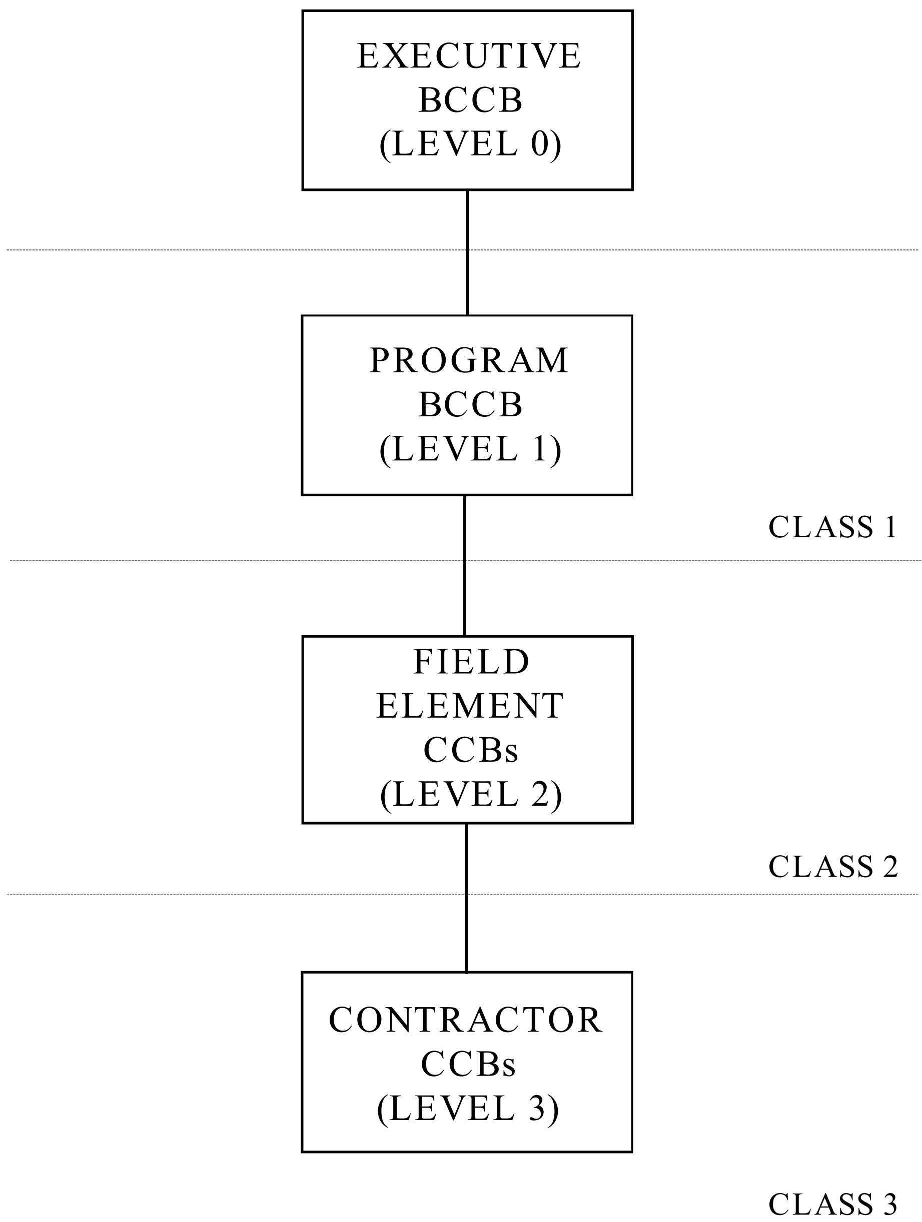

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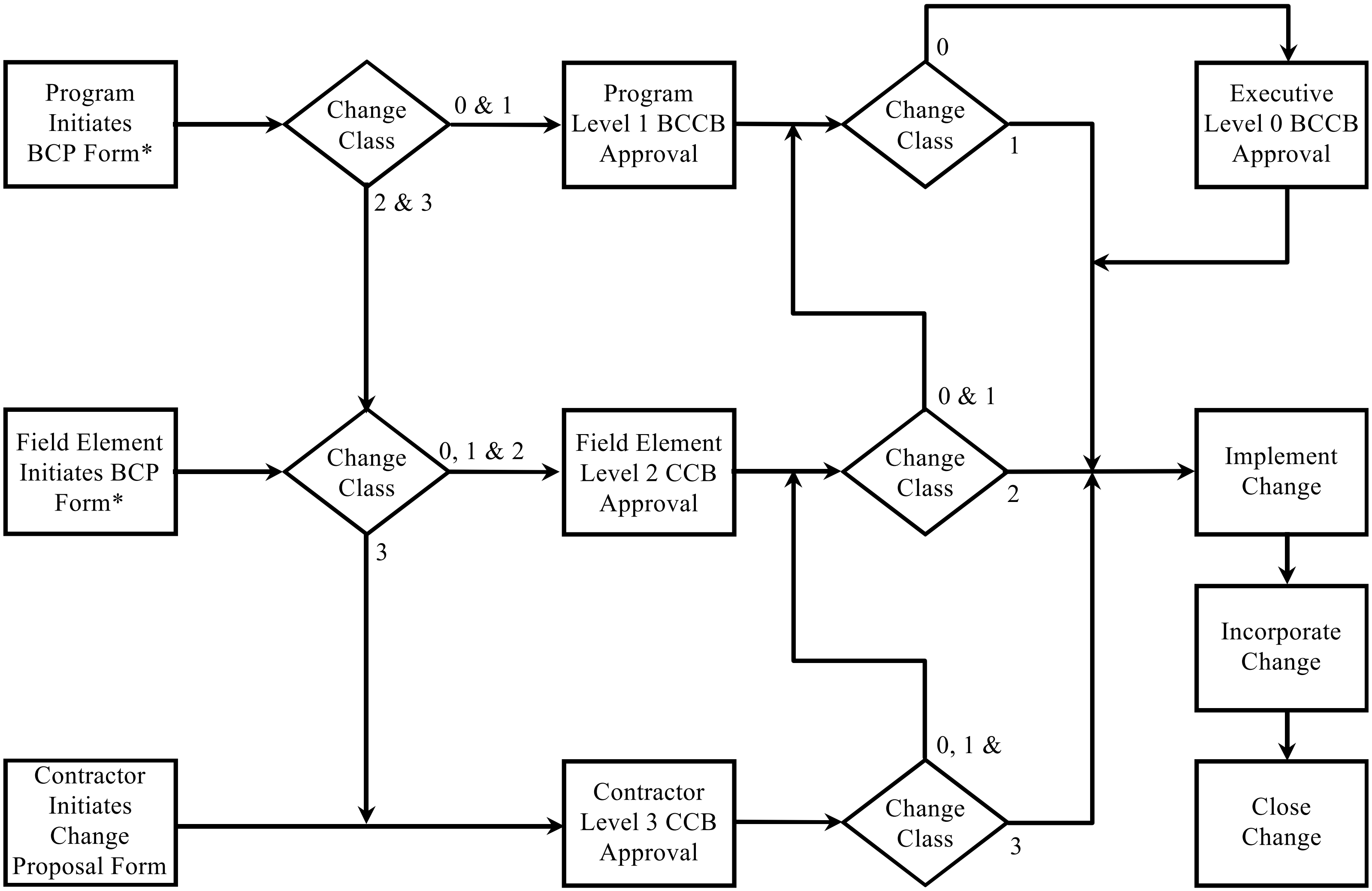
Figure 2.3-3
TYPICAL CHANGE CONTROL HIERARCHY/OVERVIEW



* Or Equivalent

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Table 2.3-1. Typical CCB Approval Criteria for Baselines.

Change Level	**Baseline Documents**
0 ESAAB BCCB	• BCPs and requests for deviations or waivers that affect Level 0 requirements
1 Program BCCB	• Functions and requirements baseline • Document change proposals and requests for deviations or waivers that affect Level 1 functions and requirements baseline • Directed changes resulting from DOE policy directives and regulatory or statutory requirements that affect baselines[1] • Proposed changes to lower-level baselined documents that Program-level baseline documents • Proposed Level 0 changes initiated at the Program level
2 Field Element CCBs	• Design requirements baseline • Configuration baseline • As-Built Configuration baseline • Revisions and requests for deviations or waivers that affect Level 2 requirements • Field changes that affect Level 2 requirements baselines • Directed changes resulting from DOE policy directives and regulatory or statutory requirements that affect baselines[1] • Proposed Level 1 changes initiated at the Field Element level • Proposed changes to lower-level baselined documents that project-level baseline documents
3 Contractor CCBs	• Design requirements baseline[2] • Configuration baseline[2] • As-built configuration baseline[2] • Revisions and requests for deviations or waivers that affect Field Element level requirements baselines[2] • Field changes that affect Field Element level requirements baselines[2]

[1] Directed changes are not approved by the CCB but should be reviewed for impact.
[2] Within the approval criteria as defined by the Field Element.

- operations and process control;
- protection systems;
- engineering development, design analyses, evaluation, and assessment;
- mathematical models;
- data base or document indexes when used as the controlled source of information for the above; and
- computer aided design/manufacturing/engineering (CAD/CAM/CAE).

2.3.8 Interface Control

The functions, requirements, and physical characteristics of the end product(s) at common boundaries among project participants need to be identified, documented and controlled. For complex projects, Interface Control Working Groups should be established to identify, document, and monitor interfaces. Interface Control Documents should be used to define interfaces, interface responsibilities, and interface requirements in terms of functions, requirements and physical characteristics, as appropriate, and interface constraints and assumptions. For changes that affect functions, requirements and physical characteristics that exist at a common boundary between two configuration items which are controlled by different organizations, the Interface Control Documents should also include interface control drawings. The Interface Control Documents should be baselined by the appropriate CCB. Detailed guidelines for interface control are given in GPG-FM-13, Interface Management.

2.3.9 Data Management

Computerized information applications should be used to collect, store, and maintain configuration management technical baseline information and changes thereto. When used, the design, development, implementation, and use of these applications should be subject to the guidelines of the configuration management program.

New facilities should develop a Master Equipment List (MEL) data base during design and construction. This list should contain structures, systems and components (SSCs) selected by the Field Element and the contractor based upon safety grades assigned to the SSCs. The list should have the following features, as a minimum:

- All SSCs should be classified (where applicable) by engineering system, start-up system, operating system, safety class, hazard category, instrument loop number, piping line number, circuit number, plant location, applicable Work Breakdown Structure (WBS) element, and any other category of interest to the users of the MEL.

- SSC lists should be extractable by category, for example, a list of all Safety Class 1 items.

- Each SSC should reference its unique identification number, engineering drawing or specification number, and other related documents, for example, applicable Safety Analysis Reports (SARs), Interface Control Document, spare parts list, and test procedure.

- Operating and maintenance procedures should be cross-referenced to their associated SSCs and operating systems as applicable.

- Each existing facility classified as a Hazards Category Class 3 or higher should develop a Safety Equipment List (SEL) for Safety Class 1 equipment only. The SEL should contain the data specified above and should be a subset of the MEL.

Detailed guidelines for configuration management related computer applications are provided in Appendix C. Appendix F, DOE's Yucca Mountain Project Configuration Identification Plan, provides a good example of determining safety grades and includes an evaluation of configuration information system needs which identifies six benefits that are universal in their applicability.

2.3.10 Reporting

Reporting processes should meet the guidelines of GPG-FM-006, *Performance Analysis and Reporting*; GPG-FM-009, *Baseline Change Control*, and GPG-FM-010, *Project Execution and Engineering Management Planning*.

2.3.11 Reviews

Assessments should be performed to measure the effectiveness of the configuration management process, and consistency between the project physical system and the documentation that represents that system. Contractor assessment and surveillance results and corrective actions should be reviewed by the Field Element.

2.3.11.1 Programmatic Assessment

Programmatic assessments should determine the acceptability of the configuration management process and implementation of the requirements contained in project execution and planning documentation. Initially, assessments should identify weaknesses of procedures and necessary corrective actions. Subsequent assessments should determine the effectiveness of corrective actions and continue to monitor and continuously improve the configuration management process.

2.3.11.2 Physical Configuration Assessments

Physical configuration assessments should determine the consistency between the documented technical baseline and the actual physical configuration. Discrepancies should be analyzed and appropriate corrective action taken to resolve them. These assessments should be performed periodically. An annual schedule for the physical configuration assessments should be prepared by the contractor and submitted as an integral part of the work planning documentation.

Configuration verification processes should meet the guidelines of GPG-FM-005, *Test and Evaluation*; GPG-FM-010, *Project Execution and Engineering Management Planning*; GPG-FM-015, *Project Reviews*; and GPG-FM-029, *Systems Analysis and Assessment*.

2.3.12 Control of Deviations and Waivers

Deviations and waivers are approved exemptions from a particular requirement of the current approved configuration for a specific case or a specified period of time. Deviations relate to variation from approved requirements prior to development or construction of the item; waivers relate to variations after the item has been developed or constructed. Deviations and waivers differ from approved engineering changes in that they do not require a change to the current approved configuration. Deviations and waivers should be minimized and only granted when there is an overriding benefit. A deviation may be processed in lieu of a change to the baseline when it is necessary to depart from a mandatory design requirement in a specific application but it is not desirable to change the design. A proposed deviation should be converted to a design change if it is determined that the deviation results in a superior design. If an item has departed from specified requirements but is considered suitable for use or for being repaired by an approved method, a waiver should be processed in accordance with applicable procedures. The deviation and waiver documents should be maintained as records to show authorization for the as-built condition to vary from the documented design requirements.

2.3.13 Waste Inventory Configuration

Where applicable, waste inventory should be controlled in a manner similar to the technical baseline. The inventory configuration should provide the consistent and approved information needed for the technical planning and engineering required to remediate the waste. This inventory configuration used for technology selecting and engineering design should be referenced in the design basis documentation. The following requirements should apply.

- A waste inventory data base should contain location, properties (physical, mechanical, thermal), composition (chemical, radiological), and quantity (volume, weight) information. As characterization of waste proceeds, the approved results should be added to this data base. Where specific properties do not exist, those facts should be included in the inventory data base such that the data base should convey information about what is, and is not known, about the inventory.

- The inventory components should contain information regarding the date when the component was measured, the source report the measurement, and the quality level of the measurement (conceptual estimate or actual physical measurement).

- A single, controlled waste inventory data base should provide the approved source of inventory data.

- Changes to the waste inventory should be communicated to a controlled distribution to ensure that the appropriate users have up-to-date inventory information.

- All inventory data should be checked to ensure internal consistency (e.g., for waste transferred from Tank A to Tank B, the inventory should show an increase in Tank B with a corresponding decrease in Tank A). Data base integrity should be preserved to ensure that data contained therein is entered, changed, or deleted only by authorized personnel and meets all other data protection policies.

- Changes to the inventory should be traceable.

- A method should be established to include projections of future waste additions. These projections should also be subject to configuration control.

- System-generated waste inventory should be linked to the physical system configuration that produces the waste.

- The configuration-controlled waste inventory should be used to support required environmental and safety reporting.

Appendix B includes guidance on configuration identification for waste characterization data samples and waste packages.

2.4 Additional Guidelines for Projects

2.4.1 Establishment of the Technical Baseline for Projects

For DOE projects, the development of the technical baseline is an iterative process through successively more detailed stages as illustrated in GPG-FM-016, *Baseline Development*, and Section 3.2 of GPG-FM-010, *Project Execution and Engineering Management Planning*. Each successive baseline extends and expands on the documentation described in the previous baseline(s). The technical baseline is established in accordance with DOE O 430.1, controlled through the baseline change control process and approved and released through the appropriate CCB.

2.4.2 Change Control for Projects

This subsection describes the recommended process for changing the approved technical baselines. The configuration control process ensures that changes to technical baselines are properly executed using the following process.

- Using standardized change proposal forms for initiation, submittal, and approval of changes.

- Reviewing changes to ensure that the change is necessary and that the proper technical approach is described.

- Performing impact evaluations by DOE organizations that are potentially affected.

- Ensuring changes are dispositioned by the appropriate CCB.

- Maintaining auditable and traceable documentation for CCB evaluations, comments and decisions.

- Providing information copies of CCB meeting minutes and approved change proposals to the next higher level Secretariat.

- Ensuring implementation of the change is done in a timely and controlled manner.
- Accomplishing any necessary training associated with a change.
- Verifying adequate closeout of the change.

Figure 2.4-1, Overview of the Technical Baseline Change Control Process, and Figure 2.4-2, Technical Baseline Change Control Process Flow Chart for Projects, present an overview of the DOE project change control process described below:

2.4.2.1 Change Initiation and Submittal

A change proposal may be initiated by any individual participating in DOE activities. A change proposal identifies affected technical baselines and technical documents. The initiator should perform an initial evaluation of the potential impact of the proposed change. This initial evaluation should identify, to the extent possible, all documents and data bases which need to be updated to reflect the proposed change. Additionally, the proposed change should be evaluated to ensure that adequate justification is provided for making the change and that the proper technical approach is described.

Proposed changes should be submitted to the appropriate CCB Secretariat (e.g., if initiated by a Field Element, the change proposal would be submitted to the Field Element CCB Secretariat). Proposed change proposals should be submitted on a BCP or equivalent form in accordance with requirements established in project execution planning documentation. Upon receipt of a change proposal, the CCB Secretariat: should review it for completeness; if complete, the Secretariat should log the change proposal, assigning it a unique number; and distribute it to all affected organizations for review and comment.

2.4.2.2 Change Review and Impact Evaluation

Affected organizations should review and evaluate the proposed change to determine if: (1) the change is necessary, (2) the technical approach is adequate and complete, and (3) the technical, scope, cost and schedule impacts are identified. The cognizant CCB Secretariat should compile and coordinate comment resolution and distribute a change package for review by the CCB members prior to CCB disposition. The change package should include, as a minimum, the change proposal, reviewers comments and comment resolutions.

The CCB evaluation addresses the options of making or not making the proposed change. Changes should be limited to those that:

- correct deficiencies, including safety deficiencies;
- offer a significant improvement in performance or functionality;
- effect substantial capital and life-cycle cost savings;
- prevent slippage in an approved schedule; or
- implement approved changes to other portions of the scope, cost, and schedule baselines or the DOE Strategic Plan.

The technical approach should be reviewed for adequacy and completeness of necessary changes. Additionally, the evaluation should review the proposed change to ensure compliance with the technical baseline and identify the documents and data bases (e.g., design criteria, training, and interface documents), for which they have responsibility, which are affected by the proposed change. This information is included as part of the change package. This evaluation should also include reviews for impact on cost and schedule baselines.

The estimated cost of each change should be identified with the appropriate WBS element(s). Supporting cost data at the next-lower level of the WBS should be supplied to relate the significant cost elements to the principal elements of the proposed change.

Projects within existing operating facilities and projects in the execution phase should perform technical reviews in accordance with applicable guidance provided in section 2.7.

2.4.2.3 Change Disposition

Proposed changes may be canceled/withdrawn, deferred, disapproved, approved with conditions, or approved by the applicable CCB. The CCB Chairperson should have full decision making authority as the CCB is an advisory, not a voting board. In their advisory capacity and for their individual areas of technical responsibility and expertise, each board member assures the chairperson that everything has been addressed that should be addressed. At the discretion of the CCB Chairperson, change proposals may be dispositioned without conducting a board meeting. Only those changes that are approved changes or approved with conditions should be implemented. Proposed changes may be canceled/withdrawn by the originator with CCB approval.

2.4.2.4 Directed Changes

For directed changes, such as DOE directives or budget adjustments, the directive is the authorization for implementing the change. However, the baseline change control process should be followed to ensure all impacts of the directed change are identified. The responsible Program Office manager should forward a copy of the directive to the responsible Field Element manager. The Field Element manager should prepare and process a BCP for the directed change in accordance with the guidelines of this section.

2.4.2.5 Change Implementation

Implementation of changes may include physical changes in addition to documentation changes. Change implementation involves the following considerations.

- If the change proposal requires physical implementation, it should be completed using the Field Element work plan process. Revisions to the approved change proposal required during physical implementation should be subject to the same requirements applied to the initial request.

- Upon completion and acceptance of the physical change (or after approval of the change proposal if no physical implementation is required) affected documents and data bases should be updated in a timely manner but, not until the physical implementation has been completed and accepted.

- Limits should be established for the maximum number of outstanding changes which can exist against a given document and the maximum time duration between approval or implementation of the change and incorporation into the affected documents. Typical limits for documents not required by operators are 5 changes or 6 months.

- Field Element procedures should establish responsibilities for physical implementation of changes, updating affected documents and data bases, and verification of completion of the change. The implementing organization(s) should verify that necessary action is completed within the time frames set forth in the change authorization document.

2.4.2.6 Training

Program Office and Field Elements should develop and implement a training program that (1) provides for understanding and proper implementation of the configuration management program guidelines and procedures and (2) ensures that appropriate facility operation and maintenance personnel are familiar with modified systems and equipment.

Figure 2.4-1
OVERVIEW OF THE TECHNICAL BASELINE CHANGE CONTROL PROCESS

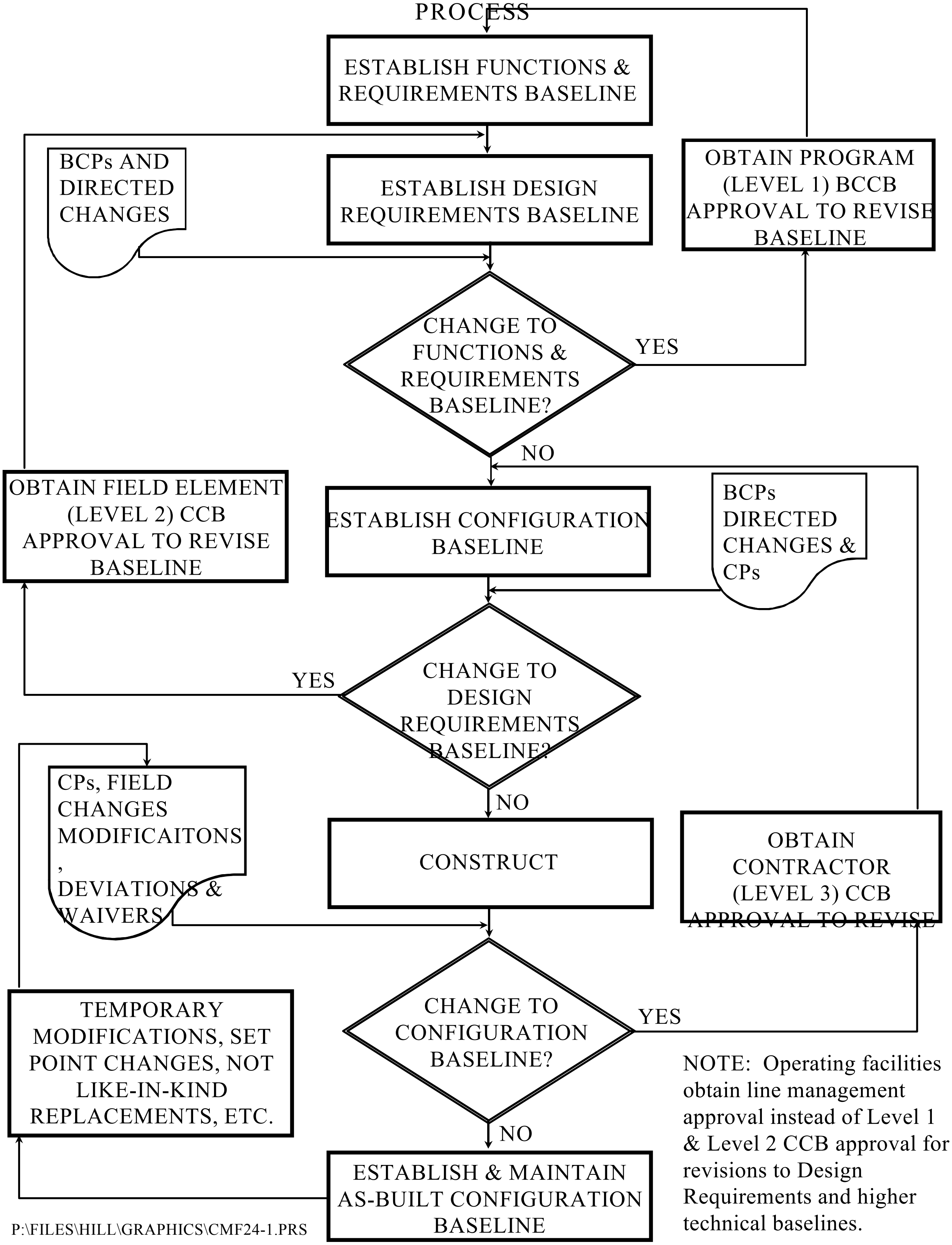

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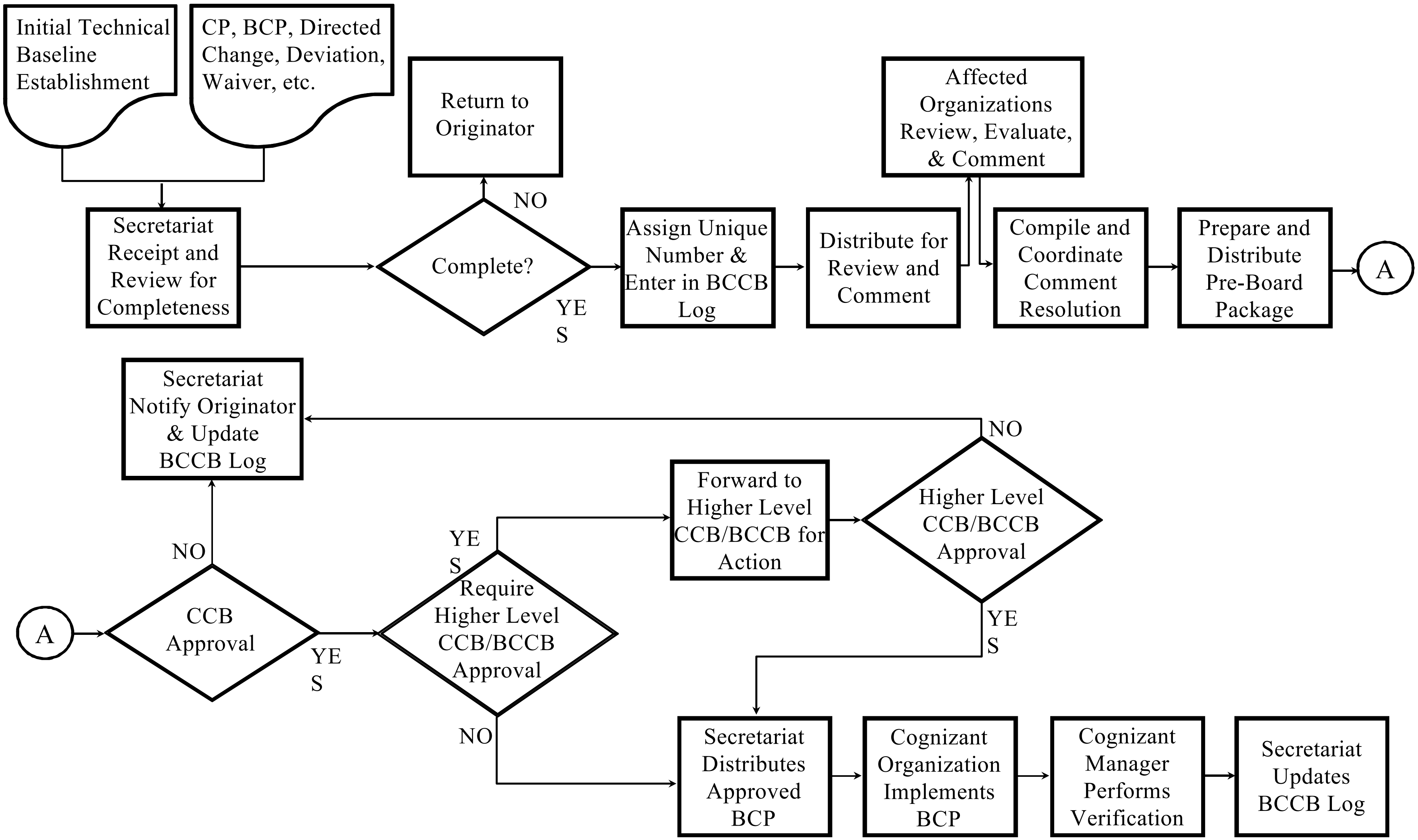
Figure 2.4-2
TECHNICAL BASELINE CHANGE CONTROL PROCESS FLOWCHART
FOR PROJECTS



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Training programs should be updated and performed using revised documents that reflect approved changes. Training programs should be updated in the following manner.

- Organizations responsible for the training should receive the revised documents early enough to evaluate and incorporate changes into training materials.

- Revised documents should be evaluated to determine what changes should be made to the training material.

- Training materials should be revised and training conducted.

2.4.2.7 Change Closeout

Change closeout should not occur until: (1) the physical change or technical document change has been completed, tested (physical changes), and accepted; (2) all affected documents and data bases have been updated to correctly reflect the change; and (3) any necessary training has been completed. Upon completion of implementation, verification, acceptance and training, change implementation should be verified to ensure each implemented change is complete and in compliance with the approved change documents. After verification is complete, the CCB Secretary should be notified for update of the BCCB log. The change proposal or BCP should be closed and submitted as a record in accordance with approved records management procedures.

2.4.2.8 Change Tracking

All changes should be tracked from the submittal of a change proposal through assessment, disposition, implementation and closeout. The tracking process should be initiated upon assignment of a change proposal identifier, and should provide the current status of any change proposal at all times. Upon completion of implementation of approved changes, the implementing organization should notify the Secretary of the CCB which authorized the change for update of the BCCB log.

2.5 Additional Guidelines for Operating Facilities

In addition to the guidance provided herein, there are a number of DOE rules, orders and standards applicable to DOE nuclear facilities that contain requirements and guidance related to elements of configuration and data management. The most significant of these, from a configuration and data management viewpoint are: DOE O 4330.4A, CONDUCT OF MAINTENANCE AT DOE FACILITIES; DOE O 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES; DOE-STD-1073-93, *Guide for Operational*

Configuration Management Program; and DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23*.

There may appear to be redundancy between this Guide and DOE-STD-1073-93, *Guide for Operational Configuration Management Program*. However, the standard predates issuance of DOE O 430.1, and many DOE projects are performed for or within existing facilities. Configuration and data management for operating facilities are addressed here to provide continuity with the life-cycle approach of DOE O 430.1 and its family of implementing Guides.

2.5.1 Establishment of the Technical Baseline for Facilities

Technical baselines for DOE facilities should be developed in accordance with DOE O 430.1 during the design and construction of each facility and maintained. However, for facilities where the technical baseline has not been consistently updated to reflect changes to the physical and functional configuration of the existing structures, systems, components, products and supporting documentation, a limited baseline reconstitution program should be implemented. DOE-STD-1073-93 provides extensive guidelines for design reconstitution programs.

When baseline reconstitution is required, facility management should ensure viable document control and change control processes are in place and develop an implementation plan which reflects the safety system classification and grading approach discussed below. The technical baseline should be re-established as follows:

- **Safety System Classification/Grading Criteria**. Systems and components should be classified by their safety, operability, and reliability significance to health, safety and the environment. For example, a fluid system carrying high heat waste is more significant than a domestic water system. Therefore, the heat waste system would have a higher priority for baseline reconstitution and subsequent design changes would be more closely reviewed. A safety classification system should be used as part of technical baselining to classify systems. Once systems are classified, a graded approach to baseline reconstitution and change control should be applied.

- **As-Built Configuration Baseline**. Facility walkdowns should be performed to determine the current, as-built, condition of facilities. The as-built conditions should serve as the starting point for technical baseline reconstitution. As walkdowns are performed, an MEL (see section 2.3.9) should be generated. Following the walkdowns:

   - component numbers should be assigned/updated,
   - components should be labeled,
   - drawings should be revised or created,
   - spare parts support should be verified/initiated,
   - operator sketches should be revised or created,
   - operating procedures should be revised,
   - maintenance procedures should be revised,
   - training requirements should be revised, and
   - instruments and setpoints should be identified and verified.

- **Design Requirements Baseline**. Once the as-built configuration is known, a system-by-system technical evaluation should establish the design requirements baseline by verifying the as-built configuration correctly represents design requirements. As part of this analysis, the systems and components should be classified using the previously developed grading criteria.

- **Functions and Requirements Baseline**. The technical evaluation to establish the design requirements baseline should also establish the functions and requirements baseline by verifying that the design requirements baseline documents correctly represent established functions and requirements, performance criteria and constraints.

- For discrepancies between the as-built configuration and design documentation identified during baseline reconstitution, new documentation should be developed or equipment modified for the most critical equipment.

- The calculations, evaluations and analysis performed as part of the technical baseline reconstitution should be documented and maintained as baseline documentation. The records management system should control these records which serve as the basis for evaluation of subsequent design change proposals.

- Where applicable, the requirements of DOE O 5480.5, SAFETY OF NUCLEAR FACILITIES; DOE O 5480.21, UNREVIEWED SAFETY QUESTIONS; DOE O 5480.22, TECHNICAL SAFETY REQUIREMENTS; DOE O 5480.23, NUCLEAR SAFETY ANALYSIS REPORTS; and DOE O 5700.6C, QUALITY ASSURANCE; as well as 10 CFR 830.120, Quality Assurance Requirements, should be incorporated into the baseline reconstitution program.

- The order and extent of baseline reconstitution should be based on considerations of nuclear safety, environmental safety, DOE mission, industrial safety, and other concerns, including financial. Baseline reconstitution to confirm the adequacy of nuclear safety-related systems and at the interfaces between existing facilities and new project construction should receive priority attention.

- When baseline reconstitution is completed, the baseline documentation should revert to normal baseline and configuration management controls.

2.5.2 Operating Facility CCBs

Each operating facility should establish a Level 3 CCB with the authority to review and approve change proposals. For facilities where a graded approach determines that a CCB is not warranted, a change control authority should be established that fulfills the functions of the CCB. Each CCB should include, as a minimum, representatives from the engineering, safety and health, environmental, and quality disciplines as well as the operations and maintenance departments and project management. The operating facility CCB should have jurisdiction on all Class 3 changes. The CCB should also be responsible for the correct functioning of the configuration management processes within the facility to ensure:

- the facility's technical baselines satisfy the design requirements;

- the physical and functional characteristics of configuration items conform to the technical baselines;

- Approved changes have been properly incorporated into the technical baselines;

- the facility's as-built configuration conforms to the approved technical baselines; and

- the entire configuration management program performs in accordance with approved plans and procedures.

Change proposals exceeding Level 3 approval criteria (see Table 2.3-1 for typical approval criteria) should be approved by the appropriate level of DOE line management. CCBs and BCCBs above Level 3 are not normally used for operating facilities. Budget change proposals (which may result from directed changes from the Program Office or from requests from contractors) should be dispositioned by the Field Element manager if the change to the scope, cost or schedule baselines does not exceed approved thresholds. All recommended changes to the technical baseline exceeding the thresholds identified for the Field Element should be submitted to the Program Office with Field Element endorsement.

When required, the Program Office director should obtain the Assistant Secretary or Deputy Assistant Secretary's disposition. The change control program for operating facilities should be administered by a secretariat organization as described in a previous section of this Guide.

2.5.3 Work Control

Work control is the process by which work at operating facilities is initiated, approved, performed, verified, and documented. Configuration change control often overlaps and interacts with work control processes. DOE 4330.4A establishes work control requirements for maintenance activities. DOE 5480.19 establishes work control requirements for operations that interface with and overlap with configuration change control and maintenance work control. Each operating facility should develop procedures which integrate these interfacing and overlapping requirements. Typically, the facility's work control process is used as the method to address all of the applicable elements.

Figure 2.5-1, Typical Work Control Process, illustrates the typical work control process. Shaded areas identify the configuration change control elements of the work control process.

2.5.4 Change Control for Operating Facilities

For operating facilities, a configuration change is any modification to the technical baselines, the facility's configuration or the operating procedures and limits. Configuration change control should ensure (1) all proposed changes are reviewed against baseline documentation and (2) all affected elements of the technical baseline are updated as needed. DOE O 5480.19 and DOE O 4330.4A include requirements for configuration management processes. Additionally, this Guide provides recommendations for (1) modification control, (2) temporary modification control, (3) setpoint control, (4) computer software control, (5) technical reviews, and (6) document control for configuration management. Table 2.5-1, Configuration Management Requirements and Guidelines for DOE Operating Facilities, identifies applicable requirements and guidance of DOE 5480.19, DOE 4330.4A, and this Guide for DOE operating facilities. Figure 2.5-2, Technical Baseline Change Control Process Flow Chart for Operating Facilities, presents an overview of the change control process described in the following subsections.

2.5.4.1 Change Initiation and Submittal

A change proposal may be initiated by any individual participating in DOE activities. A change proposal identifies affected technical baselines and technical documents. Change proposals for facility modifications, setpoint changes, and computer software changes should be initiated in accordance with the guidelines of sections 2.5.5, 2.5.7 and 2.6, respectively, and should be submitted to the operating facility's CCB Secretary for dispositioning by the operating facility's CCB. The initiator should perform an initial evaluation of the potential impact of the proposed change. This initial evaluation should identify, to the extent possible, all documents and data bases which need to be updated to reflect the proposed change. Additionally, the proposed change should be evaluated to ensure that adequate justification is provided for making the change and that the proper technical approach is described. Upon receipt of a change proposal, the CCB Secretary: should review it for completeness; if complete, the Secretary should log the change proposal, assigning it a unique number; and distribute it to all affected organizations for review and comment.

Changes dispositioned by the operating facility's CCB that require Field Element or Program Office approval should be reviewed and approved by the Field Element manager prior to forwarding the proposal to the Program BCCB Secretariat. Upon receipt of a change proposal from a Field Element manager, the CCB Secretariat should enter it in the BCC log and forward it to the responsible Program Office manager who should review it for completeness and appropriateness. If the BCP is not complete or appropriate, the Program Office manger should return it to the Field Element manager and notify the Program BCCB Secretariat.

Change proposals should be submitted on a BCP or equivalent form containing the following recommended minimum information:

- a detailed description of the proposed change, including identification of the impacts on other DOE programs and the actions necessary to implement the proposal;

- a justification for the change, including a discussion of the position taken by any regulatory agency;

- an assessment of any adverse impact on schedule, cost, regulatory, programmatic, institutional, or the public that may result from denial of the change;

- any other alternatives evaluated and the basis and rationale as to why they were not selected; and

- administrative data to facilitate identification and control of the BCP itself.

2.5.4.2 Change Review and Impact Evaluation

All change proposals should be reviewed against existing safety documentation. Technical reviews should be performed in accordance with section 2.7 to establish the adequacy of design changes and ensure that the design change does not adversely affect the safety, reliability or operability of the facility. For permanent modifications, temporary modifications, setpoint changes, and computer software changes these reviews should also consider applicable guidelines of sections 2.5.5, 2.5.6, 2.5.7 and 2.6, respectively. In addition, a review and evaluation should be performed to determine that the change is necessary and that scope, cost and schedule impacts are identified. The evaluation should address the options of making or not making the proposed change. Additionally, the evaluation should consider all appropriate aspects of the effects of the change on other DOE programs, projects, installations and waste streams; and on other DOE programs which may be affected. These considerations should include, but not be limited to: scope, cost, schedule, and compliance with regulatory guidelines.

Changes should be limited to those which:

- correct deficiencies, including safety deficiencies;
- offer a significant improvement in performance or functionality;
- effect substantial capital and life-cycle cost savings;
- prevent slippage in an approved schedule;
- implement approved changes to other portions of the scope, cost, and schedule baselines or the DOE Strategic Plan.

The estimated cost of each change should be identified with the appropriate WBS element(s). Supporting cost data at the next-lower level of the WBS should be supplied to relate the significant cost elements to the principal elements of the proposed change.

2.5.4.3 Change Disposition

Proposed changes may be canceled/withdrawn, deferred, disapproved, approved with conditions, or approved by the applicable CCB. The CCB chairperson should have full decision making authority as the CCB is an advisory, not a voting board. At the discretion of the CCB chairperson, change proposals may be dispositioned without conducting a board meeting. Only those changes that are approved changes or approved with conditions should be implemented. Proposed changes may be canceled/withdrawn by the originator with CCB approval.

Change proposals exceeding the Class 3 thresholds should be forwarded to the Field Element manager for disposition. Upon receipt from an operating facility, the Field Element manager should review and disposition the proposed change. If the change proposal is not complete or appropriate, the Field Element manager should return it to the operating facility's CCB Secretariat. If the Field Element manager concurs with the change proposal and it exceeds Level 2 approval thresholds, it should be forwarded to the Program Office for approval.

2.5.4.4 Directed Changes

For directed changes, such as DOE directives or budget adjustments, the directive is the authorization for implementing the change. However, the baseline change control process should be followed to ensure all impacts of the directed change are identified. The Program Office manager should forward a copy of the directive to the Field Element manager. The Field Element manager should determine, and document on a BCP, impacts to other baselines. For directives resulting in Class 1 and 2 changes, the Field Element manager should forward a copy of the BCP and supporting information to the Program BCCB Secretariat who should provide information copies to the Program Office manager and other managers as needed.

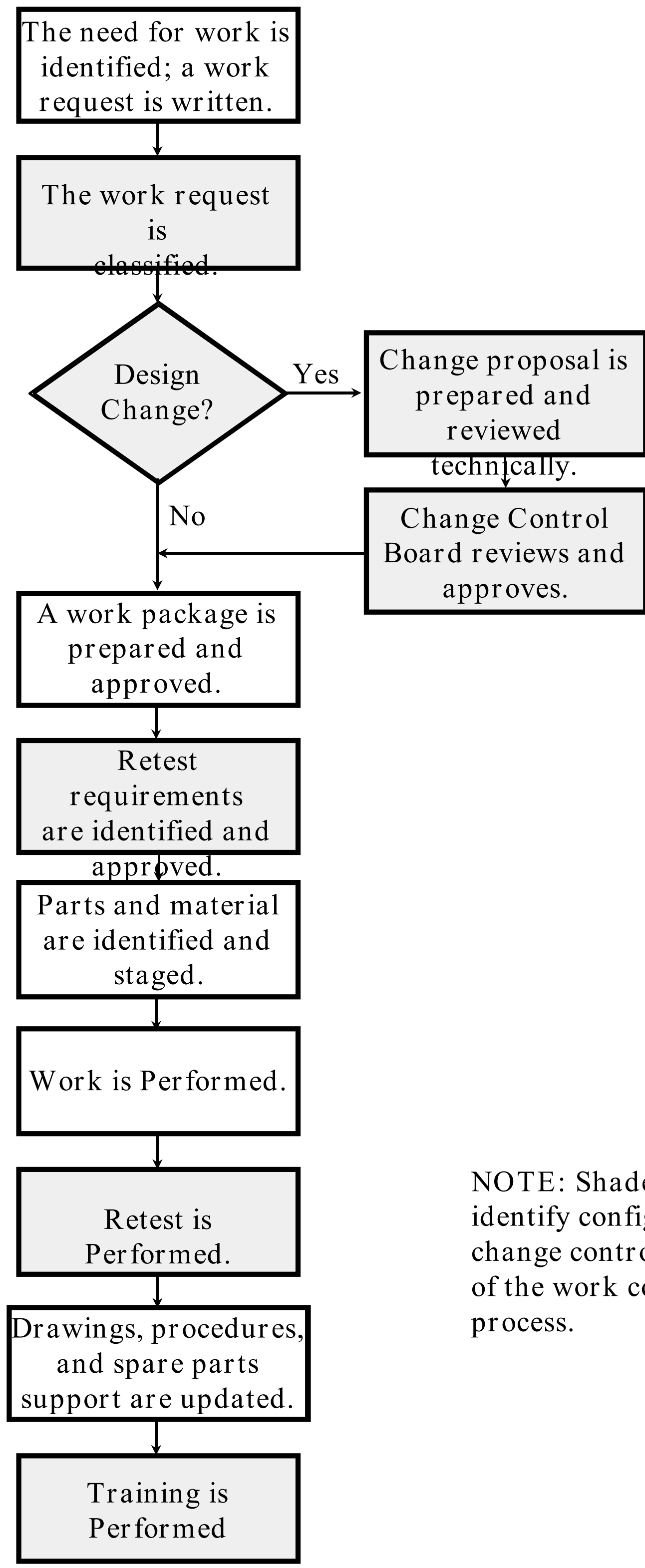
2.5.4.5 Change Implementation

When changes receive approval, the implementing organization(s) should verify that the necessary action(s) is/are completed within the time frame set forth in the BCP. This verification should include a check to verify that the change was installed per the technical baseline documents, the test requirements were satisfied, and all pertinent documents were updated. Change implementation includes change incorporation into affected documents and the update of all affected systems, documents, software, and data bases that are necessary to maintain established baselines. These include: spare parts, operating and maintenance procedures, operator and mechanic training, logkeeping requirements, preventative maintenance requirements, drawings, operator sketches, vendor information, and master equipment lists.

Implementation of changes may include physical changes in addition to documentation changes. Facility modifications, temporary modifications, setpoint changes, and computer software change control are four specific types of physical changes that are discussed in greater detail later in this section. Guidance common to implementation of physical changes includes the following.

Figure 2.5-1

TYPICAL WORK CONTROL PROCESS



NOTE: Shaded blocks identify configuration change control elements of the work control process.

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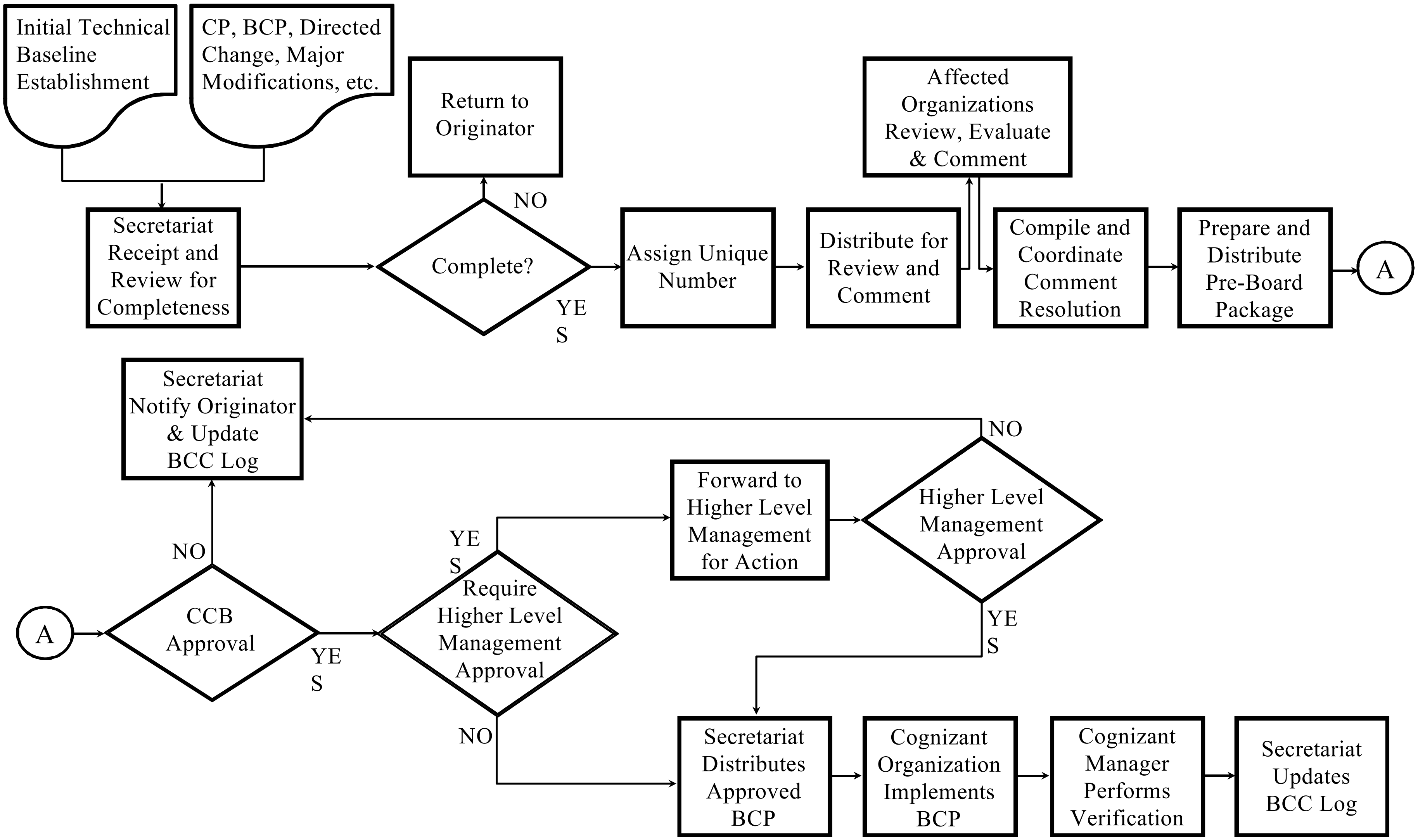
Table 2.5-1. Configuration Management Requirements and Guidelines for DOE Operating Facilities.

REQUIREMENT/GUIDELINE	APPLICABLE DOCUMENT	
Program to control proper equipment alignment and to include those components requiring special administrative control.	**DOE O 5480.19**	Chapter VIII, Control of Equipment and System Status
Work control system to include training, post-maintenance testing, temporary modification control and controls on drawings and specifications.	**DOE O 5480.19**	Chapter VIII, Control of Equipment and System Status
Equipment labeling program to ensure definition of components to be labeled, proper labeling techniques and replacements.	**DOE O 5480.19**	Chapter XVIII, Equipment and Piping Labeling
Work control program for maintenance activities.	**DOE O 4330.4A**	Chapter VII, Control of Maintenance Activities
Modification control program to ensure that modifications are conducted with the appropriate level of review, approval, design, testing and verification.	**DOE O 4330.4A** **GPG-FM-012**	Chapter XVII, Modification Work Section 2.5.5, Modification Control
Temporary modification control program to ensure that temporary modifications are managed in a manner consistent with the modification control program.	**GPG-FM-012**	Section 2.5.6, Temporary Modification Control
Setpoint control program to ensure that all safety setpoints are documented and controlled.	**GPG-FM-012**	Section 2.5.7, Setpoint Control
Computer software change control program to ensure that a baseline of the existing software is maintained and that changes are incorporated.	**GPG-FM-012**	Section 2.6, Computer Software Change Control
Technical reviews program to ensure that facility changes, procedures and test plans are adequately reviewed.	**GPG-FM-012**	Section 2.7, Technical Reviews
Document control for configuration management program to ensure adequate controls regarding facility drawings, procedures, documents, technical manuals and vendor information.	**GPG-FM-012**	Section 2.8, Document Control for Configuration Management

Figure 2.5-2
TECHNICAL BASELINE CHANGE CONTROL PROCESS FLOWCHART
FOR OPERATING FACILITIES



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- If the change proposal requires physical implementation, it should be completed using the operating facility's work plan process. Any revisions to the approved change proposal required during physical implementation should be subject to the same requirements applied to the initial request.

- Upon completion and acceptance of the physical change, or after approval of the change proposal if no physical implementation is required, affected documents and data bases should be updated in a timely manner but not until the physical implementation has been completed and accepted.

- Limits should be established for the maximum number of outstanding changes which can exist against a given document and the maximum time duration between approval or implementation of the change and incorporation into the affected documents.

- Operating Facility procedures should establish responsibilities for physical implementation of changes, updating affected documents and data bases, and verification of completion of the change. The implementing organization(s) should verify that necessary action is completed within the time frames set forth in the change authorization document.

2.5.4.6 Training

Operating facilities should develop and implement a training program as described in section 2.4.2.6.

2.5.4.7 Change Closeout

Change closeout should not occur until: (1) the physical change or technical document change has been completed, tested (physical changes), and accepted; (2) all impacted documents and data bases have been updated to correctly reflect the change; and (3) any necessary training has been completed. Upon completion of implementation, verification, acceptance and training, change implementation should be verified to ensure each implemented change is complete and in compliance with the approved change documents. After verification is complete, the CCB Secretary should be notified for update of the BCC log. The change proposal or BCP should be closed and submitted as a record in accordance with approved records management.

2.5.4.8 Change Tracking

All changes should be tracked from the submittal of a change proposal through assessment, disposition, implementation and closeout. The tracking process should be initiated upon assignment of a change proposal identifier, and should provide the current status of any change proposal at all times. Implementing organizations should inform the applicable Program Manager upon the completion of implementation of approved changes.

2.5.5 Modification Control

A modification is any change in the design of a facility structure, system, or component. Modifications may result from approved change proposal or be directed by management.

Administrative controls should be established to ensure that modifications to facility SSCs are properly designed, reviewed, approved, installed, tested, and documented.

Modifications should be accomplished in accordance with the requirements and limitations of applicable procedures, codes, standards, specifications, DOE Orders and predetermined safety restrictions.

A modification control program should be applied to all modifications, with the exception of those modifications defined within the scope of other programs, such as:

- Setpoint Control (section 2.5.7 of this Guide)

- Computer Software Change Control (section 2.6 of this Guide)

2.5.5.1 Requests for Facility Modifications

- Any employee should be able to request a modification to the facility design by submitting a change proposal (or similar mechanism), as described in section 2.5.4.1, through his immediate supervisor.

- Requests should be evaluated based on their impact on facility safety and reliability, operation and performance, personnel safety and regulatory necessity.

- Preliminary cost and benefit analyses should be performed and documented prior to approval to proceed with the conceptual design.

- Request originators should be informed of the disposition of their requests.

- The status of requests should be tracked through the modification process to ensure that associated activities are completed in a timely manner.

2.5.5.2 Design of Facility Modifications

- The organization having overall responsibility for the design of facility modifications should be clearly specified for each facility.

- Conceptual design should be developed, reviewed, and approved by design engineering and facility management prior to development of the detailed design.

- Conceptual designs should be developed with facility input and include a functional description of the modification, validation that the proposed modification should solve the root cause of a problem, a technical evaluation that addresses design inputs, a preliminary safety evaluation, as required, and an estimate of the costs of the modification.

- The detailed design should update and provide additional detail for those items addressed in the conceptual design.

- The detailed design should include all design outputs required for procurement and installation.

- Design outputs should be supported by documented calculations, assumptions, and analyses.

- Design outputs and all supporting information should be subjected to a documented independent interdisciplinary review.

- The detailed design package should specify construction, installation testing, and functional testing requirements.

- Designers should walk down the facility location for the modification to identify and eliminate interferences and operating and maintenance problems.

- Operability, maintainability, constructability, testability, and ALARA, requirements should be considered throughout the design process.

- The design change should be reviewed by appropriate disciplines throughout the design process and comments compiled and resolved by the technical support or liaison departments.

- A safety evaluation should be performed in accordance with the facility's requirements for technical reviews and section 2.7 of this Guide.

2.5.5.3 Installation

- The installation of modifications should be controlled by approved procedures, instructions, and acceptance tests.

- The onsite activities associated with installation should be performed in accordance with the applicable portions of facility administrative procedures.

- The installation should conform to the controlling procedures and the detailed design.

- Deviations from the procedures or detailed design should require management review and approval.

- Completed installations and system acceptance test results should be verified against the approved design prior to facility acceptance of the modified system/component.

2.5.5.4 Documentation

- Design documents (e.g., drawings, specifications) revised or developed from the modification process should be controlled by the design engineering department.

- SARs should be revised through an approved SAR revision procedure to reflect any modifications that are within the consequence and Operational Safety Requirement (OSR) or Technical Safety Requirements (TSR) bounds.

- Changes that increase the consequence of a potential accident beyond the bounds stated in the SAR or exceed OSR or TSR limits should be approved by the M&O Contractor and the responsible DOE Field Element prior to implementing the modification.

- Changes to these documents should be submitted to design engineering for approval prior to formal revision.

- Those design documents determined to be critical to the operation or maintenance of the facility should reflect the as-built configuration of the facility as modified, prior to returning an affected system or subsystem to service.

- Formal revision of the following documents should be completed in a timely manner:

  - design,
  - spare parts lists,
  - in-service inspection program procedures,
  - equipment history,
  - training lesson plans,
  - preventive maintenance procedures,
  - equipment qualification records.

- Controlled facility documents, such as procedures affected by modifications, should be revised prior to returning the system to service.

2.5.5.5 Training

- Training should be conducted to ensure that appropriate operations and maintenance personnel are familiar with modified systems and are sufficiently knowledgeable to operate and maintain that equipment in a safe and reliable manner.

- Appropriate training should be completed prior to the operation or maintenance of the modified system and could include required reading, preshift briefings, or formal training depending upon the complexity of the modification and its impact on operations and maintenance.

- Training programs (including simulators) should be revised to reflect modifications in a timely manner.

2.5.5.6 Quality Verification

- Quality verification hold and inspection/witness points should be established for the receipt of equipment and material, installation of modifications, and testing of modifications to ensure the quality of the affected system to meet the design as specified is appropriate.

- Quality verification controls should be reviewed for adequacy by the quality assurance department.

- Managers of those personnel performing the work should ensure adherence to quality verification hold and inspection checkpoints.

2.5.5.7 Materials Procurement

- The responsibility for the procurement of all required materials should be clearly defined.

- The responsibility for the prestaging, control, and issue of modification materials should be clearly defined.

- Procedures for the identification of needed spare parts to support the modified equipment, including shelf life considerations, should be available.

2.5.5.8 Schedule

- Activities (e.g., design, procurement, physical installation, etc.) related to each modification request should be scheduled and tracked to ensure their timely completion.

- Facility management should be kept apprised of the status of modification task activities to ensure that appropriate action is taken to modify schedules as necessary.

- A modification milestone tracking system should be used to expedite modification status determinations.

2.5.6 Temporary Modification Control

Temporary modifications are usually minor alterations to facility components, equipment, or systems with respect to approved drawings or other design documents. Examples of temporary modifications include lifted electrical leads, electrical jumpers, temporary electrical loads, pulled circuit boards, disabled annunciators, temporary setpoint changes, mechanical jumpers, blind or blank flanges, disabled automatic control valves, gagged relief valves, freeze seals, and plugged floor drains. Another type of temporary modification is the addition of temporary external loads such as lead shielding and scaffolding attached to facility systems.

Excellent temporary modification control programs are characterized by a small number of controlled temporary modifications and a high degree of worker (operator, maintenance, engineering) awareness.

Permanent facility modifications generally receive a more rigorous review than temporary modifications. These reviews normally include the use of all available resources and research to ensure the modification should be a long-term solution to the problem. Additionally, formal controls ensure adequate training and incorporation of the modification into the document control system. For this reason, temporary modifications should not be used to circumvent the permanent modification process.

Administrative control systems should be established for installation of temporary modifications on in-service equipment, and should ensure that temporary modifications to in-service facility components, equipment, and systems are properly evaluated, authorized, and controlled using methods similar to those for permanent modifications. This applies to both non-safety-related and safety-related temporary modifications. These control systems should make provisions for design verification and safety reviews, installation approval, independent verification of correct installation and removal, functional testing of proper installation and removal, documentation of the temporary modification, updating of operating procedures and documents, marking of installed temporary modifications, and periodic audits of outstanding temporary modifications. Additionally, the number and duration of temporary modifications should be minimized to ensure the control systems are manageable. Temporary modifications subsequently determined to be needed on a permanent basis should be processed as permanent modifications in a timely manner. Other temporary modifications should be restored on a predetermined schedule.

2.5.6.1 Technical Review

- Temporary modifications to components, equipment, or systems in service should receive design verification and safety reviews. A safety evaluation should be performed in accordance with the facility's requirements for technical reviews and section 2.7 of this Guide.

- The design verification should address design considerations and evaluate the effects of the change on the facility design basis.

- The safety review should ensure the proposed change should not adversely affect administrative or operational aspects of facility safety. The safety review should also include an evaluation of potential failure modes and their effects.

- These reviews should be conducted by personnel qualified to perform the reviews who know and understand the affected system's design and its basis.

- These reviews should be completed before the modified equipment or system is placed in service. For emergency situations, administrative controls should establish what reviews are required to implement the temporary modification and what reviews are required post-installation.

- Appropriate testing, operator awareness through briefings or training, and document update (e.g., operating procedures and critical drawing updates or annotation to accurately reflect the scope of the modification) should also be completed before placing the modified system into service or before operators are required to operate the affected equipment.

- Operator training should emphasize the impact of the temporary modification on system/component operation.

- Temporary modifications installed and removed in accordance with an approved procedure, such as a test procedure, are normally considered to be outside the scope of the temporary modification program. In these cases, the need for a review is met by the technical review of the procedure used to install and remove the temporary modification.

- Temporary changes to systems out-of-service, such as changes made to allow maintenance activities, should be controlled to ensure restoration to the approved design configuration prior to return to service.

2.5.6.2 Authorization

- The shift supervisor or facility manager should give final authorization for installation and removal of all temporary modifications. This authorization should be documented.

- Most activities that affect facility components are coordinated through the shift supervisor so an evaluation for operational impact is conducted. His authorization for its installation serves as a final check for potential adverse consequences. In some cases the facility manager may reserve the right to grant final authorization.

2.5.6.3 Installation

- Installation should be performed per instructions based on the design verification and safety review.

- The correct installation and removal of a temporary modification should be independently verified. However, independent verification may be waived if significant radiation exposure would be incurred and remote verification is determined to be not feasible.

- Temporary modifications should receive post-installation (and removal) testing. Such testing should be based on the results of the design verification and safety review.

2.5.6.4 Documentation

- Following installation, copies of temporary modification documentation (including the technical review) should be forwarded to the design control authority.

- Temporary modifications installed on facility systems should be documented in an appropriate log. Reference materials (logs, drawings, technical reviews, and other pertinent documents) that serve as records of outstanding temporary modifications should be readily available to operating personnel. Operating personnel should periodically review these materials.

- Shift training and turnover practices should ensure that all cognizant personnel are aware of temporary modifications and any changes in operating practices that may result from their installation.

- Critical drawings, operating procedures, valve lineups, etc., should be annotated to reflect the impact of the temporary modification prior to placing the change in service.

- While installed, a temporary modification should be clearly marked in the field so it can be distinguished from the permanent facility design. Additionally, equipment and related controls affected by temporary modifications should be marked.

Unique modification tags, caution tags, and color coding of jumpers are examples of methods used at various facilities to mark temporary modifications.

2.5.6.5 Reviews of Installed Temporary Modifications

- Audits of temporary modifications should be performed monthly to ensure that the placement of the temporary modification is physically correct and its marking device is in place. ALARA considerations, in some cases, may preclude a monthly audit of all installed modifications. Documentation of the temporary modification should be verified to be administratively correct.

- Reviews of temporary modifications should be effective in keeping the number and duration of temporary modifications to a minimum. Those that are no longer required should be removed. Temporary modifications subsequently determined to be required for continuing facility operations should be incorporated into the permanent facility design in a timely manner. Three to six months should normally be sufficient time to conduct an engineering review and process a permanent modification, eliminating the need for a temporary modification. Outage requirements may prevent actual installation for a somewhat longer time period.

- Operations, maintenance, and engineering personnel should be alert during facility tours for configuration changes to in-service equipment that are not controlled by a proper configuration control method.

2.5.7 Setpoint Control

A setpoint control program should ensure that safety system setpoints are documented and controlled in order to preclude any process parameter deviation from safe operation without detection. Control setpoints should be an integral part of the safety system design basis. Thus, changes to setpoints should be controlled to ensure proper evaluation and authorization prior to implementation.

Process controls are required to limit the maximum allowable variance of a process. Setpoints are designed to help prevent processes from exceeding prescribed values. These setpoints protect or control the process either by alerting the operator of an abnormal condition (e.g., alarms) or limiting or terminating, by some automatic action, the process prior to exceeding design limits. In either case, the point at which this action takes place, the process setpoint, is a critical feature of the total design of an engineered system and should be formally controlled to ensure operation within design limits.

The program for control of safety system setpoints should ensure that changes are properly reviewed, approved, implemented, and documented. The design controls for changes to safety system setpoints should be similar to those applied to hardware changes covered by the safety system modification program although some aspects such as cost/benefit analysis, procurement controls, etc., may not be applicable. The scope of the safety system setpoint control program should include safety system interlocks and appropriate alarms which assure compliance with OSRs or TSRs and Technical Standards.

2.5.7.1 Facility Setpoint Document Control

- Facility safety systems should be identified and documented.

- A safety system setpoint document should be maintained that contains all setpoints governed by the setpoint control program.

- The safety system setpoint document should be a controlled document.

- Each setpoint within the safety system setpoint document should be traceable to a governing calculation, test, and/or basis document.

2.5.7.2 Program Procedures

- The safety system setpoint control program should be documented to provide a description of the program, to identify responsibilities and requirements, and to identify the items that are covered in the program.

- The process for administering requested changes to safety system setpoints should be described in a procedure. This process should address the following items:

  - initial setpoint basis,
  - technical standard/OSR or TSR requirements,
  - impact on system/equipment interfaces,
  - operability requirements,
  - installation and test requirements,
  - document updates.

2.5.7.3 Technical Review of Proposed Changes

- All changes to safety system setpoints should receive a documented technical review prior to implementation as described in section 2.7, Technical Reviews.

- The level of review should be dependent upon the important of the setpoint change to safety system safety and reliability.

- Final approval to implement changes to setpoints should be given by the facility operations and technical support managers or their designates.

2.5.7.4 Implementation

- Setpoint changes should be implemented in accordance with the work control system.

- Prior to returning a system to service, required system testing, operator training, and document updates (e.g., procedure changes) should be completed, and drawing revisions should be initiated.

2.5.7.5 Closeout

- Closeout of the setpoint change package should include final document updates such as procedures, drawings, safety system setpoint document, system descriptions, FSAR, etc.

- The closeout package should be reviewed for completeness and filed with facility records.

2.6 Computer Software Change Control

Controls should be established for new computer software and modifications to existing software to ensure that the software performs its designed function.

Controls should be applied to the development and revision of software used to perform functions necessary for facility safety and reliability. Software for facility process computers, administrative computers, microprocessors, and programmable calculators should be considered for application of these controls.

2.6.1 Software Change Control

- All applicable software and software changes should be documented, described, and maintained on file.

- Inputs and outputs expected from each individual software program should be maintained and periodically verified.

- All applicable software and changes should have an independent review of software functions.

- All applicable software and changes should receive a safety evaluation using the facility procedures that govern these functions (see section 2.7, Technical Reviews).

- Computer program security measures to preclude unauthorized change should be instituted where appropriate.

- The software control program should identify all applicable computer software included in the program.

2.6.2 Software Change Packages

- Implementation of new software and changes to existing software should include instructions for installation, functional testing, and acceptability verification and validation.

- New software and changes should be logged, tracked, and controlled similar to other facility modifications.

- All affected facility documents should be revised to reflect new software, and the appropriate facility personnel should be trained on the use of new software prior to its use.

2.6.3 Periodic Verification

- Computer software necessary for safe facility operation should have periodic verification checks for accuracy to ensure continued computer program integrity.

2.6.4 Records

- Completion of the software control changes, change packages, and verification should be documented and records maintained in accordance with facility procedures.

- Software should be duplicated and stored to ensure preservation of the unaltered software in case problems arise during the modification process and also to provide traceability for work performed with earlier versions of the software.

Appendix D provides additional guidelines for control of computer software.

2.7 Technical Reviews

The technical review of a proposed change to facility design, facility test, or facility procedures should evaluate the overall effect of the change on the existing facility (e.g., design and operation). The technical review program should include the formal process of reviewing, confirming, or substantiating the adequacy of a change. Where applicable, the requirements of DOE O 5480.5, SAFETY OF NUCLEAR FACILITIES; DOE O 5480.21, UNREVIEWED SAFETY QUESTIONS; DOE O 5480.22, TECHNICAL SAFETY REQUIREMENTS; DOE O 5480.23, NUCLEAR SAFETY ANALYSIS REPORTS; and DOE O 5700.6C, QUALITY ASSURANCE; as well as 10 CFR 830.120, Quality Assurance Requirements, should be incorporated into the baseline reconstitution program. These requirements should be applied to review of new projects, tests, and procedures as appropriate.

The probability of an undesirable event may increase when changes are conceived and implemented without adequate technical reviews. Technical reviews verify the compatibility of a change with facility design and ensure that the proposed change should not adversely affect facility safety, reliability, or operation.

2.7.1 Applications Requiring Technical Reviews

- Whenever a change is proposed to a facility design, test, or procedure, a technical review should be performed.

- The level, scope, and depth of the technical review should vary depending on the nature of the change.

- A checklist or other appropriate method should be used to ensure consistency in technical reviews.

- The technical review employed should ensure that the reviewer has considered all applicable criteria.

- In every case, a safety evaluation applicability review and, where appropriate, a safety evaluation should be performed, documented, and included as part of the review process.

2.7.2 Administrative Controls

- Administrative controls should specify responsibilities, requirements, and guidance for preparation and performance of technical reviews.

- Responsibility for the implementation of the technical review program should be assigned to a specific department or group. (Typically, this would be the technical support departments).

- Personnel qualified to perform technical reviews should be designated in writing.

- The performance and documentation requirements of technical review activities should be proceduralized.

- Procedures should address the level, scope, and depth of review.

- Personnel who perform or approve technical reviews should be qualified by training and demonstrated competence.

- Technical review personnel do not need to be competent in all design analyses, but should be able to recognize when a design change may affect an analysis or an assumption in the original design.

2.7.3 Technical Review Procedures

- After determining the affected facility systems and areas, the reviewer should perform a detailed review of the items directly relating to the change.

- Consideration should be given to the following:

    - effects on service systems,
    - closed loop cooling systems,
    - electrical distribution systems,
    - fire protection system,
    - combustibles and other hazardous materials,
    - seismic analyses,

  - security systems,
  - HVAC effects (added heat load),
  - industrial safety,
  - structural analyses,
  - constructability,
  - operability,
  - maintainability,
  - material compatibility,
  - environmental concerns,
  - ALARA,
  - industry operating experience, and
  - process safety.

- All assumptions made by a reviewer should be documented.

- Reviewers should request design review support where appropriate to ensure the appropriate design calculations and assumptions are accurate.

- A SAR conformance determination should be documented as part of the technical review.

- Procedural guidance should be developed to assist with the SAR applicability determination and to ensure consistency.

- The documentation should detail the review thought process and not be restricted to a yes/no checklist.

- No changes should be implemented until it is determined that the proposed change should not result in the consequence of a potential accident exceeding the consequence bounds of the SAR, nor result in operation outside of the requirements of the OSRs or TSRs.

2.8 Document Control for Configuration Management

Programs, projects and operating facilities should establish a document control program that ensures technically correct and readily accessible information is provided to program and project participants and to support facility operations. This section covers the important aspects of a document control program.

Technically accurate and approved information written in a clear and concise format is needed to support safe and reliable program and project activities and facility operations. A document control system should be established to ensure that only accurate and approved technical information is available for the performance of program and project activities and facility operations, information controlled should include baseline documentation, specifications, procedures, operating records and documentation, drawings, vendor technical manuals, and certain correspondence.

A formal process should be in place for the preparation, review, and approval of procedures and procedure revisions. Additionally, procedures should be periodically reviewed to ensure continued accuracy and usability.

Drawings should be controlled to ensure they reflect the current configuration of structures, systems, and equipment. Similarly, vendor manuals (or equivalent) used for facility operation should be controlled to ensure they are applicable to installed equipment and contain complete and up-to-date technical information.

2.8.1 Document Control Administration

- A document control system should be established to provide for the timely receipt, processing, distribution, retention, storage, and retrieval of documents originating both within and outside the program, project or facility. The responsibility for document control may be shared by more than one department. For example, one department or section may be responsible for the control, updating, and distribution of drawings. Another department or section may be responsible for maintaining procedures and retention and storage of documents. In either case, controls should be established outlining the responsibilities and authorities of individuals or groups associated with document control.

- The document control system should include services such as records receiving and turnover, files management, and distribution control.

- A master control file of documents should be maintained, with access limited to designated personnel.

- Satellite files of controlled documents such as procedures, drawings, and technical manuals should be established as necessary to support program and project activities and facility operations. Responsibility for maintaining satellite files should be clearly established.

2.8.2 Procedures

- Controls should be established for the preparation, review, approval, distribution, and revision of procedures.

- A systematic program should be used to ensure the review and updating of procedures at regular intervals, not to exceed a specified period (normally 2 years).

- Requirements for procedure review should address the scope and depth of the review in areas such as technical and administrative content and human factors.

- A uniform procedure format should be used for all procedures. An administrative procedure should be developed that provides guidance in the prescribed methods of format, content, and numbering.

2.8.3 Drawing Control

- Only controlled drawings reflecting the current configuration of structures, systems and components should be used to perform program and project activities and facility work. Drawings should be stamped or otherwise marked to clearly indicate that the drawing is controlled. Drawing indexes should be readily available and maintained current to allow quick verification of drawings for use.

- Satellite files of controlled drawings should be established as necessary to support program and project activities and facility operations. If satellite files are used, they should be periodically checked to ensure drawings are maintained up-to-date.

- Controls should be established for distribution and updating of drawing files. Responsibility for maintaining satellite files should be clearly established. If document control personnel are not responsible for maintenance of satellite files, some means of positive verification should be used, such as return of outdated drawings. Drawings that are posted at various locations in the facility should also be controlled.

- Drawings that are not part of the controlled drawing system should be considered uncontrolled and clearly marked as such. Uncontrolled drawings should not be used for the performance or planning of program and project activities and facility work.

2.8.4 Vendor Information

- The receipt, processing, and distribution of vendor technical information relating to the systems or components installed at the facility should be controlled. The proper performance of maintenance and operations activities is strongly dependent upon the availability and use of accurate vendor technical information.

- The application of controls on vendor manuals depends on the intended use of the manual. If detailed procedures have been developed for use in the conduct of operations and maintenance, then vendor manuals should be used only as reference source material. If vendor manuals are intended as replacements, substitutes, or supplements for procedures, then their use should be controlled in the same manner as procedures. In both cases, vendor manuals should be reviewed for accuracy and applicability prior to initial use.

- Vendor manuals should be treated as facility documents with facility management retaining responsibility for maintaining the manuals current. Local changes should be approved and used as necessary to reflect equipment modifications and other relevant technical information.

- Indexes listing all vendor manuals should be developed. Controlled manuals should be readily identifiable with a means provided to allow verification that each manual is complete and current. Manuals not included in the document control system should not be used to perform facility work. Controlled manuals should be readily accessible to craftsmen and engineers to support their daily work needs.

- Control mechanisms should be developed to ensure that changes required in vendor technical manuals (whether generated by external means, such as vendor technical bulletins, or changes resulting from facility modifications) are incorporated. Changes to all manuals should receive the same review and approval as the manual itself.

Appendix E provides additional guidelines for document control for configuration management.

3. MEASURING FOR RESULTS

The effectiveness of configuration and data management planning and implementation should be assessed using established performance measures. The information derived from the performance measures should be used to: identify problems and inefficiencies in the configuration and data management products and processes, to assess the extent of the problems and inefficiencies, and to provide insight in making necessary corrections and improvements. The purpose of some configuration and data management performance measures is to assess project performance. The configuration and data management processes and procedures should be reviewed and revised periodically, using performance measure data. Typical configuration and data management performance measures should include:

- Number of configuration documentation releases (scheduled/actual);
- Number of baseline changes (by product, by classification, by phase, by time period);
- Average baseline change cycle time (by product, by classification, by major process step including higher level CCB review where applicable);
- Average revisions per baseline change (in-house, after submittal to client);
- Number of changes (by reason for change);
- Number of deviations and waivers (by product, by type, by phase, by time period);
- Number of action items per configuration review/audit (categorized by significance); and
- Average number of unincorporated changes (attachments) per engineering drawing.

GPG-FM-010, *Project Execution and Engineering Management Planning*, provides a more extensive discussion on performance measures. GPG-FM-006, *Performance Analysis and Reporting*, also discusses performance measures.

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4. SUGGESTED READING

4.1 DOE Rules, Orders, and Standards

- 10 CFR 830.120, *Quality Assurance*: this subpart prescribes requirements for documents and records, (c)(1)(iv), and design, (c)(2)(ii) applicable to contractors responsible for a DOE nuclear facility.
- 10 CFR 830.110, *Safety Analysis Reports,* March 1996.
- 10 CFR 830.112, *Unreviewed Safety Questions*, March 1996.
- 10 CFR 830.310, *Conduct of Operations at DOE Nuclear Facilities*, March 1996.
- 10 CFR 830.320, *Technical Safety Requirements*, March 1996.
- 10 CFR 830.340, *Maintenance Management*, March 1996.
- DOE O 430.1, LIFE-CYCLE ASSET MANAGEMENT.
- DOE O 4330.4A, CONDUCT OF MAINTENANCE AT DOE FACILITIES.
- DOE O 5480.5, SAFETY OF NUCLEAR FACILITIES
- DOE O 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES.
- DOE O 5480.21, UNREVIEWED SAFETY QUESTIONS.
- DOE O 5480.22, TECHNICAL SAFETY REQUIREMENTS.
- DOE O 5480.23, NUCLEAR SAFETY ANALYSIS REPORTS.
- DOE O 5700.6C, QUALITY ASSURANCE. This Order establishes requirements for documents and records (Criterion 4) and design (Criterion 6). It requires a graded approach in applying management disciplines.
- DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*.

- DOE-STD-1073-93, *Guide for Operational Configuration Management Program*,

4.2 DOE Project Management Guides

- GPG-FM-001, *Project Management Overview*
- GPG-FM-002, *Critical Decision Criteria*
- GPG-FM-005, *Test and Evaluation*
- GPG-FM-006, *Performance Analysis and Reporting*
- GPG-FM-009, *Baseline Change Control*
- GPG-FM-010, *Project Execution and Engineering Management Planning*
- GPG-FM-013, *Interface Management*
- GPG-FM-015, *Project Reviews*
- GPG-FM-016, *Baseline Development*
- GPG-FM-017, *Quality Assurance/Quality Control*
- GPG-FM-023, *Safety Analysis*
- GPG-FM-029, *Systems Analysis and Assessment*

4.3 Other References

- ANS/IEEE Standard 828-1990, *Software Configuration Management Plans*
- ANS/IEEE Standard 1042-1987, *Guide to Software Configuration Management*
- American Society of Mechanical Engineers Y14.24M, *Engineering Drawing Types*.
- American Society of Mechanical Engineers Y14.34M, *Associated Lists*.

- American Society of Mechanical Engineers Y14.25M, *Revisions to Engineering Drawings*.
- Department of Defense Directive 5010.19, *DoD Configuration Management Program*.
- Electronic Industries Association, EIA Interim Standard EIA/IS-649, *National Consensus Standard for Configuration Management*.
- Electronic Industries Association, EIA Standard IS/632, *Systems Engineering*.
- Electronic Industries Association, EIA Standard IS/640, *Software Development*.
- Institute of Electrical and Electronics Engineering, IEEE P1220, *Standard for Application and Management of the Systems Engineering Process*.
- Institute of Nuclear Power Operations (INPO) 85-031, *Requirements for the Conduct of Technical Support at Nuclear Power Stations.*
- ISO 10007, *Quality Management - Guidelines for Configuration Management*
- ISO/IEC 12220, *Information Technology-Software*
- ISO/IEC 12220-2, *Configuration Management for Software*
- MIL-STD-973, *Configuration Management*.
- MIL-HDBK-61, *Configuration Management Handbook*
- Nuclear Information Records Management Association, PP-02-1989, *Position Paper on Configuration Management.*

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5. DEFINITIONS

For a complete listing of definitions for major terms used in this Guide, see the Department's Consolidated Glossary. Definitions specific to this Guide are provided below.

Baseline. A quantitative expression of projected costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured; a configuration reference point established by approval of documentation against which all changes should be specifically related.

Change Control. Formal control of the review, concurrence, approval, issuance, and distribution of baselines and other controlled documents and revisions thereto.

Configuration. The functional and/or physical characteristics of hardware and/or software, as set forth in technical documentation and achieved in a product.

Configuration Control. The process of managing proposed changes to configuration items and technical documentation to ensure that proposed changes to the formally established technical baselines are accurately described, systematically reviewed, evaluated for impact, properly implemented upon approval, and completely closed out.

Configuration Identification. The process and methods of identifying facilities, sites, structures, systems, components, computer software, and the supporting documentation which describes the functional and physical characteristics of configuration items. The supporting documentation includes the numbers and other identifiers affixed to configuration items and documents, and the approved documents that identify and define the configuration item's functional and physical characteristics (specifications, drawings, associated lists, interface control documents, and documents referenced therein.)

Configuration Item. An aggregation of sites, facilities, structures, systems, components, computer software, data, processes, activities, or any of its discrete portions, which satisfy an end use function and are designated for configuration management and traceability.

Configuration Management. An integrated management process that identifies and documents the physical and functional characteristics of facilities, structures, systems, components, and computer software and ensures changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, and incorporated into the appropriate documentation.

Configuration Status Accounting. See Data Management.

Data Management. The process of recording and reporting the current status of configuration items, technical documentation, and all proposed and approved changes throughout the configuration management program life cycle.

Document Control. The actions necessary to provide adequate confidence that documents, including changes, are reviewed for adequacy, approved for release by authorized personnel and are distributed and used at the location where the prescribed activity is being performed.

Interface. The physical or functional juncture between two or more configuration items.

Interface Control. The coordinated activity to assure that the functional and physical characteristic between two or more configuration items, which are provided by different contractor/government agencies, are compatible.

Traceability. The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

Verification. The process of ensuring that the technical baselines satisfy the design requirements, that the physical and functional characteristics of configuration items conform to the technical baselines, that approved changes have been properly incorporated into the technical baselines, and that the entire configuration management process functions in accordance with approved plans and procedures.

6. ASSISTANCE

Questions concerning this Guide may be referred to the Office of Field Management in Washington, D.C. at (202) 586-4041.

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7. RELATED TRAINING

Overview training in configuration management and data management as it interfaces with project management is included in the DOE Professional Skills Training program modules PMMS1, Project Planning; and PMMS3, Project Execution. To find out more on these courses, contact the Training and Education Division, EM-122, at (202) 586-8793.

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8. EXAMPLES

Appendix A is a reference matrix for configuration and data management elements.

Appendix B discusses the identification of items that are critical to mission accomplishment.

Appendix C discusses data management techniques to support configuration management.

Appendix D discusses configuration management of computer software.

Appendix E explains document control for configuration management.

Appendix F is a copy of the, *Draft Plan for Implementation of Yucca Mountain Site Characterization Project Configuration Identification*, dated October 1991. This plan provides very good examples and additional guidance for configuration identification and data management.

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APPENDIX A
REFERENCE MATRIX FOR CONFIGURATION AND DATA MANAGEMENT ELEMENTS

1. CONFIGURATION MANAGEMENT PLANNING

Each participant in a DOE program, project or the activities of an operating facility should plan for configuration and data management.

For Strategic Systems; other projects with high visibility, high risk, high complexity, and/or high cost; and all operating facilities the configuration and data management planning should be formalized in a Configuration and Data Management Plan that describes how the participant will manage and conduct configuration and data management. For less complex projects, configuration and data management planning could be included in project execution planning documents.

For medium and low risk projects, configuration management and data management planning should be included in project planning documentation such as a project execution plan, clean-up planning documents for environmental restoration, or a program agreement for research and development.

When multiple participants are involved, the DOE Elements responsible for the program, project or operating facility should ensure integration of the configuration and data management processes included in the participants' planning documents.

2. DETERMINING NEEDED CONFIGURATION AND DATA MANAGEMENT ELEMENTS

Determining what configuration and data management elements should be included in a program, project or operating facility is specific to the risk, complexity, visibility and cost. It is also dependent on the specific activities being performed.

For projects, a recommended first step is to evaluate the risk and determine a graded approach using the guidance provided in the Graded Approach section of GPG-FM-010, *Project Execution and Engineering Management Planning*. For operating facilities, DOE-STD-1073-93, *Guide for Operational Configuration Management Program*, should also be referenced.

A recommended second step is to use the outline for a configuration and data management plan included in this appendix. The outline is provided in both a standard outline format and as an annotated outline in a matrix format. The matrix format identifies key configuration and data management products and references specific to each section of the outline. Appropriate configuration and data management elements can be determined by selecting the products applicable to program, project or operating facility specific activities and applying controls consistent with the previously determined risk and graded approach.

3. CONFIGURATION MANAGEMENT PLAN OUTLINE

Formal stand-alone Configuration Management Plans should conform to the following outline. The page references are to pages of the annotated version of the outline included in this attachment. Note that there are two section 5s: one for Projects and one for Operating Facilities. Use the one that is appropriate.

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 2 - Organization This section should outline the participant's organization and the organizational relationships of the individuals and activities involved in the configuration management. 2.1 Responsibilities - individuals in the participant's organizational structure, in related participant's organizations, and in Government activities should be depicted. The responsibilities of each should be defined. 2.2 Structure - personnel and organizational relationships should be outlined in chart form. 2.3 Policy Directives - policy directives that govern the program should be listed. Procedures should not be included in this section.	- Responsibility Assignment Matrix - Interface Control Documents - Configuration and Data Management Policy	2.2 Roles 2.3.8 Interface Control GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-013, *Interface Management*
Section 3 - Technical Baseline Identification 3.1 Configuration Identification The sites, facilities, structures, systems and components of DOE projects, programs and operating facilities important to the environment, safety and health and other structures, systems and components that are deemed critical to the DOE mission should be included in the configuration management program. This section should describe the process and methods of identifying components of the end product(s) subject to control and the supporting documentation which defines the project and components. It should also discuss how numbers and other identifiers (e.g., document numbers, drawing numbers, equipment numbers) will be assigned.	- Master Equipment List - Safety Equipment List Identification Schema for: - Structures, Systems & Components - Computer Software - Waste Characterization Data and Samples - Waste Packages - Documentation	2.3.5 Configuration Identification App B Configuration Identification App F YMP Configuration Identification Plan

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 3 - Technical Baseline Identification (Continued) 3.2 Technical Baselines Requirements covering preparation, submission for DOE approval, and subsequent release of the Departmentally approved documentation which defines each of the required baselines should be established in this section. The participant's method under which the documentation should be prepared, approved by DOE, and released, should be described and the time periods in which these steps should be accomplished should be indicated.	- Functions and Requirements Baseline - Design Requirements Baseline - Configuration Baseline - As-Built Configuration Baseline	2.3.2 Technical Baseline Identification 2.3.3 Establishment of Baselines 2.3.6 Traceability 2.4.1 Technical Baseline for Projects 2.5.1 Technical Baseline for Facilities GPG-FM-009, *Baseline Change Control* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-016, *Baseline Development*
Section 4 - Configuration Change Control 4.1 Change Control for Programs, Projects, and Operating Facilities This section should describe the process of managing proposed changes to configuration items and technical documentation to ensure proposed changes are accurately described, systematically reviewed and evaluated for impact, properly implemented upon approval, and properly closed out. The change control process should provide for technical, scope, cost and schedule reviews which are documented as a change package. Procedures for control of interfaces and processing requests for deviations or waivers should also be outlined in this section. Processes and controls specific to projects or operating facilities should be addressed in Section 5 or 6, respectively.	Change Control - Procedures - Approval Criteria/Thresholds - CCB Charter Interface Control - Procedures - Documents/Drawings - Interface Control Working Group Charters/Procedures - Procedures to Control Deviations and Waivers - Procedures to Control Waste Inventory Configuration - Waste Inventory Data Base	2.3.4 Change Control 2.3.4.4 Participant CCBs 2.3.8 Interface Control 2.3.12 Control of Deviations and Waivers 2.3.13 Waste Inventory Configuration GPG-FM-009, *Baseline Change Control* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-013, *Interface Management* ASME Y14.24M, *Engineering Drawing Types* ASME Y14.34M, *Associated Lists* ASME Y14.25M, *Revisions to Engineering Drawings*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 1 - Introduction Cover Sheet - should provide the nomenclature of the system or product, contractor, contract number, and date of issue. 1.1 Table of Contents 1.2 Special Material Features - the special features of the participant's facilities, which have a determining effect on the nature of the configuration management program, should be briefly described. 1.3 Special Organizational Features - characteristics such as manufacturing capabilities, design and drafting personnel, and organizational relationships should be defined. 1.4 Other and/or Special Considerations - this section should address peculiarities of the configuration management program that result from participation by a large number of organizations, use of many commercial items, use of existingþ drawings and specifications or other departures from the normal, and innovations for more effective configuration management should be described here. It should also address such traditional CM aspects as training, CM responsibilities and integrationsþ with subcontractors, suppliers, etc. <u>Note</u>: Many of the references listed for this section, such as EIS/IS-649, *National Consensus Standard for Configuration Management*, cover all aspects of configuration management and can be referenced for otherþ sections of the CM Plan. <u>Note</u>: There are two section 5s included in this outline: one for Projects and one for Operating Facilities. Use the one that is appropriate.		2.1 Process Overview 2.3.1 Plans and Procedures 10 CFR 830.120, *Quality Assurance* DOE O 430.1, LIFE-CYCLE ASSET MANAGEMENT DOE O 5700.6C, QUALITY ASSURANCE GPG-FM-001, *Project Management Overview* GPG-FM-002, *Critical Decision Criteria* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-017, *Quality Assurance/Quality Control* DoD Directive 5010.19, *DoD Configuration Management Program* EIA/IS-649, *National Consensus Standard for Configuration Management* EIA/IS-632, *Systems Engineering* IEEE P1220, *Standard for Application and Management of the Systems Engineering Process* ISO 10007, *Quality Management - Guidelines for Configuration Management* MIL-STD-973, *Configuration Management* MIL-HDBK-61, *Configuration Management Handbook* NIRMA PP-02-1989, *Position Paper on Configuration Management*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 4 - Configuration Change Control (Continued) 4.2 Computer Software Change Control Controls should be established for new computer software and modifications to existing software to ensure that the software performs its designed function. This section should identify the controls that will be applied to the development and revision of software used to perform functions necessary for facility safety and reliability.	- Procedures for Development and Acquisition of Software - System Requirements Specification - Quality Assurance Plan - Verification and Validation Plans/Reports - Users Manual - Record of Use - Procedures for Change Control of Software - Procedures for Discrepancy Reporting and Error Notification	2.3.7 Software Configuration Management 2.6 Computer Software Change Control 2.6.1 Software Change Control 2.6.2 Software Change Packages 2.6.3 Periodic Verification 2.6.4 Records App D Software Configuration Management App F YMP Configuration Identification Plan GPG-FM-010, *Project Execution and Engineering Management Planning* ANS/IEEE Standard 828-1990, *Software Configuration Management Plans* ANS/IEEE Standard 1042-1987, *Guide to Software Configuration Management* EIA Standard IS/640, *Software Development* ISO/IEC 12220, *Information Technology-Software* ISO/IEC 12220-2, *Configuration Management for Software*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 4 - Configuration Change Control (Continued) 4.3 Technical Reviews The technical review of a proposed change to facility design, facility test, or facility procedures should evaluate the overall effect of the change on the existing facility (e.g., design and operation). This section should define a technical review program that includes the formal process of reviewing, confirming, or substantiating the adequacy of a change.	- Reviewer Qualification and Training Criteria - Procedures for Conducting Technical Reviews - Safety Evaluation Applicability Reviews - Safety Evaluations	2.7 Technical Reviews 2.7.1 Applications Requiring Technical Reviews 2.7.2 Administrative Controls 2.7.3 Technical Review Procedures 10 CFR 830.110, *Safety Analysis Reports*, March 1996 10 CFR 830.112, *Unreviewed Safety Questions*, March 1996 10 CFR 830.320, *Technical Safety Requirements*, March 1996 DOE 5480.5, *Safety of Nuclear Facilities* DOE 5480.21, *Unreviewed Safety Questions* DOE 5480.22, *Technical Safety Requirements* DOE 5480.23, *Nuclear Safety Analysis Reports* DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-023, *Safety Analysis*
Section 4 - Configuration Change Control (Continued) 4.4 Document Control for Configuration Management Programs, projects and operating facilities should establish a document control program that ensures technically correct and readily accessible information is provided to program and project participants and to support facility operations. This section should cover the important aspects of a document control program.	- Document Control Procedures - Controlled Document List - Standard Distribution List	2.8 Document Control for Configuration Management 2.8.1 Document Control Administration 2.8.2 Procedures 2.8.3 Drawing Control 2.8.4 Vendor Information App E Document Control for Configuration Management

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 5 - Configuration Change Control for Projects This section should describe the process that ensures changes to the configuration of the end product(s) and their components and changes to project technical baselines are reviewed, authorized, properly executed and verified to be complete and closed out.	- Change Control Procedures - Standardized Change Proposal Forms - Change Reviews and Impact Evaluations - Auditable and Traceable Change Documentation	2.4.2 Change Control for Projects 2.4.2.1 Change Initiation and Submittal 2.4.2.2 Change Review and Impact Evaluation 2.4.2.3 Change Disposition 2.4.2.4 Directed Changes 2.4.2.5 Change Implementation 2.4.2.6 Training 2.4.2.7 Change Closeout 2.4.2.8 Change Tracking
Section 5 - Configuration Change Control for Operating Facilities For operating facilities, a configuration change is any modification to the technical baselines, the facility's configuration or the operating procedures and limits. This section should describe the configuration change control process which ensures all proposed changes are reviewed against baseline documentation and all affected elements of the technical baseline are updated as needed. Additionally, this section should describe processes for: (1) modification control (2) temporary modification control, and (3) setpoint control.	- Work Control Procedures - Change Control Procedures - Standardized Change Proposal Forms - Change Reviews and Impact Evaluations - Auditable and Traceable Change Documentation	2.5.2 Operating Facility CCBs 2.5.3 Work Control 2.5.4 Change Control for Operating Facilities 2.5.4.1 Change Initiation and Submittal 2.5.4.2 Change Review and Impact Evaluation 2.5.4.3 Change Disposition 2.5.4.4 Directed Changes 2.5.4.5 Change Implementation 2.5.4.6 Training 2.5.4.7 Change Closeout 2.5.4.8 Change Tracking 10 CFR 830.310, *Conduct of Operations at DOE Nuclear Facilities*, March 1996 10 CFR 830.340, *Maintenance Management*, March 1996 DOE O 430.1, LIFE-CYCLE ASSET MANAGEMENT DOE 4330.4A, CONDUCT OF MAINTENANCE AT DOE FACILITIES DOE 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES DOE-STD-1073-93, *Guide for Operational Configuration Management Program* INPO 85-031, *Requirements for the Conduct of Technical Support at Nuclear Power Stations*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 5 - Configuration Change Control for Operating Facilities (Continued) 5.1 Modification Control A modification is any planned change in the design of a facility structure, system, or component. Modifications may result from an approved change proposal or be directed by management. This section should address administrative controls that ensure modifications to facility SSCs are properly designed, reviewed, approved, installed, tested, and documented.	- Procedures for Modification Control - Design Documentation - Installation Documentation - Revised Safety Analysis - Revised OSR/TSR Limits - Revised Operating & Maintenance Procedures, Documentation, and Training Materials - Revised Vendor Manuals	2.5.5 Modification Control 2.5.5.1 Requests for Facility Modifications 2.5.5.2 Design 2.5.5.3 Installation 2.5.5.4 Documentation 2.5.5.5 Training 2.5.5.6 Quality Verification 2.5.5.7 Materials Procurement 2.5.5.8 Schedule 10 CFR 830.310, *Conduct of Operations at DOE Nuclear Facilities*, March 1996 10 CFR 830.340, *Maintenance Management*, March 1996 DOE 4330.4A, CONDUCT OF MAINTENANCE AT DOE FACILITIES DOE 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES DOE-STD-1073-93, *Guide for Operational Configuration Management Program* INPO 85-031, *Requirements for the Conduct of Technical Support at Nuclear Power Stations*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 5 - Configuration Change Control for Operating Facilities (Continued) 5.2 Temporary Modification Control for Operating Facilities Temporary modifications are usually minor alterations to facility components, equipment, or systems with respect to approved drawings or other design documents. This section should describe the administrative control systems for installation of temporary modifications and should include processes that ensure temporary modifications to in-service facility components, equipment, and systems are properly evaluated, authorized, and controlled using methods similar to those for permanent modifications.	- Procedures for Temporary Modification Control - Temporary Modification Documentation - Temporary Modification Control Log - Shift Training on Temporary Modifications - Annotated Drawings, Procedures - Temporary Modification Tagging - Temporary Modification Audits - Verification of Temporary Modification Removal	2.5.6 Temporary Modification Control 2.5.6.1 Technical Review 2.5.6.2 Authorization 2.5.6.3 Installation 2.5.6.4 Documentation 2.5.6.5 Reviews of Installed Temporary Modifications 10 CFR 830.310, *Conduct of Operations at DOE Nuclear Facilities*, March 1996 DOE 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES DOE-STD-1073-93, *Guide for Operational Configuration Management Program*

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 5 - Configuration Change Control for Operating Facilities (Continued) 5.3 Setpoint Control for Operating Facilities This section should describe a setpoint control program that ensures safety system setpoints are documented and controlled in order to preclude any process parameter deviations from safe operation without detection.	- Procedures for Setpoint Control - Safety System Setpoint List - Documented Technical Basis and Reviews - Installation/Implementation Documentation - Revised Safety Analysis - Revised OSR/TSR Limits - Revised Operating & Maintenance Procedures, Documentation, and Training Materials	2.5.7 Setpoint Control 2.5.7.1 Facility Setpoint Document Control 2.5.7.2 Program Procedures 2.5.7.3 Technical Review of Proposed Changes 2.5.7.4 Implementation 2.5.7.5 Closeout 10 CFR 830.310, *Conduct of Operations at DOE Nuclear Facilities*, March 1996 DOE O 5480.19, CONDUCT OF OPERATIONS AT DOE FACILITIES DOE-STD-1073-93, *Guide for Operational Configuration Management Program*
Section 6 - Data Management and Reporting 6.1 Data Management This section should outline plans for collecting, storing, handling, verifying, and reporting of configuration status information. It should indicate the techniques to be applied to provide a dynamic information system, responsive to the needs of the entire management team, a well as the manner in which the effectiveness of the CM Plan is implemented against any defined performance indicators.	- CM Computer Applications and Data Bases - Master Equipment List - Safety Equipment List	2.3.9 Data Management App C Data Management App F YMP Configuration Identification Plan

Recommended CM Plan Annotated Outline	Key CM Products	References
Section 6 - Data Management and Reporting (Continued) 6.2 Reporting This section should describe reports that will be provided on various attributes of the end product configuration and the performance of the configuration management system.	Reports on: - End Product Configuration Status - Configuration Documentation - Current/Historic Baselines - Change Requests - Change Proposals - Change Notices - Variances - Warranty Data/History - Replacements by Maintenance Action - Configuration Verification and Audit Status/Action Item Closeout	2.3.10 Reporting GPG-FM-006, *Performance Analysis and Reporting* GPG-FM-009, *Baseline Change Control* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-015, *Project Reviews* GPG-FM-029, *Systems Analysis and Assessment*
Section 7 - Reviews This section should address assessments performed to measure the effectiveness of the configuration management process, and consistency between the project physical system and the documentation that represents that system.	- Programmatic Assessments - Physical Configuration Assessments	2.3.11 Reviews 2.3.11.1 Programmatic Assessment 2.3.11.2 Physical Configuration Assessments GPG-FM-005, *Test and Evaluation* GPG-FM-010, *Project Execution and Engineering Management Planning* GPG-FM-015, *Project Reviews* GPG-FM-029, *Systems Analysis and Assessment*

APPENDIX B
CONFIGURATION IDENTIFICATION

1. GENERAL

The sites, facilities, structures, systems and components important to the environment, safety, and health and other SSCs that are deemed critical to the mission should be included in the configuration management program. Unique identifiers should be used in all phases of programs, projects, and operating facilities to ensure documentation can be assembled for the sites, facilities, SSCs as required. The example provided in Appendix F of this Guide illustrates how the information included in this appendix can be applied.

2. GUIDELINES

2.1 Identification of Physical Items

The process for configuration identification of physical items includes:

- The criteria and scope for the physical items to be included in configuration management to be defined.
- Facilities and structures to be uniquely identified.
- The identification of systems, system boundaries, and system interfaces to be clearly delineated and the systems uniquely identified.
- Major components of systems to be uniquely identified by a function code.
- The unique identifier consist of the system, function code, and address to uniquely identify the component and location within a system.
- The location (address) of components within the system to be assigned and shown on drawings.
- Labels to be attached to the physical items showing the unique identifier.
- Documentation generated throughout the life of programs and projects reference the unique identifiers.

2.2 Identification of Structures and Systems

The boundaries and interfaces for each structure and system should be clearly described and documented. These bounded structures and systems should be uniquely identified. The unique identifiers assigned to the structures and systems should be used throughout the life of the project or operating facility for identification of the structures and systems.

2.3 Identification of Components

Components within systems should be uniquely identified as follows:

- A controlled list of function codes should be developed and maintained current at each project or operating facility.

- Each component requiring unique identification should be assigned a function code from the controlled list of function codes depending on the primary function the component performs. (For example, a valve might have a controlled function code of VLV from the controlled function code list.)

- The component should be assigned an arbitrary numeric address depicting the relative position of the component in the system to other components. This relative location assignment for the component is called the "address" of the component.

- The unique identifier for a component should consist of the system identifier, the component function code and the component address.

- The unique identifier should be depicted on design drawings.

- The components should have a label affixed to show the unique identifier when possible. Labeling should comply with the requirements of DOE 5480.19, Chapter XVIII, Equipment and Piping Labeling.

Guidelines for determining the level to which individual components should be uniquely identified are given in Table B-1.

Table B-1. Level of Unique Identification of Components.

The level to which components are uniquely identified can be determined using the following guidelines:

A. The component is at a level of assembly to allow ready access to decision information.

B. The component is at a level at which change incorporation and configuration verification is required and documented.

C. The component provides the basis for preparation of operating and maintenance manuals.

D. The component requires visibility and control because of its high cost, criticality in the system, or contractual/acceptance significance.

E. The component does not contain a subassembly requiring independent change incorporation and configuration verification.

2.4 Identification of Additional Components and Subcomponents

Design changes may result in the requirement for additional components to be added to a system. These components should be assigned the appropriate function code and the correct address relative to other components and should be included on design drawings and be labeled. When desirable or required to identify subcomponents of a component, the function code for the subcomponent should be selected depending on the function of the subcomponent and the address should be the same as the component.

2.5 Identification of Assembled Packaged Equipment or Skid-Mounted Equipment

If the components would have required identification in an engineered system, the components of an assembled packaged equipment or skid-mounted equipment should have the components uniquely identified. These unique identifiers should be shown on drawings and should be labeled.

2.6 Identification of Software

Software configuration items are those computer codes that directly control processes important to operations or specify design output or are used to refine design input for a configuration item. Examples are provided in Section 2.3.7 of this Guide. Software subject to the configuration management program should be uniquely identified as a configuration item. Unique identification of software requires:

- General description and primary purpose.
- Version, release number, and level.
- Unique identifiers for each program; traceable from source listings/object modules to the codes output.
- Version and revision number and date, traceable from source listings/object module to the codes output.
- Cross reference to unique configuration item(s), if applicable.
- Cross references to the codes supporting documentation, including requirements and design specifications and user/operations manuals at the same version/revision level, as applicable.

2.7 Identification of Waste Characterization Data and Samples

Waste characterization data to be used as design or process input should be included in the configuration management program. Waste characterization requires full sample traceability and accountability. The waste characterization data and samples should be uniquely identified. This requires:

- Use of separate, unique identifiers for multiple, discrete samples.
- Identification of the individual items or portions resulting from subdivision that are readily traceable to the original sample.
- Traceability of samples to applicable documentation and documentation to applicable samples by the unique identifier.
- Traceability of samples to their origin including site location and orientation.
- Use of labels (bar codes) or other methods of identification to show the unique identifier during processing.

- Maintenance of controlled site location maps for identifying sample locations.

2.8 Identification of Waste Packages

All waste packages should be included in the configuration management program. Waste packages should be uniquely identified to ensure accountability and traceability as follows:

- A unique identifier should be assigned to each waste package.

- Labels or other methods of identification of the unique identifier should be provided for each package and applied in a manner not to compromise the integrity of the waste package.

- The unique identifier should be legible at least to the end of the period of retrievability.

- Waste package documentation should be retrievable by the unique identifier.

2.9 Identification of Documentation

Documentation associated with configuration items should be included in the configuration management program to ensure traceability of requirements and retrievability of information. Documentation associated with configuration items should be uniquely identified to ensure traceability and retrievability as follows:

- A standard numbering system for the generic baseline document types such as drawings, procedures, calculations, etc., should be established and used throughout the life of the program, project or operating facility.

- The standard numbering system should provide for unique identification and cross-referencing of all mutually dependent documents.

- The standard numbering system should be procedurally controlled.

- The unique document identifier along with the revision level and effective date should be clearly identified on each issue of a document.

- Documents supplied by vendors should either conform with the required numbering system, or have a numbering system that is judged sufficient, used consistently by the vendor, and provides for retrievability of documentation.

APPENDIX C
DATA MANAGEMENT

1. GENERAL

Computerized information systems should be used as tools to monitor configuration management technical baseline information and changes thereto. The configuration management related data bases should include an index of all configuration items and documents representing technical baseline information, an index of all proposed and approved changes to the technical baseline, and the status of the changes thereto. When used, these information systems becomes extremely important to the permitting, licensing and operations of projects and operating facilities. Configuration management computer applications along with the technical data base and the records management computer applications contain a substantial portion of the information necessary to substantiate full regulatory compliance.

The integration of these data bases and the controlled and rigorous data management techniques used in the design of the computer applications supporting configuration management should meet the requirements of the approved configuration management program. Section 4 of the example provided in Appendix F of this Guide illustrates how to the information included in this appendix can be applied.

2. DEFINITIONS

Computer Hardware, Software, and Resources. The equipment, computer programs, and information systems professionals that collectively make up the information resource management function to be utilized for development of systems that enhance the management and control functions of programs, projects and operating facilities in order to meet the goals and objectives of the Mission.

Sponsor. The organization with direct contact to the information resource management organization that (1) identifies requirements for a specific computer software application; (2) supports development, implementation, and utilization of the specific computer application; (3) budgets resources and supports procurement of information resources related to the computer software application; (4) sets priorities and long range direction for the computer software application; and (5) develops service-level requirements as they relate to the computer software application.

User Group. A formal group established to review, approve and provide priorities for development and maintenance of information systems supporting configuration management with members from affected and interested organizations to include, but not limited to, information systems.

3. ROLES

3.1 Program Office

The Program Office directors should:

- Provide requirements for computer hardware, software, and information resource management resources as they relate to the configuration management program.
- Support design, development, implementation, and utilization of computer hardware, software, and resources for the configuration management program.
- Recommend changes to other related procedures as those procedures impact the computer hardware, software, and resources that relate to the management and control of configuration management baselines and changes thereto.
- Act as sponsor for configuration management computer applications at the Program Office level.
- Establish and chair an Program Office configuration management computer applications user group.
- Provide long-range plans for information systems as they relate to configuration management systems.
- Ensure that proper records are developed documenting all approved changes to information systems.

3.2 Field Elements

Field Elements should:

- Establish configuration management software applications and support activities that meet the intent of this procedure.

- Provide short- and long-range configuration management computer hardware, software, and resource requirements to the appropriate Field Element organization responsible for information systems.

- Identify all configuration management computer applications used in the organization with identification of the software scope, sponsoring organization, input requirements, and output provided. This information is utilized to enhance the integration of computer software and help to reduce the proliferation of disconnected and inefficient computer applications.

- Review and approving specifications for configuration management computer applications.

- Identify training requirements for their organizations as they relate to configuration management software applications.

4. GUIDELINES

4.1 Development of Configuration Management Applications

In addition to the guidelines established in Appendix B of this Guide, the following guidelines apply to the development of configuration management applications.

- Joint development with affected and implementing organizations of configuration management software applications should be required in order that the goals and objectives of the configuration management program are effectively and efficiently met.

- Purchased software and hardware components should be utilized whenever feasible and practical.

- Extensive use of prototyping should be provided by the software developer to ensure requirements are met effectively and efficiently prior to final delivery of a detailed design.

- Service levels should be developed for on-line response times, batch report turnaround, error resolution, minor changes, and other service levels as considered important to the operation and use of the configuration management applications.

- Development of appropriate documentation, including a user manual, should be required prior to implementation and acceptance of developed or acquired applications.

- An operational user group should be established to review, approve, and prioritize enhancements to the software application once implemented.

4.2 Operations and Maintenance of the Configuration Management Systems

Maintenance of configuration management software applications should be treated commensurate with the original development techniques. Authorization for minor changes that include only output format changes or correction of minor software errors should be at the discretion of the information services organization; however, all normal documentation, testing, and training should continue to be required. All major changes and corrections should be reviewed by the user group for approval and priority. Operational requirements for configuration management software applications include data verification techniques, reporting requirements, and data discrepancy reporting.

In addition to the guidelines provided in section 2.3.9, section 2.6, and Appendix D; the following guidelines apply to operation and maintenance of configuration management software applications.

- Data entered into the configuration management computer applications should be independently verified. Data errors should be reported when detected.

- Project personnel should be provided tools to design, develop, and generate the maximum amount of reporting possible, minimizing the impact to information services personnel.

4.3 Configuration Management Systems Integration

The successful implementation of the configuration management program depends heavily on the ability to retrieve information using many different data attributes as key information. The traceability of information is of paramount importance in baseline control and ensuring that technical information is up to date and accurate. Configuration management actively supports the elimination of uncontrolled and redundant data, and the integration of data when feasible and cost effective. The following guidelines relate to the integration of configuration management information.

- Data management techniques should be employed in the design, development, and implementation of all data bases directly or indirectly supporting configuration management.

- Configuration management related data stored on stand-alone data bases is to be identified and scheduled for integration in a planned approach and with minimum disruption.

- Regular inventories of hardware and software should be made to determine the existence and extent of uncontrolled redundancies, and reports should be presented to the configuration management software applications users group with recommendations on integration.

- A value-added approach for incorporation of redundant and/or related data bases should be made.

- Technologies that support the elimination and efficient and effective use of configuration management related data should be evaluated and employed where cost effective.

- The computerization of configuration management information should be considered where it is cost justified and the impact to ongoing applications is minimized.

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APPENDIX D
SOFTWARE CONFIGURATION MANAGEMENT

1. GENERAL

The configuration management program should ensure that essential and critical computer software is identified and controlled. Software designated to be controlled through the configuration control process should be uniquely identified and established as part of the technical baseline. Criteria for inclusion of software in the configuration management program is provided in sections 2.3.7 and 2.6 of this Guide.

2. ROLES

2.1 Program and Field Element Secretariat Organizations

Program Office and Field Element Secretariat organizations should be responsible for providing an index of all software configuration items (SCIs), including changes and the status for use.

2.2 Field Elements

Field Elements should be responsible for:

- Establishing and maintaining procedures to control SCIs within their organizations.
- Utilizing an index for SCIs with appropriate cross-references to related information, including proposed and approved changes with status information.
- Developing a systems requirements specification for all SCIs either existing, acquired, or to be developed.
- Controlling the SCI codes and documentation throughout the software life-cycle to include controlled distribution of appropriate documentation.
- Retesting SCIs when related/involved software and hardware (operating systems, run-time routines, interpreters, microcode, input devices and others as appropriate) changes are made that have potential impact on the output of the SCI.
- Establishing a discrepancy reporting and corrective action system.

- Establishing independent reviews and approvals for developed or acquired software at major points in the development or operations life cycles per quality assurance guidelines for independent reviews.

- Maintaining a log of all uses of SCIs to ensure traceability in the event of error detection.

3. GUIDELINES

3.1 Development and Acquisition of Software Configuration Items

The following guidelines apply to the development and acquisition of software configuration items:

- Prior to development or acquisition of an SCI, a systems requirements specification should be developed identifying the basis for source code development, functional requirements, data interface requirements, hardware requirements, mathematical models, assumptions for use and any other pertinent information appropriate to the pre-design phase.

- In conjunction with the development of the systems requirements specification, a software quality assurance plan should be developed. The software quality assurance plan should identify all quality assurance measures and techniques to be used in qualifying the software for use, to include software development project organization structure, design methodology, coding standards and conventions, configuration control measures, automated tools to be used for development and testing (if applicable), hardware considerations, independent review techniques, training for project team leads and programming personnel, security considerations, and other information appropriate to the development of software quality assurance.

- The system requirements specification should be independently reviewed and approved prior to CCB submission. When the independent review is completed, the system requirements specification should be submitted to the appropriate CCB for approval. For in-house development no additional phases of work should be completed until the CCB has approved the system requirements specification.

- The source code should be independently reviewed and approved when completed. This review should be documented program by program.

- A software verification and validation plan should be created in conjunction with the detailed design phase. The software verification and validation plan should address all controls to ensure that the requirements are captured in the design and that the design meets all criteria.

- The software should be independently tested to determine that it meets the original requirements and design specifications (verification).

- The software should be independently reviewed to determine that the output is correctly computed and produces results consistently (validation) under varying assumptions to be used once the software is placed into production.

- The results of the verification and validation phases should be formally documented in the software verification and validation report. The test data should be saved and used in order to requalify the code in the event of changes to the source code and related software and hardware.

- Organizations inputting data into the system should be responsible for the accuracy and completeness of the data. Error messages and warnings generated by the code should be thoroughly researched prior to using the results.

- Development of appropriate documentation, including a users manual, should be required prior to implementation and acceptance of developed or acquired software.

- Contractors performing configuration management software development work should be formally assessed as to relevant experience and qualifications.

- A record of the use of all output should be maintained in the event that errors are discovered at some later point in time. A notification mechanism should be established to report the consequences of errors and their potential impact on uses of the software output.

3.2 Operations and Maintenance of Software Configuration Items - Change Control

Maintenance of SCIs should be treated commensurate with original development. Authorization for minor changes that include only output format changes or correction of minor software errors should be at the discretion of the software sponsor; however, all normal documentation, testing and training should continue to be required. All major changes and corrections should be reviewed by the CCB for approval. The following guidelines apply to operation and maintenance of software configuration items:

- All proposed changes to SCIs should be documented and presented to the appropriate CCB.

- The proposed change should be identified in the appropriate data management system per Appendix C of this Guide.

- Upon change approval the data management system should be updated to reflect the new status. Likewise, should the change be unapproved or held, the data management system should be updated to reflect this change in status.

- Changes should be evaluated to determine the acceptability of using results from previous revisions of the software. Where it is determined that the results produced by previous revisions of the software may result in an unacceptable output, all users of the previous revision should be notified of the changes and acknowledge that the results obtained from prior revisions do or do not materially affect their work.

- The change should be developed, tested, and implemented in accordance with approved procedures.

- Upon implementation of the change, all appropriate documentation should be updated. This documentation includes as a minimum the Users Manual and the updated systems requirements specification.

- The output generated by the software should identify the current version and revision of the software and the effective date of the revision.

- Training should be conducted and training records maintained to attest to such training, where appropriate.

3.3 Discrepancy Reporting and Error Notification

Traceability of use of design input or output is critical to safety. Discrepancy reporting provides a necessary feedback loop in the process to ensure that all errors are reported, users are notified of the situation, and as a result are able to adjust to the correct information. The following guidelines are related to discrepancy reporting and error notification.

- All uses of SCIs should be documented with the date and time of the use and the version of the SCI in effect at the time.

- Should an error in the SCI or related software be discovered, immediate notification is required using the standard methods of discrepancy reporting.

- Once the magnitude of the error is known, all previous users of the software should be notified in writing and requested to determine the impact of the error on their previous use of the software.

- Corrections to the software and root cause analysis should be immediately undertaken.

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APPENDIX E
DOCUMENT CONTROL FOR CONFIGURATION MANAGEMENT

1. GENERAL

Documents should be controlled and distributed to ensure that only the applicable approved version is available for use and to ensure prompt communication of changes. As discussed in Section 2.8, the effective control of documents is essential to the success of the configuration management program because the documents are the vehicles used to communicate information to affected organizations. The configuration management program should ensure processes are in place such that:

- Controlled documents are uniquely identified and identification systems are proceduralized.
- Controlled documents are reviewed, approved, changed, and released through change control processes.
- Controlled documents are kept current by controlled distribution, including a receipt acknowledgment process.
- Users needing controlled copies have ready access to current revisions of controlled copies.
- Data bases providing revision level information are controlled and maintained current.
- Record retrieval systems are in place that allow timely retrieval of historical documents and the cross-referenced material in those documents.
- Effective dates are established for controlled documents that allow for changes to impacted documents and related training.

All technical baseline documents should be issued as controlled documents. On approval, these documents should be entered in the appropriate controlled document list.

2. DEFINITIONS

Controlled Copy. A document that is maintained on a current basis by means of a revision control process and a formal transmittal/receipt acknowledgment system.

Controlled Document. A document that is prepared, reviewed, revised, and approved in accordance with established procedures, has controlled distribution, and is maintained on a current basis.

Controlled Documents List. A list of the documents to be controlled. This list includes information such as document number, title, revision number and date, effective date, and originating and distributing organization.

Distributing Organization. That organization responsible for reproduction, distribution, and transmittal receipt/acknowledge of controlled documents.

Document. Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

Originating Organization. That organization responsible for preparing, revising, reviewing, approving, completing, or statusing a document and releasing it to the appropriate organization for distribution.

Standard Distribution List. A list for each controlled document identifying the recipient's position, location, and controlled copy number.

3. ROLES

3.1 Program Office and Field Elements

The Program Office and Field Element directors and/or managers should:

- Approve the Standard Distribution List for the controlled documents within their areas of responsibility.
- Generate and distribute a Controlled Document List.
- Ensure only current revisions of controlled documents are used in performing quality-related work activities.

3.2 Document Originating Organizations

Controlled document originating organizations should:

- Ensure controlled documents released for distribution have been appropriately reviewed for technical adequacy and approval.

- Ensure effective dates for controlled documents are established prior to release for distribution.

3.3 Document Distributing Organizations

Controlled document distributing organizations should be responsible for ensuring controlled documents are distributed in accordance with approved procedures.

4. GUIDELINES

4.1 Document Generation

Organizations that generate documents, which are under the scope of this appendix, procedurally should define the process for the preparation, format, review, approval, revision, and verification of the technical adequacy of those documents.

4.2 Document Identification

4.2.1 Document Numbering

- Each controlled document should be identified by a unique number that appears on all pages of the document. The original identification number should be retained throughout all changes to and revisions of the document. Should a document be canceled, that unique number should not be reused.

- The current revision number of each controlled document should appear on all changed pages issued since initial issuance of or last complete revision.

- Pages within a controlled document should be numbered in a manner that allows page accountability.

4.2.2 Control Identification

Controlled documents should be clearly identified as controlled by use of colored paper or a color-identified stamp indicating a "controlled" status. Black should not be an acceptable color identification for the control stamp. Without this control identification, documents should be considered uncontrolled.

4.2.3 Controlled Documents List

A Controlled Documents List should be maintained which identifies controlled documents originated by their organizations and lists the individual document title and number, the current revision number and date, effective date, and originating and distributing organizations.

4.3 Document Revisions

- Revisions to controlled documents should be reviewed and approved by the same organizations that reviewed and approved the original issue, unless delegated to another qualified organization.

- Inclusion of revision/change information should be made part of the document by one of the methods listed below:

  - Inclusion of a revision/change record as part of the transmittal package;

  - Inclusion of a revision/change log as part of the document.

- The revision/change information should include the reason for the revision and identify the page(s) revised.

4.4 Document Review

Organizations originating controlled documents should procedurally define the required review and approval cycles. Resolution of review comments, for which resolution is considered mandatory by the responsible organization, prior to approval should be documented.

4.5 Document Release

- Organizations originating controlled documents should be responsible for ensuring controlled documents are legible, reproducible, adequately reviewed, and appropriately approved prior to release for distribution. An effective date for the controlled document should be indicated on the first page of the controlled document, allowing sufficient time for the development/revision of implementing procedures and training as appropriate.

- When the revised document is maintained in a manual, an updated table of contents or an index should be prepared which accompanies the revision that is forwarded to the distributing organization.

4.6 Document Distribution

- A unique controlled copy number should be assigned to each controlled document listed on the Standard Distribution List.

- A systematic transmittal and receipt acknowledgment process should be used to control distribution and track receipt of controlled documents. Individually addressed transmittals should be used to transmit controlled copies of documents to each person on the Standard Distribution List. The transmittal record should also contain any necessary instructions, including the deadline for return of the signed transmittal receipt and disposition instructions for superseded documents/pages.

- The recipient of each controlled copy should sign and return the transmittal to the distributing organization by the due date specified and maintain his/her controlled copy current.

4.7 Standard Distribution List

Standard distribution lists should be developed for controlled documents, and maintained by the organization distributing controlled documents. Additions to or deletions from the standard distribution lists should be authorized by the organization originating the documents. Controlled distribution should be limited to avoid the creation of an unduly cumbersome or unmanageable document control system that may ultimately be self-defeating.

4.8 Document Use

It is the responsibility of the user to ensure that only the current revision of controlled documents are used in the conduct of activities. Currency should be readily verifiable by contacting the distributing organization or reference to the Controlled Document List.

4.9 Document Assessment

At least annually, each distributing organization should require each controlled copy holder to inventory and verify currency of all controlled copies assigned to the particular position. Random assessments of controlled copies should be made by the distributing organizations to confirm the adequacy of the controlled distribution process on an as-needed basis.

4.10 Maintenance of Controlled Copies

4.10.1 Master Copy

A master copy is the copy used by distributing organizations for reproduction, distribution, and reference of the current revision. The master copy should not be checked out of the distributing organization's files and access control should be maintained. Only the current revision should be considered a master copy. Historical, superseded, or obsolete revisions should be maintained in the appropriate records systems.

4.10.2 Controlled Copies

Recipients of each controlled copy should maintain that controlled copy current, promptly inform the distributing organization of any changes in physical relocation, position responsibilities, or titles, and at least annually assess the accuracy of their controlled copy(ies).

APPENDIX F
YMP CONFIGURATION IDENTIFICATION PLAN

DRAFT
PLAN FOR IMPLEMENTATION OF
YUCCA MOUNTAIN SITE CHARACTERIZATION
PROJECT CONFIGURATION IDENTIFICATION
REVISION 0

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INTRODUCTION

Configuration management for the Yucca Mountain Site Characterization Project (YMP) supports management of the Project Baseline by providing the mechanisms to identify, document, and control the functional and physical characteristics of the YMP's products. It is an integrated approach to the technical, cost and schedule, quality assurance, and administrative actions necessary to manage the YMP. Configuration management focuses on four principal activities: configuration identification, configuration control, configuration status accounting, and configuration review. The requirements for each of these principal activities are set forth in the YMP Configuration Management Plan (CMP).

To date, the focus of the CMP and the YMP has been on establishing and institutionalizing controls for site characterization activities and development of the documents which establish the technical, cost, and schedule baselines for the Mined Geologic Disposal System (MGDS). Technical and Management Support Services (T&MSS) has recognized that current configuration management program requirements, which have been adequate for these early stages of the MGDS, should be further refined to incorporate more rigorous management controls and enhanced information systems that will be needed to support later stages of the MGDS life cycle. Configuration identification and configuration status accounting are two areas where T&MSS has performed analysis and developed the necessary refinements which are recommended for the Management and Operations (M&O) contractor to implement.

The purpose of this plan is twofold. First, it describes the recommended changes. The changes are presented in four interrelated sections:

1. Project Baseline Control

2. Configuration Item and Activity Selection

3. Configuration Item and Activity Identifiers

4. Configuration Information System

Except for the section on Project Baseline Control, each recommended change is presented in a format that includes:

1. Current Situation

2. Background Information

3. Proposed Action

The section on Project Baseline Control provides essential information that is common to the other sections.

This Plan addresses “what” needs to be changed and “why.” It does not address “how” the recommended changes should be implemented. Implementation of the recommended changes will require interface with other YMP organizations and Participants. It is probable that exact details of the recommended changes will be modified as a result of such interfaces.

A detailed implementation plan and schedule should be developed which address “how” the recommendations should be implemented. Implementation should consider current and future changes in management areas addressed by this plan. As of this writing, T&MSS is aware of proposed changes to YMP criteria for: (1) determining the importance of activities or items and (2) identifying documents and records. Additionally, this plan itself recommends changes to the WBS. These ongoing or proposed changes may require details of recommendations made by this plan to be modified. However, the basic recommendations will remain valid.

The second purpose of this plan is to bring T&MSS activities funded by the YMP to an orderly close for the configuration management subtasks of Configuration Identification and Configuration Information System Development. This information should prove useful in developing further implementation of configuration management principles and practices by the M&O contractor.

1. PROJECT BASELINE CONTROL

U.S. Department of Energy (DOE) Order DOE 4700.1 requires management of the Project Baseline which is composed of the YMP technical, cost, and schedule baselines. Configuration management is one of a number of disciplines that is applied to management of the YMP technical baseline. It also interfaces with YMP Planning and Control System (PACS) to integrate cost and schedule impacts of approved changes to the technical baseline.

Configuration management provides the management controls and tools to ensure that the product acquired satisfies the technical and operational requirements of the YMP technical baseline. It utilizes the same management controls and tools to ensure that the technical requirements are clearly defined and controlled throughout the product’s life cycle.

For the YMP, there are three product types controlled by the configuration management program. These product types are defined collectively as “configuration items (CIs)” and include: the geographical features of the Yucca Mountain site; project activities related to characterization of the site and development of MGDS technical requirements; and the physical structures, systems, components, and software of the Mined Geologic Disposal System (MGDS). Major elements of the MGDS life cycle are: site characterization, engineered subsystems design, system performance assessment, licensing, and MGDS construction, operation, and closure.

The CMP recognizes that requirements will be added and modified, and increased detail will be needed as MGDS development proceeds through its life cycle. In the early stages of the life cycle, the items controlled by configuration management are the documents that define: site features, site characterization activities, and the MGDS technical baseline. Activities controlled are those related to developing the technical baseline: site characterization, engineered subsystems design, system performance assessment, and licensing.

As development proceeds into later stages of the MGDS life cycle, items controlled by configuration management will expand to include the actual software as well as the detailed technical baseline documentation defining those physical structures, system, components, and software. Activities controlled will be those related to MGDS construction, operation, and closure including maintenance and modification of MGDS structures, systems, components, and software.

To date, the focus of the CMP and the YMP has been on the early stages of the MGDS life cycle. It is recognized that current requirements, which have been adequate for the early stages of the MGDS, should be further refined to incorporate more rigorous management controls and enhanced information systems that will be needed to support later stages of the MGDS life cycle. Configuration identification and configuration status accounting are two areas where analysis has been performed and recommendation developed for the necessary refinements.

Configuration identification is the foundation of a configuration management program. It includes both the selection of CIs to be governed by the configuration management program and the selection of the documentation which describes the functional and physical characteristics of the CIs. This documentation includes both technical baseline documentation and non-baseline documentation.

The technical baseline documentation establishes the design bases for the MGDS and describes the functional and physical characteristics of the CIs. Non-baseline documentation is comprised of operating and maintenance procedures, vendor manuals, inspection procedures, and other documents that use the technical design baseline documentation as input criteria.

Currently, configuration status accounting for the YMP utilizes both manual and computerized information system to cross-reference and track CIs and their associated baseline and non-baseline documentation. The computerized Configuration Information System (CIS) also records and reports on the implementation of changes to the CIs and their baseline documentation and triggers corresponding review and change of non-baseline documentation, if required.

Existing YMP requirements for configuration identification and configuration status accounting should be further refined to:

1. Provide more rigorous criteria for selection of items and activities to be placed under configuration control.

2. Establish a configuration item numbering convention that will support later stages of the YMP's life cycle.

3. Provide for a Configuration Information System (CIS) that is capable of supporting YMP requirements throughout its life cycle.

2. CONFIGURATION ITEM AND ACTIVITY SELECTION

2.1 Current Situation

As indicated in the previous section and in the CMP, configuration identification establishes the requirements for selection and identification of site features, site characterization activities, and MGDS items (structures, system, components, and software) that are placed under configuration control. It also integrates the YMP cost and schedule baseline impacts of approved changes to the technical baseline.

While the CMP identifies top-level CIs, it does not provide sufficient criteria for defining and selecting lower level items and activities to be placed under configuration control.

2.2 Background Information

As discussed in the previous section, there are three product types controlled by the configuration management program. These products are defined collectively as CIs and include: site features, site characterization activities, and MGDS items. These CIs are divided into two categories: those related to site characterization and those related to MGDS physical subsystems. Criteria for determining which features, activities, and items will be placed under configuration management are not clearly defined. However, there are existing YMP criteria which can be applied.

Key documents which establish the YMP criteria for determining the importance of a feature, activity, or item are 10 CFR 60, NUREG-1318, and AP-6.17Q. AP-6.17Q describes the method and responsibilities for identifying:

1. Items important to public radiological safety and waste isolation.

2. Activities that could affect a natural barrier’s ability to isolate waste.

3. Items determined to be not important to safety, waste isolation, and associated activities.

Controlled lists are in place which document the results of the determination process. However, these lists which are the primary indicators of the importance of items to the YMP, are not subject to a disciplined change management system such as the CCB mechanism. The controlled lists are identified and described as follow:

1. Q-List-identifies Items Important to Safety (IITS) and Items Important to Waste Isolation (IITWI). The Q-list has two sections and one appendix.

2. Quality Activities List (QAL) - identifies activities that could affect a natural barriers ability to isolate waste.

3. Project Requirements List (PR List) - identifies items and activities that were evaluated for inclusion in the Q-List or the QAL and determined not to be: important to safety, important to waste isolation, or quality activities. It also identifies activities exempted from the Q-List for QAL evaluation process. The PR List has two sections and one appendix.

   Exempt items or activities are those whose function or purpose have been determined, by simple logic, to be unrelated to public radiologic health and safety or waste isolation. These include:

   a. Activities whose purpose is to demonstrate feasibility of equipment, tools, or techniques; do not use technology considered to be beyond state of the art; and do not involve disturbance or characterization of natural elements of phenomena.

b. Activities that support general administration of the project such as budget exercises, action item tracking, accounting, general office services, etc.

c. Items such as office trailers, temporary office facilities, etc.

In summary, the Q-List, QAL and PR List classify items and activities as important to safety, important to waste isolation, and as quality activities. This classification scheme is summarized in Table 1.

Table 1 Classification Scheme.

LIST	CLASSIFICATION[1]	IDENTIFIERS[2]
Q-List	IITS	WBS and MGDS-SR
Q-List	IITWI (Engineered)	WBS and MGDS-SR
Q-List	IITWI (Natural)	WBS and SCPB Table
QAL	Quality Activity	WBS and SCPB
PR List	not IITS or IITWI	to be determined
PR List	not Quality Activity	WBS, SCPB, and PCA
PR List	Exempt	WBS, SCPB, and MGDS-SR

[1]An item can be both IITS and IITWI (Engineered).
[2]Identifiers are those used internal to the referenced list.

2.3 Proposed Action

The M&O contractor should revise the CMP to provide more rigorous criteria for selecting features, activities, and items to be placed under configuration control. Selection of CIs should be based on the classification discussed above and the following graded approach:

1. Q-List and QAL features, activities, and items should be selected as CIs, baselined, and subject to all requirements of the CMP.

2. PR List features, activities, and items, other than Exempt, should also be selected as CIs, baselined, and subject to the CMP requirements necessary to ensure control of the cost and schedule baselines.

3. Exempt features, activities, and items should not be selected as CIs and should not be subject to requirements of the CMP. However, they should be subject to PACS cost and schedule controls as determined by the cost and schedule management disciplines.

The approach presented above allows baseline management to focus on the items and activities important to safety, waste isolation, and quality. As the MGDS develops, the quantity of items and activities controlled and the complexity of baseline management will increase dramatically. The ability to distinguish and focus management attention on items important to the MGDS will be essential to success of the YMP.

3.0 CONFIGURATION ITEM AND ACTIVITY IDENTIFIERS

3.1 Current Situation

As discussed under Project Baseline Control and described in the CMP, configuration identification establishes the requirements for selection and identification of CIs that are placed under configuration control.

While the CMP establishes a CI numbering convention that supports current YMP requirements, it does not establish a CI numbering convention that will totally support YMP requirements through later stages of the YMP's life cycle.

Additionally, YMP contract and other management control mechanisms may not provide adequate controls on YMP Participants to ensure consistent and efficient implementation of the YMP's configuration identification methodology.

3.2 Background Information

Background information for this section is provided in six subsections. The first five subsections focus on CI numbering. The focus of the final subsection is on management control of YMP Participants.

The first subsection addresses configuration identification principles while the second subsection identifies the multiple methods of identification currently being used on the project. The third subsection addresses management control of the WBS and the fourth subsection describes a proposed CI numbering convention which integrates the multiple methods currently being used. The fifth subsection recommends configuration identification responsibilities for implementation of the proposed CI numbering convention.

3.2.1 Configuration Identification Principles

Identification of a CI with its corresponding baseline and non-baseline documentation is accomplished through the use of unique identifiers for both the CI and for its documentation.

Documentation may describe more than one CI and therefore identifiers are required within a document to specify which CI is being described and to cross-reference CIs and documents with other CIs and documents.

Likewise, a CI may be composed of a number of subcomponents, parts, or subactivities that, in turn, may have documents uniquely applicable to them, therefore requiring the subcomponent, part, or subactivity to have its own unique identifier.

The YMP's configuration identification numbering scheme must be able to recognize these relationships and the relationships show in Figure 1.

3.2.2 Multiple Methods of Identification

Currently, there are five methods by which the YMP identifies site features, activities and items, and documentation thereof:

1. The YMP WBS Dictionary.

2. The numbering convention used in the Site Characterization Program Baseline (SCPB).

3. The major system acquisition cost account identification code assigned by the YMP MGDS-Systems Requirements (MGDS-SR) document.

4. The configuration item numbering convention established in Section 3 of the CMP.

5. The convention used to identify documents and records as specified in the Records Management Plan (RMP).

For configuration management to successfully integrate the technical, cost and schedule, quality assurance, and administrative activities necessary to manage the Project Baseline, a CI numbering convention must be established that will integrate all five of the above methods. A brief description of these five methods of identifying site features, activities, items, and documentation is provided in the following paragraphs.

The YMP WBS Dictionary identifies and defines individual YMP work elements as the basis for assignment of tasks, budgeting, schedule planning, integrating key YMP functions, measuring and monitoring technical, cost, and schedule progress, and the reporting of progress. Each YMP work element is assigned a numerical identifier that has a hierarchical relationship to other YMP work elements.

The SCPB defines the program to provide data used to determine the suitability of a site for the MGDS, to support MGDS licensing, and to support design of the MGDS. It establishes a numbering convention based on an issues hierarchy approach to resolve questions about the performance of the MGDS. The numbering convention reflects the three-tiered framework consisting of key issues, issues, and information needs.

The MGDS-SR is a system level technical baseline document that identifies MGDS requirements and functions, defines MGDS subsystem physical boundaries, and describes physical and functional interfaces between subsystems. Section III of the MGDS-SR provides a listing and definition of each physical subsystem that comprises the MGDS. Each Subsystem is assigned a uniform major system acquisition cost account identification code that will be used in all design documents that deal with MGDS physical subsystems.

The CMP establishes the YMP's approach to and requirements for configuration identification. Section 3 of the CMP establishes a configuration item and activity identifier based on the third-level elements of the YMP WBS Dictionary in combination with a four-digit number that is unique to each item or activity. The CMP also establishes a numbering convention for the documents that identify, describe, or define the configuration characteristics of the item or activity. This descriptor document number is based on the configuration item number and a four digit serial number that is unique for each document.

The RMP establishes a numbering convention for documents and records. The convention is based on the WBS number corresponding to the activity that generated the document or record and an alpha code to identify the type of document or record.

3.2.3 Management Control of the WBS

DOE 4700.1, Part II.B.3 states that, "Following design and the development of a specification tree, the WBS shall be revised to reflect the end product. Throughout systems engineering, the WBS shall be updated to reflect current status of the end product." This requirement is also discussed in the DOE WBS Guide, DOE/MA-0295, IV.B.2, which states, "The framework for designating the configuration items on a project is the WBS, which needs to be extended sufficiently to clearly define all element subject to configuration management."

As the SCPB, the MGDS-SR, and subordinate design requirements documents are developed, the WBS should be revised to reflect revised site characterization activities and more detailed identification of the MGDS physical structures, systems, and subsystems. The YMP does not currently implement this approach to managing the WBS.

If this approach is adopted by the YMP, the WBS would integrate the multiple methods of identification and the numbering convention proposed in this plan could be further simplified.

3.2.4 Proposed Numbering Convention

As discussed previously, CI is a collective term that includes site features, site characterization activities, and MGDS items. For assignment of configuration identifiers, these CIs are divided into two categories: those related to site characterization and those related to MGDS physical subsystems.

Site features and activities significant to development of data for site characterization and systems requirements will be placed under configuration management and have a unique configuration identifier.

Likewise, items comprising the physical structures, systems, components, and software of the MGDS will be placed under configuration management and be assigned a unique component identifier.

A configuration item and activity numbering convention that will integrate all of the above has been proposed as shown in Figure 2.

The proposed identifier has three major segments. The first segment establishes a tie to the YMP WBS Dictionary and is followed by an alpha designator that indicates whether the third segment is related to site characterization or to a systems requirement. If the third segment is to identify a site characterization feature or activity, then it will be as shown in Figure 3. If the third segment is to identify a systems requirement physical subsystem component, it will be as shown in Figure 4.

A more comprehensive explanation of the proposed configuration item and activity numbering convention is provided in Attachment 1 of this plan.

3.2.5 Proposed Configuration Identification Responsibilities

The responsibilities for developing, assigning, and utilizing site characterization configuration identifiers would be as follow:

1. Project Control Branch (PCB) develops the WBS and extends it sufficiently to clearly define all elements subject to configuration management based on the design baseline (i.e., SCPB, MGDS-SR, ESF-DR).

2. The Regulatory and Site Evaluation Division (RSED) develops the SCPB to define the site characterization investigations, studies, and activities needed to resolve design and performance issues.

3. The YMP Assessment Team identifies items and activities to be placed on the Q-List, QAL and PR List.

4. The M&O contractor determines the site features and activities that will be placed under configuration management based on the Q-List, QAL and PR List (see Proposed Action discussed under Configuration Item and Activity Selection).

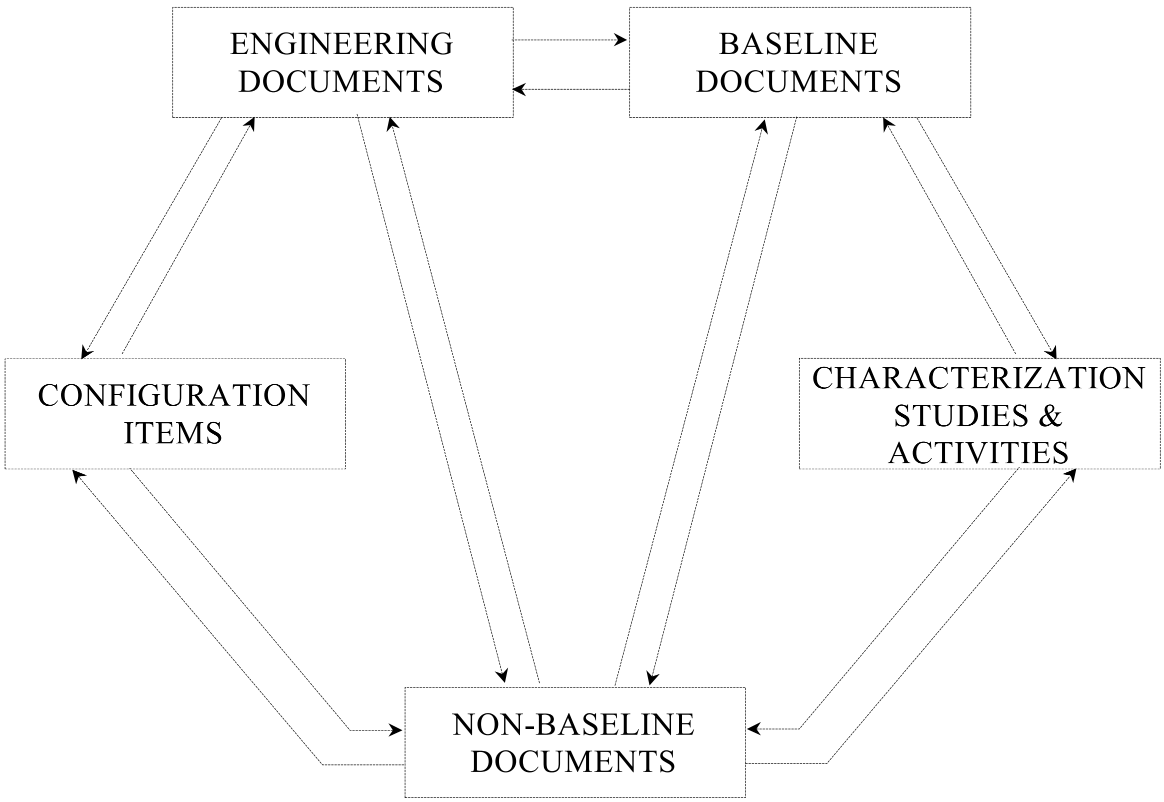
5. The M&O contractor assigns identifiers at the activity level, based on the WBS and SCPB.

6. The responsible YMP Participant assigns alphanumeric descriptors to features or activities below the activity level of the SCPB.

7. YMP Participants utilize these configuration identifiers and cross-reference to these identifiers throughout the life of the YMP.

8. The responsible YMP Participant prepares data sheets or enters the unique identifier into the CIS along with other descriptive and cross-reference information, such as name of the feature or title of the activity, and documentation that describes the feature or activity.

FIGURE 1
TYPICAL CONFIGURATION ITEM AND
DOCUMENTATION RELATIONSHIPS



NOTE: Engineering Documents consist of the drawings and specifications required to define, procure, fabricate, construct, install, and test the specific piece of equipment defined as a configuration item.

EXAMPLE: A proposed change to an engineering document could impact a baseline document requiring revision of the baseline document before the engineering document could be changed. The change to the engineering document could also impact: other engineering documents; the physical configuration of the CI; and non-baseline documents, such as operating procedures.

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Responsibilities for developing, assigning, and utilizing MGDS subsystem component configuration identifiers would be as follow:

1. The WBS, Q-List, QAL, and PR List are developed and maintained as described above.

2. In the MGDS-SR and subordinate design requirements documents, the Engineering and Development Division (EDD) defines the physical subsystems and establishes the uniform major system acquisition cost account identification codes which will be used in all design documents that deal with the physical subsystems.

3. The M&O contractor defines the function codes to be used for components and sub-components consistent with those recommended by the Institute of Electrical and Electronic Engineers (IEEE) but customized to meet the needs of the YMP.

4. EDD assigns identifiers based on the WBS, MGDS-SR and subordinate design requirements documents, Configuration Management defined function codes, and EDD assigned unique "addresses."

5. EDD captures the configuration identifier for the component on the drawings.

6. YMP Participants use these component identifiers and cross-reference to these identifiers throughout the life of the YMP.

7. EDD or the responsible YMP Participant prepare data sheets or enter the unique component identifier into the CIS along with other descriptive and cross-reference information, such as name of the component, next higher assembly, documentation that describes the component, and part numbers.

3.2.6 Management Control of YMP Participants

DOE 4700.1, Part III.C.3 states that non-DOE organizations participating in the project, "...Be required for their portion of the work to prepare and maintain a configuration management plan that integrates with the project level plan." The Order further states that, "The plan should include discussion of how configuration management will be conducted on the project and what items will be so managed."

The intent of DOE 4700.1 is to contractually require YMP Participants to develop configuration management programs that are integrated with the YMP CMP. The YMPO has yet to fund this for Participants and so this is not currently being done for the YMP.

FIGURE 2
CONFIGURATION ITEM AND ACTIVITY IDENTIFIER

<u>XXXXX</u> <u>Y</u> <u>ZZZZZZZZZZ</u>

ITEM OR ACTIVITY IDENTIFIER

ALPHA DESIGNATOR, S = SITE CHARACTERIZATION
M = MGDS SYSTEM

WBS 3rd, 4th, 5th, 6th, & 7th LEVEL IDENTIFIER

FIGURE 3
SITE CHARACTERIZATION CONFIGURATION IDENTIFIER

<u>XXXXX</u> <u>S</u> <u>ZZ</u> <u>ZZZZZZZZ</u>

CHARACTERIZATION FEATURE OR ACTIVITY DESCRIPTOR

ITEM OR ACTIVITY IDENTIFIER

ALPHA DESIGNATOR, S = SITE CHARACTERIZATION
M = MGDS SYSTEM

WBS 3rd, 4th, 5th, 6th, & 7th LEVEL IDENTIFIER

FIGURE 4
MGDS SUBSYSTEM COMPONENT CONFIGURATION IDENTIFIER

<u>XXXXX</u> <u>M</u> <u>ZZZ</u> <u>ZZZZZZZ</u>

UNIQUE COMPONENT CODE AND ADDRESS IDENTIFIER

MGDS-SR SUBSYSTEM CODE

ALPHA DESIGNATOR, S = SITE CHARACTERIZATION
M = MGDS SYSTEM

WBS 3rd, 4th, 5th, 6th, & 7th LEVEL IDENTIFIER

The changes proposed to resolve the issues impacting the integrity of configuration identification and to enhance control of the Project Baseline require consistent implementation on the part of YMP Participants. Without appropriate contractual agreement commitments on YMP Participants, YMP management controls will be inadequate to ensure consistent implementation of the YMP's configuration identification methodology.

3.3 Proposed Action

To ensure a CI numbering convention that will support YMP requirements throughout the YMP life cycle:

1. The M&O contractor should revise the YMP CMP to incorporate and implement the numbering convention and configuration identification responsibilities proposed in this plan.

2. The M&O contractor should revise the WBS to reflect revised site characterization activities and more detailed identification of the MGDS physical structures, systems, and subsystems. When this approach is adopted by the YMP, the numbering convention proposed in this plan can be simplified.

To ensure consistency and efficient implementation of the YMP's configuration identification methodology by YMP Participants, DOE should implement contractual agreement changes that will require YMP Participant compliance with the revised YMP CMP and allocate funding for the development and implementation of Participant configuration management plans and processes.

4. CONFIGURATION INFORMATION SYSTEM

4.1 Current Situation

As discussed under Project Baseline Control, configuration status accounting is essential for the YMP to maintain configuration control. The YMP currently has a limited Configuration Information System (CIS) written in the INGRES language, to track change requests and interface memoranda.

However, the existing CIS/INGRES system cannot support the volume of data and complexity of data relationships (See Figure 1) required over the YMP's life cycle.

Additionally, the YMP's Controlled Document Information System (CDIS), which is used to manage and control the flow of documents, is incompatible with CIS/INGRES which prevents accurate, detailed, and expedient retrieval of CI related document information.

4.2 Background Information

DOE O 4700.1 calls for the establishment of an information data base to maintain the Project Baseline. In support of this requirement, the CMP established configuration status accounting requirements including the requirements for a computerized information system to track and cross-reference CIs and their associated baseline and non-baseline documentation.

The existing information system, CIS/INGRES, cannot support the YMP's configuration status accounting requirements. The inadequacy of the CIS/INGRES and the need for an enhanced CIS was recognized eighteen months ago. Efforts towards obtaining an enhanced CIS include:

1. Development of a Functional Analysis Report (July 1990).

2. Development of the Software Requirements Specification Report (July 1991).

3. Completion of the Make-or-Buy Analysis Report (August 1991).

The Make or Buy Analysis Report recommended that the YMP lease a configuration management software product called CMstat. The capabilities of CMstat are discussed in detail in the referenced reports. However, it should be noted that CMstat was leased for a six month period to analyze and evaluate its capabilities. Information from the analysis was used in development of the YMP software requirements specification. CMstat was also used at the Yucca Mountain Site Office during initial field work where it proved to be instrumental in supporting configuration management activities.

CMstat can also be used to provide the required level of document and CI information integration that the YMP is currently lacking. The primary cause of this integration problem is that CIS/INGRES and CDIS are written in two different and incompatible computer languages. The inability of the two data based to directly communicate means that CI to document relationships cannot easily be established either electronically or mechanically. An upgraded version of CMstat that has the functionality needed to manage and maintain controlled documents will be released Winter 1991. Replacing both CDIS and CIS/INGRES with CMstat, a single data base, resolves the language incompatibility and provides accurate, detailed, and expedient retrieval of information for both configuration status accounting and document control.

The benefits of replacing CDIS and CIS/INGRES with CMstat are numerous and include:

1. Document Control will be able to index documents by CI, cross-reference CIs to documents, and record the changes to the documents.

2. Configuration Management will be able to provide computerized review, approval, and tracking of documents, Change Requests, deviations, and waivers.

3. Configuration Management will be able to assess change impacts and create Affected Document Notices based on information already in the data base.

4. Records Management will be able to obtain reports for any given CI that identify all reference documents including their history, and deviations and waivers associated with the CI.

5. Configuration Management will be able to provide information on the configuration hierarchy including what CIs have changes posted against them, which documents are affected by a change, where changes are in the review and approval process, complete and thorough impact analysis, and indentured part and document lists.

6. YMP Participants can access CMstat to determine the latest revision of a document, identify documents affected by a proposed change, and prepare preliminary change impact assessments. This represents a significant improvement in timeliness of information.

4.3 Proposed Action

The M&O contractor should replace the current CIS INGRES with CMstat. This will ensure a CIS that can support the volume of data and complexity of data relationships required over the YMP's life cycle.

The M&O contractor should replace the current CDIS with CMstat. This will ensure a document information system which can support the required level of document and CI information integration.

ATTACHMENT 1
CONFIGURATION IDENTIFIERS
FOR
SITE CHARACTERIZATION FEATURES AND ACTIVITIES
AND
MGDS PHYSICAL SUBSYSTEM COMPONENTS

Configuration Identifiers for Site Characterization Features and Activities

Site features and activities significant to development of data for site characterization will be placed under configuration management and have a unique configuration identifier. The identifier will be based on the WBS and SCPB as follows:

- The lowest level identifier from the YMP WBS Dictionary (currently the "study" level) for the feature or activity will be included in the configuration identifier.

Example: 32842 WBS third through seventh-level identifier for study: Loc. & Rec. of Fault Near Prosp. Surf. Facil.

- The configuration identifier will include identification of features or activities by their SCPB paragraph number (currently the "activity" level). This portion of the identifier will be prefixed by an "S" to identify it as site characterization.

Example: S02 Where "02" is SCPB activity identifier 8.3.1.17.4.2.2, "Conduct Exploratory Trenching in Midway Valley," for SCPB study 8.3.1.17.4.2 corresponding to WBS 1.2.3.2.8.4.2

- Features or activities below the activity level will be uniquely identified in the configuration identifier by an alphanumeric descriptor.

Example: QFT01 for Quaternary Fault Trench 01

- The complete identifier is then established.

Example: 32842S02QFT01

Figure 1-1 illustrates the complete breakdown of the identifiers.

FIGURE A-1
SITE CHARACTERIZATION CONFIGURATION IDENTIFIER

3 2 8 4 2 S 02 Q F T 0 1 - - -

QUARTERNARY FAULT TRENCH 01

CONDUCT EXPLORATORY TRENCHING IN MIDWAY VALLEY

DESIGNATES AS SITE CHARACTERIZATION

WBS 7th LEVEL - LOC. & REC. OF FAULT NEAR PROSP. SURF. FACIL.

WBS 6th LEVEL - DATA COLLECTION AND ANALYSIS

WBS 5th LEVEL - PRECLOSURE TECTONICS

WBS 4th LEVEL - GEOLOGY

WBS 3rd LEVEL - SITE

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Configuration Identifiers for MGDS Subsystem Components

Items comprising the physical structures, systems, components, and software of the MGDS will be placed under configuration management and be assigned a unique component identifier. The component identifier will be based on the WBS and MGDS-SR as follows:

- The lowest level identifier from the YMP WBS Dictionary applicable to the component will be included in the identifier.

Example: 67100 WBS third through seventh-level identifier for: ESF Underground Service Systems: Utilities, Services & Communications

- The uniform major system acquisition cost account identification code for physical subsystems from the MGDS-SR will be part of the unique identifier. This portion of the identifier will be prefixed by an “M” to identify it as a system requirement.

Example: M468 Where “468” is the code for ESF Underground Utility System, Fire Protection System

- The code for the components major function will be part of the unique identifier.

Example: FCV Where “FCV” is the IEEE recommended code for a Flow Control Valve

- A unique address for the component within the subsystem will be part of the component identifier.

Example: 1003

- The complete identifier is then established.

Example: 671000M468FCV1003

Figure 1-2 illustrates the complete breakdown of the identifier

FIGURE A-2
MGDS SUBSYSTEM COMPONENT CONFIGURATION IDENTIFIER

6 7 1 0 0 M 4 6 8 F C V 1 0 0 3

UNIQUE ADDRESS WITHIN SYSTEM/SUBSYSTEM

IEEE CODE FOR FLOW CONTROL VALVE

CONDUCT EXPLORATORY TRENCHING IN MIDWAY VALLEY

DESIGNATES AS MGDS SYSTEM

WBS 7th LEVEL - NONE

WBS 6th LEVEL - NONE

WBS 5th LEVEL - UTILITIES, SERVICES & COMMUNICATIONS

WBS 4th LEVEL - UNDERGROUND SERVICE SYSTEMS

WBS 3rd LEVEL - ESF

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Subcomponent Identification

As design evolves or as operations and maintenance needs require, a further breakdown of the component into subcomponents can occur. The unique identifier for the subcomponent consists of:

- The WBS identifier, MGDS-SR Code, and address portions of the parent component unique identifier, per above

Example: 67100M708___1003 with

The IEEE code for the subcomponent's major function in place of the IEEE code for the component's major function.

Example: 67100M708FCI1003 Where "FCI" is the IEEE recommended code for the Flow Control Indicator associated with the FCV