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Preliminary Paper

Integrated Control Process for the Development of the Mined Geologic Disposal System

Abstract

The U.S. Department of Energy (DOE) Order 430.1, Life Cycle Asset Management begins to focus DOE Programs and Projects on the total system life cycle instead of looking at project execution or operation as individual components. As DOE begins to implement this order, the DOE Management and Operating contractors must develop a process to control not only the contract baseline but the overall life cycle baseline. This paper presents an integrated process that is currently being developed on the Yucca Mountain Project for DOE. The process integrates the current contract/project baseline management process with the management control process for design and the configuration management change control process.

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Integrated Control Process for the Development of the Mined Geologic Disposal System

Introduction/Background

The U.S. Department of Energy (DOE) Order 430.1, Life Cycle Asset Management begins to focus DOE Programs and Projects on the total system life-cycle instead of looking at project execution or operation as individual components. DOE Order 430.1, Life Cycle Asset Management places requirements on DOE Programs and Projects to :

- use a value-added, quality driven, graded approach to life-cycle asset management;
- use an integrated systematic approach that shall ensure consideration of maintainability, operability, life-cycle costs, and configuration integrity in designs and acquisitions;
- use a configuration management process to ensure the integrity of physical assets and systems.

As DOE begins to implement this order, the Management and Operating (M&O) contractors for DOE must develop a process to control not only the contract baseline but the total system life cycle baseline. This paper presents an integrated process that is currently being developed on the

Yucca Mountain Site Characterization Project (YMP) for DOE. The process integrates the current contract/project baseline management process with the management control process for design and the configuration management change control process.

The objectives of the YMP are to develop a Viability Assessment, Environmental Impact Statement, a Site Recommendation report, and, if the site is approved, complete and submit a License Application for construction of a Mined Geologic Repository for spent nuclear fuel and high-level waste. The development phase of the YMP includes the characterization of the natural barrier (site); design of the engineered barrier, waste package, waste handling facilities/systems, and balance of plant; performance assessment of the natural and engineered barriers; and development of regulatory documentation, supporting the above objectives. Currently, a Project Baseline has been established which controls the contractual baseline with the Civilian Radioactive Waste Management System (CRWMS) Management and Operating (M&O) Contractor during this development phase. The work products being developed by the CRWMS M&O Contractor that are prescribed by the Project Baseline include the specification for the design of the potential Mined Geologic Disposal System (MGDS). These design outputs provide the basis for the overall total system life-cycle cost. To control the life cycle cost, schedule, and design, a total system life-cycle baseline is being established.

An effort is underway to provide a process for the control of the total system life-cycle cost, schedule, and technical baseline as well as the Project Baseline (work scope, technical

requirements baseline, cost, and milestones). The CRWMS M&O Contractor is integrating three separate processes into a single control process in order to reduce redundancy and to ensure directed changes to requirements, or design, are captured not only in the Project costs, but in the total system life-cycle costs. This Integrated Control Process is being developed to provide adequate controls for the work, the products, and processes of the development phase for both contractual baselines and total system life-cycle baselines. The associated control processes on the YMP are Project Baseline Management, Management Controls, and Configuration Management

Project Baseline Management

The Project Baseline is approved and changed through the authority of the DOE's YMP Change Control Board (CCB). The YMP CCB is chaired by the DOE's Project Manager for the Yucca Mountain Site Characterization Office (YMSCO) and its membership is comprised of the YMSCO Senior Managers and staff.

The Project Baseline Management process establishes and manages changes to the Project Baseline and supporting data. The Project Baseline is used to measure the technical, cost and schedule progress and performance of the YMP and contractors during the development phase of the MGDS. The Project Baseline involves defining and understanding the scope of work, scheduling of work elements (activities) and resultant products, and estimating the cost of the

work elements (budget).

The scope of work includes the structure and description of work elements, specifying the Project requirements and constraints for the work elements, and the identification of the products and completion criteria associated with each of the work elements.

The milestones are the dates for the completion of the work and the associated activity durations and interdependencies (schedule).

The budget is the planned cost of the work scopes supported by a detailed cost estimate of the activities.

The DOE's technical requirements are established in a set of controlled documents that are referred to as the Technical Requirements Baseline portion of the Project Baseline. During the development phase, the technical work scope consists of the analyses (e.g., scientific investigations, criteria, design, performance assessment, regulatory, etc.) and supporting activities (e.g., project control, ES&H, construction, operations, etc.) that are needed to derive solutions to the Technical Requirements Baseline. As part of the establishment of the Project Baseline, the traceability to the Technical Requirements Baseline is documented in the work scope elements.

This data structure allows for the quick identification of the work scope potentially impacted, when there is a change to Technical Requirements Baseline. A work scope analysis is conducted that then defines the work scope elements that need to be rescheduled, added, or deleted. New or revised cost estimates are then produced for the affected work scope elements. The results of this effort provide the means for the systematic management of changes to the Project Baseline resulting from changes to the Technical Requirements Baseline.

Management Control

The second process, Management Control, provides a structured methodology for approving changes to the MGDS reference design, which is an output of the work prescribed in the Project Baseline. In the development of the design, a formal design control process is used to control technical changes to design. This process has included detailed peer and management reviews of the technical aspects of design analyses as well as design drawings and specifications. The management control process was established to provide a detailed evaluation of the total system life cycle cost and life cycle schedule impacts associated with the approved technical changes to the design. This provides management with the opportunity to evaluate the implementation of a design change based on the total systems life-cycle cost, schedule and technical impacts.

The process is initiated after approval of a design product (analyses, specification, drawing, etc.). Once approved, the lead design engineer provides a summary of the total system life-cycle cost

and schedule impacts for all changes to configuration items contained in the reference design. In addition, a brief summary is provided which includes the reason for the technical change, as well as a description of the change. This cost/technical approval package is then reviewed by the Design Manager to provide concurrence on the package.

If the Design Engineer provides concurrence on the package, the package is submitted to the responsible CRWMS M&O Operations Manager, the CRWMS M&O Assistant General Manager, the DOE Assistant Manager for Licensing, DOE Project Manager for the YMSCO, and to the OCRWM Director for review and approval based on established life-cycle thresholds. The establishment of the life cycle operating and capital cost thresholds allows the Project to implement a graded approach to the management control process. Once approved, at the appropriate level, all managers are informed of the decision in order to provide clear communication among the CRWMS M&O, the YMSCO and the OCRWM - HQ. After approval, the change is incorporated in the MGDS reference design.

Configuration Management

The CRWMS M&O is implementing an approved Configuration Management (CM) Program. The CM Program identifies, documents, and controls the physical, functional, and interface characteristics of hardware and software design, throughout their life cycles, providing overall design traceability. It is the means by which the CRWMS M&O documents, structures,

manages, and tracks the evolution of the design, its basis, associated cost and schedule, and verification of compliance to requirements. The primary elements of the CM Program include Configuration Identification, Change Control, Status Accounting, Configuration Verification, and Interface Management. This section addresses the Configuration Identification and Change Control portions of the CM Program.

The CM Program uses a System Architecture to delineate the physical (e.g., structures, systems, and components) that comprise the MGDS. Documentation associated with each element of the System Architecture is tracked, retrievable, and traceable to that element.

Once the System Architecture is documented, configuration items (CIs) are identified. A CI is a key element in the design and operation of the MGDS. CIs are selected by applying approved CI selection criteria to Project system, structure, and component physical and functional characteristics identified in design input and output documentation.

A graded approach is used to assign different levels of control between CIs and non-CIs. Potential impacts caused by modifications to CIs require a higher level of technical and management review, documentation, and disposition. Reviews for CIs are performed by an established Configuration Control Board (CCB) or change authority. Modifications to non-CIs are not typically reviewed by the CCB, but are documented, tracked and controlled using the Engineering Change Request process and the Configuration Identification System (CIS).

Modifications to a CI can affect its form, fit, and/or function and alter its prescribed design and/or operational requirements. The Engineering Change Request (ECR) is used to document relevant information for proposed modifications including cost/schedule impacts, importance to safety and waste isolation, affected documents, and justification for the modification. The ECR process is complemented by the Cross Reference Index (CRI) data base and the Changes Pending Log (CPL) tracking system. The CRI data base provides the ability to identify user documentation affected by a modification. The CPL tracks ECRs against a document. The functional effectiveness of these three processes is dependant on processing this information through a single point of control (i.e. the CCB). An Action Item (AI) Log identifies, tracks, and communicates assigned action items from the CCB, or other CM Program activities, to responsible individuals and organizations.

The CM Program provides the mechanism for establishing a Configuration Baseline for the MGDS. The Configuration Baseline is the result of the work conducted as prescribed in the Project Baseline.

Integrated Control

The integration of the three control processes (Project Baseline Management, Management Control, and Configuration Management) has just recently been initiated on the YMP. As such the information provided here is preliminary. The final paper will include the updated process

for control.

It is currently envisioned that the three processes can be integrated in the following fashion. First, the Project Baseline Management process provides the control of the work, cost, and schedule that generates the products developed during the development phase. This work includes the development of requirements documents, criteria analyses, design analyses, specification, and scientific analyses. The Management Control process provides a structured methodology for the control of the MGDS reference design and associated total system life-cycle cost and schedule. Finally, the Configuration Management process controls and structures the detailed design output documentation for the MGDS configuration and associated detailed cost estimate and schedule. To integrate the processes, the same levels of management approval in the Management Control process are being implemented in the Configuration Management process. In addition, the Program and Project Change Control Boards for the control of the Project Baseline are being integrated with a CRWMS M&O Configuration Control Board for the control of the MGDS configuration. The following example is provided to describe how the three processes are planned to be integrated.

First, a change to a Project requirement is identified. After the requirement is identified, a change request is developed to make the change to the Project work scope (i.e., analyses). This change reflects the estimated Project cost associated with updating the requirements documents (criteria and functional analyses) and conducting the analysis to determine the impacts on design.

This change request includes the Project work scope, cost, and milestone changes that are required to execute the change. After approval, the requirement document is updated and the criteria and design analyses completed. After completion, the proposed changes to the design are identified and a configuration change proposal submitted to the appropriate level CCB for approval. The change proposal includes a description of the life cycle cost and schedule impacts, as well as, the impacts to the System Architecture. After approval of the change control proposal, the design change is implemented in the design specifications or detailed design drawings as required. In addition, the updates are documented in the System Architecture and CI listing. Finally, after the change is implemented, the change is captured in the System Description Documents and the Reference Design Description.

Summary

The Yucca Mountain Site Characterization Project is in the process of integrating three processes for the control of the developmental phase work scope, cost, and milestones and the overall life-cycle cost, schedule, and technical baselines. The process presented provides a method of ensuring the CRWMS M&O and DOE control the Project Baseline (work scope, cost, milestones, and Technical Requirements Baselines) associated with the current contractual phase while ensuring the MGDS is designed in a controlled and cost effective manner with respect to the overall system life cycle.

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Mr. Daniel is a Sr. Systems Engineer for TRW working on the Mined Geologic Disposal System for the storage of high-level radioactive waste. He has been responsible for leading the team effort to develop the Reference Design Description Document for a Geologic Repository and the Management Control Process for Design. Mr. Daniel has also lead the efforts to update the MGDS Concept of Operations and was the initial team leader for the development of the Technical Management Implementation Plan. Mr. Daniel has also served as the TRW Task Leader to Westinghouse at the Savannah River Site on the Spent Nuclear Fuel Transfer and Storage Facility.

Prior to joining TRW, Mr. Daniel was a Deputy Division Manager for SAIC for 3 years. His work concentrated on the measurement of the radiation environments on the underground nuclear effect tests. In addition Mr. Daniel served 10 years in the USMC. Mr. Daniel is a graduate of the US Naval Academy with a BS in Marine Engineering. He also has a MS in Nuclear Engineering (Effects) from the Air Force Institute of Technology.

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Mr. Harbert has 10 years of experience in systems engineering and configuration management on large, complex DOE projects. Mr. Harbert is currently a Systems Engineer for TRW supervising the Project Baseline management function on the Yucca Mountain Site Characterization Project. His experience includes technical and programmatic functional and requirements analysis, system requirements document development, configuration management, and development of technical management and project management plans. Previously, Mr. Harbert was the Lead Systems Engineer for the Accelerator systems of the APT facility during the Conceptual Design phase and the Configuration Management Manager on the Yucca Mountian Site Characterization Project. He is a member of INCOSE and ACDM. Mr. Harbert

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Mr. Calloway has over 25 years of technical and management experience in civil engineering, design change control, configuration management, information systems development, quality assurance, records management, and document control. This experience includes 17 years in the Tennessee Valley Authority's division of Engineering Design. During this period, his duties included interfacing with the Nuclear Regulatory Commission (NRC) to assure design change control activities conformed to NQA-1 and NRC requirements. He has broad experience in the development, implementation, and management of information systems and project management plans that meet federal and nuclear requirements. He currently serves as Configuration Management Supervisor for the Mined Geologic Disposal System (MGDS). Prior to joining the MGDS, Mr. Calloway provided configuration management support for environmental restoration and waste management activities for the Oak Ridge National Laboratory (ORNL) and Idaho National Engineering and Environmental Laboratory (INEEL). Mr. Calloway received his BS in Civil Engineering from Tennessee Technological University and CMII Certification from the Arizona State University in 1994.

Technical Track: SE Applications

Special Interest Area: Other: Project Baselines/Configuration Management