QA: N/A

Preliminary Paper

Development of the Reference Design Description for a Geologic Repository

Abstract

As the Management and Operating Contractor for the Department of Energy (DOE), TRW developed the "Reference Design Description for a Geologic Repository." The document describes the current design expectations for a potential geologic repository that could be located at Yucca Mountain in Nevada. The Reference Design Description conveys the surface and subsurface repository and the disposal container design. Additionally, it presents the expected long-term performance of the potential repository. This paper presents the systems approach used to develop the document. In addition, the role of the Reference Design Description in the overall systems design approach to the Mined Geologic Disposal Systems (MGDS) is discussed. Finally, the overall benefits provided to the Civilian Radioactive Waste Management System (CRWMS) and Yucca Mountain Project (YMP) by the Refernce Design Description are discussed.

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Development of the Reference Design Description
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Introduction

As the prime contractor for the Management and Operating Contract with the DOE, TRW Environmental Safety Systems has developed a "Reference Design Description for a Geologic Repository." The document was based on the Baseline Concept Description/Baseline System Description (BCD/BSD) document concept developed by TRW. The document effectively simplifies systems engineering/configuration management tasks by serving as a vehicle for documenting the results of the iterative approach to the development of the Mined Geologic Disposal System. This document also serves to communicate the system design to members of the Civilian Radioactive Waste Management System (CRWMS) team, stakeholders and oversight groups.

During March 1997, senior management from the M&O and from the DOE determined that the design control process being utilized by the M&O should be enhanced. The M&O design was being controlled through a quality affecting control process. In addition, the advanced conceptual design had been completed and the M&O was developing a design for a key project milestone, Viability Assessment. However, a mechanism to manage the changes during these early phases of design had not been established. As such, the Reference Design Description was developed to provide senior management visibility into the current reference design. In addition, a change process was developed to control changes to the Reference Design Description document. Thus, the document and the process to change the document served to enhance the current M&O design control process.

Due to the high priority of the task, the M&O was asked to develop, produce and distribute this reference design description within a two month period. As such, a systems engineering approach was used to develop the document. The following sections describe how the system engineering approach was used to develop the document and also discusses how the RDD satisfied the enhancement of the design control process by providing a simplified configuration management function. In addition, the benefits derived from the RDD and the RDD change process are presented.

RDD Requirement Development

In order to complete the document in the required time, the key to success was determined to be

the development and concurrence on the requirements for the RDD scope, the level of detail to be presented and the format the document would utilize. As with many large projects, failure to accomplish this task could result in failure since managers at each level had a vision for the document content. In order to determine the requirements and to get buy-in/approval from management, a draft of three or four key pages in the RDD was established. The pages served to present the format and level of detail that would be included. In addition, a detailed table of contents was developed. The table of contents was developed around the key physical architecture (systems, structures, and components (SSCs)) that were currently defined for the Project. In addition, a simple analysis was performed to determine the effect of changes in the key systems on the Project costs and schedule. A review of the analyses previously conducted was performed to determine which SSCs were important to radiological safety or waste isolation and did not have Nuclear Regulatory Commission (NRC) precedence.

Once the draft sample pages were developed (based on the BCD/BSD concept), the table of contents was developed and an initial meeting of the key M&O management was conducted to review the sample pages and table of contents. After receiving acceptance of the approach from management, a development team was organized as discussed below. In addition, the draft concept was presented to DOE management to ensure that the final M&O product would meet the customers needs and expectations.

As a result of these meetings, an overall concept was developed, a page limit was established, the key SSCs to be included in the RDD were identified and the level of detail for the document was defined.

RDD Team Development

The RDD was established to capture the key design aspects for the potential repository. As such, it was a document that cut across all teammate and organizational boundaries. The format and context of the RDD also required that professional technical writers and graphic artists be involved in the development. This complexity led to the development of an Integrated Product Team. The multi-disciplined team consisted of personnel from the MGDS Systems Engineering and Integration, Surface Design, Subsurface Design, Waste Package Development, Institutional and External Affairs, and Graphics departments. The MGDS Requirements, Integration, and Configuration Management Department facilitated the document development and served to integrate the input from the technical leads.

This team organization also served to assist in integrating the overall reference design concepts. By meeting on a daily basis and providing continuous feedback, the team was informed on the progress that was being made as well as the details that were being incorporated. The primary goal of the development team was to establish the initial revision of the RDD. The team then served as the integration mechanism for resolving comments from the M&O management

reviewers.

RDD Development and Review

As stated above, the initial drafts of the RDD pages were developed by the technical leads. These drafts were then consolidated and integrated by the systems engineering lead into a draft document. As the technical input was being prepared, the information was also being passed to the technical writer and the graphic artist. This provided a possibility for rework if changes to the technical input were made and also provided a control mechanism for changes. Since all changes were forwarded to the technical writer and graphics personnel through the systems engineering lead, changes could be managed and controlled.

In order to approve the RDD, three levels of M&O approval and two levels of DOE approval were required. In order to expedite the review, a process was established which integrated the M&O and DOE approvals and also utilized review presentations to the reviewers instead of a formal document review process. The initial review presentation was to the Project Engineering, MGDS Development, and MGDS Systems Engineering/Integration Managers. This review served to ensure the design was consistent with management direction and that the design was integrated within the M&O engineering organization. After completion of this review, a review presentation was made to key DOE management and the M&O engineering organization managers. During the formal briefings for review, an informal review was conducted with the other M&O managers as well as the M&O personnel supporting the overall Civilian Radioactive Waste Management System Program. This informal review served to make the other areas within the Project/Program aware of the task being performed and provided these areas the opportunity to note potential interface conflicts. After completion of these reviews, signatures were obtained from the M&O management and final approval from the M&O Assistant General Manager was obtained.

After completion and publication of the RDD, it was noted that the RDD was a great communication tool but that the RDD itself did not control the design. However, the process utilized to develop the document and the approval of the document did serve to control the design. As such, the RDD change procedure was developed to capture the process. The procedure was also used to define the cost and schedule threshold for each level of M&O or DOE management approval.

Role of the RDD

The original role of the RDD was to provide management control for changes in the design. However, the RDD document itself, as developed, serves as a communication tool within the Project/Program as well as a communication tool for external stakeholders and oversight groups (including the Nuclear Regulatory Commission, the Nuclear Waste Technical Review Board, Congressional staff, and the general public). Internal to the Project, the RDD provides a summary of the current design which is reviewed quarterly and updated as needed based on design changes.

This collection of the key design features serves to integrate the design components (surface, subsurface, and waste package) as well as the scientific studies, environmental impact analyses and the performance assessment. Even though the RDD is currently a summary level document, the document contains enough information to provide the reader with the key concepts. The detailed information can then be obtained in the formal design drawings, specifications and analyses.

In addition to the RDD document being a communication tool, the RDD process has proven to be an extremely beneficial design control tool for the Project. This process is providing a management control mechanism which ensure management buy-in and approval of technical changes to the design concepts. This process will serve to provide this control until the formal design specifications and drawings are brought under configuration control.

Conclusion

The development of the RDD has exceeded the requirements established for the document. The RDD has become a valuable tool for the senior level manager as well as the technical leads on the Project. By utilizing the structured systems engineering approach, the requirements were developed up front and the expected results were measurable. In addition, the utilization of the Integrated Product Teams allowed the RDD to be developed in parallel between design organizations and the support personnel. The utilization of the Integrated Product Teams also provided the basis for the overall integration of the document. Finally, the review process as well as the documentation of the review process has provided the enhancement to the M&O design control process as required.