

IMPLEMENTATION OF NUREG 1318 GUIDANCE
WITHIN THE YUCCA MOUNTAIN PROJECT

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L. B. La Monica, J. D. Waddell, E. L. Hardin
Science Applications International Corp.
101 Convention Center Dr.
Las Vegas, NV 89109
(702)794-7000

ABSTRACT

The U. S. Department of Energy's Yucca Mountain Project is implementing a quality assurance program that fulfills the requirements of the U. S. Nuclear Regulatory Commission (NRC) as set forth in 10 CFR Part 60, Subpart G-Quality Assurance. Additional guidance for this program was provided in NUREG 1318, "Technical Position on Items and Activities in the High-Level Waste Geologic Repository Program Subject to Quality Assurance Requirements" for identification of items and activities important to public radiological safety and waste isolation for placement on a "Q-List" and "Quality Activities List" and also for graded application of QA measures. The process and organization for implementing this guidance is discussed.

INTRODUCTION

The aims of the U. S. Department of Energy (DOE) and the Yucca Mountain Project are to (1) characterize the Yucca Mountain site in order to determine its suitability for development of the nation's first high-level waste repository and (2) if the site is acceptable, obtain a license from the U. S. Nuclear Regulatory Commission to construct and operate a repository at the site. The site characterization activities and related waste package and repository design efforts encompass a broad range of disciplines and work activities, all of which must be controlled in a consistent manner to achieve these aims.

The principal regulation governing the licensing of a repository is contained in 10 CFR Part 60¹. Subpart G specifies that the DOE shall implement a quality assurance (QA) program based on the criteria of Appendix B of 10 CFR Part 50, as applicable, and supplemented by additional criteria as necessary. The Subpart G requirement applies to items on the "Q-List," namely all systems, structures, and components important to public radiological safety ("important to safety") and engineered barriers "important to waste isolation." The requirement applies also to the "Quality Activities List,"

which includes those activities that influence the characterization of the site, may have an adverse impact on the site, or may impact items on the Q-List. NUREG-1318, "Technical Position on Items and Activities in the High-Level Waste Geologic Repository Program Subject to Quality Assurance Requirements²," provides guidance for the identification of items and activities subject to QA and for the graded application of QA measures.

The Yucca Mountain Project has developed procedures for a two step process (Figure 1) to implement the guidance in NUREG 1318. The first step involves the determination of importance of items and activities. The second step involves the application of graded QA. This grading step not only identifies controls for the "Q-List" and "Quality Activities List," but also allows the project to identify any necessary controls required by DOE Order 5700.6B³ for those items and activities not appearing on these lists.

Through this process important items and activities and applicable QA controls are identified early in the work planning and authorization process. In this way, appropriate resources and schedules may be developed to integrate applicable QA controls into the performance of work and ensure the quality of the work product. The procedures are general in scope to accommodate the broad range of disciplines and work activities in the project and yet allow detailed specification of controls.

DETERMINATION OF IMPORTANCE

A combination of methods have been employed by the Yucca Mountain Project Office (Project Office) to determine the importance of items and activities in a geologic repository. These methods involve the conduct of probabilistic and deterministic safety analyses, performance allocation, performance assessment, and comprehensive evaluations of site characterization, construction, performance confirmation, operation and decommissioning activities.

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The overall process of determining importance begins with the preparation and maintenance of a set of documents that form the basis for the determination. This set of documents is known as the "basis" (Figure 1). The "basis" includes those documents that describe Project items, the full scope of Project activities, and information or data that is useful for their analysis (meteorological, hydrological, etc.). Changes to the documents that form the basis are evaluated and their effects are factored into the determination of the importance of items and activities. This ensures that the results of the process of determining importance (Q-List, Quality Activities List) are a reflection of the current version of the basis.

The documents that form the basis are provided to Assessment Teams (Figure 2) whose responsibility is to perform the technical analyses and evaluation required to determine importance. Since there is a natural division of efforts involved in determining importance to safety, a preclosure concern, and in determining importance to waste isolation, a postclosure concern, there is a separate Assessment Team for each effort. Following the guidance given in NUREG 1318, the Assessment Team responsible for determining the items important to safety analyzes the basis utilizing a combination of deterministic and probabilistic techniques to determine those "...engineered structures, systems, and components essential to the prevention

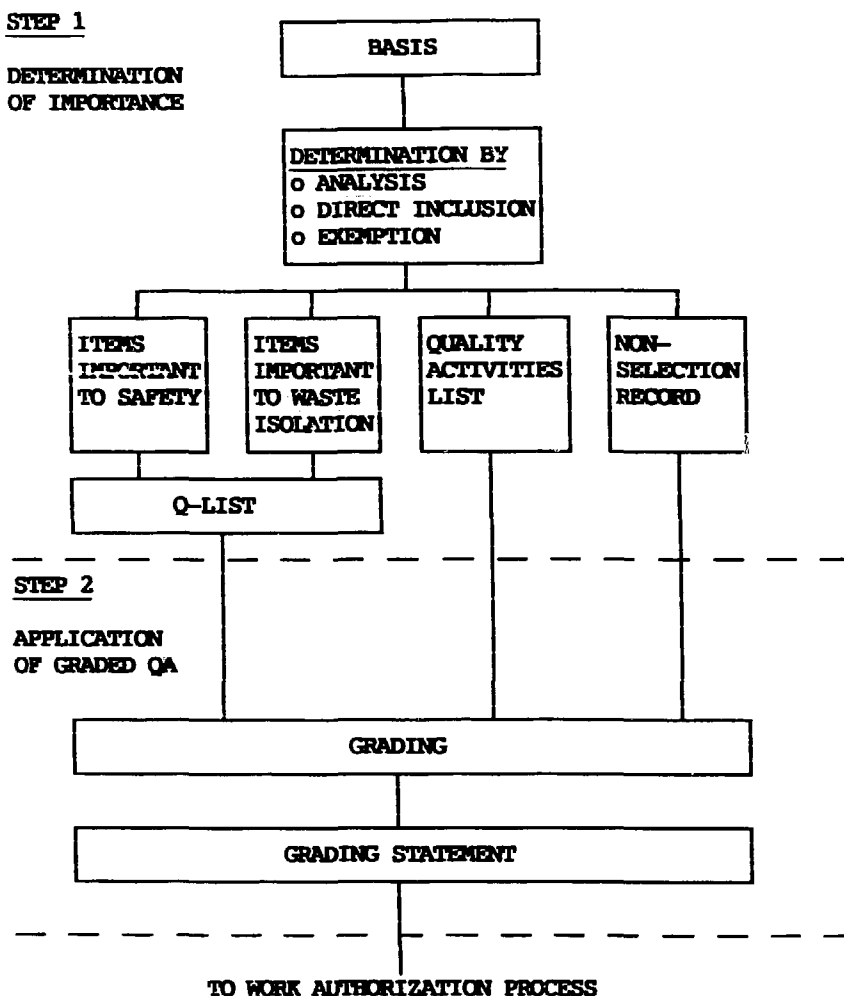


FIGURE 1. SIMPLIFIED LOGIC OF THE YUCCA MOUNTAIN PROJECT PROCESS FOR IMPLEMENTATION OF NUREG 1318 GUIDANCE.

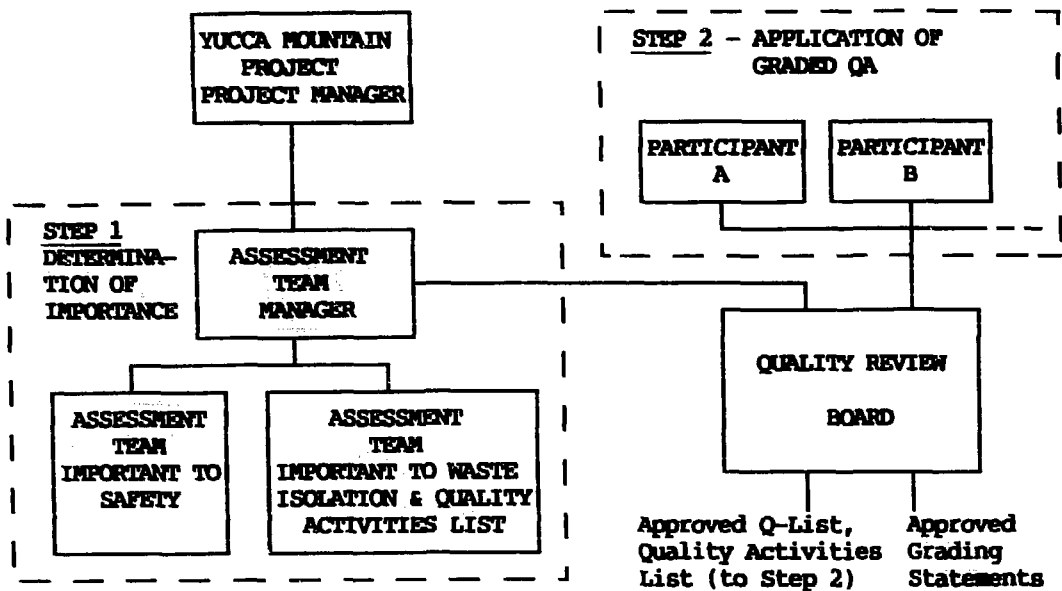


FIGURE 2. YUCCA MOUNTAIN PROJECT ORGANIZATIONAL STRUCTURE FOR IMPLEMENTATION OF NUREG 1318 GUIDANCE.

or mitigation of an accident that could result in a radiation dose...of 0.5 rem or greater at or beyond the nearest boundary of the unrestricted area..." (10 CFR 60.2). Other aspects of safety, such as worker radiological safety, are not addressed in the analysis, but are addressed by the responsible Project participants during the grading step. The Assessment Team responsible for determining the items important to waste isolation utilize performance allocation and performance assessment techniques. This Team also performs evaluations of activities to identify those activities that are important to site characterization or performance assessment or that may adversely impact a natural barrier important to waste isolation.

The Assessment Teams may also assign importance through processes known as Direct Inclusion and Exemption. The Direct Inclusion routine may be used in those instances where either the basis is not sufficiently mature to support an analysis or where it is imperative that work proceed and the time involved in conducting an in-depth analysis would be counterproductive. In these instances, it is permissible by Direct Inclusion to place an item on the Q-List or an activity on the Quality Activities List and then move on to the assignment of controls in accordance with the procedure for the grading step. The use of Direct Inclusion will in some cases lead to the conservative assignment of QA requirements. Once an item or activity is placed on either list by Direct Inclusion, it may be removed only by completing the required analysis and proving that the item or activity does not have a relationship with safety or waste isolation.

The Exemption routine is provided for use in those instances where the basis indicates a item or activity whose function and purpose are obviously unrelated to safety or waste isolation. Items and activities receiving exemption will be placed in the Non-Selection Record along with those items and activities found not important through analysis. Although an item or activity may be exempt from in-depth analysis, it is not exempt from the secondary screening for importance described by the procedure for the grading step.

After completion of their analyses and processing of requests for Direct Inclusions and/or Exemptions, the Assessment Team compile the "Items Important To Safety" and "Items Important To Waste Isolation" portions of the Q-List, the Quality Activities List and the Non-Selection Record. These three documents identify all items and activities described by the basis and indicate their importance. The Q-List contains all items that are important to public radiological safety and all engineered barriers important to waste isolation. The Q-List also includes an appendix that identifies all natural barriers important to waste isolation. The Quality Activities List contains all site characterization activities, performance assessment activities, and activities that may have an adverse impact on a natural barrier found to be important to waste isolation. The Non-Selection Record contains all items and activities that have been evaluated and do not qualify for entry on the Q-List or Quality Activities List.

The Q-List, Quality Activities List, Non-Selection Record and their supporting documentation are submitted to the Project Office Quality Review Board (ORB) (Figure 2) for technical and policy reviews. The function of the ORB is three fold: (1) to perform or direct a technical review of the lists and supporting documents, (2) to identify those areas where the Q-List, Quality Activities List, or Non-Selection Record differ from existing DOE positions, such that adjustments in other areas can be initiated, and (3) to assure that the documentation meets the standards for completeness specified by procedure. The approved Q-List, Quality Activities List, and Non-Selection Record are maintained and distributed as controlled documents in accordance with project records management procedures.

APPLICATION OF GRADED QA

The second step in the implementation of the guidance in NUREG 1318 is the determination and assignment of appropriate QA controls, a process called "grading." This step is carried out by the Project participants as part of the work planning exercise. The procedure defining this grading step not only identifies the controls required by 10 CFR Part 60 Subpart G for the "Q-List" and "Quality Activities List," but also allows the Project Participants to identify any necessary controls required by DOE Order 5700.6B for those items and activities appearing on the Non-Selection Record. The procedure involves the following sequence of actions: identify item or activity, determine importance, rate characteristics, identify applicable QA criteria, approve grading statement, and distribute statement.

Initially, the participant identifies and describes the item or activity to be graded. The Participant next reviews the current version of the Q-List or Quality Activities List and Non-Selection Record to determine its importance. If the participant's item is an item or component of an item on the Q-List (important to safety), the Participant's item is therefore important to safety. Likewise, an activity is important if it is part or all of an activity on the Quality Activities List. By this means the participant may label the item or activity as important to safety, important to waste isolation, quality activity, or as non-selected. This tag is used later in the grading process.

The lumping of lower level items or activities under a higher level Q-List item or quality activity will sometimes result in conservative assignment of QA controls. The procedure for identification of importance (Step 1 in Figure 1) provides for participant requests to re-evaluate and revise the Q-List and Quality Activities List to properly allocate importance in such cases.

Each item or activity not selected as important under the NUREG 1318 guidance is subjected to a secondary screening for its importance relative to factors such as worker radiological safety, operational reliability, and other categories of importance to be determined by the Project Office. This evaluation is necessary to ensure that QA controls are applied as required by DOE Order 5700.6B.

After determining the importance of the item or activity being graded, the participant next evaluates the characteristics of the item or activity to identify where and to what extent QA controls are necessary. The specific criteria for this evaluation are derived from the guidance in NUREG 1318 Section 5.5:

- Uniqueness
- Reproducibility or Replacement
- Complexity
- Quality History
- Degree of Standardization
- Available Codes or Standards
- Need for Process Control
- Special Shipping, Handling, and Storage

The participant rates the characteristics of the item or activity against these criteria to identify areas where control is critical. Alternative methods of control such as codes and standards may also be identified. The results of the characteristics rating process are entered on the grading statement.

The identification of applicable QA requirements is the final action in the preparation of the grading statement. The process initially assumes that all the requirements of the Yucca Mountain Project Quality Assurance Plan apply to the subject item or activity. The participant then reviews each of the 18 QA criteria versus the work scope for the item or activity in order to identify those requirements that are not pertinent. For example, requirements governing procurement are irrelevant for activities where no procurement is made.

Next, the participant considers the importance of the item or activity and the characteristics ratings to determine the applicability and extent of applicability of the remaining QA criteria. For Q-List items and quality activities and non-selected items and activities deemed important through the secondary screening process, the QA criteria shall apply, but the extent of applicability may be modified in response to the characteristics ratings to allow, for example, the use of final inspection and testing in place of in process controls to ensure quality. For non-selected items and activities not deemed important the QA criteria may not apply; however, applicable codes and standards may still be identified.

Once the participant completes a grading statement, the statement is submitted to the Quality Review Board. The review board's responsibility in this area is three fold: (1) to ensure the grading statement accounts for all aspects of an item or activity; (2) to ensure that the logic given for not selecting certain QA requirements is sound and consistent with that specified for other items or activities of a similar nature; and (3) to assure that the grading statement meets the standards set by the procedure. The grading statement is then released through the participant responsible for the item or activity and is the basis for implementation of QA controls during the course of the work.

CONCLUSION

The preparation and maintenance of the Q-List, Quality Activities List, the Non-Selection Record and the associated grading statements is a necessary part of the planning and implementation of technical activities on the Yucca Mountain Project. The process developed by the Yucca Mountain Project for the determination of importance and application of graded QA implements the guidance in NUREG 1318 and will result in the application of QA control which reflects the importance of the item or activity. The process determines importance in a manner that allows conservative assessment of QA requirements early on but provides for orderly and consistent re-evaluations as site characterization proceeds and designs mature. The grading statements establish criteria from which implementation of the QA program can be measured.

ACKNOWLEDGEMENT

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