SIXTEENTH ANNUAL NATIONAL ENERGY DIVISION CONFERENCE

Date & Place: September 17 - 20, 1989
Ft. Lauderdale, Florida

RECONSTITUTION OF DESIGN BASES AND DESIGN DOCUMENTS

BY

EUGENE V. IMBRO, CHIEF
TEAM INSPECTION DEVELOPMENT SECTION B
U.S. NUCLEAR REGULATORY COMMISSION

D102
011

RECONSTITUTION OF DESIGN BASES AND DESIGN DOCUMENTS

Introduction

The United States Nuclear Regulatory Commission has been conducting Safety System Functional Inspections (SSFIs) and Safety System Outage Modification Inspections (SSOMIs) since 1985. These inspections are somewhat different in approach. The SSFI is a system oriented inspection as opposed to the SSOMI, which focuses attention on plant modifications. Both examine design in detail. A common thread emerging from these inspections is that design basis information to support the as-configured system design and proposed plant modifications is not available. As a result of this lack of design basis information, the NRC has found in some instances plant modifications being made that potentially jeopardize the ability of safety systems to perform their intended safety function due to the lack of full understanding of the original system design requirements.

These NRC inspection findings have prompted many nuclear utilities to evaluate the availability and control of design basis documents at their facilities as a part of an overall configuration management program. In order to fill gaps discovered in the availability of design basis information, the reconstitution or regeneration of original design basis information has been necessary. However, at this point in time there is no regulatory guidance or clear industry consensus as to what constitutes an adequate set of design basis documents and many questions have been raised regarding the necessity, extent and time table for recreating missing design basis documents.

Discussion

The term "design basis document" is commonly used but not well defined. Title 10 of the Code of Federal Regulations defines "design bases" in part as that information which identifies the specific functions to be performed by a structure, system or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. Design basis documents are the documents which can be used to verify that the structures, systems or components of a facility have been designed to perform their specific identified functions and that the specific values or ranges of values for controlling parameters have been properly chosen and incorporated in the plant design. Although many consider design basis documents to be only design input documents as described below, for operating facilities we have defined the design basis documents as the set of documents that support the "as-built" plant configuration, forming the basis for future plant modifications. Design basis documents include (1) design input documents such as those that specify the performance requirements of structures, systems and components, licensee commitments to the NRC, industry standards, regulatory requirements and documented generally accepted good engineering practices; (2) design analyses such as calculations or other engineering evaluations; and (3) design output documents such as facility drawings, lists of qualified equipment, equipment purchase specifications and documents which contain interface information necessary to develop plant operating guidelines or provide information to other engineering organizations.

Design basis documents provide a necessary starting point for plant modifications. For example, without design analyses which correctly reflect the current plant configuration the impact of a plant modification on the existing design margins cannot be reliably determined. Design basis documents, in particular design output documents such as facility drawings, piping and instrumentation diagrams, electrical single-line diagrams and schematics, and equipment purchase specifications form a living record of the as-configured plant. These design output documents are necessary for plant modifications as well as for plant operations and maintenance. In addition, design input documents are also necessary. Plant modifications made without design input documents may unknowingly compromise initial design considerations since the design input documents specify the functional requirements and design criteria for structures, systems and components.

Many nuclear utilities are currently in the process of regenerating design bases. For many, this consists of preparing upper tier documents for each plant system or each plant-wide design consideration such as environmental qualification, seismic design, pipe break outside containment, etc. These system level and topical design documents vary widely in content from containing all pertinent design inputs, design analyses and design output documents, to being a summary of pertinent design inputs with references to the design analyses and design output documents. There is currently no standard approach to the format or content of the system level or topical design documents; each utility has been satisfying its own needs.

However, the development and use of these upper tier documents should reduce the possibility for design errors during the modification process by making information accessible in a single location. These upper tier documents should not be considered as a substitute for the specific plant design basis documents, i.e., design input documents, design analyses and design output documents as previously described. Therefore, for each planned modification to a structure system or component, sufficient design basis documentation should be available to support the final as-modified configuration such that a credible design verification as specified in ANSI N45.2.11-1975, "Quality Assurance Requirements for the Design of Nuclear Power Plants," can be performed.

Nuclear plants that have not appropriately controlled their design basis documentation or whose design basis documentation is unavailable, may find it necessary to recreate design analyses to support planned plant modifications. The extent that other missing calculations and design basis documents must be regenerated is an area which the industry needs to jointly address. Industry guidance which would promote the use of design basis documents in the modification process would also be of value.

One key and probably the most elusive attribute that is useful in the upper tier system and topical design basis summary documents is the reasoning behind the design, i.e., why is the design the way it is? In many cases, this will be very difficult to recapture as corporate memories of why various decisions were made have faded over the years. This information, however, if available, is extremely valuable to an engineer designing a

plant modification. Insights as to why perhaps certain components were selected or why components were installed in a particular location may not be immediately apparent. However, when the original intent is determined, systematic use of such information can prevent modifications being made to a plant that would inadvertently compromise a particular design consideration.

Conclusion

The development of system specific and topical design basis summary documents can markedly improve the modification process by providing a centralized access point for design basis information and a key to accessing the supporting design basis input, analyses, and output documents. The existence of these upper tier design basis summary documents, however is not a substitute for the supporting design basis documents. Design basis documents that support the as-configured plant design must be controlled and be readily available for use and reference by the engineering staff. A sufficient design basis must be available to support planned plant modifications such that a credible design verification can be performed in accordance with the guidance in ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants." If an adequate calculation basis does not exist to quantify the design margins remaining following a proposed modification, design analyses should be performed or recreated as necessary to support the final as-configured design of the system being modified.