



DRAFT REGULATORY GUIDE

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DRAFT REGULATORY GUIDE DG-1093

GUIDANCE AND EXAMPLES FOR IDENTIFYING 10 CFR 50.2 DESIGN BASES

A. INTRODUCTION

In 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," § 50.2, "Definitions," contains a definition of "Design Bases." Although the staff and the nuclear industry have always agreed that it is important to understand what constitutes the design bases of a plant, there has not always been agreement about the implementation of the definition in 10 CFR 50.2. The staff, in fact, has not been consistent in its implementation of the definition; further, there is a wide variation in the amount of information contained in licensee final safety analysis reports. In the mid-1980s, the staff conducted many system-specific engineering inspections and developed inspection findings that demonstrated that some licensees had not adequately maintained their design bases information as required by the NRC's regulation. In response to the problems identified during the NRC inspections and those identified by licensees, most reactor licensees initiated design bases reconstitution programs. These programs sought to identify missing design documentation and to selectively regenerate missing documentation.

In October 1990, the Nuclear Management and Resources Council (NUMARC) published its "Design Bases Program Guidelines," NUMARC 90-12.<sup>1</sup> The staff concluded that these guidelines provided a useful standard framework for implementing design reconstitution programs. The guidelines briefly discussed the definition of design bases information but did not focus on it.

In February 1991, the staff published NUREG-1397, "An Assessment of Design Control Practices and Design Reconstitution Programs in the Nuclear Power Industry."<sup>2</sup> This report provided the results of a survey that reflected the scope and performance of several utility design change control programs and design document reconstitution programs. The definitions section of this report stated that design bases

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<sup>1</sup>Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273 or (800)397-4209; fax (202)634-3343; email <[PDR@NRC.GOV](mailto:PDR@NRC.GOV)>. Electronic copies are also available in NRC's Public Electronic Reading Room, which can be accessed through the NRC's web site, <[WWW.NRC.GOV](http://WWW.NRC.GOV)> .

<sup>2</sup>Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202)512-1800); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161; (telephone (703)487-4650; <<http://www.ntis.gov/ordernow>>. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273 or (800)397-4209; fax (202)634-3343; email is [PDR@NRC.GOV](mailto:PDR@NRC.GOV).

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This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received complete staff review and does not represent an official NRC staff position.

Public comments are being solicited on the draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments may be submitted electronically through our web site, <[www.nrc.gov](http://www.nrc.gov)>. Copies of comments received may be examined at the NRC Public Document Room, 2120 L Street NW., Washington, DC. Comments will be most helpful if received by **June 15, 2000**.

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include only the design constraints that are included in current licensing bases and form the bases for the staff's safety judgments.

In August 1992, the Commission published a policy statement on "Availability and Adequacy of Design Bases Information at Nuclear Power Plants."<sup>1</sup> In the policy statement, the Commission concluded that:

[M]aintaining current and accessible design documentation is important to ensure that (1) the plant physical and functional characteristics are maintained and are consistent with the design bases as required by NRC regulation, (2) systems, structures, and components can perform their intended functions, and (3) the plant is operated in a manner consistent with the design bases.

In the policy statement, the Commission also said that all power reactor licensees should assess the accessibility and adequacy of their design bases documentation and decide whether a design reconstitution program is necessary. With regard to the NUMARC guidance, the Commission stated that:

The guidance outlines a framework to organize and collate nuclear power plant design bases information. This information provides the rationale for the design bases consistent with the definition of design bases contained in 10 CFR 50.2.

In response to the findings related to the regulatory burden of team inspections identified in the 1991 Regulatory Impact Survey<sup>1</sup> and voluntary implementation of the NUMARC guidance by licensees, the staff reduced its effort on specific, resource-intensive, design-related team inspections and followed the issue of accurate and accessible design documentation at plants principally as an element of inspection and follow up of operations-related activities.

In 1996, the staff's findings during inspections and reviews began to identify broad programmatic weaknesses that resulted in design and configuration deficiencies at some plants, which could affect the operability of required equipment, raise unreviewed safety questions, or indicate discrepancies between the plant's UFSAR and the as-built or as-modified plant or plant operating procedures. As a result of these findings, the staff issued a letter<sup>3</sup> in accordance with 10 CFR 50.54(f) to all licensees requesting information to provide the NRC added confidence and assurance that the plants were operated and maintained within the design bases and any deviations were reconciled in a timely manner.

SECY-97-160,<sup>1</sup> dated July 24, 1997, informed the Commission of the follow up activities resulting from the staff's review of licensee responses to the 10 CFR 50.54(f) request. In this paper, the staff stated that:

Based on the review of licensee responses to the 50.54(f) letter, the staff concluded that while licensees had established programs and processes to maintain their facility's design bases, there was a need to implement plant-specific follow up activities. This determination was based upon the staff having identified: (1) instances in which licensees failed to reconcile regulatory performance with their assertions that their programs and processes were

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<sup>3</sup>Letter from J. Taylor, EDO, NRC, to all nuclear utility CEOs, October 9, 1996. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273 or (800)397-4209; fax (202)634-3343; email <PDR@NRC.GOV>.

effective in maintaining their design bases, or (2) that there was a need to gain a better understanding or to validate a particular aspect of a licensee's programs and processes.

SECY-97-160 referred to the above-mentioned follow up activities as Phase 4 and stated that they were to be a combination of architect-engineer design team inspections led by the Office of Nuclear Reactor Regulation and region-led inspections, such as safety system functional inspections and safety system engineering inspections.

In addition to the 10 CFR 50.54(f) letters and the inspection activities, the staff conducted lessons-learned reviews regarding Millstone and Maine Yankee. One of the conclusions of these reviews was that the definition of design bases should be clarified. In SECY-97-205,<sup>1</sup> dated September 10, 1997, the staff provided the Commission with several options for an integrated approach to solving the problems identified during the lessons-learned reviews. In the staff requirements memorandum<sup>1</sup> on SECY-97-205, dated March 24, 1998, the Commission directed the staff to continue to develop guidance regarding design bases issues, such as specifying the type of information to be considered as design bases information. This effort was subsequently included in the staff's response to the Chairman's tasking memorandum of August 7, 1998. This regulatory guide provides the guidance requested by the Commission.

Regulatory guides are issued to describe to the public methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, to explain techniques used by the staff in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. Regulatory guides are issued in draft form for public comment to involve the public in developing the regulatory positions. Draft regulatory guides have not received complete staff review; they therefore do not represent official NRC staff positions.

The information collections contained in this draft regulatory guide are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget, approval number 3150-0011. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

## **B. DISCUSSION**

### **OBJECTIVE**

The staff's objective is to develop guidance that provides a clearer understanding of design bases information. A clearer understanding will help the staff and the industry implement the regulations that use the term "design bases."

### **DEVELOPMENT OF INDUSTRY GUIDELINE, NEI 97-04**

In October 1997, NEI submitted NEI 97-04,<sup>4</sup> which is an update to NUMARC 90-12; both are titled "Design Bases Program Guidelines."<sup>1</sup> NEI 97-04 gave additional examples of design bases information and directly addressed the reportability of conditions outside the design bases of the plant. This submittal started a series of letters and public meetings that

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<sup>4</sup>Electronic copies of Appendix B to NEI 97-04 are also available in NRC's Public Electronic Reading Room, which can be accessed through the NRC's web site, <[WWW.NRC.GOV](http://WWW.NRC.GOV)> under ADAMS Accession Number ML003679532.

has led to the staff endorsing the NEI guidance. A brief summary of the significant letters and meetings follows.

The staff commented on NEI 97-04 in August 1998 and presented draft criteria for determining design bases information in a letter to NEI<sup>1</sup> dated January 4, 1999. In a letter to the staff<sup>1</sup> dated January 27, 1999, NEI presented a revised Appendix B to NEI 97-04 that contained specific examples to distinguish between 10 CFR 50.2 design bases and supporting design information. After a public meeting with NEI on February 18, 1999, to discuss draft industry guidance on design bases information, the staff sent comments to NEI in a letter<sup>1</sup> dated April 14, 1999. NEI provided proposed guidance for identifying 10 CFR 50.2 design bases in a letter<sup>1</sup> to the staff dated May 7, 1999. The staff sent a final draft position on what constitutes design bases information to NEI in a letter<sup>1</sup> dated May 14, 1999. The staff and NEI held a public meeting to discuss their proposed positions on May 24, 1999, and NEI submitted a draft revision of Appendix B to NEI 97-04 in a letter dated June 25, 1999. The staff provided comments on the draft revision in a letter<sup>1</sup> to NEI dated July 19, 1999, and during a public meeting on July 22, 1999. In a letter<sup>1</sup> dated August 17, 1999, NEI presented a final draft revision to Appendix B to NEI 97-04 for staff review. This final draft revision was discussed during a public meeting on September 8, 1999. During this meeting, NEI committed to incorporate comments from the staff and to submit a revised Appendix B for endorsement by the staff. NEI presented revisions to Appendix B to NEI 97-04 in a letter<sup>1</sup> to the staff dated September 28, 1999, and these revisions were discussed in a public meeting on October 14, 1999. The staff and NEI resolved two of the three issues identified in the September 28, 1999, letter<sup>1</sup> during the meeting and NEI agreed to modify the Appendix and resubmit it for endorsement by the staff. In a letter<sup>2</sup> dated October 28, 1999, NEI submitted further revisions to the appendix reflecting consideration of staff comments provided during the public meeting on October 14, 1999.

## **C. REGULATORY POSITION**

### **1. Appendix B to NEI 97-04**

NEI 97-04, "Design Bases Program Guidelines,"<sup>4</sup> was developed to help utilities organize and collate design bases information and supporting design information. The staff has concluded that these guidelines provide a useful standard framework for implementing design reconstitution programs, however, the industry has not requested staff review and endorsement of the entire document. This regulatory guide only endorses Appendix B, "Guidelines and Examples for Identifying 10 CFR 50.2 Design Bases," to NEI 97-04, with the following exceptions.

Appendix B of NEI 97-04 was updated by the industry and submitted for staff review and endorsement. The staff has concluded that the November 17, 1999, version of Appendix B to NEI 97-04 provides guidance and examples that are acceptable to the staff for providing a clear understanding of what constitutes design bases information with the following clarifications. The staff expects licensees to apply this guidance in a uniform manner.

#### **1.1 Defense-in-Depth**

The staff considers aspects of the designed defense-in-depth strategies like redundancy, diversity, and independence to be important aspects of the plant's principal design criteria, as specifically required by several regulations, especially the General Design Criteria. These criteria require that defense-in-depth strategies are then implemented for

individual SSCs through plant design features, such as multiple components, independent power supplies, and physical separation. These criteria provide part of the standard for judging the adequacy of the plant's design bases.

## **1.2 Relationship of 10 CFR 50.2 Design Bases to UFSARs**

The staff wants to ensure that the language in Appendix B to NEI 97-04 is interpreted in a manner consistent with that of other sections. Specifically, the staff believes that the design bases for a plant may change as a result of new NRC requirements as well as licensee changes to ensure compliance with NRC requirements. In addition, the staff believes design values such as pressure or temperature are considered to be supporting design information unless they are associated with a design function.

### **D. IMPLEMENTATION**

The purpose of this section is to provide information to licensees and applicants regarding the NRC staff's plans for using this regulatory guide.

This draft regulatory guide has been released to encourage public participation in its development. The clarification to be described in the final version of this guide, reflecting public comments, will be used in the evaluation of licensees' definition of what constitutes design bases information. However, adopting this clarification is not mandatory and licensees may choose not to change the way they are implementing the term "design bases."

## VALUE/IMPACT STATEMENT

The term “design bases” is defined in 10 CFR 50.2 because it is used in several regulations in Part 50. Specifically, it is currently found in 10 CFR 50.34(a) and (b), 50.72, 50.73, and Appendices A and B. The staff considered how the implementation of the proposed guidance would affect each of these applications. This is discussed below.

### Guidance Discussion

Consistent with the rule definition, the guidance focuses on functions and values. However, in implementing the regulation, it is necessary to bound the scope of the functions considered to be design bases because the rule itself does not specifically define those functions. The NEI guidance specifies that design bases functions are those required by regulation, license condition or order, and functions credited in the safety analysis. In recent years, the staff’s consideration of functions in implementing the definition of design bases has been broader than that proposed in the guidance. Accordingly, many individual component functions recently considered in implementing the definition of “design bases” will no longer be so considered under the guidance. Nonetheless, the staff agrees that the regulations, license conditions, orders, and safety analysis provide an appropriate bound for defining the functions considered in establishing design bases and are consistent with the rule language.

The staff notes that its implementation of the design bases definition has been inconsistent over the years. When considering applications for licenses to operate nuclear power plants in the mid-to late 1960s, the staff had, in general, a narrow view of what information constituted design bases. This view was reflected in the initial version of Regulatory Guide 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants,” published in February 1972. The scope of design bases information, however, is not consistent among systems in this guidance. In addition, subsequent revisions to this Regulatory Guide have increased the scope of information that is labeled as design bases. Although the scope of information has evolved, the staff did not intend to include the functions of every structure, system, or component within the scope of design bases functions. As stated earlier, there has been considerable debate within the industry and within the staff about what constitutes design bases information.

Using the auxiliary feedwater system as an example, under the proposed guidance, the required flow delivered by the system will be part of the design bases; however, the flow delivered by each individual pump will not. This will likely be the same for other component level functions and values.

This interpretation has been a point of difficulty because the rule does not specifically define the functions to which it refers. The staff believes that, in general, regulations, license conditions, orders, and safety analyses focus on system-level functions. There are obviously exceptions, such as the reactor pressure vessel and containment (note: these are frequently considered “systems” and/or “structures”), which have specific regulation-defined functions. However, the staff concludes that design bases functions may also be defined in terms of functions specified by NRC requirements or credited in safety analyses.

The staff acknowledges that the definition has been read by some to mean that all functions described in the UFSAR are design bases functions. In addition, the definition does not, by its terms, specify the functions considered in establishing design bases; therefore, it does not limit the scope of components having design bases to those that have a bearing on system function or have their own independent function. The staff believes, however, that

since there is regulatory precedent for evaluations at the system level and there has been substantial variation in the implementation of the definition, this clarification of functions is warranted.

With regard to values, the guidance focuses on reference bounds for design necessary to meet design bases functional requirements as defined above. The rule, however, does not directly link the values solely to the “functional requirements” since the rule also refers to “controlling parameters as reference bounds for design” and, in the next sentence, states that these values “**may** be derived from. . . practices for achieving functional goals.” Thus, whether the entire set of bounding values (which may be derived from a number of considerations) are “design bases,” or only those values directly corresponding to the design bases functions has also been a point of controversy in the past.

The extent of reference values is illustrated by an example presented in the guidance, related to the pressure integrity of the auxiliary feedwater system piping. Some in the staff have historically considered the maximum system design pressure chosen for a safety-related system, like auxiliary feedwater (AFW), as being a “design bases” value, holding that it was the bounding value for piping integrity chosen to assure that the “functional goal” of the system is met (holding water). However, the proposed guidance would not consider this value (maximum system design pressure) as a design bases value. This is because the design bases function or required function for this system is to deliver sufficient water to the steam generators against the pressure in the steam generators, consistent with the accident analysis. The maximum system design pressure, in this case, is not a value needed to achieve this required function (delivering water into the steam generators at a minimum pressure). Rather, the design bases values for this function would be a certain AFW flow rate at the given minimum pressure. In contrast, the maximum system design pressure (used to evaluate piping integrity) is derived from the design bases pressure into which the AFW system must deliver its minimum flow rate.

To summarize this point, only values directly corresponding to design bases functions will be considered as design bases values under the proposed guidance. For the AFW example, only the flow rate and the steam generator pressure into which that flow rate must be delivered would be considered design bases values under the proposed guidance. The maximum system design pressure would not be so considered. Although certain values may no longer be considered as design bases information under this guidance, these values are retained in Updated Final Safety Analysis Reports (UFSARs) (e.g., as design descriptions as required by 10 CFR 50.34) and supporting design documents, thus ensuring that important safety information is maintained up-to-date and easily accessible.

#### 10 CFR 50.34

The importance of understanding what constitutes design bases information with regard to its use in 10 CFR 50.34 is that the design bases are required to be included in the final safety analysis report (FSAR) and, through 10 CFR 50.71(e), the UFSAR. The staff has worked closely with the industry and has endorsed, through Regulatory Guide 1.181, NEI 98-03, “Guidelines for Updating Final Safety Analysis Reports.” This document describes a method for complying with the requirements of 10 CFR 50.71(e) and also gives suitable guidance for modifying the content and format of the updated FSAR. Note that this document also clarifies our implementation of a regulation that has been subject to varying implementation approaches by the staff and the industry over the years.

The guidance in NEI 98-03 states that UFSARs should contain (1) design bases, (2) safety analyses, and (3) a facility description sufficient to permit understanding of the design bases, safety analyses, and facility operation. Clarifying the implementation of the definition of design bases will help licensees understand what information should be included in FSAR updates. The staff does not believe that the clarification will result in less information being included in the UFSAR, however, since the design bases are only one portion of the information required. In other words, the contents of the UFSAR can be divided into different categories (e.g., design bases and supporting information) but the same information will still be contained in the UFSAR regardless of how it is categorized. In addition, the treatment of information in the UFSAR does not depend on whether the information is treated as design bases or supporting design information. For example, any changes to the plant as described in the UFSAR will still need to be evaluated under 10 CFR 50.59. Degraded or nonconforming conditions are also treated in a manner independent of whether the information describing the structure, system, or component (SSC) is classified as design bases information.

#### 10 CFR 50.72 and 50.73

The current reporting requirements of 10 CFR 50.72 and 50.73 specify that licensees must notify the NRC following the occurrence of any event or condition that results in the nuclear power plant being in a condition that is outside of the design bases of the plant. One possible outcome of this clarification is that licensees may make fewer reports for such conditions under the current reporting requirements.

The issue of when a plant is outside its design basis and when and why the NRC should be notified has been the subject of much discussion between the industry and the staff. The staff has published a proposed rule that would, among other things, delete the requirement for reporting a condition that is outside the design basis of the plant. A condition outside the design basis of the plant would still be reportable if it is significant enough to qualify under other existing criteria. In addition, a new criterion was proposed that would capture an event or condition that requires corrective action for a single cause or condition in order to ensure the ability of more than one train or channel to perform its specified safety function. The staff believes that the proper forum for deciding what level of information the staff needs to receive is this rulemaking effort on 10 CFR 50.72 and 50.73 and not the definition of design bases.

#### 10 CFR 50.59

A recent revision to 10 CFR 50.59 added a criterion to require prior NRC approval if a change, test, or experiment would result in a departure from a method of evaluation used in establishing the design bases or in the safety analyses. This rule change will become effective in late 2000. The staff believes that the clarification of the definition of design bases may help licensees determine which methods are included in the scope of this new criterion. The staff also believes that, because most methods currently described in the UFSAR establish design values that are consistent with the NEI guidance for design bases values, few UFSAR methods will be excluded by this clarification.



## Other Applications

The term “design bases” is used in some of the criteria in Appendix A to 10 CFR Part 50 in defining the principal design criteria. The definition of design bases is also used in the quality assurance requirements in Appendix B to 10 CFR Part 50, such as Criterion III for design control. Although the scope of design bases information will likely be reduced, the guidance will have no effect on the scope of SSCs designated as safety-related. Therefore, the staff does not believe this guidance will affect the implementation of these regulations.

The definition is also sometimes used by the NRC staff in the inspection process. Recent efforts among staff and other stakeholders to develop a new reactor oversight process have highlighted the importance of inspections in evaluating licensees’ engineering programs. When the task forces working on the new reactor oversight process developed a set of performance indicators, they determined that design issues are difficult to assess and that added emphasis on inspection will be required. However, for these design engineering inspections, the NRC is moving away from inspections focused on designations like “design bases” and moving more in the direction of inspections focused on risk-significant systems. As a result, the staff has found that the proposed scope of design bases is appropriate.

## NRC Reactor Arena Performance Goals

With regard to the four NRC Reactor Arena Performance Goals, the staff has evaluated this guidance against each and provided a discussion below. The staff has reviewed the effect of this guidance on the regulations where the definition of design bases is used and has determined that this interpretation acceptably defines the scope of design bases. As a result, the staff believes the implementation of this guidance will maintain safety. Additionally, because the staff believes the guidance defines a clearer scope of design bases, there may be a reduction in unnecessary regulatory burden. Where some licensees may currently be interpreting the design bases to be very large, there will likely be a reduction in unnecessary burden. Although this effort of providing guidance to the existing rule was not intended to reduce burden, the staff is confident that burden to the licensees has not increased, and in some cases has been reduced.

The staff believes that the guidance is clearer and easier to implement than the rule alone. As a result, the staff believes that effectiveness and efficiency have been improved. The staff also believes that there are still some ambiguities in the guidance. For example, how functions credited in the safety analysis are included in the design bases and the scope of safety analyses considered are not fully addressed. The staff is anticipating that there will be input from stakeholders on these issues during the public comment period for the draft regulatory guide. Additionally, although the guidance does not conflict with the rule definition, the guidance does narrow the scope of the rule as recently implemented.

As noted above, the staff believes that the guidance is clearer and easier to implement than the rule alone. The staff also believes that the guidance will provide a more appropriate safety focus to design bases issues. From this standpoint, public confidence should be improved. However, since the scope of information currently considered “design bases” will most likely be reduced, there will likely be fewer reports required under 10 CFR 50.72 and 50.73. These aspects of the guidance may not increase public confidence. As a result, some aspects of the guidance should increase public confidence and others may not.

## Summary

The NRC staff position is that the value to individual licensees, the industry, the NRC, and the public that results from a clear, common understanding of the interpretation of 10 CFR 50.2 design bases outweighs the costs to licensees and the NRC that are presently associated with confusion regarding the definition.

In the final regulatory guide, the NRC staff intends to endorse the industry's proposed approach, described in Appendix B to NEI 97-04, as one acceptable method for defining what constitutes design bases information. The final regulatory guide, if issued, will represent a method acceptable to the staff that reflects the industry's preferred approach, as modified by the NRC, to address public comments received on the guidance.

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