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Review of Light Water Reactor Regulatory Requirements

Identification of Regulatory Requirements That May Have Marginal Importance To Risk

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Operated by
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Commission

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EXECUTIVE SUMMARY

The U. S. Nuclear Regulatory Commission has initiated a program to identify regulatory requirements associated with 10 CFR 50 that, if deleted or appropriately modified, would improve the efficiency and effectiveness of the NRC regulatory program without adversely affecting safety (October 3, 1984, Federal Register, 49 FR 39066). This report describes the results of a study conducted by Pacific Northwest Laboratory (PNL) to assist the NRC in executing the program. The report identifies 45 regulatory requirements (and associated regulatory guidance) that could potentially be relaxed or eliminated to reduce regulatory burdens without compromising public health and safety. If subsequent, more detailed studies and evaluations confirm these initial findings, NRC staff will recommend and implement appropriate regulatory changes, which may include modification or elimination of some requirements.

APPROACH

Formal interviews were conducted with 12 of the largest nuclear utilities, 1 architect-engineering firm, 1 reactor vendor, 2 industry associations and 1 NRC regional office. Two separate questionnaires also furnished information for this report. One questionnaire was prepared and sent by the Atomic Industrial Forum (AIF) to more than 100 industry organizations including utilities, architect-engineers, equipment manufacturers and law firms that are members of the AIF Committee on Reactor Licensing and Safety. A second questionnaire was sent to NRC staff.

From these discussions with the industry and the NRC Regional Office, and from the responses to the questionnaires, 45 requirements were identified as candidates for modification or elimination. These regulatory requirements are listed in Table S.1. Because of the large number of requirements identified, they were sorted into two groups. The first group consists of those requirements most frequently mentioned in the interviews and questionnaires. The second group includes the requirements that were mentioned less frequently. It should be stressed that this screening method is not a precise cost-benefit prioritization of the regulatory requirements in need of reexamination. However, the screening does indicate some of the primary areas of concern, as determined from the interviews and questionnaires.

This study is the initial step in a comprehensive program to review existing regulatory requirements; as such, some limitations of the study should be noted. First the screening process, as mentioned earlier, is neither precise nor rigorous. The requirements identified in this report are potential candidates for modification or elimination, but more detailed studies of the individual requirements must be performed before definitive conclusions can be reached or regulatory changes initiated.

Second, the information obtained for this study is only a limited sampling; thus the requirements discussed in this report do not constitute a complete and exhaustive listing of all regulatory requirements that may have marginal

TABLE S.1. Candidate Regulatory Requirements for Reexamination

Number	Description	Number of Interview Responses	Number of AIF Questionnaire Responses	Number of NRC Questionnaire Responses
Most Frequently Mentioned:				
10 CFR 50.36	Technical Specifications	14	4	7
10 CFR 50, App. R	Fire Protection Requirements	13	3	1
10 CFR 50.90 - 92	Sholly License Amendment Process	12	1	1
10 CFR 50.47 & App. E	Emergency Plan	15	3	2
10 CFR 50.109	Backfit Requirements	10	-	-
10 CFR 50.49	Environmental Qualification of Electrical Equipment	10	-	-
10 CFR 50, App. K	ECCS Evaluation Models	11	2	2
10 CFR 73	Security	8	-	-
10 CFR 50.72 -73	Immediate Notifications and LERs	6	1	-
NUREG-0737, Item II.F.2	Reactor Vessel Level Indication System	6	1	-
10 CFR 50.44	Standards for Combustible Gas Control	7	1	-
10 CFR 50, App. J	Containment Leakage Testing	8	-	2
10 CFR 50.34g	Standard Review Plan	4	-	9
10 CFR 50, App. B	Quality Assurance	3	1	1
NUREG-0737, Item II.B.3	Post-Accident Sampling System	3	1	-
Less Frequently Mentioned:				
10 CFR 20	De Minimis Wastes	-	-	2
10 CFR 21.3(a)	Commercial Grade Procurement	-	-	1
10 CFR 50.33a	Antitrust Review Information	2	-	-
10 CFR 50.55a	Codes and Standards	2	-	-
10 CFR 50.55(e)	Conditions of Construction Permits	-	-	1
10 CFR 50.70	Inspections	2	-	-
10 CFR 50.71	Maintenance of Records, Making of Reports	-	-	2
10 CFR 50	Proposed Ruling on Station Blackout	2	-	-
10 CFR 50, Appendix C	A Guide for the Financial Data Required to Establish Financial Qualifications	-	-	1
10 CFR 50, Appendix L	Information Requested by the Attorney General for Antitrust Review of Facility License Applications	1	-	1
10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Waste	-	-	-
10 CFR 70	Domestic Licensing of Special Nuclear Materials	1	-	-
10 CFR 100, Appendix A	Seismic and Geologic Siting Criteria	-	-	1
10 CFR 170	License Amendment Fee	1	-	-

TABLE S.1. (Continued)

Number	Description	Number of Interview Responses	Number of AIF Questionnaire Responses	Number of NRC Questionnaire Responses
Regulatory Guides 1.3-4	Assumptions Used for Evaluating the Radiological Consequences of LOCAs	1	-	3
Regulatory Guide 1.29	Seismic Design Classification	2	-	-
Regulatory Guide 1.52	Design, Testing, and Maintenance Criteria for Post-Accident ESF Atmosphere Cleanup System	1	-	-
Regulatory Guide 1.60	Design Response Spectra for Seismic Design	1	-	-
Regulatory Guide 1.61	Damping Values for Seismic Design	1	-	-
Regulatory Guide 1.64	Quality Assurance Requirements	2	-	-
Regulatory Guide 1.70	Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants	-	-	1
Regulatory Guide 1.78	Control Room Assumptions for Habitability During a Postulated Hazardous Chemical Release	1	-	-
Regulatory Guide 1.88	Collection, Storage, and Maintenance of QA Records	1	-	-
Regulatory Guide 1.96	Design of BWR Main Steam Isolation Valve (MSIV) Leakage Control System	1	-	-
Regulatory Guide 1.97	Post-Accident Plant and Environs Conditions Assessment Instrumentation	3	-	-
Regulatory Guide 1.115	Protection Against Low-Trajectory Turbine Missiles	-	-	1
Regulatory Guide 4.2	Preparation of Environmental Reports	-	-	1
NUREG-0094	NRC Operator Licensing Guide	3	-	-
NUREG-0612	Control of Heavy Loads	3	-	-
NUREG-0737	Clarification of TMI Action Plan	2	-	-

importance to safety. There are certainly other regulatory requirements not identified in this study that would be promising candidates for reexamination.

EXAMPLES OF REGULATORY REQUIREMENTS IDENTIFIED AS CANDIDATES FOR REEXAMINATION

To illustrate some of the problems, suggested modifications, and risk considerations associated with the candidate regulatory requirements, three requirements from Table S.1 are discussed briefly in the following paragraphs. More detailed discussions of these requirements are presented in Chapter 2.

10 CFR 50.36: Technical Specifications

Problem

Based on the information collected by PNL, the major problems with technical specifications are that they are too complex and that they contain extraneous information not directly related to plant operation and safety, such as organization charts, staff qualifications, and training requirements. Other problems with technical specifications may be categorized into five areas: 1) surveillance and testing requirements, 2) the amendment process, 3) technical bases, 4) action statements and 5) administrative issues.

Suggested Modification

The consensus among those surveyed was that the technical specifications should be split into two volumes. One volume would contain only safety-related information directly relevant to the operation of the plant. The other volume would contain all other information not essential for safe operation and would be subject to a simplified amendment process that would relieve some of the administrative burdens associated with the current amendment process.

Risk Consideration

Dividing the technical specifications into two volumes would not have an adverse impact on safety, if done judiciously. In fact, there are reasonable indications that streamlined technical specifications would be easier for operators to use in the day-to-day operation of the plant and might reduce the potential for human error in the control room or in the interpretation of safety limits and required actions.

10 CFR 50, Appendix R: Fire Protection

Problem

Many of the utilities contacted for the study felt that several aspects of Appendix R increased licensee's costs without significantly limiting the risks of fire-caused accidents. Examples mentioned include the requirements to 1) consider transient combustible loading in all fire-sensitive areas, 2) consider a loss of offsite power concurrent with a fire, 3) provide 3-hour fire barriers for separation of redundant trains of safety-related equipment, and 4) disallow credit for operator actions taken to mitigate the effects of fire.

Suggested Modification

While all utilities contacted in this survey agreed that protection against fire was necessary, some recommended the complete elimination of Appendix R as a codified requirement, others suggested that it should be made a regulatory guide, and still others suggested that Criterion 3 of the General Design Criteria (10 CFR 50, Appendix A) was sufficient.

Risk Consideration

The large contribution of fire-related initiators to core melt frequency suggests that protection against fire is necessary, a point on which all utilities contacted in this study agreed. Therefore, fire protection requirements cannot be completely eliminated from the regulations without a substantial potential for increase in public risk. However, more cost-effective requirements could probably be formulated, based on realistic estimates of fire risk, including the probability of a fire occurring in various areas of the plant. Judicious use of more realistic risk information could potentially reduce regulatory burdens without causing an adverse effect on public health and safety.

10 CFR 50.90, 50.91, 50.92: License Amendment Process

Problem

Based on the information obtained from the interviews and questionnaires, the overwhelming concern with the license amendment process is the time and cost burden associated with processing an amendment request. This burden is a potential disincentive for licensees to apply for amendments that enhance plant safety. The utilities contacted also expressed doubt that the burdens of the current license amendment process are commensurate with the benefits. They noted the limited amount of public and state interest in license amendments: of about 2200 license amendment requests, hearings were requested in only 3 cases. In other words, a large cost burden was imposed on the utilities applying for license amendments with little apparent benefit.

Suggested Modification

The licensees contacted in this study, along with some of the NRC project managers that attended the interviews, suggested shortening the amendment process by defining categories of routine amendments that could be granted by NRC with minimal delay.

Risk Consideration

From a risk perspective, the amendment review process would ideally be able to include provisions for distinguishing between the great majority of amendments that have little risk significance and little public interest (these could be implemented with minimal delay) and the small fraction that might require more consideration before implementation. Streamlining the process in such a fashion seems to be defensible and desirable, at least from a risk perspective.

CONCLUSIONS

This study has identified a number of existing regulatory requirements associated with 10 CFR 50 that, in the opinion of those contacted, are promising candidates for reexamination and possible relaxation or elimination to reduce regulatory burdens without compromising public health and safety. Based on the information collected, the potential savings in terms of reduced regulatory burdens, both for the industry and for the NRC, appear to be substantial. However, this study is only an initial step toward achieving a full review and assessment of existing regulatory requirements. A long-term and concerted effort, with the strong support of all interested parties, will be needed to realize the potential benefits of a comprehensive reassessment of the current regulatory structure.

In the course of analyzing the information collected through the questionnaires and interviews, several other findings were noted:

- Several of those contacted during this study identified existing regulatory requirements that may even have some adverse impacts on public health and safety. Examples mentioned include certain aspects of technical specifications, pipe whip restraints, some sections of the Standard Review Plan, and the license amendment process. In such cases, eliminating or relaxing the requirements may reduce regulatory burdens and improve safety at the same time.

- The utilities and industry organizations contacted indicated that the regulations themselves (i.e., 10 CFR 50 per se) were generally reasonable, although some exceptions were noted. Many of the difficulties highlighted in this report seem to stem from detailed and sometimes inconsistent interpretations of the regulations--for example, the Standard Review Plan, regulatory guides, and NUREGs. Furthermore, many of those interviewed noted that "guidance" documents, such as regulatory guides, frequently become de facto requirements, even though, in principle, compliance with such documents is not required.

- Most of those contacted expressed support for NRC's program to review existing requirements. Both industry and NRC staff contacted for the study devoted considerable effort to preparing for the interviews and responding to the questionnaires. The information and perspectives that they provided have been invaluable. Their continued cooperation will also be helpful in subsequent phases of the program.

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TABLES

1.0 INTRODUCTION

Pacific Northwest Laboratory (PNL) conducted a study to identify regulatory requirements (and related regulatory guidance) associated with 10 CFR 50 that appear to be the most promising candidates for possible relaxation or elimination to reduce regulatory burdens with only marginal effects on safety. The work was performed in support of an NRC program to improve the effectiveness of its regulation of nuclear power plants. The candidate requirements were identified primarily on the basis of a series of interviews with industry and NRC staff, and from the responses to questionnaires sent to NRC staff and industry.

The NRC program to review existing regulatory requirements is in its initial phase, and this report is but one of a number of inputs. If the NRC decides to pursue further some of the candidate regulatory requirements identified in this report, a more detailed and comprehensive study of those individual requirements will be undertaken; any changes to the existing requirements will be implemented through the appropriate regulatory procedures.

1.1 BACKGROUND

On October 3, 1984, NRC published a notice in the Federal Register (Vol. 49, No. 193, p. 39066) announcing a new program to review the effectiveness of existing light water reactor (LWR) regulatory requirements in limiting risk. The objective of the program, as stated in the Federal Register notice (see Appendix), is "to identify current regulatory requirements which, if deleted or appropriately modified, would improve the efficiency and effectiveness of the NRC regulatory program without adversely affecting safety." Initially, the program is focusing on one portion of the NRC's regulations: the regulatory requirements and guidance associated with 10 CFR 50.

The program was initiated in response to guidance received from the Commission in its Policy and Planning Guidance (PPG) for 1984 (NUREG-0885, Issue 3, January 1984) and specific programmatic direction from the Executive Director for Operations. The Commission, in the section of its Policy and Planning Guidance entitled "Improving Regulation of the Nuclear Industry," stated:

> "Existing regulatory requirements that have a marginal importance to safety should be eliminated."

The Policy and Planning Guidance for 1985 (NUREG-0885, Issue 4, February 1985) reiterated this objective:

> "Existing regulatory requirements should be reviewed to see if some could be eliminated without compromising safety."

As part of the program guidance developed in support of the Commission's PPG, the Executive Director for Operations called for a three-pronged effort to systematically review existing regulations. The effort was to address the following distinct aspects of the existing regulatory structure:

1. existing operating reactor licensing actions

2. technical specifications

3. rules and associated regulatory guidance, with the initial emphasis on 10 CFR 50

Programs have been initiated in each of these three areas. The work discussed in this report is part of the program formulated to address the third area, i.e., the regulatory requirements of 10 CFR 50.

As part of the overall program, Pacific Northwest Laboratory (PNL) was asked to provide technical information and analyses to support the NRC staff in its work. PNL's work in FY 1985 has consisted of two principal tasks:

1. Identification of regulatory requirements that might be relaxed or eliminated to reduce regulatory burden without compromising public health and safety. The purpose of this task was to screen the existing regulatory requirements and guidance associated with 10 CFR 50 and identify, tentatively, a set of candidates for further detailed study.

2. Detailed analysis of several regulatory requirements selected by NRC staff. The purpose of this task was twofold. First, the task was to produce technical information for the NRC staff to consider in deciding whether the selected requirements could be eliminated or relaxed without compromising safety. Cost-benefit assessments of the consequences of changing or eliminating the requirements are an important part of this technical information. Second, the task was intended to demonstrate the assessment methods and tools needed to provide a technical information base for NRC regulatory decisions concerning the effectiveness of existing regulatory requirements in limiting risk.

This report presents the results of Task 1. A companion report covers Task 2.

The idea of reviewing existing regulatory requirements to assess their efficacy and continued importance is not new, of course, nor is it unique to the nuclear regulatory environment. Such reassessments are a natural consequence of:

- accumulated experience with the regulations
- refinements in the methods and data used to measure risks, costs, and benefits
- improvements in knowledge of the technology being regulated.

Such reassessments, sometimes referred to as "sunset reviews," played a prominent role in legislative proposals for regulatory reform in the 1970s and have been pursued by some government agencies (e.g., EPA). In the nuclear field, many individuals and groups have made suggestions along these lines. Probabilistic risk assessment (PRA) techniques have been prominently featured in most of the proposals, inasmuch as PRA provides a systematic, quantitative approach for appraising the benefits (in terms of risk reduction) of regulations. A systematic risk-based review of the regulations has the potential to both strengthen and streamline the regulatory structure. The risk-based approach to reviewing existing regulatory requirements is being considered in more detail in Task 2.

As a final note of introduction, the identification and analysis of requirements appearing to need reexamination is a scoping study that serves as a pilot for the NRC's program of regulatory review; the insights obtained from the interviews and the responses to the questionnaires are of a preliminary nature. Before final decisions to eliminate or relax regulations can be made, more rigorous regulatory analyses must be performed, including more detailed and comprehensive assessments of the costs and benefits of modifying the regulations.

1.2 APPROACH

Because of the large number of regulatory requirements associated with 10 CFR 50, including regulations, regulatory guides, Standard Review Plan (SRP) sections, Branch Technical Positions, and NUREGs, a detailed examination of each was not practical. To screen the regulatory requirements without expending an inordinate amount of resources, the scope of the work was designed to rely on the public responses to the Federal Register notice and on the expertise and experience of the nuclear industry, the NRC staff, and PNL staff.

Since there was very little public response to the Federal Register notice, information was collected from a combination of interviews and questionnaires. Formal interviews were conducted with a representative sample of the nuclear industry, including 12 of the largest nuclear utilities, 1 architect-engineering firm, 1 reactor vendor, 2 industry associations, and one NRC regional office. A broad spectrum of suggestions was solicited, including those regarding requirements related to design, construction, and operations. The 16 nuclear industry organizations interviewed are shown in Table 1.1. Information from these interviews was used extensively in formulating the material in Chapters 2 and 3.

Two separate questionnaires also furnished information for this report. One questionnaire was prepared and sent by the Atomic Industrial Forum (AIF) to more than 100 industry organizations including utilities, architect-engineers, equipment manufacturers, and law firms that are members of the AIF Committee on Reactor Licensing and Safety. A second questionnaire, prepared by NRC, was sent to NRC staff. Information from the questionnaires is included in the report. However, due to the modest number of questionnaire responses, the interview results were the primary basis of the material in Chapters 2 and 3. In addition to the interviews and questionnaires, a limited number of public comments were received in response to the Federal Register notice. These public comments were also factored into the report.

TABLE 1.1. Industry Organizations Interviewed

Atomic Industrial Forum
Bechtel
Carolina Power and Light
Commonwealth Edison
Duke Power
Electric Power Research Institute
Florida Power and Light
Georgia Power
Pacific Gas and Electric
Philadelphia Electric
Portland General Electric
Southern California Edison
Tennessee Valley Authority
Virginia Electric Power
Washington Public Power Supply System
Westinghouse

The interviews were arranged by the appropriate NRC project manager, in the case of the utilities, or by the NRC program manager for this project. Interviews with the utilities included the NRC project manager for one of the utility's plants, and sometimes included a representative from the respective NRC Regional Office. All who participated in the interviews were well prepared and their responses reflected an open, balanced perspective of the impact of regulations on the nuclear utility, the vendor, or the NRC. They presented examples to clarify the problems, costs to indicate the level of burden (whenever available), and relationships among regulations.

From these discussions with the industry and the NRC Regional Office, and from the responses to the questionnaires, 45 requirements were identified as candidates for reevaluation. Table 1.2 lists these and the number of times each was either discussed in an interview or submitted via the questionnaires. Because of the large number of regulatory requirements identified, it was decided to sort them into two groups. The first 15 requirements shown in the table were identified more frequently than the rest. Therefore, these 15 were selected for detailed discussion in Chapter 2. The remainder of the requirements and their respective problems and suggested modifications are presented more briefly in Chapter 3.

In several cases, the industry observed not only that particular requirements caused undue burden, but also that certain requirements seemed to lack perspective and balance. This additional complexity in operations and maintenance appeared to detract from safety in some cases. Additionally, it was repeatedly stated that the regulations of 10 CFR 50 (excluding the Appendices) were often not unreasonable per se. Rather, the detailed interpretations of the regulations given in ancillary documents, such as the

TABLE 1.2. Candidate Regulatory Requirements for Reexamination

Number	Description	Number of Interview Responses	Number of AIF Questionnaire Responses	Number of NRC Questionnaire Responses
Most Frequently Mentioned:				
10 CFR 50.36	Technical Specifications	14	4	7
10 CFR 50, App. R	Fire Protection Requirements	13	3	1
10 CFR 50.90 - 92	Sholly License Amendment Process	12	1	1
10 CFR 50.47 & App. E	Emergency Plan	15	3	2
10 CFR 50.109	Backfit Requirements	10	-	-
10 CFR 50.49	Environmental Qualification of Electrical Equipment	10	-	-
10 CFR 50, App. K	ECCS Evaluation Models	11	2	2
10 CFR 73	Security	8	-	-
10 CFR 50.72 -73	Immediate Notifications and LERs	6	1	-
NUREG-0737, Item II.F.2	Reactor Vessel Level Indication System	6	1	-
10 CFR 50.44	Standards for Combustible Gas Control	7	1	-
10 CFR 50, App. J	Containment Leakage Testing	8	-	2
10 CFR 50.34g	Standard Review Plan	4	-	9
10 CFR 50, App. B	Quality Assurance	3	1	1
NUREG-0737, Item II.B.3	Post-Accident Sampling System	3	1	-
Less Frequently Mentioned:				
10 CFR 20	De Minimis Wastes	-	-	2
10 CFR 21.3(a)	Commercial Grade Procurement	-	-	1
10 CFR 50.33a	Antitrust Review Information	2	-	-
10 CFR 50.55a	Codes and Standards	2	-	-
10 CFR 50.55(e)	Conditions of Construction Permits	-	-	1
10 CFR 50.70	Inspections	2	-	-
10 CFR 50.71	Maintenance of Records, Making of Reports	-	-	2
10 CFR 50	Proposed Ruling on Station Blackout	2	-	-
10 CFR 50, Appendix C	A Guide for the Financial Data Required to Establish Financial Qualifications	-	-	1
10 CFR 50, Appendix L	Information Requested by the Attorney General for Antitrust Review of Facility License Applications	1	-	1
10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Waste	-	-	-
10 CFR 70	Domestic Licensing of Special Nuclear Materials	1	-	-
10 CFR 100, Appendix A	Seismic and Geologic Siting Criteria	-	-	1
10 CFR 170	License Amendment Fee	1	-	-

TABLE 1.2. (Continued)

Number	Description	Number of Interview Responses	Number of AIF Questionnaire Responses	Number of NRC Questionnaire Responses
Regulatory Guides 1.3-4	Assumptions Used for Evaluating the Radiological Consequences of LOCAs	1	-	3
Regulatory Guide 1.29	Seismic Design Classification	2	-	-
Regulatory Guide 1.52	Design, Testing, and Maintenance Criteria for Post-Accident ESF Atmosphere Cleanup System	1	-	-
Regulatory Guide 1.60	Design Response Spectra for Seismic Design	1	-	-
Regulatory Guide 1.61	Damping Values for Seismic Design	1	-	-
Regulatory Guide 1.64	Quality Assurance Requirements	2	-	-
Regulatory Guide 1.70	Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants	-	-	1
Regulatory Guide 1.78	Control Room Assumptions for Habitability During a Postulated Hazardous Chemical Release	1	-	-
Regulatory Guide 1.88	Collection, Storage, and Maintenance of QA Records	1	-	-
Regulatory Guide 1.96	Design of BWR Main Steam Isolation Valve (MSIV) Leakage Control System	1	-	-
Regulatory Guide 1.97	Post-Accident Plant and Environs Conditions Assessment Instrumentation	3	-	-
Regulatory Guide 1.115	Protection Against Low-Trajectory Turbine Missiles	-	-	1
Regulatory Guide 4.2	Preparation of Environmental Reports	-	-	1
NUREG-0094	NRC Operator Licensing Guide	3	-	-
NUREG-0612	Control of Heavy Loads	3	-	-
NUREG-0737	Clarification of TMI Action Plan	2	-	-

Standard Review Plan, the regulatory guides, the NUREGs, etc., were the major source of difficulties.

Once the candidate regulations were identified and sorted into groups, PNL qualitatively evaluated each regulatory requirement and modification suggested for their impact on plant safety and public risk. Our related experience in value-impact and risk analyses, including work on the Prioritization of Generic Safety Issues, provided substantial background for assessing the risk effects of the suggested modifications. In some areas, examples from PRAs and other ongoing work at PNL were included to clarify the discussion. Chapter 2 contains the bases and results of these evaluations.

1.3 REPORT CONTENTS

This report covers PNL's work on the first of the two tasks described in Section 1.1. The regulatory requirements identified in this study are described in Chapters 2 and 3. Chapter 2 contains detailed descriptions of the 15 regulatory requirements mentioned most often in the interviews and questionnaire responses. The discussion of each requirement includes a description of its purpose, its problems and burdens as reported by industry and NRC staff contacted, the modifications suggested, and observations regarding the risk significance of the modifications. The risk discussions are based primarily on the judgment and experience of PNL staff; the costs, burdens, and examples were primarily obtained through the interviews and questionnaires.

Chapter 3 contains a brief description of those regulatory requirements that were mentioned less frequently. It should be stressed that these requirements may be excellent candidates for reexamination; the fact that they were mentioned less frequently should not be interpreted as an absolute indication that they are of less importance. Rather, it indicates that relatively little information concerning these requirements was obtained during this study.

2.0 MAJOR REGULATORY AREAS IDENTIFIED

The major regulatory areas identified as potential candidates for reexamination in the interviews and questionnaires are presented in this chapter. First, the purpose of the regulation is briefly reviewed to establish a common understanding of intent. Second, the problems associated with the regulation, from the perspective of those participating in the study, are presented. Third, the modifications suggested by those contacted are presented along with a consideration of the risks associated with the regulation or its suggested modification. This consideration of risk is based primarily on the judgment and experience of PNL staff. Finally, an evaluation of the risk associated with the requirement is presented based on PNL's knowledge of the regulations, plant systems, plant operations, and risk evaluations.

2.1 TECHNICAL SPECIFICATIONS: 10 CFR 50.36

Technical Specifications are appended to each facility's operating license and constitute those parameters of plant operation that must be observed for the plant to be operated safely. These specifications are derived from the analyses and evaluations conducted for and included in the safety analysis report for the facility. Generally, they are negotiated between the licensee and the NRC, starting usually with the standard technical specifications and ending with a set of specifications that reflect the specific features of the plant. A summary of the technical basis for each limit and its associated action is included.

Technical specifications are required by Section 50.36 to contain safety limits, limiting safety system settings, and limiting conditions for operation. To prove or verify that these limits are met, technical specifications also contain surveillance requirements for systems, components, structures, and equipment. Compliance with the limits of the technical specifications, as demonstrated by the successful completion of surveillance tests, is required by the license. When limits cannot be met, action statements specify the action to be taken to reduce the risk of abnormal conditions. These actions range from immediate shutdown to programmed shutdowns to reports to the NRC of equipment out of service.

Those who participated in the interviews and responded to the questionnaires identified as candidates for modification the surveillance and testing requirements, the amendment process, the technical bases, the action statements, and the administrative aspects of technical specifications. It should be noted that technical specifications are currently the subject of several NRC programs that are addressing many of these concerns.

2.1.1 Surveillance and Testing Requirements

Purpose

The specific purpose of surveillance and testing requirements is to demonstrate by test, observation or inspection that equipment required for the safe operation of the plant is maintained in working order. These requirements are particularly important for safety systems that are in a standby mode during normal operation and may not be called on to operate for many years. Surveillance requirements involve starting pumps, stroking valves, testing signal actuation systems, measuring flow rates and stroke times, verifying emergency water supplies, etc. The technical specifications prescribe a specific schedule for conducting these tests with only a small amount of flexibility. If the scheduled surveillance for an item governed by technical specifications is missed, the item must be declared inoperable and the actions required by the appropriate action statement must be commenced. Of course, once the surveillance is successfully completed, the action statement can be exited and the administrative portions of the technical specifications define whether further actions, such as a report, are required.

Problems

One of the major problems with surveillance testing, according to the interviews and questionnaire responses, is the potential degradation of equipment reliability caused by excessive surveillance testing. The primary example of this situation is the requirement to cold-start the station emergency diesel generators (within 10 seconds) and demonstrate that they can synchronize and take load (within 60 seconds). The frequency of this surveillance test ranges from once per diesel per 31 days (if there have been less than 2 failures in the last 100 tests) to once per diesel per 3 days (if there have been more than 4 failures in the last 100 tests). The requirement applies during all modes of plant operation except cold shutdown and refueling. In addition, tests on other plant equipment, such as the emergency core cooling systems (ECCS), may also require cold diesel generator starts. These tests wear the engines and degrade their reliability.

A second area of concern with surveillance requirements is the frequency and sheer volume of surveillances that must be conducted. One utility stated that there are approximately 3500 surveillances required that have a testing interval of once per month or less. They estimated that conducting these surveillances consumed about half their instrumentation and control technicians full time. Besides the cost and complexity of such an extensive program, surveillances are also viewed as contributing to risk, since twice as many automatic shutdowns (with the resulting challenges to safety systems) occur during surveillance testing as during any other plant activity (including power ascension, power descent, on-line maintenance).

A third problem with surveillance requirements is the apparent lack of prioritization of surveillance requirements based on the safety importance of the component or system being tested. It is observed, for example, that safety-related instrumentation is tested on the same frequency at many plants regardless of differences in risk-dominant sequences among plants.

Finally, utilities expressed concern over the difficulty of changing surveillance requirements when plant operations or equipment reliability considerations suggest that a change in frequency or acceptance criteria is warranted. While this is partially a function of the problems created by the license amendment process, licensees also maintained that surveillance requirements are not as important as the safety limits, the limiting safety system settings and the limiting conditions for operation contained in the specifications; therefore surveillance requirements should not be controlled by the same rigorous change process as these more important limits.

Suggested Modifications

A suggestion to remedy the problems associated with technical specification surveillance requirements is to conduct a value-impact analysis of surveillance requirements that considers the costs of lost reliability through excessive testing and the benefits in risk improvement for such rigorous testing. This type of analysis would factor a risk perspective and the inherent reliability of the components being tested into the technical specifications.

A second suggestion involves the use of successful tests as the basis for relaxing subsequent surveillance testing frequencies. This has the benefit of decreasing the amount of surveillance on equipment or systems that perform properly on demand and increasing the surveillance on those components or systems that are problematic and fail to perform according to design expectations.

To address the difficulty of modifying surveillance requirements, many licensees suggested that surveillance requirements be placed in a separate, controlled document that is not appended to the license and therefore not governed by the license amendment process. Plants already have several types of documents in this category, including the on-site emergency plan, the quality assurance plan, the process control program, and the offsite dose calculation procedure. Facility design changes (such as those covered by 10 CFR 50.59) are also controlled by means other than the technical specifications.

Risk Considerations

In general, reducing surveillance testing frequency (increasing intervals between tests) may have a negative impact on safety, since undetected failures may exist for a longer time period before discovery. However, several countervailing factors must also be considered.

Reduced testing frequency may be beneficial, for example, for equipment with a limited number of life cycles for which the very act of testing reduces the effective life of the component. A second area in which reduced surveillance testing frequencies might be beneficial stems from the fact that some tests render the equipment unavailable for the period of the test. The significance of this unavailability depends on the safety function of the equipment and the duration of the test. In this case, the increased availability obtained by increasing the interval between tests must be weighed against the increased failure probability due to less frequent testing.

For the reasons given above, the effect of reducing the frequency of surveillance testing is largely dependent on the individual component and its specific tests. A value-impact analysis of surveillance requirements would quantify and account for the risks associated with modifying or removing any surveillance requirement and would factor in the risk importance of the component or system being tested. Also of benefit would be the inclusion of costs associated with performing the surveillance tests since such an inclusion would tend to foster more efficient use of resources. A value-impact approach to modifying the surveillance test frequencies and requirements would weigh the advantages and disadvantages of changes and would therefore not allow surveillance test requirements to be changed without consideration of potentially adverse safety impacts.

The use of successful or failed tests as a basis for adjusting the frequency of surveillance requirements does not affect the overall risk of a plant if it can be shown that the probability of failure remains unchanged. The use of successful tests represents an alternative to frequency-driven surveillance testing for assuring that equipment required for safe operation of the plant is available for operation when needed. The benefit to utilities of adopting such an action is primarily economic. First, equipment is tested on a schedule that is consistent with its importance and its performance. Second, equipment that consistently performs well (i.e., passes its surveillance tests) does not suffer the reliability degradation that may accompany excessive testing. Third, the utility may be able to reduce the amount of time and money spent conducting surveillance testing.

Basing the surveillance testing frequency on successful tests may result in an overall benefit to the NRC and the public, since a utility would have an economic incentive to properly maintain and operate its equipment so that it performs well in surveillance testing, thus reducing the amount of surveillance.

Removal of surveillance requirements from the technical specifications would not affect public health and safety, since surveillance testing would still be conducted by the licensee and the NRC would still be able to assure that surveillance testing is properly conducted. Simplifying the amendment process for changes in surveillance requirements should have minimal effect because, as will be pointed out in the discussion of the amendment process, there has been very little public interest in amendment requests. Utilities and the NRC would save substantial money, time and resources through more reasonable procedures for changing surveillance requirements. Finally, utilities would be better able to make voluntary changes to enhance the safe operation of a facility.

2.1.2 License Amendment Process

Purpose

While this is the direct subject of Section 2.3, the License Amendment Process, a brief mention of the problem in this section clarifies the overall difficulties expressed with technical specifications. Because the technical specifications are appended to the facility operating license, changes in technical specifications become amendments to the operating license. The NRC license amendment process is formalized so that appropriate consideration is given to changes in the license. Furthermore, the process is designed to allow the public an opportunity to participate in the process.

Problem

The time and cost associated with amending technical specifications was presented as an impediment in certain cases to the safe operation of some facilities.

Several interviewees cited instances in which licensees were reluctant to apply for a license amendment to change the plant technical specifications to improve plant safety. These instances generally involved conditions that some licensees discovered to potentially improve a safety margin or lower a risk. The costs and time delays associated with the amendment process tended to cause these types of requests to be delayed, possibly to be submitted with another amendment request.

Suggested Modifications

The licensees, along with several of the NRC project managers, suggested shortening the amendment process by defining specific categories of routine amendments that could be granted with minimal delay. This suggestion and others relating to the license amendment process are examined in greater detail in Section 2.3.

Removing administrative, extraneous, superfluous, and trivial items from the technical specifications was suggested to reduce the impact of the amendment process on plant operations. This suggestion is discussed in greater detail in Section 2.1.5.

Risk Considerations

Reductions in public risk due to public and state input in the amendment process will occur when 1) amendments that compromise plant safety are modified or blocked before implementation, and 2) amendments that increase plant safety are facilitated. Past experience indicates that only three requests for public or state input have been made; therefore, the risk reduction attributable to the current license amendment process is probably small. The emphasis on public and state input is more a question of due process than one of risk reduction.

The time-consuming nature of the amendment process prevents immediate implementation of license modifications, including those to enhance safety. Therefore, reducing the cost and time required to implement an amendment may make a positive contribution to the protection of public health and safety.

From a risk perspective, the amendment process would ideally include provisions for distinguishing between the great majority of amendments, which have little risk significance and little public interest (these could then be implemented with a minimum of delay), and the small fraction that may require more consideration before implementation. Streamlining the amendment process in such a fashion seems defensible and desirable, at least from the risk perspective.

Identifying types of license amendments that can be granted without satisfying the rigors of the "no significant hazards consideration" and holding public hearings will not have an adverse impact on the protection of public health and safety. These types of amendments will be of minor importance in overall plant operation and be of minimal significance to the level of risk associated with a plant and its operation. Similarly, removal of items not associated with the safe operation of the plant will have no effect on plant risk.

Licensees do, however, stand to benefit financially from changes of this sort, as does the NRC. Costs and delays of license amendments will be reduced and licensees will be able to operate the plant more efficiently and safely.

2.1.3 Technical Basis

Purpose

The overall technical basis of the technical specifications was founded on the desire to establish the operating parameters that must be controlled in order for a plant to always be capable of responding successfully to the accidents postulated in the safety analysis report. The basic philosophy is deterministic rather than probabilistic or risk-based. It involves some initiators and sequences with very low probabilities of occurrence. This philosophy was necessary when the first technical specifications were written, since risk assessment was relatively new and had not been applied to reactor operations.

Problem

With the advent and refinement of risk assessment techniques, the value of technical specification limits based on design basis accidents has been scrutinized by licensees and others. While this issue was not articulated by any one individual interviewed, many comments taken together indicate that large expenditures of utility and NRC resources are directed at complying with these conservatively based limits.

Many comments were received indicating that all items in the technical specifications are treated with equal importance. This has been discussed above with respect to surveillance requirements. In addition, many of those contributing information to this study indicated that there is no prioritization of action statements; minor items, such as fire doors, receive as much attention as major items, such as engineered safety feature operability.

Suggested Modifications

It was suggested that the technical specifications be structured to reflect a risk-based importance of limits, taking into consideration some of the accident sequences identified in PRAs that contribute more to overall risk than design basis accidents (such as large break LOCAs). An approach of this type has the advantage of considering the initiator and accident sequences that dominate public risk and tailoring the technical specifications to those areas. Resources and efforts could be directed at more important issues than is sometimes the case today.

Risk Considerations

Design basis accidents used in the establishment of technical specifications were chosen to define a worst-case operating envelope for plant equipment. A risk-oriented approach to optimize technical specifications would be beneficial because it would direct risk management resources toward the most significant contributors to public risk. Although the risk profile of the plant might be altered, the overall level of protection of public health and safety would be maintained or even improved; resources would be utilized more efficiently.

It is important to emphasize the benefits of the risk-oriented approach to safety enhancements over the more traditional approach based on design basis accidents. Consider, for example, a piece of equipment designed to respond to very rare and extremely severe design basis accidents. In some cases, the design required by those extreme conditions can impair the ability of the equipment to function in response to more frequent, less severe events. In this category is plant piping that is designed to withstand a double-ended guillotine break. Such piping is secured by restraints to prevent pipe whip. These restraints, however, reduce the capability of the piping to respond to more frequent thermal transients or to seismic events. They also increase the complexity of plant design, construction, and operations, and increase occupational exposures to plant staff.

It is difficult to make any definitive statements regarding the potential risk impacts of changing the basis of technical specifications from design basis accidents to risk importance. The potential benefits are clear: the importance of some of the specifications may be reduced and action times or surveillance requirements may be relaxed. The risk impacts, however, would depend on the precise nature of the changes to the specifications.

2.1.4 Action Statements

Purpose

Action statements are associated with each limiting condition for operation. Whenever a limiting condition for operation is not satisfied in the technical specifications, (for example, when a train of residual heat removal is inoperable because of a failed breaker in the starting circuitry of the pump), the requirements of the action statement must be met. In the example, the action statement may require the reactor to be placed in hot standby within 6 hours. Generally, the plant staff has the time allowed in the action statement to repair the item and conduct a successful surveillance test or comply with the action.

Problem

Many licensees indicated that several action statements contain overly restrictive time constraints that are inconsistent with the relative importance of the item. One example cited in the interviews was an action statement for the reactor trip breakers that allows 2 hours before the plant has to be shut down. To complete the surveillance test on a breaker, it has to be cleared (i.e., removed from service and declared inoperable, thus entering the action statement). Each breaker requires 12 hours for surveillance testing alone. Rather than shut the plant down to satisfy the 2-hour action statement, the licensee conducts the surveillance in a series of segments, each of which is less than 2 hours in length. Thus, this 2-hour action statement seems overly restrictive when it is considered that 1) the breaker really is out of service for a cumulative total of at least 12 hours (neglecting the short periods of operability between tests), and 2) the potential for plant trips is increased, since the breaker is repeatedly cleared and returned to service.

Suggested Modifications

Risk importance and system/component reliability based on PRA results could be used to establish appropriate periods for action statements. Licensees anticipate that some action statement times could be relaxed under such considerations, allowing more flexibility for repair and surveillance. An added benefit of such an action is a reduced number of plant shutdowns required by technical specifications because of insufficient action statement times. This would reduce the time the plant is in a transitory (or less safe) condition.

A second suggestion is to tailor the action statements to avoid plant transients (such as shutdowns and startups) wherever possible by eliminating unnecessary mode changes. This suggestion implies that some action statements require shutdowns when not absolutely necessary. Implementation of this suggestion could save licensees the costs of replacement power (quoted as $500,000/day by one utility) for each action statement that no longer required a plant shutdown.

Risk Considerations

The use of risk considerations and system/component reliability estimates for establishing appropriate limits on action statement time could maintain the overall level of safety while fostering more efficient use of resources. It is believed that there is some potential for improvements in safety due to elimination of convoluted maintenance or testing activities, as described above for the reactor trip breakers. Savings to licensees are accrued through more efficient maintenance and surveillance testing operations and fewer shutdowns.

2.1.5 Administrative Issues

Purpose

The technical specifications contain an entire chapter of administrative items including plant organization, staff qualifications, training requirements, charters of on-site and off-site review and audit committees, reporting requirements, records retention requirements, radiation protection program requirements and definitions, environmental radiological monitoring procedure requirements and criteria, and requirements for major changes to the radioactive waste treatment systems.

Many of the administrative items were included in the technical specifications to control a certain aspect of plant operation, and because the technical specifications were the most convenient vehicle for implementing that control. As a result, some of these items have no direct bearing on the safety parameters that insure the safe operation of the facility.

Problems

The major problem with the administrative section of the technical specifications is the amount of superfluous material. Many licensees mentioned the difficulty that control room operators have in quickly and conveniently locating important information in the technical specifications because of extraneous material.

A second problem noted by the utilities is the use of several specifications to control a certain plant parameter. For example, requirements for control of reactor coolant system flow are contained in two separate specifications, requirements for operability of plant radiation monitoring instruments are contained in four separate specifications, and shutdown margin limits for mode 1 operation (power generation) are contained in two separate specifications. This practice requires operators to check all possible specifications for requirements affecting some plant equipment.

A third area of difficulty is the inclusion of organizational information in the technical specifications. Every time a licensee wishes to reorganize the plant staff, a license amendment is required. Other items, such as committee charters, procedural requirements etc., could be effectively controlled or monitored by NRC without inclusion in the technical specifications.

Finally, utilities cited problems with specifications that are trivial and unrelated to the safe operation of the plant. One of the examples cited was the requirement for the repair or disposal of leaking sealed radioactive sources.

Suggested Modifications

The main suggestion of utilities was to split the technical specifications into two or more documents. The document to remain appended to the facility operating license would contain the safety limits, the limiting safety system settings, the limiting conditions for operation, and the actions required when any of these limits are exceeded. All other material presently contained in the technical specifications would be placed in other documents. The remainder of the items not needed in the technical specifications are those specifications that are nonessential to the safe operation of the plant.

Risk Considerations

There is no adverse risk associated with splitting the technical specifications to remove material not related to plant operation, because this material is not used by the operators in mitigating the consequences of an accident, nor does it change accident initiator probabilities. In fact, streamlined technical specifications will be easier for operators to use in the day-to-day operation of the plant, thereby reducing the potential for human error in the control room or in the interpretation of safety limits and consequent required actions.

2.2 FIRE PROTECTION: 10 CFR 50, APPENDIX R

The requirements contained in Appendix R are intended to specify the fire protection features required to satisfy General Design Criterion 3 of 10 CFR 50, Appendix A. These more specific requirements were deemed necessary in the aftermath of the fire in the Browns Ferry cable spreading room. Appendix R contains requirements for a fire protection program, a fire hazards analysis, and fire prevention features intended to protect those systems necessary to shut down the reactor and maintain it in a cold shutdown condition. The appendix also contains requirements for other aspects of fire protection, such as fire brigade training and emergency lighting.

The responses of those contacted in this study can be divided into two categories: those problems, modifications and risk considerations directed at Appendix R as a whole, and those directed at particular features in Appendix R. The general issues concerning Appendix R are discussed in the next section, followed by sections addressing each specific issue.

2.2.1 General Fire Protection Issues

Problems

Some utilities find the changing interpretations of Appendix R costly and time consuming. One utility reported that such changes were responsible for schedule delays, extended outages and costly plant modifications that, in the utility's view, were not justified by corresponding safety benefits. This utility spent approximately $30 million per plant site following the changing regulations. Other utilities indicated costs approached $80 million per plant for Appendix R modifications.

Suggested Modifications

Several utilities contacted in this study suggested the complete elimination of Appendix R as a codified requirement. Some felt that it should be made a Regulatory Guide, while others suggested that criterion 3 of the General Design Criteria (Appendix A) would be sufficient for fire protection. For new plants or plants that have not yet met the requirements, elimination of Appendix R would eliminate the need for some plant modifications, resulting in significant design and construction cost savings. Operational cost savings would also accrue. For most plants, the costs that would be saved by eliminating Appendix R are some of the daily operational costs associated with some fire protection surveillance tests, fire barrier maintenance costs, and reinstatement of some of the automatic functions that are manually accomplished in the presence of the fire protection separation requirements.

Changing the fire protection requirements of Appendix R into a Regulatory Guide in support of criterion 3 of the Appendix A General Design Criteria may have less impact than completely eliminating them. The plants would still have to satisfy the design criterion to protect equipment required for the safe shutdown and long term cooling of the plant. It was suggested that the criteria of the Regulatory Guide should be based on risk considerations of fires and the costs to utilities of such requirements. If licensees had the option of following either regulatory guidance or an alternative approach that satisfies the general design criterion, they could then select the most cost-effective approach for their plant. Some NRC staff time may be saved by the avoidance of processing exemption requests to Appendix R. However, fire protection reviews would still have to be conducted.

Risk Considerations

Based on three PRAs that considered the effects of fires (Big Rock Point, dated 1981, NRC docket 55-155; Indian Point 2, NRC docket 50-247; and Indian Point 3, NRC docket 50-286, both dated 1982), the contribution of fires to core melt frequency ranged from 25% to 40% of the total core melt frequency from all initiators. The major portion of the fire-caused core melt frequency resulted from cable damage in cable spreading rooms. These PRAs appear to have considered the probabilities of failure of the automatic detection systems, failure of manual suppression efforts (i.e., fire brigade), and failure of automatic sprinkler systems. The PRAs did not appear to consider fires in other areas of the plant that might affect safety-related equipment functions, nor was it apparent that they included the effects of Appendix R fire suppression modifications.

The large contribution of fire to core melt frequency suggests that protection against fire is necessary, a point that all utilities interviewed agreed on, and that fire protection requirements cannot be completely eliminated from the regulations without a substantial potential for increase in public risks. However, the requirements for fire protection could be based on risk significance and the probability of a fire occurring in various areas of the plant. Such an approach could improve the cost-effectiveness of the requirements, and if judiciously implemented, would not significantly change public risk due to fire.

2.2.2 Automatic Features Disabled

Purpose

Sections III.G.2 and G.3 of Appendix R contain requirements for protection of the safe shutdown capability. Specifically, in locations where cables and equipment (including associated non-safety circuits) could prevent the operation or cause the malfunction of systems required for shutdown due to hot shorts, open circuits, or shorts to ground, Appendix R requires 1) separating the redundant trains of equipment by installing a 3-hour fire barrier, 2) providing a 20-foot combustion-free horizontal separation between redundant trains, and installing fire detection and suppression equipment in the fire area, or 3) enclosing one train of the redundant equipment in a 1-hour fire barrier (Appendix R, III.G.2) and installing fire detection and suppression equipment in the fire area.

Problem

Since this requirement was a retrofit for many plants, the options for providing suitable separation of redundant equipment were limited. Licensees solved the problem, in some cases, by removing or disabling some of the automatic features associated with equipment and systems that are used in normal or abnormal operations not associated with fires. The result of these modifications could be the loss of some automatic transfer functions from one train to another, some automatic system realignments, or some automatic transfers of power supply when certain abnormal conditions occur.

At one plant, compliance with Appendix R resulted in the removal of power from 20 to 25 motor-operated valves (MOVs) in the component cooling water system (CCW) to avoid the potential of hot shorts, open circuits, or shorts to ground preventing system operation or causing malfunction. These valves had been installed to provide operational flexibility if one of the CCW trains became inoperable. In this instance, control room operators could set the system to automatically change or swap over to the swing train to keep the supply of component cooling water available and prevent a plant shutdown. The example cited occurred at a twin unit site with three trains of component cooling water: train A supplies unit 1, train B supplies unit 2, and train C is used as a swing train, capable of supplying either unit. Thus, if one unit suffered a CCW train malfunction, the swing train could be automatically valved in, thereby avoiding a plant shutdown.

In the plant's present posture, with the power removed from the MOVs, the facility has lost its automatic flexibility. If a problem occurs, auxiliary operators must be dispatched to the motor control centers to manually realign the trains. The utility reviewed its operating, abnormal and emergency procedures to insure that proper guidance is given to the control room staff and auxiliary operators in the event of a CCW train failure. Finally, retraining was required to familiarize operators with the elimination of the automatic transfer feature and insure that they were capable of realigning the trains properly in the available time.

Suggested Modification

One suggestion that has some bearing on this problem is to allow credit for noncombustible or self-extinguishing cable insulation. The assumption that all cable insulation is combustible (which is not supported by laboratory test results) increases the combustible loading in and around cable trays, making it very difficult to satisfy the separation requirements. The advantage of relying on the more realistic combustible loading estimates by taking credit for noncombustible or self-extinguishing cable insulation is the reduction of fire protection equipment and features in areas where there is little or no risk of fire. Finally, it may allow some of the disabled automatic features to be re-enabled, thus restoring some of the safety features previously lost, as discussed above.

Risk Considerations

Allowing licensees to take credit for noncombustible or self-extinguishing cable insulation and allowing more realistic estimates of combustible loadings has little effect on risk, because the actual risk of fire in an area is dependent on the actual fire loading, not the loading assumed in the analysis. Since the actual combustible loading is not being changed, there can be no increase in risk. Actually, the design of fire protection features to realistic loadings (with appropriate margins) rather than to assumed high loadings may slightly reduce the overall risk of the plant by decreasing the amount of ancillary equipment, whose maintenance, operation, or testing may be a source of failure or damage to nearby safety-related equipment.

From a risk perspective, public risk may increase due to the removal of power from the MOVs, as illustrated in the case involving the component cooling water system. The risk impact is due to the longer time required to manually realign the system. In that period of time, it is conceivable that a plant trip may occur due to the loss of CCW. Furthermore, the manual realignment process may increase the probability of misalignment due to operator error. The risk of a plant trip due to loss of CCW must be compared to the risk reductions obtained by incorporating the fire protection requirements in that area of the plant. It could then be determined, based on risk, whether the removal of power from the MOVs improves or degrades safety. A similar evaluation is indicated for all automatic plant features that may be disabled as a result of Appendix R requirements.

2.2.3 Transient Combustible Load Requirements

Problem

Perhaps one of the most difficult items for licensees to comply with is the requirement to consider transient combustible loading in areas containing shutdown systems, equipment, and cabling susceptible to fire damage. While Appendix R requires licensees to develop administrative controls to govern the handling and limitation of transient fire loads, most licensees contacted have been constrained to use a 55-gallon drum of oil as the defined transient combustible load in all fire-sensitive areas. In some instances, this hypothetical drum of oil is the only combustible material in the area and costly fire protection requirements are imposed solely because of this hypothetical hazard. This assumed transient combustible loading has led to the installation of fire suppression systems in the suppression pool of some BWRs.

Suggested Modifications

Almost every licensee interviewed suggested that a roving 55-gallon oil drum not be interpreted as the transient combustible load. While it is reasonable to consider transient combustible loads, it is unusual in plant operation to wheel a drum of oil through every fire-sensitive area. Furthermore, some credit should be allowed for satisfying the requirement to provide administrative controls of transient combustible loads.

Risk Considerations

The use of more realistic transient combustible loads in the fire hazards analysis will not affect the probability of a fire; it will only reduce fire protection requirements in an area. Based on the assumption that the fire hazards analysis accurately reflects fire loading conditions, the risk of fires will not change. Allowing licensees credit for administrative controls of transient fire loads, especially in the case of the roving 55-gallon drum of oil, would again permit more realistic analyses. Since the 55-gallon oil drum is assumed to represent the envelope of transient combustible loads in all areas of the plant, use of smaller, more realistic loads in those areas does not increase actual plant risk, which is based on actual combustible loadings, not those conservatively assumed for analyses.

2.2.4 Loss of Offsite Power

Problem

Several utilities questioned the appropriateness of the requirement to consider loss of offsite power concurrent with a fire. They indicated that such an occurrence is highly unlikely and increases the costs of fire protection unnecessarily.

Suggested Modifications

Several licensees that were interviewed agreed that loss of offsite power concurrent with a fire is a low probability event, both when loss of offsite power results from an initiator other than fire and when it results directly from fire. These licensees recommend that the complications of concurrent loss of offsite power not be imposed with the fire protection requirements.

Risk Considerations

As noted previously, several PRAs have estimated that fires in nuclear plants represent approximately 25% to 40% of overall risk. The risk contribution of concurrent loss of offsite power and fire, however, is estimated to be quite small. Data for nuclear facilities (NUREG/CR-2258) shows a total of 51 actual fires, one of which occurred in an electric switchyard and two of which occurred in relay rooms. These are the only fires with a potential for fire-caused loss of offsite power. In comparison to other types of fires recorded in the database, these three fires represent a small portion of the total. The database records 10 fires (20% of all fires) in diesel generator rooms, indicating that far more risk from fire is associated with loss of emergency electric power sources than offsite power sources.

2.2.5 Three-Hour Fire Barriers

Problem

In areas of low combustible loading, Appendix R requires 3-hour fire barriers for separation of redundant trains of safety-related equipment, the same as for areas of higher combustible loadings. Several utilities indicated that the three-hour fire barriers are more expensive to construct because more expensive material, larger volumes of material, and longer construction times are required.

Suggested Modifications

The use of 3-hour fire barriers for separating redundant trains of shutdown equipment could be relaxed without impacting the safe operation of the plant, according to several licensees interviewed. These licensees propose 1-hour fire barriers in areas of low combustible loading. One utility estimated that such a change would save over $1 million in initial installation costs; operational cost savings would be smaller.

Risk Considerations

Using 1-hour fire barriers in areas of low combustible loading would likely reduce utility costs. However, from a risk perspective, the ability of the fire brigade to control the fire within 1 hour, or the ability of the fire brigade to provide manual protection of the protected equipment or cabling before the barrier is degraded by the fire and damage to the safety-related equipment occurs must be considered. If the fire brigade can control fires that quickly, the safety of the facility would not be degraded. Alternatively, a detailed value-impact assessment of each fire barrier might be necessary to demonstrate that the costs of fire protection in the area exceed reasonable risk savings. In summary, the regulation could be modified to allow the use of 1-hour fire barriers in areas that meet specified criteria aimed at limiting the risks associated with the 1-hour barrier compared to the costs of 3-hour barriers.

2.2.6 Allowance for Operator Actions

Problem

Several utilities contacted in this study maintained that Appendix R disallows credit for operator actions in mitigating the effects of plant fires. Operator response to a fire is composed of two types of actions: 1) fire suppression activities and 2) plant control (including shutdown) activities. Those utilities that mentioned this problem were referring to the general requirement in Appendix R that invokes the defense-in-depth concept "to provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant" (Appendix R, Section II.A). Their concern deals with the first of the above two types of operator actions; i.e., fire suppression activities.

While the assumption that fires will not be extinguished is obviously conservative and is directed toward obtaining defense in depth, utility representatives indicated that the complications it adds to fire protection features are substantial. They maintain that fire brigade members are well-trained in controlling fires in the plant, that operators are trained in operating the plant with entire systems out of service, and that operators are capable of shutting down the plant under a host of abnormal situations.

Suggested Modifications

The licensees interviewed suggested that some credit for operator and fire brigade actions be allowed in the fire hazards analysis. As a minimum, the fire hazards analysis could be relaxed in areas where licensees have specific emergency operating procedures to respond to systems that might be rendered inoperable in a fire. Alternatively, the analysis may take into consideration the mitigating effects of operators in areas where fire drills are conducted that demonstrate the capability of the fire brigade to 1) respond quickly with the proper fire fighting equipment, 2) quickly and correctly identify and locate safety-related equipment and cabling in the area that need protection, and 3) gain access to the safety-related components without encountering a combustible material that might be burning. Licensees estimated that substantial savings in capital and operating costs would result. Some indicated that a reduction in fire protection equipment reduces the hazards of damage to adjacent safety-related equipment that may occur either from inadvertent fire protection system actuation or from maintenance and testing of fire protection systems.

Risk Considerations

Operator actions to mitigate the effects of transients are considered in some analyses, such as PRAs, by allowing control room operators to restore equipment out of service for maintenance or make certain transfers that are not automatic (such as changing to containment recirculation). While in most PRAs, operator actions are responsible for a nontrivial portion of the overall plant risk, the systems that are being protected by Appendix R requirements are those standby safety systems that would only be activated during a fire if a transient occurred concurrently with the fire. It appears reasonable to strike some middle ground in this case; that is, allow credit for specific, well-defined operator actions that are reliably performed. Therefore, those operator actions accomplished as a result of immediate operator actions contained in the emergency operating procedures could reasonably be considered in the fire hazards analysis.

2.2.7 Emergency Lighting

Problem

The requirement to provide emergency lighting in the plant in case of a fire is excessive, according to several utilities interviewed. No credit is allowed for hand-held lighting, even though most operators routinely carry a flashlight on their belts to aid in identifying equipment in areas of poor lighting.

Suggested Modifications

Many of the licensees that discussed fire protection requirements in the interviews suggested that credit be allowed for the use of hand-held lighting in some areas. They agreed that emergency lighting is justified in major exit routes from the plant and in and around the remote shutdown panel. However, they could see no justification for emergency lighting for the routes that operators might need to take to operate equipment in an abnormal situation, since most operators always carry a flashlight. According to the utilities, elimination of the lighting requirements in these types of areas would reduce the capital cost of installing the lighting in new plants, decrease the load demand on the station emergency generators and batteries, and eliminate the costs of maintaining the lighting systems in working order.

Risk Considerations

Emergency lighting in areas of operator travel during an abnormal event is certainly preferable to either darkness or use of flashlights, other things being equal. However, the cost of this choice exceeds some licensees' sense of benefit. The potential increase in risk that might be associated with the elimination of the lighting requirement in walkways and access areas is associated with delays in operator actions. It is reasonable to conclude that an operator will be able to find the emergency shutdown panel or the emergency boration valve, for example, with a flashlight; it may simply take him longer to get there.

This regulation presents an interesting conflict in requirements: On one hand, very little credit is accorded in most analyses to the mitigating effects of operator actions, while on the other hand, lights are required to aid the operator in taking mitigating action more quickly. It seems reasonable that either credit for operator action can be increased or the requirements that aid operators in taking quick action can be reduced. One solution might be to allow credit for operator actions as contained in the immediate operator action section of the emergency operating procedures and to continue to require that permanent lighting be provided to aid the operator in the efficient and reliable performance of that action, whether it be in the control room or in the plant.

2.3 SHOLLY LICENSE AMENDMENT PROCESS: 10 CFR 50.90, 50.91, AND 50.92

The revised license amendment process that licensees and members of NRC discussed in the interviews and questionnaires centers around the recent change in the regulation that resulted from the case of Sholly vs. NRC and Public Law 97-414, which amends the Atomic Energy Act. The decision of the court was to fortify the right of the public and the states to review proposed license amendments and request public hearings. The NRC revised its regulations to better accommodate the state and public review process and public hearings, if requested. Figure 2.1 illustrates one utility's interpretation of the flow of an amendment application after implementation of the new regulation.

The major changes instituted by the new law are the increased requirements for Significant Hazards Considerations (SHC) and public and state hearings. The new regulation modified the requirements for performing SHCs increasing their complexity and impacting the amount of paperwork needed to support the SHC. Several utilities and industry organizations indicated that these changes greatly increased the time required to obtain even an "emergency" license amendment. The new law requires a more comprehensive SHC and a lengthy notification cycle in all cases. For amendments involving significant hazards, notice must be given in the Federal Register with at least 30 days for response. By way of procedure, NRC routinely publishes amendment requests only once a month, thereby introducing a cumulative delay prior to the decision to conduct hearings of at least one month and at most 2 months. (Recently, NRC has been publishing notices of license amendment requests twice a month in an attempt to reduce the time delay.) This license amendment process applies to any and all changes in a facility operating license, which includes the plant technical specifications.

Problems

The overwhelming concern with the revised amendment process, expressed by representatives of industry and NRC staff alike, is the increased time and cost associated with processing a license amendment. A side effect of this condition is a disincentive for licensees to apply for amendments that enhance plant safety.

A second area of impact due to the time required to process a license amendment may occur as a licensee applies for core reload. If the new reload design involves changes to the FSAR or the technical specifications, or involves an unreviewed safety question, the licensee, according to 10 CFR 50.59, must advise NRC of the change prior to its implementation. In cases in which the core reload affects technical specifications, the license amendment process is applied and the reload is reviewed by the NRC with public and state review, if requested. The entire process took approximately 1 year prior to the Sholly decision; with the new requirements for state and public notice and allowance for review, the licensee must now submit core reload requests involving license amendments 2 to 3 months earlier than before. The first impact on the licensee is that projections of the end-of-cycle core conditions prior to ordering new fuel must be made 3 to 4 months earlier than before. This increases the probability that his projections will not coincide with actual end-of-cycle conditions and increases the potential size of his prediction error. Errors in

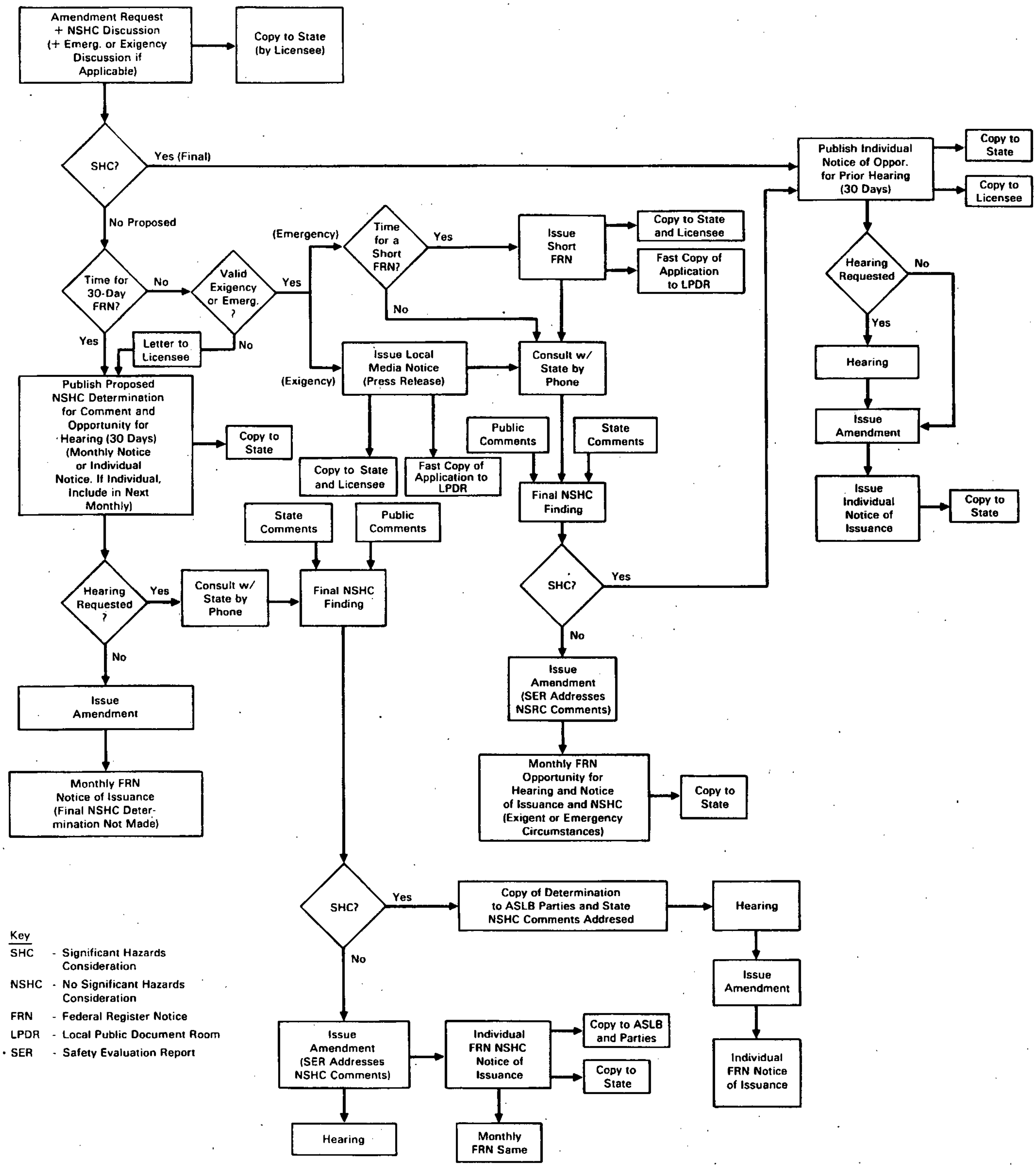

FIGURE 2.1. Flow Chart of License Amendment Process following Sholly Decision

prediction of end-of-cycle core conditions result in less-than-maximum utilization of the fuel and up to 1 or 2% loss in core power over the next operating cycle. The second impact on licensees is the higher cost off processing core reload amendments; one utility reportedly spent $400,000 to prepare information to support the notices required by the Sholly decision, and no public comments or interest were received.

Finally, with regard to the time required for a license amendment, licensees contacted in this study maintain that without the capability of obtaining an immediate emergency license amendment, operating costs and down time may soar unnecessarily as the plant remains shut down until the significant hazards consideration, at a minimum, can be processed.

Some of the utilities expressed doubt that the new license amendment process was actually something in which the states and public wanted to participate. One utility had looked at the amount of public interest in license amendments and found that out of about 2200 license amendment requests at that time, the public only expressed interest in 3 cases. In this same vein, the utility maintained that public and state reviews do not decrease the risk of plant operations; if anything, the review process serves only to increase the public's perception of plant risk. As indicated above, the cost of preparing material in support of the amendment process is a financial burden for power companies.

Some NRC project managers who attended the interviews also mentioned that they experience similar difficulties while working with licensees to obtain amendments within the confines of the new regulation.

Some of the licensees interviewed also object to NRC's policy of requiring the licensee to perform the significant hazards consideration on amendments resulting from NRC requirements. These utilities maintain that the burden should be borne by the NRC staff that developed the requirement imposed on the licensee.

Finally, an NRC questionnaire respondent indicated that the examples prepared by the agency to aid in determining Sholly amendment applicability and in reviewing significant hazards considerations are not valuable in guiding NRC staff because the examples are not representative of the amendment applications that they are required to process.

Suggested Modifications

First and perhaps foremost, the utilities interviewed in this study suggested that NRC find a workable provision for granting emergency license amendments prior to the significant hazards consideration, with public notice being served after the issuance of the amendment. This would allow licensees to make needed emergency license changes quickly and proceed with plant operation with minimum impact on downtime and cost.

Some licensees suggested that the state and public involvement provisions be removed from the process, since these groups have shown little interest in the process to date.

Finally, it was suggested that NRC clarify and, if necessary, codify its interpretation of the amendment process to eliminate confusion between licensees and NRC reviewers. Perhaps implied by this suggestion is the need for the NRC to establish sample amendment request cases to be used by NRC reviewers as models for establishing the applicability of Sholly provisions to the license amendments that they receive.

Risk Considerations

Contributions to risk from public and state input in the amendment process will only occur when 1) amendments that compromise plant safety are modified or blocked before implementation, and 2) amendments that increase plant safety are facilitated. Experience cited in the interviews indicates that few requests for public or state input have been made. Therefore, the risk reduction attributable to the current license amendment process is probably small. The emphasis on public and state input is more a question of due process than one of risk reduction.

In contrast, the time-consuming nature of the amendment process prevents immediate implementation of license modifications, including those to enhance safety, as pointed out in the utility interviews. Reducing the cost and time required to implement an amendment may therefore make a positive contribution to the protection of public health and safety.

From a risk perspective, any modifications to the amendment process would ideally include provisions for distinguishing between the great majority of amendments that have little risk significance and little public interest (these could be implemented with a minimum of delay) and the small fraction that may require more consideration before implementation. Streamlining the amendment process for changes contributing to plant safety seems to be defensible and desirable, at least from a risk perspective.

The effect of identifying categories of license amendments that can be granted without satisfying the rigors of the "significant hazards consideration" and holding public hearings will not have any impact on public health and safety. These items will be of minor importance in overall plant operation and of minimal significance in the level of risk associated with a plant and its operation. Similarly, removal of items not associated with the safe operation of the plant will have no effect on plant risk.

While it must be recognized that this regulation is different from most others because of the Sholly court decision and the public law amending the Atomic Energy Act, the burdens of the regulation and the risks avoided could be evaluated to establish the risk-effectiveness of the regulation. Because of the statutory requirements, however, the method of modifying this regulation may be much more complicated than the other regulations identified in this report.

2.4 EMERGENCY PLANNING: 10 CFR 50.47 AND APPENDIX E

Purpose

The conditions for issuing construction permits and operating licenses [10 CFR 50.34(a) and (b)] contain requirements for preparing and demonstrating that emergency preparedness plans are adequate for responding to radiological emergencies. Appendix E contains minimum requirements for emergency plans and describes the elements necessary in the plan. These elements include emergency organization, required assessment actions, activation of emergency organization, notification procedures, emergency facilities and equipment, training, maintenance of emergency preparedness, and recovery. Section 50.47 contains the standards that must be met by the emergency preparedness plan and the requirement for Federal Emergency Management Agency (FEMA) review and acceptance of the plans. Also included is the definition of the plume exposure pathway emergency planning zone (EPZ) as an area about 10 miles in radius and the ingestion pathway EPZ as an area about 50 miles in radius. The requirements to construct emergency management facilities; to establish communication centers and links; and to establish notification procedures for advising local, state, and federal agencies are specified.

Problem

The most frequently mentioned problem of the emergency plans was the size of the EPZs, both the plume exposure pathway and the ingestion exposure pathway. Some of the licensees interviewed have found that the immediate notification system to alert the public within the plume exposure pathway is expensive to design, install, and maintain, and contributes to negative public sentiments about the nuclear plants. One utility spent $1.2 million installing sirens in the plume exposure pathway. Most importantly, the utilities feel that the zones are larger than necessary for effectively limiting the risk to the public from radiological releases from the plant.

A second area of burden to the utilities is the requirement to notify local, state, and federal agencies within 15 minutes of activating the emergency plan. Some licensees stated that in the first 15 minutes very little may be known about what is happening and there may be great difficulty in presenting the information that these agencies need to know in order to make decisions. Often, in the first hour of an event, the most qualified person in the control room is diverted from the control boards and management of the transient to explain the events of the transient or answer questions regarding the anticipated resolution of the event.

Third, some licensees questioned why different source terms were used for various analyses throughout the regulations rather a single, consistent value. Licensees generally feel that the source term used in setting the emergency plan requirements was too conservative.

Finally, those interviewed stated that some protective action guidelines actually increase risk of exposure to the public. The requirement to conduct evacuations, they claim, exposes the public to the risk of being exposed to the plume during evacuation and the risk of being injured in the evacuation.

Suggested Modifications

The utilities contacted in this study suggested the use of risk assessment techniques to prioritize the activities associated with emergency planning. They believe that comparisons of risks to the costs of some emergency planning items will indicate areas in which large expenditures of resources yield small benefits. In this category are emergency facilities such as the technical support center and the emergency offsite facility, the frequency and rigor of the annual emergency plan exercises, and the size of the plume and ingestion exposure pathway EPZs. One utility reported spending $60 million per site for emergency response facilities, excluding the ongoing maintenance and other costs associated with the buildings.

The industry as a whole, including the architect-engineering firms and the reactor vendors, encourages and supports the current source term reevaluations being conducted. The industry would like the NRC to adopt the revised source terms and relax many requirements, one of which is the emergency planning requirements. They wish to see the disparity of source terms presently used in the regulations resolved as a result of the current studies.

It was suggested that the times allowed in the regulations for notifying governmental agencies be relaxed to improve the quality of the information available for decision making and to allow the control room personnel to concentrate on the transient. Closely related to this action is the suggestion by some to completely eliminate the first and least significant of the four emergency classifications, the unusual event. Those utilities that found reporting times to be burdensome indicated that in most cases an event was trivial at the time of the first notification (that is, upon the declaration of an unusual event).

Most utilities interviewed suggested a reduction of the size of the EPZs: from 10 miles to 2 miles for the plume exposure pathway; and from 50 miles to 10 miles for the ingestion exposure pathway. Their rationale is that likelihood of a release that would require protective actions over the entire 10-mile and 50-mile EPZs is very remote. Part of this rationale is based on the utilities' experience in preparing scenarios for annual emergency exercises. These scenarios corroborate PRA results indicating that large releases have low probabilities. Multiple concurrent failures of plant equipment must be postulated and combined with almost complete disallowance of mitigating operator and maintenance actions in order to generate a release scenario for the exercise that is capable of approaching the protective action guideline for evacuation. Were these assumptions not made, the local agencies are not likely to be exercised since any releases could be terminated before actions are required to protect the surrounding population.

Finally, it was suggested that the FEMA certification of the emergency plan be conducted only once, rather than annually. Utilities indicate that the benefit of conducting annual drills does not offset the cost of the drills, which can range from $150,000 to $300,000 per site per year, depending on the number of local agencies affected by the emergency plan.

Risk Considerations

The impact of using risk assessment techniques to establish priorities for emergency planning issues would be beneficial in principle, although it might be controversial. Ideally, licensees would direct their resources to areas demonstrated through the risk assessments that require the most attention. Overall risk to the public would remain unchanged, although the risk profile would be different. Total expenditures for emergency planning would probably be reduced.

The use of standardized source terms, as opposed to the current practice of using several different source terms, would have no substantial adverse impact on public risk. The fact that other, perhaps lower, source terms are currently used in some analyses of other plant functions and responses implies that the associated risks of the other source term are considered acceptable. A uniform, standardized approach should be no less acceptable.

Modification of the reporting times may have a small adverse impact on public health and safety, since some core melt scenarios proceed very rapidly. While these accidents are extremely improbable, the reporting time requirements should be carefully evaluated based on plant-specific core melt scenarios and risks associated with those events. On the other hand, a potential safety benefit could be gained by allowing the control room supervisor to manage the transient instead of having to notify local, state, and federal agencies.

The elimination of the unusual event category of the emergency plan classifications would have little or no impact on public health and safety since the items reported are not expected to develop into accidents. This notification does not change the consequences or frequency of events. Notifications of public officials of an unusual event cannot limit risk since, in most emergency plans, no response action is planned; it serves merely as a notification.

A reduction in the size of the EPZs at the present time (i.e., prior to adoption of the new source term) appears to have little, if any, impact on public health and safety. The risks of evacuating people within a 10-mile radius are inherently greater than the risks associated with evacuating people within a 2-mile radius EPZ. Furthermore, because of the large differences in population distribution and topography at each site, it is somewhat inconsistent to specify universally sized EPZs for all plants. A reasonable starting point for determining the appropriate size of the plume exposure pathway EPZ surrounding a plant might be to find the locus of points surrounding each site where the risks associated with evacuation from that location equal the risks associated with no evacuation. That locus of points would establish the areas where it is risk-effective to allow evacuations (inside the EPZ) and those areas where risks are greater for evacuations (outside the EPZ). These areas of risk-effective evacuations would become the plume exposure pathway EPZ.

Elimination of subsequent annual emergency plan exercises, assuming a successful initial exercise, would allow the efficacy of the emergency response team to degrade without detection. While the modification or elimination of the annual emergency exercise has no effect on the frequency of core melt, it does potentially affect the dose received by the public. Reduced public exposure during an accident can only be achieved by an informed public acting on directions from an informed and organized authority. It seems reasonable, therefore, that complete elimination of the annual emergency exercises is not the most prudent course of action. A reduction in the frequency of the exercises or a modification of their complexity, however, might be a viable option.

2.5 BACKFITTING: 10 CFR 50.109

Regulations regarding imposition of plant backfits by the NRC were being revised at the time of the interviews, so the outcome of the proposed revisions was not yet known. Therefore, the industry commented on the problems and burdens associated with the existing backfitting regulation, which had been in effect for 15 years. A revised backfitting rule has now been adopted (50 FR 38097). While the revised rule addresses most of the concerns raised in the interviews, the comments received during the interview are presented here for the sake of completeness.

Purpose

The former backfitting regulation was intended to give the NRC the means to impose backfits (defined as the addition, elimination or modification of structures, systems or components of a facility) if it finds such action would provide substantial, additional protection of public health and safety. The regulation contained no provisions for considerations of impacts other than public health and safety and no criteria were provided for establishing the definition of "substantial, additional protection."

Problem

The utilities interviewed stated that backfits imposed by the NRC frequently resulted in excessive burdens, because no criteria for cost effectiveness were contained in the regulation. In the aftermath of the TMI-2 accident, licensees cited numerous examples of backfits imposed at great expense that, from their perspective, yielded either marginal benefits or in some cases, actually resulted in increased risks.

Suggested Modifications

The industry recommended immediate implementation of the industry-sponsored backfit rule modification, which would require the NRC to demonstrate the cost-effectiveness of a proposed backfit prior to imposing it on a licensee. The basic intent of the licensee's suggestion was to implement a rule that requires consideration of industry costs and some balancing of costs and benefits.

Risk Considerations

In September 1985, the NRC commissioners approved a revised backfitting rule. It was published in the Federal Register on September 20, 1985 (50 FR 38097). While the revised rule is not identical to that proposed by various industry organizations, the thrust of the rule addresses the concerns expressed in the utility interviews; the revised rule requires the NRC staff to prepare a regulatory analysis that includes a value-impact assessment of the proposed backfit. The effects on public health, industry costs, and NRC costs are estimated and presented in the value-impact assessment. In summary, the revised backfitting rule addresses to a large extent concerns expressed by industry while still providing for backfits necessary to protect public health and safety. Any remaining concerns are likely to center on implementation and interpretations of the rule, rather than on the rule itself.

2.6 ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT: 10 CFR 50.49

Purpose

Certain electric equipment important to safety is required to be capable of withstanding the environmental conditions to which it might be exposed in the event of a design basis accident. To meet this requirement, the licensee is required to establish a program for qualifying electric equipment important to safety by 1) preparing a list of all equipment meeting the definition of important to safety contained in the regulation, 2) establishing the environmental conditions that each piece of equipment might experience, 3) qualifying each piece of equipment through testing or analysis, 4) maintaining a record of the qualification, and 5) qualifying replacement equipment for each item identified in the program.

Problem

Some of the licensees interviewed indicated that they experienced compatibility problems as they replaced unqualified equipment with environmentally qualified equipment. Often the replacement part was a new model, or different in some other way, and did not perform suitably during normal operation. Utilities expended substantial sums of money in the process, since environmentally qualified equipment is several times more expensive than the original equipment, and sometimes it did not function properly and had to be replaced a second time.

According to the utilities contacted in this study, the second difficulty with environmental qualification requirements stems from the deterministic rationale that underlies the regulation. The risk benefits of the environmental qualification requirements are believed to be small compared with the costs because the requirements are based on design basis events that have an extremely low probability of occurrence, e.g., large break LOCAs.

A third area of concern among those interviewed is the tendency for these environmental qualification requirements to drive vendors out of the marketplace. Licensees are faced with paying high prices for qualified equipment or they must conduct or contract their own qualification program for equipment that has been discontinued or is not available with qualifications.

Finally, industry contacts believe that the accelerated aging techniques used to qualify the equipment may underestimate its useful life. Therefore, licensees believe they are replacing items with expired qualification lives sooner than is really necessary, i.e., before there is a substantial risk that the component will not function in the post-design-basis-accident phase.

Suggested Modifications

First, industry representatives suggested a more limited scope of equipment for qualification. 10 CFR 50.49 is based on responding to design basis accidents, and the definition of important-to-safety equipment is broad. The industry would like to see the resolution consider only those components whose direct malfunction would impair the ability of the plant to respond to a transient or accident. Furthermore, only the environmental conditions that a component must withstand should be used for establishing its environmental qualification criteria. For example, if a pressure transducer is essential for recovery from a small break LOCA and not essential for recovery from other accidents, it should be qualified only to the environmental conditions expected during the small break LOCA. Granted, should a different accident occur, the pressure transducer might be damaged and would thus be unsuitable for further service. If the utility wanted to recover from such an accident and resume operation, then it would have to replace all environmentally qualified equipment exposed to an environment in excess of its qualification.

Another major problem that utilities encounter with environmental qualification requirements has developed over several years because the temperatures at which electric equipment must be qualified have been revised upward. This has cost some utilities twice the price of compliance with qualification requirements because they have had to identify new equipment to meet the higher temperatures and in some cases have had to conduct or contract special qualification testing on the new equipment. To prevent this problem, the utilities interviewed suggest that the temperatures be defined and not changed further.

Risk Considerations

The judicious reduction of the number of items in the environmental qualification program and the adjustment of qualification requirements to reflect the environmental conditions of individual components cannot have a negative effect on public health and safety because these actions do not change the plant's ability to respond to a transient. The only negative effect is that a licensee may have to replace equipment not used in responding to a transient that may have been damaged by an environment more severe than its qualification. Licensees would benefit from these changes by being able to use parts with less stringent qualification requirements for normal plant operations and would be relieved of some of the paperwork associated with assuring equipment qualification.

The issue regarding the temperature to which a component should be qualified for service may affect plant safety if the methods for predicting that temperature underestimate the actual temperature that may be reached in the transient. Additional information on the confidence intervals of the temperatures must be considered before the risk effect of this issue can be addressed further.

2.7 EMERGENCY CORE COOLING SYSTEM EVALUATION MODELS: 10 CFR 50, APPENDIX K

Purpose

The detailed emergency core cooling system (ECCS) evaluation model of Appendix K is intended to demonstrate that the calculated cooling of the ECCS systems are capable of assuring adequate core cooling following postulated loss of coolant accidents (LOCAs). Appendix K sets forth certain required and acceptable features of ECCS evaluation models including sources of heat during a LOCA, swelling and rupture of the cladding, fuel rod thermal parameters, blowdown phenomena, ECCS heat removal, and required documentation. This is where the assumptions and equations for hydrogen generation and critical heat flux are referenced. Many of the references for equations to calculate the various parameters date to the late 1960s.

Problem

Some utilities observed that the ECCS evaluation model of Appendix K is based on the consideration of the large break LOCA, which places the greatest demand on the ECCS, while recent PRAs indicate that the risk contribution of the large break LOCA is small compared to other initiator sequences (such as small break LOCAs). This leads to a model that is too conservative, causing utilities to overdesign the ECCSs. It was mentioned that the requirement to install core flood tanks or accumulators in PWRs arose from the conservatisms of this model. Additionally, the utilities commented that the best estimate of peak cladding temperature has been shown to be about 1400 F, rather than the 2200 F used in the model (as specified by 10 CFR 50.46).

The utilities also stated that the model's decay heat generation criteria for small break LOCAs led to unnecessarily restrictive technical specifications with respect to axial power distribution and high pressure safety injection pump flow.

The prescriptiveness of the appendix was criticized as impacting risk adversely, since there is no flexibility to consider plant specific features or improvements in the modeling of ECCSs.

The utilities participating in this project indicated that the regulation requires the use of an overly conservative safety factor for decay heat removal systems, causing the systems to be overdesigned and more costly to install.

Lastly, some utilities indicated that the requirements of 10 CFR 50.59, relating to design changes and unreviewed safety questions, occasionally require the utility to recalculate portions of the ECCS calculations for every core reload. They maintained that these recalculations have had no effect on risk, since the reanalysis never results in any physical changes to the plant. These calculations are performed for each reload to insure that the margin of safety as defined in the technical specifications is not reduced. However, most reloads are standardized, and core thermal power and other parameters remain relatively constant for each fuel cycle. Therefore, the utilities indicated that the requirement to reanalyze the ECCS for each reload to comply with 10 CFR 50.59 is unnecessary.

Suggested Modifications

Some of the utilities suggested that the contents of Appendix K be placed in a regulatory guide in support of 10 CFR 50.46 requirements for ECCS acceptance criteria. It was also suggested that the requirements in 10 CFR 50.59 that lead to reanalysis of the ECCS for each core reload be removed from the regulations or specifically exempted.

Some utilities suggested that the models and criteria for small break LOCAs should be revised to include up-to-date information and developments in understanding small break LOCAs. Some members of the industry also feel that the maximum peak cladding temperature can be reduced substantially without adversely affecting the safety of the plant or its operation. Finally, it was suggested that the safety factor for decay heat removal be relaxed to reflect more sophisticated decay heat removal modeling.

Risk Considerations

Elimination of Appendix K from 10 CFR 50 and inclusion of the material in a regulatory guide would have no effect on public risk if 10 CFR 50.46 were rewritten at the same time to present the criteria for acceptable ECCS operation. Allowing the utilities more flexibility in demonstrating conformance to the criteria would save costs.

It appears that the ECCS reanalysis requirements for some core reloads do not contribute significantly to public health and safety, if the reload enrichments and the core shuffling scheme are consistent with previous reloads and significant physical changes do not result from present reanalysis. For fuel reloads that differ substantially from previous reloads by some as-yet undefined criterion, reanalysis of the ECCS for safety margin considerations (i.e., peak clad temperatures) is a sound practice.

Revising models of small break LOCAs to more accurately reflect actual phenomena would not degrade risk, since the actual probability of occurrence, as well as its consequences, would not be changed.

The issue of peak cladding temperature reduction may affect a variety of areas involving safe reactor operation. Areas that may be affected are the rate of hydrogen generation in the event of a core melt accident and the effectiveness of core reflooding in the same scenario. While these two examples represent very low probability initiators, peak cladding temperature reduction needs to be investigated more completely prior to recommending relaxation.

Revision of the safety factor for decay heat removal has no impact on risk if it is simply a matter of reducing conservatisms in the analysis. The physical phenomena remain unchanged, as does the ability of the decay heat removal systems to remove heat.

2.8 SECURITY: 10 CFR 73

Purpose

The regulations in Part 73[a] specify requirements for the establishment and maintenance of a physical protection system for safekeeping special nuclear material against radiological sabotage and theft or diversion. It includes requirements for protection of material at fixed sites, such as reactors, and during transport.

Problem

Industry representatives contacted indicated that security requirements imposed by 10 CFR 73 sometimes hamper compliance with fire protection and emergency plan requirements. Examples of the difficulties generally concern locked doors and their interference with fire fighting or emergency response. Some utilities have been criticized by FEMA during emergency exercises because security requirements impacted operator or rescue actions.

Another area of concern is the impact of security on normal plant operations. One utility reported that it lost $1.5 to $2 million per year in efficiency and productivity as a result of complying with security requirements. Some of the ways that security impacts normal plant operation and maintenance are in the accessing of vital areas for repairs that involve removal of security barriers. To remain in compliance with the security plan, whenever a security barrier is breached for maintenance, a compensatory measure, usually in the form of an around-the-clock guard, is required to maintain the integrity of the barrier. Therefore, if it is necessary to open the containment equipment hatch for maintenance, a security guard must be scheduled to observe the hatch the entire time it is open. Similar measures required in other areas of the plant create a situation in which the need to provide security guards as compensatory measures sometimes limits plant operations. It is not unusual in the course of maintenance to wait for a security guard to observe a barrier or wait for a part or truck to be inspected before entering the plant protected area.

Some utilities stated that guard forces at plants are excessively large and costly. One utility reported 450 guards for one twin-unit site, at a cost of about $20 million per year. Another reported 400 guards for a single protected area.

Most utilities that identified 10 CFR 73 as a potential regulation for relaxation cited the burdensome lighting requirements contained in paragraph 73.55(c)(5), which calls for lighting in all exterior areas of the protected area. Lighting is therefore required on rooftops, in construction equipment areas, under trailers, under stairways and in other areas where light is not

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(a) While the scope of this study was focused on 10 CFR 50, security concerns were mentioned frequently enough to warrant inclusion of 10 CFR 73 in this report.

needed for the safe plant operation. Since the protected area fence is already lighted, alarmed and patrolled, utilities believe that the additional lights do not add to plant integrity.

Another area of difficulty expressed by the utilities was the cost of administering employee psychological screening tests. While this requirement is not specifically contained in Part 73, several utilities indicated that it is included in the standards (e.g., ANSI/ANS-3.3-1982 and ANSI N18.17-1973) used as the basis for security plans submitted to NRC for plant licensing. Typically, employee screening is accomplished by administering the Minnesota Multiphasic Personality Inventory (MMPI) to all applicants. One utility indicated that administration of the MMPI cost $750,000 over 3 years, and another indicated that the benefits were marginal since out of 776 applicants screened, only one was denied employment based on MMPI results. At another site, 5000 contractors and employees were subjected to the screening, with only 10 being rejected on the basis of the MMPI. For perspective, more than 4 times as many were rejected at this plant because of physical examination results. Some proposals are being developed for dealing with the issue of psychological screening. Among them are the industry-proposed standard for fitness for duty, as well as contemplated NRC rulemaking.

Finally, some utilities indicated that the requirement to control plant staff access to vital areas based on the need to enter for a specific job was particularly burdensome. Operators, fire brigade members, and plant management require access to all areas. Maintenance workers and others might be required to enter any vital area on short notice to conduct emergency repairs. The ability of security systems to change an individual's access is sometimes slow, depending on alarm rate, system load, and the availability of security personnel to verify and make the changes.

Suggested Modifications

To eliminate the conflicts between security, fire protection, and emergency response, some utilities suggested that the number of vital and locked areas be reduced rather than increased. Furthermore, they recommended that security requirements be relaxed to facilitate staff access to all areas of the plant.

All utilities that discussed security as a candidate for reexamination suggested that a relaxation of outside lighting requirements would not increase plant vulnerability to sabotage or theft of material. These utilities indicated that substantial savings could be obtained through relaxation or elimination of this requirement.

Industry representatives suggested that the procedures for psychological screening contained in current security plans and contemplated in future rulemaking could be eliminated, since the numbers of individuals rejected is minimal and the cost is so great.

Risk Considerations

Staffing levels for guards seem to vary a great deal among plants. This variance may be due either to inconsistency in licensee interpretation of the requirements or to differences in NRC application of the requirements at the region, or headquarters level. The wide variation in staffing levels needs to be investigated further if security requirements are selected for further evaluation.

Preliminary results of current sabotage research at PNL indicate that the major risk due to sabotage lies with insiders rather than outsiders. MMPI screening is aimed directly at identifying unstable individuals and is regarded as one of the most effective and accurate instruments for that purpose. It is limited, however, to an assessment of the individual at the time of the test and cannot predict future changes that may occur due to personal stresses or job dissatisfaction. Other alternatives may be preferable. For example, employee assistance programs, offering counseling without recrimination, are believed to be effective in reducing the effects of employee behavioral changes when management is capable of identifying employees suffering from stress without making them feel threatened.

Because the major threat to plant security appears to be from the insider and because security systems are very effective in controlling outside access to the protected area, the requirement to maintain lighting in the yard areas inside the protected area appears to be excessive. Yard lighting would not be effective in forestalling an act of insider sabotage.

The requirement for restricting plant staff access to vital areas is intended to minimize the threat of sabotage by insiders. Recent considerations of scenarios involving insider sabotage indicate that in some cases, access restrictions may be less effective than alternative methods of limiting vulnerability; further study of these alternatives is needed, however, before any firm conclusions can be drawn.

Security measures can be effective against the threat of outsiders, and those security measures that are directed at preventing and discovering intrusion are important in controlling public risk.

2.9 NOTIFICATION OF SIGNIFICANT EVENTS AND LICENSEE EVENT REPORTS: 10 CFR 50.72 AND 50.73

Purpose

10 CFR 50.72 includes the requirement to notify the NRC Operations Center via the Emergency Notification System (ENS) of significant plant events. The events that must be reported in Licensee Event Reports (LERs) include those events requiring immediate notification; conditions outside the design basis of the plant; automatic or manual actuation of an ESF system; and any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe condition, to remove residual heat, to control the release of radioactive material, or to mitigate the consequences of an accident. LERs provide written documentation of these abnormal conditions to the NRC.

Recently the LER system was revised by the NRC in an attempt to decrease the burden of reporting by removing some of the superfluous reports.

Problem

Some licensees expressed the view that the requirement to notify the NRC via the red phone on the declaration of an Unusual Event per the emergency plan is an excessive requirement given what the NRC does with the notification and the minor nature of the events that trigger an unusual event declaration. One utility indicated that the majority of the events requiring notification were corrected and resolved before the reporting time expired. Utilities generally felt that immediate notification of the NRC of any unusual event could have little bearing on risk unless the NRC were going to take immediate action to mitigate accident consequences.

Some of the licensees indicated that the new LER rule has not decreased the reporting burden and that some superfluous items must still be reported. One utility cited the example of a spurious actuation of an ESF system. The utility indicated that no risk was involved in the actuation and there were no adverse impacts on public health and safety to be mitigated by NRC action.

Some utilities indicated that in some cases, risk of operations might be increased by the immediate notification requirements, since notification usually diverted the most senior and qualified individual from the control room.

Suggested Modifications

The utilities suggested that the NRC relax the 1-hour notification requirement of Section 50.72 in order to relieve the burden on control room staff in the initial stages of an incident and to reduce the costs of making such notifications. They felt that a 4-hour reporting time was reasonable and would be more useful to the NRC because it would provide more complete information on the event.

The utilities interviewed expressed a desire to see all the NRC reporting requirements contained in one regulation. While Regulatory Guide 10.1 attempted to summarize all the reporting requirements, it is out of date. As a step less drastic than rewriting all the regulations to consolidate the reports, Regulatory Guide 10.1 could be updated.

The utilities suggested that risk importance be used to establish the basis for reports and the time frame of submittal. Consideration of the significance of the report, combined with the significance of any actions likely to result from the report, could be used in restructuring the reporting system.

Risk Considerations

The relaxation of the 1-hour reports to 4-hour reports should have no effect on public health and safety in most cases unless the NRC takes some immediate action in the management of the event. Generally, a delay of 3 hours in initial notification would minimally impact the timeliness of the action.

The suggestion to consolidate all the reporting requirements into one regulation may not be the optimal solution, since there are also legitimate reasons for keeping the reporting requirement in the section of the regulations that require the report to be submitted. The suggestion to update and maintain the currency of Regulatory Guide 10.1 is reasonable and would improve the ability of licensees to identify the reports that must be submitted. It might even contribute to safer operation of plants, since the discussions following an abnormal event or condition will center around cause of the condition, solutions and prevention, rather than reportability debates.

Reducing report scope by considering the risk significance of each report is a desirable change since it will allow a clearer distinction between superfluous reports and important reports, while taking into account the effects on public health and safety. NRC is currently reviewing LER experience to determine if the rule should be modified to eliminate reporting of events with very low safety significance.

2.10 REACTOR VESSEL LEVEL INDICATION SYSTEM: NUREG-0737

The reactor vessel level indication system (RVLIS)[a], implemented by Generic Letter 82-28 as a post-TMI requirement, was mentioned by several utilities. In some cases it was characterized as an example of a backfit required by NRC that resulted in substantial costs not supported by improvements in risk. In all instances, it is regarded as a system that is burdensome to licensees.

Purpose

The requirement to install a RVLIS emerged in the post-TMI era as a direct result of one of the contributory causes of the accident. The system is intended to give control room operators direct indication of the coolant in the reactor vessel in order to avoid uncovering the core. The system may use differential pressure indications or a series of heated-junction thermocouples submerged in the reactor vessel at various depths. When the level of coolant drops, pressure or temperature changes result in control room indications.

Problem

According to several utilities interviewed, the RVLIS is not risk effective when compared to the proposed safety goals. One utility cited a PRA of the RVLIS that conservatively estimated a decrease of about 1.5% in core damage frequency, and an averted public dose decrease of 0.14 man-rem/year. The obvious conclusion drawn from these results is that the RVLIS does not significantly reduce core damage frequency or public dose. These estimates, combined with the cost of the RVLIS (quoted as $2 million by the utility), can be used to calculate the cost versus risk of the RVLIS, which is about 2.1 man-rem saved per $1 million expended. This estimate is thought to be quite conser-

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(a) While the scope of this study was primarily focused on 10 CFR 50, RVLIS was mentioned frequently enough to warrant its inclusion in this report.

vative, and it is still far less than the benefit-cost guideline included in the proposed safety goal. This guideline indicates that a reasonable ratio is 1000 man-rem saved per $1 million expended.

Several utilities indicated that they have operating procedures based on the NRC-approved emergency response guides that are more cost-effective in identifying inadequate core coverage and capable of providing results more quickly. One utility pointed out that their RVLIS does not present a direct indication of liquid level in the reactor because corrections must be applied to the RVLIS indications to account for variables such as number of pumps running; corrections must also be made for two phase flow.

Finally, operating experience with the RVLIS has been poor. The system has required substantial maintenance, thus increasing costs and occupational exposure.

Suggested Modifications

The utilities suggested the complete elimination of the requirement to provide a RVLIS. They felt that operating procedures, coupled with the extensive training on inadequate core cooling, was more risk effective than the RVLIS and would save them large capital expenses (if the system were not yet installed) and significant operating costs and radiation exposures.

Risk Considerations

As indicated by the utility PRA, it appears that the RVLIS as designed and installed does not contribute significantly to reductions in core melt frequency or public radiation exposure; furthermore, it costs the utilities significant amounts of money to install and maintain. An alternative would be to eliminate the requirement if the utilities can demonstrate the effectiveness of their procedures and the ability of their operators to quickly recognize inadequate core cooling and respond correctly.

On the other hand, simply because the systems installed in plants do not function properly is no reason to arbitrarily eliminate the requirement. This appears to be a design issue, not a regulatory issue. A complete evaluation of this requirement, as it is intended to function (i.e., providing direct vessel level indication), should consider the potential for designing a system that satisfies the criteria of the requirement without the implementation difficulties mentioned by the licensees.

2.11 STANDARDS FOR COMBUSTIBLE GAS CONTROL: 10 CFR 50.44

Purpose

10 CFR 50.44 sets forth the standards for control of hydrogen gas that may be generated following a postulated loss of coolant accident (LOCA). In addition to the control of hydrogen, 10 CFR 50.44 specifies the criteria to be used to measure hydrogen in containment, and to ensure that the atmosphere

in containment is mixed following a postulated LOCA. It also specifies provisions for venting noncondensible gases from the reactor vessel head.

Problem

One provision of 10 CFR 50.44 calls for the inerting of BWR Mark I and II containments 6 months after initial criticality. This does not allow sufficient time for completion of startup testing. The average time to complete startup testing of BWRs is 312 effective full power days (EFPD). As a result, plant personnel and contractors/vendors experience increased risks during startup testing when adjustments and/or modifications need to be made to equipment inside the inerted containment. The inerting of BWRs adds more than 8 hours to shutdowns and prevents rapid access to containment for repairs.

The utilities generally agreed that hydrogen recombiners do not decrease public risk from potential core damage events, since the recombiners are generally incapable of processing the rate of hydrogen generated under hypothetically extreme conditions of core damage. The economic burden of Class 1E recombiners is high because of the initial cost of procurement and installation and because of continuing operational costs. Since two independent trains of recombiners are required, the unavailability of one train places the plant into an LCO (limiting condition for operation), which requires shutdown if the availability of the recombiner system is not restored within the time constraint specified in the technical specifications. Many utilities indicated that the technical specification requirement was unnecessary based on their view that the recombiner system does not decrease public risk from potential core damage events.

One utility indicated that the head vent system has an adverse impact on safety. The purpose of the head vent system is to remove noncondensible gases from the upper head region of the reactor vessel to reduce reactor coolant system (RCS) pressure if necessary. The utility's concern is that a means of relieving RCS pressure already exists through the power-operated relief valves (PORVs) and safety relief valves on the pressurizer. Furthermore, should a PORV stick in the open position, a motor-operated valve downstream of the PORV can be closed. If a head vent valve sticks in the open position, there is no way to prevent blowdown of the RCS. A head vent valve did stick open during surveillance at one PWR. The utility felt that the risks of the head vent system far outweighed the benefits.

Suggested Modifications

Licensees suggested that the requirement for initial inerting of BWR Mark I and II containments be based on completion of startup testing or the average number of EFPDs required to complete startup testing. This would allow licensees to make equipment adjustments during startup testing without having to wait for deinerting.

Some licensees suggested that they be allowed to take credit for the fact that containments have been demonstrated to be stronger than originally estimated and reduce the combustible gas control requirements accordingly.

The utilities also suggested that the method of providing protection against uncontrolled hydrogen burning in nuclear power plants should be determined on a plant-specific basis, considering the plant-specific sequences of events that are significant with respect to public health and safety. Additionally, they suggested that the requirements for calculating the rates and total amounts of hydrogen generated be eliminated, since the sequences of events significant to public health and safety may vary from plant to plant and are not related to the calculations defined in this regulation.

Finally, it was suggested that the head vent system be removed, disabled and sealed up, since the risks of using this system outweigh the benefits.

Risk Considerations

Eliminating the required calculational procedure for the rates and total amounts of hydrogen generated, as defined in 10 CFR 50.44, would have no effect on public risk. The regulation need not specify the actual procedure to be used; rather, it could be revised to contain criteria for establishing the hydrogen generation rate. In some instances, this revision may even enhance public safety by allowing plant-specific calculations to account for the design differences that exist between plants.

Basing the initial inerting of BWR I and II containments on completion of startup testing or EFPDs would not have a significant impact on the level of risk to the public and would reduce the level of risk to plant personnel in some cases. NRC has granted inerting exemptions to several BWRs.

The utility's comment regarding the head vent system and its impact on safety appears to be a design problem, rather than a regulatory problem. 10 CFR 50.44 does not require the head vent system for RCS pressure control; it is intended to vent noncondensible gases only. The regulation does not replace or duplicate the pressure controlling functions of the pressurizer or the relief valves. The incident of a stuck-open head vent valve suggests a design problem involving appropriate operational redundancy, rather than a superfluous or overly restrictive regulation.

A plant-specific reduction or relaxation of combustible gas control requirements based on containment design and strength would not have a negative effect on risk due to the many conservatisms that are built into containment design (e.g., credit is not allowed for the elastic properties of material in containment design; only the inelastic properties can be considered).

2.12 CONTAINMENT LEAKAGE TESTING: 10 CFR 50, APPENDIX J

Purpose

The requirements of 10 CFR 50.54(o) state that primary reactor containments must meet the containment leakage test requirements set forth in Appendix J. These Appendix J requirements provide for preoperational and periodic verification by tests of the leak-tight integrity of the containment and the systems and components that penetrate the containment. Acceptance criteria for the test are established by the appendix. The purpose of the tests is to assure that 1) the leakage through the primary reactor containment and the systems and components penetrating containment shall not exceed allowable leakage rates specified in the technical specifications and 2) periodic surveillance of reactor containment penetrations and isolation valves is performed so that the containment and its systems and components are properly maintained and repaired.

The NRC Office of Nuclear Regulatory Research has been reviewing Appendix J and has prepared a draft revision that has been submitted to the Advisory Committee on Reactor Safeguards (ACRS) and the Committee to Review Generic Requirements (CRGR) for review. Notice of proposed rulemaking in the Federal Register is expected soon.

Problems

Some utilities stated that the frequency of the integrated leak rate tests (ILRTs) performed on containment is burdensome and not significant from a risk perspective. The current requirements specify an ILRT every 3 years. One utility commented that on two occasions a plant was shut down solely to accommodate the calendar-based ILRT requirement. They indicated that an ILRT, when conducted at a scheduled shutdown, adds 3 to 5 days to the outage critical path, at $500,000 per day for replacement power; in some cases, replacement power costs can be even higher.

According to the licensees, the acceptance criteria for an ILRT are much too conservative. The leak rate (0.1% per day for PWRs and 1% per day for BWRs) is equivalent to a hole 1/8 in. in diameter. The utilities pointed out that the risk significance of containment leakage is low for leaks less than 10% per day.

One utility felt that the requirement to conduct air lock testing even when containment integrity was not required by the technical specifications was excessive and costly.

One NRC questionnaire respondent observed that high NRC manpower costs are incurred to support the degree of containment leak tightness required by the regulation.

The utilities also addressed the local leak rate testing (LLRT) required by Appendix J. Approximately 150 local tests must be conducted; each one generally removes from service the system that is penetrating containment. Some tests can be done at power. Tests that must be conducted during outages generally extend the length of the outage.

The utilities mentioned that the testing logic is not entirely consistent. Some valves that actually resist containment pressure in series, and that are tested in series by the ILRT, are tested in parallel in LLRTs when pressure is applied between the valves. This complicates the correlations between ILRT leak rates and LLRT leak rates. A second inconsistency is the air testing of BWR ECCS lines in the torus that are always flooded with water.

Suggested Modifications

Many utilities suggested that the ILRT (or Type A test) frequency be relaxed to once every 10 years. They feel that the integrity of containments coupled with the insignificant nature of leaks less than 10% of containment volume per day results in a small enough change in public risk that it is insignificant. One utility, however, suggested that the frequency of ILRTs remain the same but that the leakage rate criteria be relaxed.

The utility that mentioned the problem with air lock testing suggested that the seal leakage test of Appendix J, paragraph III.D.2(b)(iii), be used for the air lock when containment integrity is not required by plant technical specifications. This modification would relax the requirement to test the air locks at a pressure not less than the calculated peak containment internal pressure.

One utility suggested that the LLRTs could be eliminated by relying solely on the ILRTs. Another suggested that the frequency of ILRTs be based on the successful number of ILRTs conducted in the past with the LLRTs verifying all other leakage paths.

Risk Considerations

An increase in the ILRT (or Type A) test interval would tend to increase the probability that the reactor is operating with a containment leakage rate higher than the technical specifications allow. However, as will be discussed below, the technical specification leakage rate limits are believed to be conservative, and a factor of 10 to 100 increase in leak rate may not be risk significant. Assuming that the requirements for the Type B and C LLRTs remain in place, a decrease in the ILRT frequency to once per 10 years may not result in a significant risk impact.

Recent studies have shown that LWR accident risks are relatively insensitive to containment leakage rate. This issue is examined more carefully in a companion report on Task 2. The analysis presented there illustrates that increases in containment leakage rates may not be risk significant. Compliance with increased leakage rate criteria would still have to be demonstrated by an effective Type A, Type B and Type C testing program.

If a plant has a good Type A (or ILRT) test record, a decrease in the test frequency coupled with the continued use of Type B and Type C tests (the LLRTs) to ensure containment integrity might have little risk impact. If existing containment leakage rate criteria remain in place, the risk discussion given above for relaxing Type A test frequency applies.

The suggestion to eliminate Type B and Type C local tests and rely solely on Type A integrated tests conducted at time intervals longer than those for Type B and Type C tests may increase the probability that a reactor is operating with a leakage rate higher than allowed by the technical specifications. Type A tests may not test the leak tightness of all Type B and Type C components in their post-accident operating modes. This suggested modification may have significant risk impacts; further study would be needed to provide a rigorous evaluation of this option.

The suggestion to modify the air lock testing requirements for periods when the air lock is open and containment integrity is not required by technical specifications appears to have negligible risk effects. In fact, the draft revision of Appendix J being prepared by the NRC Office of Nuclear Regulatory Research incorporates this change.

2.13 CONFORMANCE WITH THE STANDARD REVIEW PLAN: 10 CFR 50.34(g)

Purpose

This regulation requires that applications for construction permits and operating licenses docketed after May 17, 1982 shall include an evaluation of the facility against the criteria contained in the Standard Review Plan (SRP), NUREG-0800. The evaluation required by the regulation must identify and describe all differences in design features, analytical techniques, and procedural measures proposed for a facility and those corresponding features, techniques, and measures given in the SRP acceptance criteria. These evaluations of differences must discuss how the alternative proposed provides an acceptable method of complying with NRC's regulations regarding power plants. Paragraph 50.34(g)(3) states that the SRP is not a substitute for regulations and that compliance is not a requirement; the SRP merely serves to establish the criteria the NRC staff intend to use in the evaluation of an application.

The SRP is written to support and coincide with the standard format for safety analysis reports and covers a variety of site conditions and plant designs.

Problems

Among the utilities interviewed, the most commonly mentioned problem with the SRP was the requirement to identify, describe and evaluate departures from the SRP. The utilities felt that they were having to perform the regulator's role by evaluating the applicability of the departures. The utilities proposed that they be required to demonstrate compliance of their design to SRP criteria using the SRP approach or other suitable techniques. NRC should, they maintained, verify validity of alternative techniques. Several indicated that this added to the capital cost of the plant.

Some utility and NRC respondents indicated that some sections of the SRP may have negative impacts on public health and safety. Examples of these sections are:

1. The requirement to provide a leakage control system for BWR main steam isolation valves (SRP 6.7) can allow leakage of radionuclides through the plant vent, rather than into the condenser (refer to Generic Safety Issue C-8, NUREG-0933). This leakage control system costs utilities several million dollars per plant. NRC staff res-

ponding to the questionnaire rated the cost impacts of reviewing leakage control systems as a moderate burden.

2. The requirement to provide automatic injection of containment spray additives into PWR containment spray systems (SRP 6.5.2) decreases the effectiveness of the spray additives in reducing fission products because automatic injection occurs at the initiation of the accident, not at the time the fission products are released into the containment. The NRC cost impact of this requirement is low.

3. The requirements to use impregnated charcoal filters (SRP 6.4, 6.5.3, and 15.7.4, as well as Regulatory Guide 1.52) for reducing the consequences of virtually all accidents and for maintaining control room habitability might enhance the movement of noble gases into the control room by increasing ventilation flows. The filters are designed to remove released iodine, which may not even be present. If it is present, the effectiveness of the filters depends on the concentration and chemical form of the released iodine. Moderate NRC cost impacts were assigned to this issue by NRC staff responding to the questionnaire.

4. The requirement that no credit can be taken for the retention of iodine in the suppression pool of BWRs does not accurately represent physical phenomena and diverts design attention from the problem of suppression pool bypass. Negligible NRC cost impacts were indicated for this area of review.

5. The requirements of SRP 6.4 and Regulatory Guides 1.3, 1.4, 1.5, and 1.25 incorporate dose conversion factors and whole body/organ dose equivalents that are obsolete because they overstate the radiotoxicity of iodine, thereby influencing design in areas where risks are known to be smaller. Moderate NRC cost impacts result from reviews required by these SRP sections.

6. The requirement that all operators must take and pass a simulator examination (item J.A.3.1 of NUREG-0737, referenced in SRP 13.21) may condition those operators at plants where a site-specific simulator is not available to incorrect responses or actions. It was suggested that testing operators on simulated plants and control boards not identical to the plant they will operate may decrease the ability, at least initially, of the operator to efficiently and safely operate the plant. Moderate NRC costs result from the simulator exam requirements.

Some of the utility and NRC questionnaire respondents indicated that some sections of the SRP may have no impact on public health and safety. Examples of these sections are:

1. The requirements for dose calculation of rod ejection and rod drop events (SRP 15.4.8, Appendix A, and 15.4.9, Appendix A) have no risk benefit. As evidence for this, the following observation was offered. In the current vintage of plants where the calculated

results were above the SRP acceptance criterion, the designs were nevertheless accepted because the NRC recognized that the projection of fuel failures was grossly overconservative. Low NRC cost impacts are associated with this requirement.

2. The requirement to use computed off-site doses to establish the capacities for ESF systems using the provisions of 10 CFR 100.11 (SRP 6.5.2, 6.5.3, 15.6.5 and appendices) has no risk significance, yet adds stringent requirements to the design. NRC cost impacts are high for the evaluation of ESF capacities using computed offsite doses.

3. The requirements of SRP 3.5.1.3, 10.2.3 and Regulatory Guide 1.115 on turbine missiles have no risk effect, since the problem they are addressing has been virtually eliminated by improved materials and designs for turbine disks and rotors combined with elaborate inspection procedures to facilitate flaw detection before flaws reach a critical size. Furthermore, NRC is in the process of transferring full responsibility for this area to licensees and vendors. NRC experiences moderate cost impacts in the review of turbine missile issues.

Some utility and NRC respondents indicated that some sections of the SRP have only marginal impact on public health and safety and could be relaxed to lower industry and NRC staff costs. Examples of these sections are:

1. The use of the TID-14844 fission product releases, attenuation, atmospheric transport, occupancy, standard man, and ICRP-2 dose conversion factors in assuring compliance with the low population zone boundaries, containment requirements, filter requirements, spray requirements, etc., contribute only slightly to public risk. High NRC staff costs were indicated in the NRC questionnaire responses for this issue.

2. The requirements that define a very low leakage containment (SRP 6.2.6, 15.6.5, Appendix A, and Regulatory Guides 1.3 and 1.4) contribute small safety benefits, since substantial increases in containment leak rates are unlikely to increase public risks appreciably if containment integrity is maintained. NRC cost impacts are high for the reviews of containment leakage rates.

3. The requirements that licensees use iodine spiking assumptions in the dose consequence evaluations of SRP 15.1.5, Appendix A have only marginal effects on risk. Moderate NRC staff costs result from these requirements.

In response to SRP requirements, one utility was required to submit seismic information on issues previously addressed in the construction permit safety evaluation report. The additional work cost $9 million, with no change in results from the initial work.

Suggested Modifications

NRC staff that identified the portions of the SRP with negative impacts on public health and safety recommended that those sections be eliminated. This action would result in a net reduction in public risk.

For those SRP sections identified as having no impact on risk, modifications to reduce costs were suggested. The modifications will not impact public risk.

The areas of the SRP identified as having marginal, or small, effects on public risk may actually increase risks slightly, if eliminated or relaxed. The suggested modifications for these items are listed below:

1. Develop a methodology based on the emerging source term research, risk rebaselining, and contemporary emergency planning and health physics technologies. Use this methodology as a replacement for the TID-14844 fission product releases, attenuation, atmospheric transport, occupancy, standard man, and ICRP-2 dose conversion factors in assuring compliance with the dose guidelines of 10 CFR 100 and in establishing exclusion area boundaries, low population zone boundaries, containment requirements, filter requirements, spray requirements, etc.

2. Modify the SRP (and technical specifications) to categorize containment types and acceptable leak rates based on risk effects and containment integrity guidelines in place of the low leakage containment requirements.

3. Review iodine spiking phenomena and models to remove undue conservatisms.

The utilities suggested that the philosophy surrounding the SRP should be made consistent with the stated intent of the SRP, i.e., guidance, rather than de facto requirements. This suggestion extends to deviations from the SRP. Utilities suggest that submissions that do not use the guidance of the SRP should contain comparable levels of detail as specified in the SRP without the evaluation of suitability that, in their view, should be performed by the NRC.

Risk Considerations

The SRP, as it is intended to be used, is a necessary and worthwhile instrument to aid in the licensing review of applications. Its extension into a compliance-oriented requirement appears to be an extrapolation of its intent that is burdensome to the industry without corresponding benefits to public health and safety.

Those SRP sections that may be adverse to public risk are excellent candidates for reexamination because of the increased safety that could potentially be achieved in this way. The benefits of reduced costs to both the utilities and the NRC staff are also desirable.

Considering all the comments on the SRP, it appears that the SRP needs to be reviewed as a whole, with risk significance as one of the major considerations.

2.14 QUALITY ASSURANCE REQUIREMENTS: 10 CFR 50, APPENDIX B

Purpose

Every applicant for a construction permit to build a nuclear power plant must apply a quality assurance (QA) program to the design, fabrication, construction, and testing of facility structures, systems, and components. Each applicant for an operating license must include in the application a description of the managerial and administrative controls to be used to assure safe plant operation. The components, structures and systems that are controlled by the QA program include those that prevent or mitigate the consequences of postulated accidents that could cause undue risk to public health and safety. Appendix B establishes the QA requirements for all activities affecting the safety-related functions of plant equipment. The affected activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying.

Part of the compliance to QA requirements is verified by the inspection and retention of records that are intended to establish the quality of the equipment in the facility or the quality of the work done on that equipment.

Problems

Most of the members of the nuclear industry who were interviewed observed that the QA program emphasis on verification of correct paperwork does not correlate well with the actual quality of the equipment installed. In this vein, the industry commented that the 18 QA criteria of Appendix B are appropriate for controlling quality; the problem arises in the interpretations that are made of the criteria in regulatory guidance documents, such as Regulatory Guide 1.64.

Another comment regarding the effectiveness of the QA requirements deals with apparently arbitrary requirements that do not have any risk significance, yet involve large cost burdens to utilities. One example is that QA does not recognize or allow credit for design margins. Costs can increase by a factor of 3 or 4 as a result.

The one comment that was expressed by virtually all the nuclear industry contacted is that QA is extremely costly. One industry source indicated that QA adds $1 billion to the cost of a single plant. It increases equipment costs, and may add as many as 200 to 800 inspectors to construction staffing levels. For operating plants, QA requirements dramatically increase the cost of replacement parts (e.g., acquiring a standard $800 pump bearing produces a final cost of $8000 with the QA requirements applied), and in some cases threaten the supply of spare parts by driving vendors out of the nuclear marketplace. The industry indicates that the impact of these QA requirements is not offset by an appreciable gain in quality or perceived quality of the facility. Without improvements in the actual quality of safety-related, the industry sees no reductions in public risk from QA.

Suggested Modifications

The industry contacts interviewed suggested that the achievement of public risk reduction through QA efforts requires the refocusing of QA away from the paper requirements to the physical inspections of hardware and conduct of operations. To accomplish this, the replacement of paperwork inspections with "readiness reviews" was suggested. In this way, inspectors would review actual installations, designs, and equipment for conformance to requirements. A second method suggested for focusing on hardware quality is to apply fewer resources to QA paper inspections and concentrate more attention and effort on quality control (QC). The major difference between QA and QC is that QC is focused on verifying that all requirements are met during fabrication, construction, installation, and operation by direct observation of the process, with less emphasis placed on the paperwork that the process generates.

Utilities, vendors, and architect-engineers interviewed suggested that use of better-qualified people to inspect the plants for conformance to QA and design requirements would reduce the large number of QA inspectors and consequently would trim large payrolls. They suggested placing the responsibility for achieving quality in construction and modification with the field engineer responsible for the work and his line management. The verification of quality in construction or modification would be assigned to the design engineer responsible for the work being done. The industry maintains that higher quality work would be achieved and that the assurance function would be much more rigorous.

Risk Considerations

QA requirements in a nuclear plant impact risk to the extent that compliance with the requirements insures some measure of confidence in the condition of plant equipment. This, in turn, reflects on the expected reliability of the equipment as expressed in probabilistic risk estimates. The problem that the industry appears to express is the lack of complete correlation between intrinsic quality and the paperwork evidence of quality. It is apparent that an inspection of paperwork can provide no measured change in the performance of equipment, and hence no change in risk, from the perspective of risk assessment technology. If the actual equipment is inspected, then compliance with requirements can be ascertained, or problems can be found which require correction. Compliance with requirements provides confidence that the reliability of the components and systems as installed is, in fact, as assumed in the design. Correction of problems found in equipment results in actual safety improvements by restoring the reliability of the equipment to its originally expected level.

2.15 POST-ACCIDENT SAMPLING SYSTEM: NUREG-0737, ITEM II.B.3

Purpose

The requirement for a post-accident sampling system (PASS)[a] in NUREG-0737, Item II.B.3 was developed as a result of the TMI-2 incident. It requires licensees to have the capability to obtain samples of the reactor coolant and containment atmosphere within 3 hours from the time a decision is made that sampling is needed. The samples must be taken without incurring a whole body radiation dose greater than 3 rem to any individual. The results of these whole body analyses are intended to provide information for assessing the status of accidents involving core damage and determining the amount of hydrogen inside containment. PASS does not perform a safety function directly; it is intended to be a tool that provides the necessary information to evaluate the performance of safety systems and to plan the necessary actions to be taken during or after an accident.

Problems

Some of the utilities interviewed explained that PASS does not contribute to the reduction of core melt frequency and therefore cannot change the risks associated with core melt accidents. They indicated that the cost of designing, installing and maintaining PASS is a medium-sized burden. The major impact cited by these utilities is satisfying the 3-hour analysis requirement; they find that they must maintain an around-the-clock dedicated staff of 3 people to maintain the PASS, to obtain the samples, and to analyze them in the event of an accident. While this around-the-clock staff is not required by NUREG-0737, some utilities are finding by experience that it is necessary to have staff onsite at all times, due to staff call-in times and system maintenance requirements that preclude them from satisfying the 3-hour requirement in any other manner.

Some NRC staff respondents also expressed concern with this requirement, observing that a large expenditure of resources is required for an unlikely event.

Suggested Modifications

One utility suggested that a value-impact analysis be conducted to determine the value of the PASS; they were confident that the analysis would reveal the lack of cost-effectiveness. Others that mentioned difficulties with PASS suggested the complete elimination of the system.

Risk Considerations

Since the post-accident sampling system cannot affect the frequency of core melt accidents, the only way in which it could possibly affect risk is by using the results of the samples to recommend or plan protective actions for

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(a) While the scope of this study primarily focused on 10 CFR 50, PASS was mentioned frequently enough to warrant its inclusion in this report.

the public through the implementation of the emergency plan. Because the emergency plan response to an accident is generally based on worst case projections of releases potentially resulting from the accident initiator, the use of information from PASS in response to an accident is unlikely, thus reducing the ability of PASS to affect risk.

The suggestion to conduct a value-impact analysis is a reasonable action to take at the present time. In the analysis, the costs associated with the system can be quantified and the effects of using PASS information in emergency response actions can be evaluated for risk reduction potential.

3.0 SUMMARY OF ADDITIONAL REGULATORY ISSUES

In addition to the 15 most prominent regulatory concerns discussed in detail in Chapter 2, a large number of other regulatory requirements were identified in this study as potential candidates for reexamination and eventual revision. The purpose of this chapter is to briefly identify the major concern with each of these regulatory requirements. Due to their large number and lesser relative importance based on the initial screening, no attempt has been made to evaluate the relative balance of benefit versus burden for each of the regulatory requirements mentioned in this chapter.

Table 3.1 lists the regulatory requirements discussed in this chapter. The order of the requirements should not be interpreted as indicating their relative importance or priority. Referring to Table 1.2 in Chapter 1.0, which shows the level of response to each regulatory requirement, the issues discussed in this chapter were mentioned by only a few respondents.

3.1 DE MINIMIS WASTE: 10 CFR 20

Problem

Because the requirements of Part 20 do not permit the disposal of any waste with measurable levels of radioactivity, 2 members of NRC staff explained that licensees must dispose of very low level wastes, sometimes at great expense. This situation results from the lack of a threshold activity, below which material can be considered nonradioactive. One plant cited an example of over 1200 drums of soil being packaged and shipped to a burial site at a cost of over $500,000. The soil was so low in radioactive content, that it fell below the U.S. Department of Transportation threshold for classification of radioactive material.

Suggested Modification

The NRC staff members suggested that regulatory changes establish a reasonable de minimis threshold for radioactive materials. Such a modification would result in more effective utilization of existing disposal facilities, would help to control costs, and would reduce the resources needed for case-specific NRC licensing actions.

3.2 COMMERCIAL GRADE PROCUREMENT: 10 CFR 21.3(a)

Problem

One NRC staff member expressed concern that the procurement requirements for commercial grade products may be too restrictive and may unnecessarily increase utilities' procurement costs.

TABLE 3.1. Additional Regulations and Regulatory Guidance Noted as Needing Revision

Number	Name
10 CFR 20	De Minimis Wastes
10 CFR 20.3(a)	Commercial Grade Procurement
10 CFR 50.33a	Antitrust Review Information
10 CFR 50.55a	Codes and Standards
10 CFR 50.55(e)	Conditions of Construction Permits
10 CFR 50.70	Inspections
10 CFR 50.71	Maintenance of Records, Making of Reports
10 CFR 50	Proposed Ruling on Station Blackout
10 CFR 50 Appendix C	A Guide for the Financial Data Required to Establish Financial Qualifications
10 CFR 50 Appendix L	Information Requested by the Attorney General for Antitrust Review of Facility License Applications
10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Waste
10 CFR 70	Domestic Licensing of Special Nuclear Materials
10 CFR 100 Appendix A	Seismic and Geologic Siting Criteria
10 CFR 170	License Amendment Fee
Regulatory Guides 1.3-4	Assumptions Used for Evaluating the Radiological Consequences of LOCAs
Regulatory Guide 1.29	Seismic Design Classification
Regulatory Guide 1.52	Design, Testing, and Maintenance Criteria for Post-Accident ESF Atmosphere Cleanup System
Regulatory Guide 1.60	Design Response Spectra for Seismic Design
Regulatory Guide 1.61	Damping Values for Seismic Design
Regulatory Guide 1.64	Quality Assurance Requirements
Regulatory Guide 1.70	Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants
Regulatory Guide 1.78	Control Room Assumptions for Habitability During a Postulated Hazardous Chemical Release
Regulatory Guide 1.88	Collection, Storage, and Maintenance of QA Records
Regulatory Guide 1.96	Design of BWR Main Steam Isolation Valve (MSIV) Leakage Control System
Regulatory Guide 1.97	Post Accident Plant and Environs Conditions Assessment Instrumentation
Regulatory Guide 1.115	Protection Against Low-Trajectory Turbine Missiles
Regulatory Guide 4.2	Preparation of Environmental Reports
NUREG-0094	NRC Operator Licensing Guide
NUREG-0612	Control of Heavy Loads
NUREG-0737	Clarification of TMI Action Plan

Suggested Modification

The NRC staff member suggested the relaxation of the present requirements (particularly those in Regulatory Guide 1.123) for the procurement of both safety-related and commercial grade material and equipment based on the lack of significant benefits to public health and safety.

3.3 ANTITRUST REVIEW INFORMATION: 10 CFR 50.33a

Problem

Two utilities noted that this regulation has no bearing on safety and is therefore not appropriate for inclusion in a safety analysis report. Also, when a utility has several reactors, the same information on the utility must be resubmitted for each reactor. This duplication of effort appears to be unnecessary and could be avoided if the regulatory requirement were relaxed.

Suggested Modification

The utility suggested elimination of the requirement to submit financial information to the NRC; the antitrust status of the company would be evaluated by the Securities and Exchange Commission. As an alternative suggestion, the financial information for antitrust reviews should only have to be submitted once by a company with more than one reactor unless a significant change occurs between applications.

3.4 CODES AND STANDARDS: 10 CFR 50.55a

Problem

Some utilities explained that they would prefer to have the inservice inspection (ISI) programs, as required by Section XI of the ASME Code, based on the same edition and version of the code for all reactors at multiple-unit sites. Since the ISI program must be revised to incorporate the requirements of the latest edition of Section XI referenced in Section 50.55a at the conclusion of each 10-year inspection interval, utilities with two or more similar units at one site must revise the ISI program for each reactor separately. Some utilities indicate that they have been able to combine the ISI Programs for similar units at the same site. However, the process is not streamlined, and each request involves solving the same problems over again.

Suggested Modification

These utilities suggest that a regulation be established or a provision be included in Part 50.55a that establishes the conditions for combining ISI programs. Among questions that must be addressed are the methods for shortening the second unit's inspection interval to coincide with the interval of the first unit. This involves accelerating the completion of some inspections or waiving the requirements to complete them.

3.5 CONDITIONS OF CONSTRUCTION PERMITS: 10 CFR 50.55(e)

Problem

In the view of one NRC staff member, Part 50.55(e) overlaps, and in some instances conflicts with, the quality assurance requirements in 10 CFR 50, Appendix B, the requirements for reporting defects and noncompliances of 10 CFR 21. For example, 10 CFR 50.55(e) requires initial notification of any deficiency within 24 hours and a written report within 30 days, whereas 10 CFR 21 requires initial notification within 2 days and a written report within 5 days.

Suggested Modification

It was suggested that 10 CFR 50.55(e) be deleted. Alternatively, 10 CFR 21 could be modified to incorporate the requirements of 10 CFR 50.55(e). This NRC staff member indicated that either of these two solutions should improve the clarity of requirements and reduce paperwork, with no adverse effect on public health and safety.

3.6 INSPECTIONS: 10 CFR 50.70

Problem

Two of those interviewed indicated that they felt the NRC spent considerable time inspecting items that had been checked several times before without discovering a failure, discrepancy, or deviation.

Suggested Modification

It was suggested that safety could be enhanced by applying NRC resources to areas that had not been inspected repeatedly without findings or to areas of recurring problems. These industry respondents suggested that the NRC could factor into the inspection plans the results of prior inspection efforts, the results of the licensee's ISI program, and considerations of risk significance.

3.7 MAINTENANCE OF RECORDS, MAKING OF REPORTS: 10 CFR 50.71

Problem

Two respondents to the NRC questionnaire observed that the requirements for maintaining records during construction may be excessive.

Two NRC staff members commented that the requirement of 10 CFR 50.71 to update the FSAR had no effect on safety. They indicated that licensees rarely used the FSAR after obtaining an operating license; the only ones to use the FSAR were NRC inspectors.

Suggested Modification

To address the records requirements during construction, it was suggested that one area for relaxation would be the elimination of required Certifications of Compliance when material was marked in accordance with Manufacturers' Standardization Society Standard Practice.

These NRC staff members also suggested that the requirement to annually update the FSAR be eliminated in favor of relying on the licensees' records of changes made to the plant.

3.8 PROPOSED RULING ON STATION BLACKOUT: 10 CFR 50

Problem

Several utilities expressed concern that the proposed ruling on station blackout being considered by NRC does not adequately consider recent data on the loss of offsite power and the generally short duration of such events.

Suggested Modification

The utilities suggested that the recent data be considered in the proposed rule and that the short duration of the events be factored in.

3.9 A GUIDE FOR THE FINANCIAL DATA AND RELATED INFORMATION REQUIRED TO ESTABLISH FINANCIAL QUALIFICATIONS FOR FACILITY CONSTRUCTION PERMITS: 10 CFR 50, APPENDIX C

Problem

One NRC questionnaire response indicated that this requirement is only indirectly related to safety and the control of public risk. In addition to the utility costs of preparing the information, the NRC does not have the resources to monitor this area with a high degree of expertise.

Suggested Modification

It was suggested that the deletion of this appendix would not cause any significant impact on public health and safety. Moreover, such a change would allow the NRC to reallocate resources to areas of greater safety significance.

3.10 INFORMATION REQUESTED BY THE ATTORNEY GENERAL FOR ANTITRUST REVIEW OF FACILITY LICENSE APPLICATIONS: 10 CFR 50, APPENDIX L

The same problems and suggestions given in the section on Appendix C (see Section 3.9) apply to Appendix L.

3.11 LICENSING REQUIREMENTS FOR LAND DISPOSAL OF RADIOACTIVE WASTES: 10 CFR 61

Problem

It was pointed out that some of the provisions of this regulation may be unnecessary from the viewpoint of safety. For example, licensees are required to invest considerable effort into classifying, characterizing, and documenting radioactive wastes. Although a great deal of information is produced in this way, it is not clear in many cases that the information is needed or used in any way.

Suggested Modification

It was suggested that much of the paperwork burden associated with this regulation could be drastically reduced or eliminated without any significant risk impact.

3.12 DOMESTIC LICENSING OF SPECIAL NUCLEAR MATERIALS: 10 CFR 70

Problem

One utility noted that it is burdensome to apply for a separate license for special nuclear materials.

Suggested Modification

It was suggested that the license for special nuclear material be a part of the construction permit and operating license for reactors. Industry observed that since all reactors require the license, savings could be obtained with little or no impact on risk if such a modification were made.

3.13 SEISMIC AND GEOLOGIC SITING CRITERIA FOR NUCLEAR POWER PLANTS: 10 CFR 100, APPENDIX A

Problem

One NRC questionnaire respondent was concerned about the time and resources required to conduct seismological investigations needed to design a plant for the geologic and seismic hazards covered in this regulation. It was stated that the seismic hearings for one plant required about 24 person-years of NRC staff time. The respondent also maintained that the perception of the hazard is overly conservative and somewhat arbitrary. To illustrate the arbitrary nature of the requirement, the criteria for establishing maximum vibratory ground motion acceleration for the operating basis earthquake is at least one-half of the maximum for the safe shutdown earthquake. Industry indicated that the differences in geologic characteristics at each site might allow a reduction of the operating basis earthquake accelerations to one-third the value for the safe shutdown earthquake without increasing risk.

Suggested Modifications

It was suggested that this requirement is too prescriptive and that it should be modified to require simply that the applicants conduct the necessary investigation to determine the site-specific seismic and geologic hazards and design the plant to meet those hazards with a certain realistic design margin.

It was also suggested that the investigations and analyses required by this appendix be updated to incorporate state-of-the-art techniques and findings in this field. Their incorporation into a regulatory guide would allow new developments and changes in the field of earth sciences to be added easily.

3.14 LICENSE AMENDMENT FEES: 10 CFR 170

Problem

One utility mentioned the license amendment fees required by 10 CFR 170 ($150) as an unnecessary administrative burden that has no effect on risk.

Suggested Modifications

The utility suggested complete elimination of the fee or a change in the payment method to reduce the administrative burden of submitting numerous small payments. For example, fees could be accumulated and paid on an annual basis, rather than separately for each amendment.

3.15 ASSUMPTIONS USED FOR EVALUATING THE RADIOLOGICAL CONSEQUENCES OF LOSS OF COOLANT ACCIDENTS: REGULATORY GUIDES 1.3 AND 1.4

Problem

One industry representative indicated that these regulatory guides, which contain guidance on fission product releases, attenuation, atmospheric transport, and dose conversion factors, are based on unrealistically large source terms. It was observed, for example, that iodine attenuation in BWR suppression pools is not considered.

Suggested Modifications

It was suggested that the regulatory guides allow consideration of water-soluble material attenuation in the suppression pools of BWRs and in the containment spray systems of PWRs.

3.16 SEISMIC DESIGN CLASSIFICATION: REGULATORY GUIDE 1.29

Problem

The seismic design classification of this regulatory guide was mentioned by two industry sources because it establishes higher (and thus more restrictive) seismic classifications for some equipment (e.g., spent fuel storage system, post-accident cleanup system) than is felt to be necessary. The sources indicated that these classifications caused the design specifications of the systems to be more stringent than warranted, given the relative unimportance of the systems in limiting risk.

Suggested Modifications

No specific suggestions for changing this requirement were offered by those identifying the problem. However, an obvious alternative would be to reconsider the seismic classification of some equipment.

3.17 DESIGN, TESTING, AND MAINTENANCE CRITERIA FOR POST-ACCIDENT ESF ATMOSPHERE CLEANUP SYSTEMS: REGULATORY GUIDE 1.52

Problem

One utility indicated that RG 1.52 requirements for impregnated charcoal filters increase risk to the public, with capital costs of about $200,000 per unit. The risk comes from the increased releases of noble gas as building atmospheres are circulated to remove iodine. The utilities also said that the effectiveness of these systems to reduce the risks of iodine releases to the atmosphere is limited by the presence and chemical form of any iodine that may have been released.

Suggested Modifications

The utility suggested that the requirement for impregnated charcoal filters be eliminated.

3.18 DESIGN RESPONSE SPECTRA FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS: REGULATORY GUIDE 1.60

Problem

One utility expressed that the conservatism of the vertical ground design response spectrum at other than near-field sites was overly conservative and costly. The conservatism was not warranted by the risk significance of the issue, in its estimation.

Suggested Modification

It was suggested that consideration be given to the use of vertical ground design spectra based on a probabilistic evaluation of the site geology and seismicity, or be defined as two-thirds of the values specified for the horizontal ground design response spectrum across the entire frequency range.

3.19 DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS: REGULATORY GUIDE 1.61

Problem

It was pointed out in one interview that the damping values in the regulatory guide were higher (and thus more conservative) than the values contained in NUREG-0098. Industry felt the conservatism was not warranted.

Suggested Modification

It was suggested that the damping values of NUREG-0098 be incorporated into the regulatory guide with the provision that higher values should only be used if supported by documented test data.

3.20 QUALITY ASSURANCE REQUIREMENTS FOR THE DESIGN OF NUCLEAR POWER PLANTS: REGULATORY GUIDE 1.64

Problem

While this regulatory guide is related to the discussion in Chapter 2 on Quality Assurance, industry experiences difficulty with one particular section of the regulatory guide. Specifically, section c(2) precludes the verification of designs by the immediate supervisor of the individual performing the design. Those representatives of industry who have experience in the design and construction of plants maintain that the immediate supervisors are among the best qualified to perform design verifications. The requirement of the regulatory guide that others must verify the designs leads to increases in staff sizes in the design and construction phases on the order of 100 to 800 people per plant, increasing costs 25% to 35% when the labor, materials and schedule impacts are considered.

Suggested Modifications

The industry representatives who identified this part of the regulatory guide as a problem area suggested that the requirements be restructured to make the designer responsible for the quality of the design; that is, the correctness and the ability of the design to perform according to the design specifications. The design verification function, or the assurance that the design met the design specifications without introducing other problems, should be the responsibility of the immediate supervisor.

3.21 STANDARD FORMAT AND CONTENTS OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS: REGULATORY GUIDE 1.70

Problem

One NRC questionnaire respondent indicated that this regulatory guide requires the submission of the same information in several different sections of the safety analysis report, causing extra time and expense for report preparation by the applicant and for report review by the NRC. As an example of the problem, the respondent indicated that sections 2.5.1.2 and 2.5.3.1 both require detailed descriptions of the site's geological history and structure.

Suggested Modification

It was suggested that the repetition of information be eliminated wherever possible and that references to other sections be allowed.

3.22 CONTROL ROOM ASSUMPTIONS FOR THE HABITABILITY OF A NUCLEAR PLANT CONTROL ROOM DURING A POSTULATED HAZARDOUS CHEMICAL RELEASE: REGULATORY GUIDE 1.78

Problem

One utility noted that the requirement in this regulatory guide to include sulfur and ammonia detectors in the control room ventilation systems was not justified by the hazards around the plant. Furthermore, this utility indicated that the entire system, costing more than $1 million, was not necessary and could be eliminated.

Suggested Modification

The utility suggested the elimination of requirements for a control room pressurization and ventilation system.

3.23 COLLECTION, STORAGE, AND MAINTENANCE OF QA RECORDS: REGULATORY GUIDE 1.88

Problem

Industry response indicated that the requirements of this regulatory guide for collection, storage, and maintenance of QA records multiplied the amount of paperwork without reducing public risk.

Suggested Modification

No suggestion was offered for this problem. However, an obvious option would be to reduce the requirements for QA records, thereby reducing the costs of their collection, maintenance and storage.

3.24 DESIGN OF BWR MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEMS: REGULATORY GUIDE 1.96

Problem

As mentioned in the discussion in Chapter 2 on the Standard Review Plan, the leakage control systems for BWR main steam isolation valves (MSIVs) are viewed as contributing to public risk. This regulatory guide contains the requirement to route any leakage through the process gas control system. One member of the industry felt that this leakage will eventually be released through the plant vent, thereby increasing risks to the public.

Suggested Modification

It was suggested that eliminating the MSIV leakage control system would lower the risks of plant operation slightly.

3.25 POST-ACCIDENT PLANT AND ENVIRONS CONDITIONS ASSESSMENT INSTRUMENTATION: REGULATORY GUIDE 1.97

Problem

Three industry respondents indicated that this regulatory guide requires extensive instrumentation for assessing post-accident conditions. They maintain that while many instruments already exist at the plant to monitor the same parameters as required by the regulatory guide, the ranges of the installed instruments may not satisfy the requirements. The utilities are then required to upgrade the instruments to the required range or replace them with instruments meeting the range requirements. The respondents indicate that the expense of upgrading or replacing these instruments does not appear warranted from a safety perspective.

Suggested Modification

These utilities suggest that Regulatory Guide 1.97 be eliminated or revised to be more flexible in its requirements for post-accident monitoring instrumentation ranges. They maintain that the regulatory guide should be limited in scope to the broad objectives of post-accident monitoring, rather than the specifics.

3.26 PROTECTION AGAINST LOW-TRAJECTORY TURBINE MISSILES: REGULATORY GUIDE 1.115

Problem

One NRC respondent indicated that since this regulatory guide was written, better materials and new designs for turbine discs and rotors have been developed. Additionally, inspection procedures have been developed that enhance flaw detection before flaws become critical. The stated acceptable hazard rate for loss of an essential system from a low-trajectory turbine missile is 10^{-7} per year, which is substantially less than the safety goal of 10^{-4} per year for core melt.

Suggested Modification

It was suggested that this regulatory guide be reevaluated and modified to account for the latest improvements in materials and turbine design; its safety significance should also be reassessed in light of the proposed safety goal.

3.27 PREPARATION OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER STATIONS: REGULATORY GUIDE 4.2

Problem

The complete duplication of an environmental report for multiple reactors on the same site was identified as an excessive and unnecessary burden by one NRC respondent.

Suggested Modification

It was suggested that a methodical revision of the information requirements for preparation of an environmental report for plants located on the same geographical site could reduce the burden to the licensees and the NRC without adversely impacting public risk.

3.28 NRC OPERATOR LICENSING GUIDE: NUREG-0094

Problem

Three utilities questioned the requirements for operator requalification examinations. One of the utilities also indicated that the initial written examination often did not reflect plant-specific subject matter, and was therefore confusing to the applicants. One response from the NRC indicated that the guidance provided in NUREG-0094 is not current.

Suggested Modification

According to industry comment, NUREG-1021, Operator Licensing Examiner Standards, should be considered as a replacement for NUREG-0094 in Section 13.2 of the Standard Review Plan.

3.29 CONTROL OF HEAVY LOADS: NUREG-0612

Problem

Three utilities indicated that plant-specific design differences are not considered in NUREG-0612. Consequently, variations in utility submittals to the NRC create some interpretational difficulties that lead to unnecessary costs to the utilities, as well as the NRC.

Suggested Modification

The utilities who commented on this requirement suggested that they be given the option to formulate a safe heavy loads management program that is consistent with the intent of NUREG-0612. Reasonable alternatives to NUREG-0612 (particularly the substitution of ANSI N45.2.15 for ANSI N14.6) should be assessed by the NRC.

3.30 CLARIFICATION OF TMI ACTION PLAN REQUIREMENTS: NUREG-0737

Problem

More than one utility commented that the shift technical advisor (STA), as required by NUREG-0737, was not necessary and provided no real contribution to safety. The utilities who commented felt that in an emergency, virtually all the staff could be at the plant or the technical support center within 1 hour, and more rapid advice could be available via the telephone.

Some utilities commented that the requirement to perform complete control room design reviews was an unnecessary burden. Simple fixes, such as better labeling, would correct most of the problems, and these solutions have been identified without having to perform costly control room reviews.

Other utilities commented that the Safety Parameter Display System (SPDS) does not add appreciably to safety, has been greatly overemphasized, and is costly. They maintain that SPDS does not provide the operators with information beyond that already available in the control room.

Some utilities commented that the requirement that BWRs have the containment purge and vent isolation valves automatically close on a high radiation signal was unnecessary and very costly to implement. Automatic isolation is already achieved from high drywell pressure and low reactor water level; therefore, they suggest that the regulation has no technical basis.

Suggested Modification

The utilities interviewed suggested performing cost-benefit analyses on these requirements to determine the cost and safety impacts.

APPENDIX A

FEDERAL REGISTER NOTICE

Proposed Rules

Federal Register
Vol. 49, No. 193
Wednesday, October 3, 1984

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

Public Notice of Availability of Program Plan to Review Effectiveness of LWR Regualtory Requirements In Limiting Risk

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice of availability.

SUMMARY: The NRC staff intends to initiate a review of the risk importance of current regulatory requirements for Light Water Reactors (LWR). This program is being initiated to identify current regulatory requirements which, if deleted or appropriately modified, would improve the efficiency or effectiveness of NRC's regulatory program for nuclear power plants without adversely affecting safety. Initially, this program will systematically assess the risk importance of selected current regulations in 10 CFR Part 50 and related regulatory requirements. The NRC staff is seeking public comment on the Program Plan prepared by the staff to describe the review program.

ADDRESS: A copy of the Program Plan is available for public inspection and copying in the NRC Public Document Room, 1717 H Street NW., Washington, DC. Copies may also be obtained by writing to Dr. Anthony Tse at the address listed below.

FOR FURTHER INFORMATION CONTACT: Dr. Anthony N. Tse, Regulatory Analysis and Materials Risk Branch, Division of Risk Analysis and Operations, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555; telephone: (301) 443-7920.

SUPPLEMENTARY INFORMATION: At the direction of the Executive Director for Operations, the NRC staff has initiated a program to identify current regulatory requirements which, if deleted or appropriately modified, would improve the efficency and effectiveness of the NRC regulatory program for nuclear power plants without adversely affecting safety. A number of existing programs [1] assess the adequacy of present regulations. However, these programs are not specifically designed to weed out existing regulations or regulatory requirements which do not reduce risk significantly. Initially, this program is designed to (1) systematically screen all current regulatory requirements associated with 10 CFR Part 50 and to assess the importance of selected requirements based first on their contribution to assuring that nuclear power plants are safely designed, constructed, and operated and second on their impact on licensee, applicant, and NRC resources, and (2) identify and propose appropriate modifications to eliminate duplication, inconsistency or unnecessary requirements and thus focus available NRC and industry resources more directly and precisely on the significant safety areas and issues.

Prime candidates for modification will be (1) old regulatory requirements which in light of present knowledge may no longer be considered risk important or whose risk importance may have been reduced substantially by the implementation of newer requirements and (2) areas in which there are large safety margins or conservatisms which can be reduced without measurably increasing the level of risk. In such cases modification could produce a significant safety benefit, since the attention and resources of licensees, applicants, and the NRC that are now directed to these areas could be redirected to other areas of greater safety significance.

The initial work, to be completed in FY 1985, will include a survey of regulatory requirements associated with 10 CFR Part 50 to categorize them according to their relative safety significance. In a parallel effort, several requirements that appear to be good candidates for modification or elimination will be evaluated in detail to assess their safety benefits and the NRC and industry costs of implementation. At the end of 1985, the NRC will ascertain the usefulness of this program and determine whether any of the identified candidates should be pursued further in a rulemaking.

As part of the program, the NRC will solicit suggestions from the regulated industry as to candidate requirements that might be eliminated or modified to improve the effectiveness and the efficiency of the regulatory program. The NRC will also consider any other public comments received. All suggestions will be evaluated by the staff, but none will be considered as petitions for rulemaking or as formal comments that require response. Any petitions for rulemaking must be submitted as directed in § 2.802 of 10 CFR Part 2 of the Commission regulations.

Any suggestions would be welcomed and should be sent to Dr. A.N. Tse.

Dated at Washington, DC, this 17th day of September 1984.

For the Nuclear Regulatory Commission.

William J. Dircks,

Executive Director for Operations.

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BILLING CODE 7590-01-M

[1] Examples include (1) the Generic Issue and Unresolved Safety Issue programs; (2) programs and tasks that would be guided by the Severe Accident Policy Statement when issued; (3) the Integrated Safety Assessment Program for operating reactors; (4) the operating experience review by the Office for Analysis and Evaluation of Operational Data; and (5) the many studies, analyses, test and experiments supported by the Office of Research.

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13. ABSTRACT *(200 words or less)*

In a study commissioned by the Nuclear Regulatory Commission, Pacific Northwest Laboratory (PNL) identified burdensome light water reactor regulatory requirements that appeared to have marginal importance to risk. PNL obtained industry and NRC input to the identification process through formal interviews and questionnaires. Over 40 regulatory requirements were identified and these are discussed in the report. Based on the information collected, the potential savings in terms of reduced regulatory burdens, both for NRC and the industry, appear to be substantial without compromising public health and safety.

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