

December 24, 2008

MEMORANDUM TO: James E. Lyons, Chairman
Committee to Review Generic Requirements

FROM: James T. Wiggins, Deputy Director */RA by Jack Grobe for/*
Office of Nuclear Reactor Regulation

SUBJECT: TRANSMITTAL OF PROPOSED REGULATORY ISSUE SUMMARY
ON INCLUSION OF EXTERNAL EVENTS IN MAINTENANCE RULE
10 CFR50.65 (a)(4) ASSESSMENTS

Enclosed is the package for a proposed Regulatory Issue Summary (RIS) prepared to remind licensees of the Nuclear Regulatory Commission (NRC) staff expectation that the impact of external events must be included in their Maintenance Rule 10 CFR 50.65 (a)(4) assessments. External events include but are not limited to, fire, flood, seismic, other facility, and transportation accidents. In 2006, Nuclear Energy Institute (NEI) created draft guidance to industry on how to evaluate the impact of external events which has not yet been incorporated in their Maintenance Rule guidance document, NUMARC 93-01. The staff agrees with the qualitative approach that NEI proposes as an acceptable method for licensees who do not have detailed fire or seismic probabilistic risk assessment (PRAs). To avoid any further misinterpretation of the rule, the RIS was drafted to reiterate the staff position on handling all risks during all configurations. Enclosure 1 of this package contains the response to the Committee to Review Generic Requirements (CRGR) Charter Appendix C questions. The draft RIS and supporting documents in the response to the questions are contained in enclosures 2 and 3, respectively.

We request that the CRGR perform a formal review of this package and we would like to schedule a brief presentation to the Committee at your earliest convenience. We intend to issue the RIS for public comment after incorporation of any comments or suggestions the Committee may have.

Enclosures:

- 1) RIS Package for CRGR Review
- 2) Draft RIS
- 3) Supporting Documents

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ENCLOSURE 1 – RIS PACKAGE FOR CRGR REVIEW

Regulatory Issue Summary Package For Committee to Review Generic Requirements Review

Charter Ques (i) The new or revised generic requirement or staff position as it is proposed to be sent out to licensees or to be issued for public comments. The staff should focus on developing generic actions which are less prescriptive and are consistent with the Nuclear Regulatory Commission's (NRC) move to performance-based and risk-informed regulation. The proposed requirement should merely specify the objective or result to be attained, rather than prescribing to the licensees how the objective or result is to be attained. The objective or intended result of a proposed generic requirement or staff position should be clearly stated such that it can be achieved by setting readily quantifiable standards, which have an unambiguous relationship to a readily measurable quantity, and is enforceable.

Response: The draft Regulatory Issue Summary (RIS) is presented in Enclosure 2.

Charter Ques (ii) Draft papers or other documents supporting the requirements or staff positions. (A copy of all materials referenced in the document shall be made available upon request to the Committee to Review Generic Requirements (CRGR) staff. In the event a Committee member requests the CRGR staff to obtain a copy of any reference material for his or her use, copies of the said material will be distributed to all members and will also be retained in the CRGR meeting files.)

Response: Enclosure 3 contains the following supporting documents:

1. RIS 2001-09 – Control of Hazard Barriers;
2. RIS 2004-05 Grid Reliability and the Impact on Plant Risk;
3. SECY 98-165 and Regulatory Analysis on the Maintenance Rule.

Documents 1 and 2 show the historical staff intention that the risk from all event contributors must be included for Maintenance Rule evaluations done for changes in plant configuration. Document 3 presents the regulatory analysis which was done prior to the issuance of 10 CFR 50.65 (a)(4). Other documents will be made available to CRGR upon request.

Charter Ques (iii) Each proposed requirement or staff position shall contain the sponsoring office's position as to whether the proposal would modify requirements or staff positions, implement existing requirements or staff positions, or relax or reduce existing requirements or staff positions.

Response: The proposed RIS will remind licensees on implementing existing requirements and the NRC staff position on evaluating configuration risk in the Maintenance Rule.

Charter Ques (iv) The proposed method of implementation and resource implications, along with the concurrence (and any comments) of Office of the General Counsel (OGC) on the method proposed, and the concurrence of all affected offices, including regions, or an explanation of any non-concurrences.

Response: This RIS is informational in nature. However, in order to evaluate licensee performance, the following short and long term action plans are proposed.

Short Term - A temporary instruction (TI) will be developed to assess licensee progress in achieving compliance with the regulation with regard to consideration of risk of fire and other external events or conditions in 10 CFR 50.65 (a)(4) risk assessment and management. The TI will include a preliminary inspection module on expected licensee responses to various maintenance configurations. For bench-marking purposes, quantitative assessments may be compared to results from existing standardized plant analysis risk-external events (SPAR-EE) models or possibly Appendix F of IMC-0609.

Long Term - Long term verification of compliance will be integrated into existing Reactor Oversight Process baseline inspection programs through Inspection Procedure (IP) 71111.13, "Maintenance Risk Assessment and Emergent Work Control."

OGC has concurred with the draft RIS and has no legal objection (NLO).

Charter Ques (v) Regulatory analysis generally conforming to the directives and guidance of NUREG/BR-0058 and NUREG/BR-0184, as applicable. (This does not apply to backfits that ensure compliance or, define or re-define adequate protection. For power reactors, a documented evaluation is required as discussed under item (ix) of this Appendix. For nuclear materials items, for the purpose of CRGR review of such items under this Charter, a similar documented evaluation should be provided by the staff as part of the CRGR review package.)

Response: A regulatory analysis was prepared as part of SECY-98-165 titled "Proposed Revision to 10 CFR 50.65(a)(3) to Require Licensees to Perform Safety Assessments," dated July 2, 1998, in which the staff proposed revision to 10 CFR 50.65 (a)(3) prior to the creation of paragraph (a)(4). It is presented in Enclosure 3, Document 3 of this package.

Charter Ques (vi) Identification of the category of power reactors or nuclear materials facilities or activities to which the proposed generic requirement or staff position is applicable (i.e., whether it is only applicable to future plants, operating plants, all pressurized water reactors (PWRs), all boiling water reactors (BWRs), specific nuclear steam supply system (NSSS) vendor types, specific vintage types plants, gaseous diffusion plants (GDPs), etc.).

Response: The RIS will be addressed to all holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Charter Ques (vii) For proposed backfits, other than either the compliance or the adequate protection backfits, a backfit analysis as defined in the Backfit Rule (10 CFR 50.109 for power reactors and 10 CFR 76.76 for the GDPs) should be performed. The backfit analysis shall include, for each category of nuclear power reactor or nuclear materials facility or activity, an evaluation which demonstrates how the proposed action should be prioritized and scheduled in light of other ongoing regulatory activities. The backfit analysis shall document for consideration pertinent information available concerning any of the following factors, as appropriate, and any other information, which is relevant and material to the proposed action:

- (a) Statement of the specific objectives that the proposed action is intended to achieve;
- (b) General description of the activity that the licensee or applicant would be required to perform in order to complete the action;
- (c) Potential change in the risk to the public from the accidental offsite release of radioactive material;
- (d) Potential impact on radiological exposure of facility employees and other onsite workers;
- (e) Installation and continuing costs associated with the action, including the cost of facility downtime or the cost of construction delay;
- (f) The potential safety impact of changes in plant or operational complexity, including the relationship to proposed and existing regulatory requirements and staff positions;
- (g) The estimated resource burden on the NRC associated with the proposed action and the availability of such resources;
- (h) The potential impact of differences in facility type, design, or age on the relevancy and practicality of the proposed action;
- (i) Whether the proposed action is interim or final, and if interim, the justification for imposing the proposed action on an interim basis;
- (j) For both rulemaking actions and proposed generic correspondence, staff evaluation of comments received as a result of the notice and comment process;

(k) How the action should be prioritized and scheduled in light of other ongoing regulatory activities. The following information may be appropriate in this regard:

1. The proposed priority or schedule,
2. A summary of the current backlog of existing requirements awaiting implementation,
3. An assessment of whether implementation of existing requirements should be deferred as a result, and
4. Any other information that may be considered appropriate with regard to priority, schedule, or cumulative impact. For example, could implementation be delayed pending public comment?

Response: The staff does not feel that any additional backfit and associated backfit analysis is required for the RIS at this time.

Charter Ques (viii) For each proposed backfit analyzed pursuant to 10 CFR 50.109(a)(2), 10 CFR 72.62(c), or 10 CFR 76.76(a)(3), (i.e., for backfits other than either adequate protection backfits or compliance backfits), the proposing office director's determination, together with the rationale for the determination based on the consideration of the previous paragraphs (i) through (vii), that

- (a) a substantial increase in the overall protection of public health and safety or the common defense and security will be derived from the proposal, and
- (b) the direct and indirect costs of implementation for the facilities affected are justified in view of this increased protection.

Although, as a legal matter, 10 CFR 50.109 does not apply to nuclear materials facilities and activities that are not licensed under Part 50; however, footnote 6 does apply to the evaluation of proposed backfits affecting the selected nuclear facilities and activities items submitted to CRGR for review. However, specific provisions of 10 CFR 72.62 and 10 CFR 76.76 should be considered, as appropriate, when considering backfit-related matters for independent spent fuel storage installations (ISFSI) and the monitored retrievable storage installations (MAS), GDPs, respectively. Additionally, in the context of Part 70 licensing actions, the Commission supported the requirement that "...any new backfit pass a cost-benefit test without the "substantial" increase in safety test. The Commission believes that modest increase in safety at minimal or inconsequential cost should be justified on a cost-benefit basis."

Response: The staff does not feel that any additional backfit and associated backfit analysis is required for the RIS at this time.

Charter Ques (ix) For adequate protection or compliance backfits affecting power reactors, evaluated pursuant to 10 CFR 50.109(a)(4) (or analogous provisions in 10 CFR 72.62 or 10 CFR 76.76, as appropriate),

- (a) A documented evaluation consisting of:
 - (1) the objectives of the modification
 - (2) the reasons for the modification
 - (3) if the compliance exception is invoked,
 - (A) the requirements (e.g., Commission regulation, license condition, order) or written licensee commitments, for which compliance is sought.
 - (B) an assessment of risk/safety implications of not requiring licensees to immediately restore compliance, and the basis for determination that a reasonable concession could be allowed to defer restoration of compliance at a later time (e.g., next refueling outage).
 - (C) demonstrated consideration of other possible alternatives and rationale for rejecting them in favor of compliance backfitting.
 - (D) evaluation from cost-benefit considerations (not a full-blown regulatory analysis) and a rationale for compliance exception.
 - (4) If the adequate protection exception is invoked, the basis for concluding that the matter to be addressed involves adequate protection, and why current requirements (e.g., Commission regulation, license condition, order) or written licensee commitments do not provide adequate protection.
- (b) In addition, for actions that were immediately effective (and therefore issued without prior CRGR review as discussed in Section III of the CRGR Charter), the evaluation shall document the safety significance and appropriateness of the action taken and (if applicable) consideration of how costs contributed to selecting the solution among various acceptable alternatives.

Response: The staff does not feel that any additional backfit and associated backfit analysis is required for the RIS at this time.

Charter Ques (x) For each request for information from power reactor licensees under 10 CFR 50.54(f), which is for purposes other than to verify compliance with the facility's licensing basis, an evaluation that includes at least the following elements:

- (a) A problem statement that describes the need for the information in terms of potential safety benefit.
- (b) The licensee actions required and the cost to develop a response to the information request.
- (c) An anticipated schedule for NRC use of the information.
- (d) A statement affirming that the request does **not** impose new requirements on the licensee, other than submittal of the requested the information.
- (e) The proposing office director's determination that the burden to be imposed on the respondents is justified in view of the potential safety significance of the issue to be addressed in the requested information.

Under the provisions of 10 CFR 50.54(f), unless the request for information is for the purpose of verifying compliance with the licensing basis of a facility, the Executive Director of Operations (EDO) shall approve the staff's justification. Additional guidance for preparing this evaluation is provided in Section 5.4 of NUREG/BR-0058, Revision 2.

Include an analogous evaluation addressing items (a) through (e) for each information request directed to the licensees of the selected nuclear materials facilities or activities referred to in Section III of the CRGR Charter.

Response: The RIS in itself will not require a response from licensees. A proposed TI will be developed to verify licensee compliance with the Maintenance Rule which does not fall under 10 CFR 50.54 (f).

Charter Ques (xi) For each proposed power reactor backfit analyzed pursuant to 10 CFR 50.109 (a)(2) (i.e., backfits other than either adequate protection or compliance backfits), an assessment of how the proposed action relates to the Commission's Safety Goal Policy Statement.

Response: The staff does not feel that a backfit and associated backfit analysis is required for the RIS at this time.

1. Ref: NUREG/BR-0058, Revision 2, dated November 1995, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission" and NUREG/BR-0184, dated January 1997, "Regulatory Analysis Technical Evaluation Handbook."

2. As a legal matter, the Backfit Rule does not strictly apply unless a backfit is required by, for example, a rule or an order. However, the NRC backfit process, including the CRGR Charter, is defined on the principle that new positions, as well as new requirements, are to be reviewed for backfitting considerations and, if appropriate, meet the standards of the backfit rule before they are issued to the licensee(s). New generic positions in documents, such as generic letters, bulletins, and regulatory guides, whether affecting power reactors or nuclear materials facilities/activities, are to be considered and justified as backfits before they are issued.

3. Types of actions to which the standards of the backfit rule do not apply include: (1) voluntary actions, (2) actions mandated by statute, and (3) requests for information. (See NUREG-1409, "Backfitting Guidelines," dated July 1990. See Section 2.1.1 for further discussion.)

4. Reporting requirements, such as those contained in 10 CFR 50.72 and 10 CFR 50.73 (for power reactors), or those contained in 10 CFR 70.50 and 10 CFR 70.52 (for nuclear materials activities), are more akin to the information requests covered under 10 CFR 50.54(f) than they are to modifications covered under the backfit rule (10 CFR 50.109). They should be justified by an evaluation against criteria similar to the analogous provision in 10 CFR 50.54(f) (i.e., by demonstrating that the burden of reporting is justified in view of the potential safety benefits to be obtained from the information reported).

5. Generic communications which state a new staff position or seek additional licensee commitments affecting power reactors are generally noticed for public comment. The Commission's instructions in this regard are documented in the following staff requirements memoranda:

(1) Memorandum for J. M. Taylor from S. J. Chilk, dated October 27, 1992, Subject: SECY-92-338—Implementing Procedures for Issuing Urgent Generic Communications;

(2) Memorandum for J. M. Taylor from S. J. Chilk, dated July 17, 1992, Subject: SECY-92-224— Revised Implementing Procedures for Issuance of Generic Communications; and

(3) Memorandum for J. M. Taylor from S. J. Chilk, dated December 20, 1991, Subject: SECY-91-172—Regulatory Impact Survey.

6. Appendix D to this Charter provides additional guidance on consideration of qualitative factors in applying the "substantial increase" standard of 10 CFR 50.59 for actions affecting power reactors. By its terms, 10 CFR 50.109 does not apply to nuclear material facilities and activities that are not licensed under Part 50; but the staff should consider in conjunction with other Commission directives, the applicable guidance in Appendix D in evaluating qualitative factors that may contribute to the justification of proposed backfitting actions directed to nuclear materials facilities and activities.

7. Certain proposed actions affecting power reactors may not meet the "substantial increase" standard but, in the staff's judgment, should be promulgated nonetheless. The Commission has indicated the willingness to consider such exceptions to the Backfit Rule on a case-by-case basis; but such exceptions would be promulgated only if the proposal (not to apply the Backfit Rule to the proposed rulemaking) is made the subject of public notice and comment.
 8. The Staff Requirements Memorandum - SECY-98-85 - Proposed Rulemaking - Revised Requirements for the Domestic Licensing of Special Nuclear Material," dated December 1, 1998.
 9. Detailed guidance for addressing the Commission's safety goals is contained in "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Guidelines" (NUREG/BR-0058, Revision 2, dated November 1995).
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**ENCLOSURE 2 – DRAFT RIS
CONSIDERATION OF RISK OF FIRE AND OTHER EXTERNAL EVENTS IN RISK
ASSESSMENT AND MANAGEMENT PURSUANT TO PARAGRAPH (a)(4) OF 10 CFR 50.65,
THE “MAINTENANCE RULE”**

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

, 2008

NRC REGULATORY ISSUE SUMMARY 2008-0XX
CONSIDERATION OF RISK OF FIRE AND OTHER EXTERNAL EVENTS IN RISK
ASSESSMENT AND MANAGEMENT PURSUANT TO PARAGRAPH (a)(4) OF 10 CFR 50.65,
THE “MAINTENANCE RULE”

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to clarify its expectation that consideration of the risk of fire and other external events, even if only qualitatively, in maintenance risk assessment and management is necessary for adequate compliance with paragraph (a)(4) of Section 50.65, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” of 10 CFR 50.65, the “Maintenance Rule.” The NRC expects that recipients will review the information for applicability and consider actions as appropriate. No specific action or written response is required on the part of an addressee.

BACKGROUND

The revision to 10 CFR 50.65, the Maintenance Rule, that introduced the new paragraph (a)(4) became effective on November 28, 2000 (64 FR 34,913 (June 1, 2000)). Paragraph (a)(4) states:

“Before performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and preventative and corrective maintenance), the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The scope of the assessment may be limited to structures, systems, and components that a risk-informed evaluation process has shown to be significant to the public health and safety.”

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During the development of the revised rule, fire risk was discussed as one of several types of external events or conditions. Fire risk is recognized as being a significant contributor to plant risk. The Statement of Consideration (SOC) for the revised rule, published in the *Federal Register*, July 19, 1999 (64 FR 38551), did not discuss individual sources of risk, nor did it exclude any type or source of risk, indicating, therefore, that all risk was expected to be considered. As indicated in the SOC, the new paragraph (a)(4) was intended to require licensees to

“(1) Perform an assessment of the plant conditions before the proposed maintenance and the changes expected to result from the proposed maintenance activity.”

Therefore, paragraph (a)(4) requires licensees to assess risk from all plant conditions and initiating events, qualitatively or quantitatively, that are posed by maintenance activities or plant configuration changes related to maintenance. Accordingly, the risk related to fire and other external events or conditions increased by the maintenance activity must be assessed and managed in order to comply adequately with the regulation.

In May 2000, the NRC issued Regulatory Guide (RG) 1.182, “Assessing and Managing Risk Before Maintenance at Nuclear Power Plants.” RG 1.182 endorsed the industry guidance for implementation of 10 CFR 50.65(a)(4) contained in the February 22, 2000, revision to Section 11, “Assessment of Risk Resulting from Performance of Maintenance Activities,” of NUMARC 93-01, “Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.” R.G. 1.182, which endorsed the revised Section 11, consistent with the SOC, did not address individual sources of risk, nor did it take exception to the omission of explicit fire and other external event risk consideration in the guidance. The staff position was that consideration of external events, including fire, at least qualitatively are addressed in the NUMARC guidance because they are recognized risk factors and they were not excluded. The other sections of NUMARC 93-01, Revision 2, remained effective as endorsed by Revision 2 of RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

To verify implementation of the staff position, NRC Inspection Procedure (IP) 71111.13, “Maintenance Risk Assessments and Emergent Work Control,” issued on November 30, 2000, three days after 10 CFR 50.65(a)(4) became effective, stated that fire risk is a type of external event that should be considered, if only qualitatively, in (a)(4) risk assessments. It stated as follows:

“The RA [risk assessment] should consider external events such as weather or fire if such conditions are imminent or likely to have a high probability of affecting the plant during the planned out-of-service duration.... For example, fire within the plant (considered an external event) may be a significant risk contributor due to plant design, and the nature of the work may increase the risk of starting a fire (e.g., hot work)....”

SUMMARY OF THE ISSUE

The types of maintenance activities of concern are those that (a) impact the ability to shut down the plant and maintain it in a safe shutdown condition in the event of an internal plant fire, internal flood, or other event or condition modeled in probabilistic risk analysis (PRA) as an “external event” requiring plant shutdown, (b) increase the risk of fire or other external events, or (c) increase risk of spread of fire or effects of other external events or damage to vital equipment in case of fire or other external events. The staff has termed these types of maintenance activities “external event-risk-sensitive” maintenance activities. Examples of external event-risk-sensitive maintenance activities are (1) removing fire-safe-shutdown-path structures, systems and components (SSCs) from service for maintenance or otherwise impairing their functionality due to maintenance activities, especially if the potential fire zone could encompass and impact safe-shutdown SSCs or functions, (2) hot work or handling of

flammable or volatile substances like diesel fuel or solvents, and (3) removal of hazard barriers for access to SSCs to be worked on. RIS 2001-09, "Control of Hazard Barriers," addressed (a)(4) risk assessment and management involving fire, flooding and other hazard barriers. Note that PRA external events may originate physically within the plant or from without. Note that based on the scope of the Maintenance Rule established during its development, the types of SSCs of concern here do not include those involved in fire protection, per se, (i.e., detection and suppression) in accordance with 10 CFR Part 50, Appendix R, or 10 CFR 50.48(c), "Fire Protection."

In recent years, during performance of (a)(4) inspections in accordance with IP 71111.13, as well as other IPs involving review of fire protection, NRC regional and resident inspectors have identified that many licensees have no provisions to consider fire risk or some other external events or conditions in their programs for implementation of (a)(4). Lack of or inadequate program procedures is not in itself a violation of (a)(4). However, at least one violation for inadequate (a)(4) risk assessment, due in part to lack of consideration of fire risk when warranted has been identified. Since then, several other instances have been identified in which licensees did not take the configuration-specific impact of the risk contribution of internal plant fires or other external events into account quantitatively or qualitatively. Enforcement action regarding these instances has not been taken pending final resolution of this issue.

However, in several industry forums in recent years, including the Risk-Informed Regulation Forum, the Configuration Risk Management Forum and the Maintenance Rule Users Group meetings, the NRC staff stated in its formal presentations that this issue was of concern, that it is safety-significant and generic and that it warranted improved technical guidance. In many of these same forums, the Nuclear Energy Institute (NEI) acknowledged in its presentations that the issue warranted consideration and that industry guidance was needed. In the summer of 2006, NEI developed suggested interim guidance which it provided to all NRC nuclear plant licensees. This guidance was intended to aid licensees in recognizing situations in which fire risk may be significant and should be considered, even if only qualitatively. Further, it suggested strategies for consideration of fire risk in (a)(4) risk assessment and management, although it addressed fire risk at power only. Therefore, the NRC staff finds that it is necessary to clarify the staff's expectations in this area. In addition, the staff believes it is appropriate for NEI to clarify the existing industry guidance to ensure consistently adequate licensee maintenance risk assessment and management in compliance with 10 CFR 50.65(a)(4). To that end, the NRC staff intends to work with NEI to incorporate acceptable fire risk guidance into NUMARC 93-01 and to endorse such guidance in a revision to RG 1.160. RG 1.182, being no longer needed, would then be withdrawn.

SAFETY SIGNIFICANCE

To illustrate the safety significance of this issue, the staff performed an evaluation using Standardized Plant Analysis Risk for External Events (SPAR-EE) models. Because fire risk has long been known to be a significant and sometimes dominant risk contributor, SPAR-EE models were considered suitable to be used as a screening tool for such an illustration. From the group of 13 SPAR-EE models available, the staff selected three pressurized water reactor and three boiling water reactor models for evaluation. For each plant, the staff selected for evaluation one

risk-significant component (based on its Fussel-Vesely importance measure) that is routinely removed from service for periodic maintenance. The risk increase in terms of core damage frequency (CDF) from removing the component from service was evaluated using internal-events analysis only and compared to the risk increase seen when both internal events and internal fires, treated as an external event in PRA, were considered in the analysis. The results are presented graphically in Attachment 1. A substantial increase in CDF was seen upon the inclusion of fire impacts, assuming only the component in question was out of service for maintenance. It is also apparent from this illustration that even greater increases in CDF from the internal fire risk contribution would result for multiple and sometimes concurrent maintenance activities involving the components examined and also other similar risk-significant SSCs, especially those credited in fire-safe-shutdown paths. Therefore, not considering fire risk (and the risk of certain other PRA external events) in maintenance risk assessments can result in substantially underestimating the total risk incurred at the facility. This unrecognized risk can in turn result in placing plants unintentionally in high-risk configurations.

GENERIC APPLICABILITY

To illustrate generic industry applicability, an evaluation was also performed using the results presented in NUREG-1742¹. Table 3.2 of Volume 2 of the final report presented each licensee's fire CDF along with the reported internal-events CDF. Ten of these licensee submittals showed a fire CDF which was approximately an order of magnitude higher than that of the internal-events CDF. Forty-six of the submittals had a fire CDF within the same order of magnitude as the internal-events CDF, which would roughly double the base frequency. The remainder of licensees reported fire CDF within an order of magnitude lower than the base internal-events CDF. These results demonstrate that in a majority of cases, there is a potential for a substantial increase in CDF for maintenance configurations if fire impact is included. The ramifications are that licensees may have previously determined certain maintenance activities and associated plant configurations to have borderline risk, neglecting fire or other PRA external-event risk; whereas, the risk may actually have exceeded licensee-established thresholds, but was unrecognized. Exceeding thresholds may introduce the need for additional risk management actions ranging from total proscription of the configuration and rescheduling of concurrent activities to extra contingencies with management approvals. Therefore, the impact of all external events should be considered by all licensees, at least qualitatively, to comply with the regulation and to maintain safety.

BACKFIT DISCUSSION

Paragraph (a)(4) of 10 CFR 50.65 requires that prior to performing maintenance activities, licensees shall assess and manage the risk associated with the proposed maintenance activities. It also provides that the risk assessment may be limited to SSCs that a risk-informed evaluation process has determined to be important to public health and safety. The staff believes that R.G. 1.182 guidance is that consideration of external events, including fires, at least qualitatively is addressed in the NUMARC guidance because they are recognized risk

¹U.S. Nuclear Regulatory Commission, "Perspectives Gained From the Individual Plant Examination of External Events (IPEEE) Program", NUREG-1742, April 2002.

factors and are not excluded. This RIS discusses consideration of the risk of fire and other events treated in PRA as external events in (a)(4) risk assessment and management, in view of the fact that fire, for example, is recognized as a significant contributor to plant risk during fire-risk-sensitive maintenance activities. Those are maintenance activities involving increased risk of fires starting, disabling fire barriers, and taking out of service for maintenance SSCs that are relied upon to provide a safe shutdown path in the event of a fire. The staff's positions discussed in this RIS represent longstanding means acceptable to the staff for implementing paragraph (a)(4) that have not changed since the effective date of that regulation, as evidenced by the identification of fire as an external event to be considered, at least qualitatively, in NRC Inspection Procedure 71111.13, "Maintenance Risk Assessment and Management and Emergent Work Control," and identification of at least one violation for an inadequate (a)(4) risk assessment consistent with this staff position. Although this RIS does not require actions or written responses, licensees are expected to take actions necessary to achieve compliance with the subject regulation. The definition of backfitting taken from 10 CFR 50.109 (a)(1) is:

"Backfitting is defined as the modification of or addition to systems, structures, components, or design of a facility; or the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct, or operate a facility; any of which may result from a new or amended provision in the Commission rules or the imposition of a regulatory staff position interpreting the Commission rules that is either new or different from a previous applicable staff position...."

The NRC staff position that 10 CFR 50.65 requires assessment and management of risk from all sources, including fire and other external events is not an introduction of a new or amended provision to the Commission's rules, nor is it the imposition of a regulatory staff position interpreting the Commission's rules that is new or different from a previous applicable staff position.

[PLACEHOLDER] The NRC's Committee for Review of Generic Requirements reviewed the staff's position as expressed herein and concluded that it is not a new staff position (ADAMS Accession No. _____). The Office of General Counsel has reviewed this RIS and has no legal objection. Accordingly, the staff's positions stated in this RIS do not constitute backfitting under 10 CFR 50.109 and no backfit regulatory analysis was performed.

FACTORS CONTRIBUTING TO APPARENT MISINTERPRETATION OF THE APPLICABLE STAFF POSITION

Several factors have contributed to this situation. First, the SOC for the revision of 10 CFR 50.65 that added paragraph (a)(4) contemplated the consideration of all risk contributors, including the risk of fire and other PRA external events in licensee maintenance risk assessments. Some risk factors are plant specific and cover a wide spectrum, both in terms of source and magnitude. Therefore, at the time, the staff and the Commission did not believe it necessary to delineate the various individual contributors to risk in the SOC for the revised rule. Rather, the SOC referred to risk factors in general terms stating, for example:

"...an appropriate assessment and management process should include the following

considerations: a. The likelihood that the maintenance activity will increase the frequency of an initiating event, b. The probability that the activity will affect the ability to mitigate the initiating event....”

The staff established its position consistent with this view in endorsing NUMARC 93-01, Section 11 through R.G. 1.182. Some confusion may have resulted from the language of NUMARC 93-01 regarding external events and its silence on fire risk. The industry guidance for (a)(4), the February 22, 2000, revision to Section 11 of NUMARC 93-01, does prescribe consideration of external events.

With regard to quantitative (a)(4) risk assessments, the guidance states that they need be based only on the plant’s Level I, at-power, internal-events PRA which would not address fire or other PRA external events. Thus, the language of the revised Section 11 of NUMARC 93-01 may have materially contributed to the erroneous notion that fire and other PRA external events need not be considered at all. In this regard, the revised Section 11 states, in part:

“Thus, the (a)(4) assessment scope may be limited to the following scope of SSCs:

- 1. Those SSCs included in the scope of the plant’s level one, internal events PSA and;*
- 2. SSCs in addition to the above that have been determined to be high safety significant (risk significant) though the process described in Section 9.3 of this document.”*

Further, Appendix E of NUMARC 93-01 states, in part:

“This guidance should be considered in determining the degree of confidence that can be placed in the use of the PSA for the assessment and whether additional qualitative considerations should be brought to bear:

- 1. The PSA should address internal initiating events.*
- 2. The PSA should provide level one insight (contribution to core damage frequency).*
- 3. The PSA is not required to be expanded to quantitatively address containment performance (level 2), external events, or condition other than power operation. Use of such an expanded PSA is an option.”*

Nevertheless, the guidance does address qualitative risk assessment of external events. Section 11.3.4.2, Item 5, of the revised Section 11 of NUMARC 93-01 stated:

“5. Qualitative considerations may also be necessary to address external events and SSCs not in the scope of the level one, internal events PSA [probabilistic safety assessment] (e.g., included in the assessment scope because of expert panel considerations).”

However, external events had already been characterized as those physically external to the plant and once again, fire and other PRA external events were not mentioned.

Finally, issuing Regulatory Guide (RG) 1.182, which endorsed the revised Section 11, consistent with the SOC, did not address individual sources of risk, nor did it take exception to the omission of explicit fire and other PRA external event risk consideration in the guidance.

Thus, the staff position is consideration of PRA external events, including fires, at least qualitatively, are addressed implicitly in the NUMARC guidance because they are recognized risk factors and they were not excluded. However, the staff recognizes that they were not specifically mentioned as examples in NRC or industry documents pertaining to 50.65(a)(4) and guidance language may have been misleading. As a result, apparently, many licensees incorrectly inferred from the factors described above that internal fire risk and other events and conditions treated in PRA as external events, but sometimes originating within the plant, could be disregarded, which is contrary to the staff position.

ALTERNATE STRATEGIES FOR FIRE RISK

The applicable NRC staff position is that consideration of the impact of plant fires as part of 10 CFR 50.65 (a)(4) risk assessment and management is required by the regulation and staff guidance. The information on fire vulnerability for most licensees originates from fire risk assessments performed approximately 10 years ago for the Individual Plant Examination for External Events (IPEEE) program by using either the fire PRA or Fire Induced Vulnerability Evaluation methodologies developed by the Electric Power Research Institute (EPRI). In light of the approval for use of National Fire Protection Association Standard NFPA-805 by paragraph (c) of 10 CFR 50.48, "Fire Protection," some licensees have chosen to perform a fire PRA either as part of compliance with NFPA-805 or as a stand-alone analysis using NUREG/CR-6850, "EPRI/NRC-RES Fire Protection PRA Methodology for Nuclear Power Facilities." Since the state of fire analysis is changing and quantitative risk assessment is not required by the staff position, the NRC staff recognizes that licensees may perform a qualitative assessment of the fire risk associated with the planned maintenance activities, which would be supplemental to the quantitative maintenance risk assessments already performed under current guidance. In addition, compensatory measures for safe-shutdown-path SSCs and/or fire barriers impacted or impaired by maintenance activities or precautions for increased risk of fires starting as a result of certain maintenance activities, implemented, as required, in accordance with licensees' approved 10 CFR Part 50, Appendix R, or 10 CFR 50.48(c) fire protection programs, could be credited as part of the risk management required by 10 CFR 50.65(a)(4).

ASSESSMENT OF LICENSEE RESPONSE

Short Term - A temporary instruction (TI) will be developed to assess licensee progress in achieving compliance with the regulation with regard to consideration of risk of fire and other external events or conditions in 10 CFR 50.65(a)(4) risk assessment and management. The TI will include a preliminary inspection module on expected licensee responses to various maintenance configurations. For bench-marking purposes, quantitative assessments may be compared to results from existing SPAR-EE models or possibly Appendix F of IMC-0609.

Long Term - Long term verification of compliance will be integrated into existing Reactor Oversight Process baseline inspection programs through Inspection Procedure IP 71111.13, "Maintenance Risk Assessment and Emergent Work Control."

FEDERAL REGISTER NOTIFICATION - Although this RIS is informational, a notice of opportunity for public comment is expected to be published in the *Federal Register*.

CONGRESSIONAL REVIEW ACT - The NRC has determined that this RIS is not a rule as designated by the Congressional Review Act (5 U.S.C. §§801-808) and, therefore, is not subject to the Act.

PAPERWORK REDUCTION ACT STATEMENT – This RIS does not contain information collections and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

CONTACT - Please direct any questions about this matter to the technical contacts listed below or to the appropriate NRR project manager.

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

ATTACHMENT 1 - SAFETY SIGNIFICANCE ILLUSTRATION

Figure 1 Fire vs. Internal Events CDF Increase on One Single Configuration for Six Representative Plants

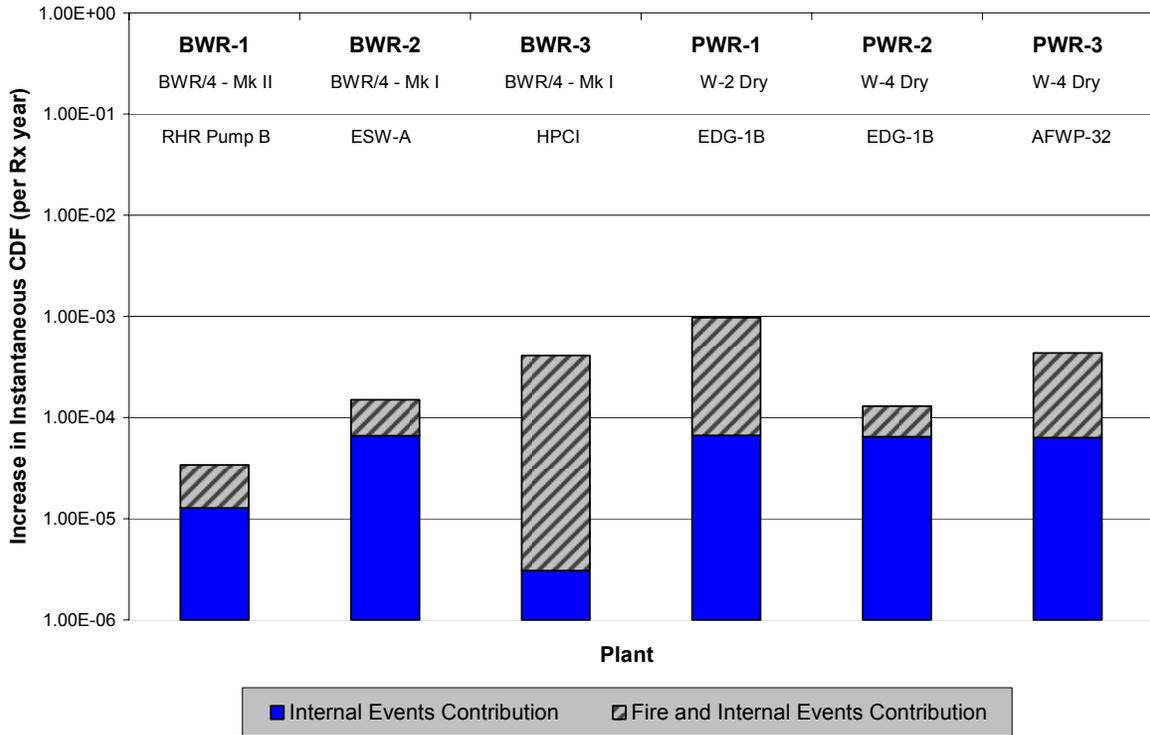


Figure 2 - Risk Band/Color Changes

	BWR-1	BWR-2	BWR-3	PWR-1	PWR-2	PWR-3
SSC ->	RHR Pump B	ESW-A	HPCI	EDG-1B	EDG-1B	AFW Pump 32 (TDP)
Color of Configuration - Internal Only	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Color of Configuration - Internal and Fire (evaluated against internal criteria)	Orange	Orange	Red	Red	Orange	Orange

ENCLOSURE 3 – SUPPORTING DOCUMENTS

- [1] RIS-2001-09**
- [2] RIS-2004-05**
- [3] SECY 98-165**

RIS 2001-09 Control of Hazard Barriers

April 2, 2001

Addresses

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Intent

The U.S. Nuclear Regulatory Commission ([NRC](#)) is issuing this regulatory issue summary (RIS) to inform addressees that recent changes to the maintenance rule (Section 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," of [Part 50 of Title 10](#) of the *Code of Federal Regulations* ([10 CFR 50.65](#))) have a bearing on plant hazard barriers. In addition, the recent major revision of [10 CFR 50.59](#), "Changes, tests, and experiments," contains a new provision, which modifies its applicability to the removal of hazard barriers. This RIS requires no action or written response on the part of an addressee.

Background Information

Hazard barriers are plant features or structures that are credited with protecting plant equipment from external and internal hazards such as flooding, tornado missiles, turbine missiles, and the effects of design basis events such as a loss-of-coolant accident (LOCA) or a high energy line break (HELB). Licensees and NRC inspectors have previously raised questions about how hazard barriers should be controlled during plant maintenance and modification activities. For example, may a barrier be removed for a short time to facilitate access to an area that contains safety-related equipment in order to perform corrective maintenance, or may a control room door that is credited with providing protection from a HELB be removed and repaired while the plant is operating at full power? In the second case, two units share the same control room, making it difficult to schedule maintenance on the door during a time when the hazard does not exist.

The NRC amended the maintenance rule ([10 CFR 50.65](#)) on July 19, 1999 (64 FR 38551). Paragraph (a)(4) of the amended regulation requires nuclear power plant licensees to assess and manage the increase in risk associated with the performance of maintenance activities. The guidance on assessing and managing increases in risk associated with maintenance activities is provided in [NRC Regulatory Guide \(RG\) 1.182](#), "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants," dated May 2000, which endorses the February 22, 2000, revision of Section 11, "Assessment of Risk Resulting From Performance of Maintenance Activities," of Nuclear Management and Resource Council (NUMARC) 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." In a June 1, 2000, [Federal Register](#) notice (65 FR 34913), the NRC announced the availability of RG 1.182 and that the amended maintenance rule would become effective on November 28, 2000.

New paragraph (c)(4) of [10 CFR 50.59](#) states that the provisions of the regulation do not apply to changes to the facility when the applicable regulations establish more specific criteria for accomplishing such changes. For the removal of hazard barriers, [10 CFR 50.65\(a\)\(4\)](#) is the applicable regulation under certain circumstances. The industry guidance for the implementation of the revised 10 CFR 50.59 is contained in [Nuclear Energy Institute](#) (NEI) 96-07, "Guidelines for 10 CFR 50.59 Implementation," Revision 1, dated November 2000. NEI 96-07, Revision 1, has been endorsed by the NRC in [RG 1.187](#), "Guidance for Implementation of 10 CFR 50.59, Changes Tests and Experiments."

This RIS provides guidance on the control of hazard barriers that is consistent with the provisions of the maintenance rule, RG 1.182, Section 11 of NUMARC 93-01, 10 CFR 50.59, RG 1.187, NEI 96-07, Revision 1, [Generic Letter \(GL\) 91-18](#), "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability," and GL 91-18, Revision 1, "Information to Licensees Regarding NRC Inspection Manual Section on Resolution of Degraded and Nonconforming Conditions."

Summary of Issue

A hazard barrier may be removed on a temporary basis to facilitate plant maintenance, the implementation of a design change, or the implementation of compensatory measures to address degraded or nonconforming conditions. The revised Section 11 of NUMARC 93-01 states that maintenance may involve temporary alterations for the duration of the maintenance activity. The examples given of such temporary alterations include barrier removal. It further provides that the risk assessment [required by [10 CFR 50.65\(a\)\(4\)](#) for the maintenance activity] should include consideration of the impact of these alterations on plant safety functions. One of the factors that should be considered in the risk assessment is the actual duration of the maintenance activity. In addition, NUMARC 93-01 points out that *during power operations*, if temporary alterations associated with maintenance are expected to be in effect for more than 90 days, the temporary alteration should be screened and, if necessary, evaluated in accordance with [10 CFR 50.59](#) prior to implementation. (Section 4.1.2 of NEI 96-07, Revision 1, provides that temporary alterations in support of maintenance activities are treated as maintenance activities that are governed by 10 CFR 50.65(a)(4); therefore, consistent with paragraph (c)(4) of 10 CFR 50.59, evaluation of such maintenance-related temporary alterations under §50.59 is not required unless (1) during power operations, the temporary alteration will remain in effect for more than 90 days, or (2) the temporary alteration is not removed and the plant fully restored upon completion of the maintenance.)

Note that as long as the plant is shut down, the 90-day time limit does not apply with regard to §50.59. However, should the maintenance activity need to be prolonged beyond the time period considered in the original risk assessment performed in accordance with 10 CFR 50.65(a)(4), the risk assessment must be updated to reflect the prolonged maintenance activity and risk management actions updated accordingly. Note also that treatment of the maintenance activity and any associated temporary alterations under 10 CFR 50.65 may not require any risk assessment because it may not involve or impact plant structures, systems or components (including hazard barriers) that are within the limited risk assessment scope allowed by paragraph 10 CFR 50.65(a)(4). Therefore, it is conceivable that removal of a certain hazard

barrier in support of maintenance may require neither a 10 CFR 50.59 evaluation nor a 10 CFR 50.65(a)(4) risk assessment.

With regard to removal of hazard barriers to facilitate implementation of a design change, Section 4.1.2 of NEI 96-07, Revision 1, also states that the implementation of a design change is considered to be a maintenance activity. Therefore, as part of that maintenance activity, the same rules would apply to temporary alterations (including hazard barrier removal) associated with that design change implementation.

However, Section 4.1.2 further provides that temporary alterations that are implemented as compensatory measures for degraded or nonconforming conditions (i.e., not associated with maintenance, and regardless of duration) should be screened and, if necessary, evaluated under 10 CFR 50.59. In addition to these considerations, provisions of the operating license and other regulations may also apply.

Prior to removing a hazard barrier for maintenance purposes (either to facilitate plant maintenance or to perform maintenance on the barrier), the risk associated with the maintenance activity must be controlled and managed in accordance with paragraph 50.65(a)(4) of the maintenance rule. The resultant risk management actions may impose time limits for barrier removal. In addition, other considerations, such as the administrative provisions for controlling fire barriers and the plant technical specifications (TS), may place limitations on continued reactor operation with a hazard barrier removed. For example, an auxiliary feedwater (AFW) pump that is credited with mitigating a HELB event would be rendered inoperable if a barrier that is credited with protecting the AFW pump from the effects of the postulated HELB event is removed to allow maintenance to be performed in the AFW pump room. The AFW pump would not be able to mitigate the HELB event with the barrier removed and, consistent with the guidance provided in GL 91-18,⁽¹⁾ the TS limiting condition for operation for the AFW pump would apply. It may be possible to take compensatory measures to maintain pump operability and avoid entering the TS action statement for shutting down the reactor (e.g., installing a temporary barrier that provides equivalent protection⁽²⁾). Also, if the hazard does not exist at the time (e.g., if the high energy line is isolated and depressurized), the pump would remain operable.

GL 91-18 provides guidance for assessing and resolving nonconforming and degraded conditions, and this guidance is applicable to hazard barriers that are discovered to be degraded. The operability guidance in GL 91-18, allows continued operation of the reactor in this situation provided the degraded barrier does not cause TS equipment to be inoperable. In addition to these considerations, the provisions of the operating license and other applicable regulations, such as the administrative requirements that have been established for controlling fire barriers may also apply and should be considered.

[Attachment 1](#) provides several examples that illustrate the applicability of TS requirements with respect to hazard barriers. Although other requirements may also apply, the examples primarily focus on TS considerations.

Backfit Discussion

This RIS requires no action or written response. Consequently, the staff did not perform a backfit analysis.

***Federal Register* Notification**

The staff did not publish a notice of opportunity for public comment in the *Federal Register* because the RIS is informational and pertains to a staff position that does not represent a departure from current regulatory requirements and practice.

Paperwork Reduction Act Statement

This RIS does not request any information collection.

If there are any questions about this matter, please contact the person listed below.

/RA/

David B. Matthews, Director
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

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1. Attachments: [Examples of Hazard Barrier Control](#)
2. [List of Recently Issued NRC Regulatory Issue Summaries](#)

(ADAMS Accession Number ML003768935)

Examples of Hazard Barrier Control

Example 1

An entry door to the control room must be removed for repair. The door forms part of the control room envelope, and for this example, is credited with protecting control room equipment and personnel from the effects of a main steam line break in the vicinity of the control room. A technical specification (TS) limiting condition for operation (LCO) specifies allowed outage times (AOTs) and action requirements for the control room emergency ventilation system, which maintains the control room at a positive pressure of greater than or equal to 1/4-inch water gauge relative to atmospheric pressure.

In this situation, not only is it necessary to assess the increase in risk associated with doing maintenance on the control room door and implement appropriate compensatory measures to manage this risk in accordance with paragraph 50.65(a)(4) of the maintenance rule, but also to adhere to TS requirements for the control room emergency ventilation system. With the control room door removed, both trains of the control room emergency ventilation system are inoperable because the system can not maintain the required positive pressure in the control room. Consequently, the corresponding ACTION statement would apply and, if the maintenance could not be performed within the COMPLETION TIME, the maintenance activity should be deferred to a more appropriate time.

An alternative approach would be to install a temporary barrier to preserve the control room envelope and allow the required pressurization of the control room. If the temporary barrier provides equivalent protection (i.e., ensures control room integrity for postulated design basis accidents, including the main steam line break accident), the control room emergency ventilation system remains operable.

While it is obvious the control room emergency ventilation system TS applies to this situation, it is likely that other TS requirements would need to be considered since essentially all safety-related systems interface with the control room. Consistent with the guidance of GL 91-18, the licensee should also evaluate whether control room equipment that is relied upon to mitigate a main steam line break could function in the harsh environment with the control room door removed -- and whether the reactor operators could perform their duties in accordance with the facility Emergency Operating Procedures.

Example 2

An inspection port in the ventilation duct for the electrical area heating, ventilation and air conditioning (HVAC) system must be removed for about 10 hours to inspect a damper as part of the recommended preventive maintenance for the damper. The ventilation duct serves as a pressure boundary in the event of a HELB in an auxiliary steam line, but has no other safety

function and has no TS operability requirements. The only piece of equipment that would be exposed to the HELB environment with the inspection port removed is the Train A safety injection (SI) pump. The licensee has determined that the auxiliary building filtered ventilation exhaust system (which must be able to maintain a negative pressure in the emergency core cooling pump rooms) will be able to perform its function with the inspection port removed, and that the relevant TS requirements for this system will not be affected by this activity. The SI pump is not required to mitigate an auxiliary steam line break, and the auxiliary steam line break is not mentioned in the TS bases for the SI pumps.

Removing the inspection port in the ventilation duct does not render the Train A SI pump inoperable because the SI pump is not credited with mitigating a break in the auxiliary steam line. No TS requirements are affected because (1) the electrical area HVAC system has no TS operability requirements, (2) the electrical area HVAC system is not credited with cooling safety-related equipment during postulated accident conditions, and (3) the auxiliary building filtered ventilation exhaust system is able to perform its function with the inspection port removed. The only remaining applicable requirements is paragraph 50.65(a)(4) of the maintenance rule. However, if the inspection port will remain open for more than 90 days while the plant is operating at power, a 10 CFR 50.59 review should also be completed.

Example 3

To perform a required surveillance on the main steam isolation valves, it is necessary to run a temporary air line through a door into an area that is credited with protecting both motor-driven auxiliary feedwater (AFW) pumps from a HELB. From past experience, the licensee expects the door to be blocked open for less than 60 minutes. The TS provide AOTs and action requirements for the AFW system, and the TS bases state that a safety function of the AFW system is to mitigate HELB events. The licensee has concluded that the motor-driven AFW pumps will not be able to function during a HELB with the door blocked open, but that the turbine-driven AFW pump and its flow paths would be unaffected.

According to GL 91-18, both motor-driven AFW pumps are inoperable because neither pump can mitigate a HELB when the door is blocked open. In this case, with only the turbine-driven AFW pump operable, the TS require the plant to be in at least HOT STANDBY within 6 hours and in HOT SHUTDOWN within the next 6 hours, unless the licensee can maintain or restore operability of the AFW system by implementing compensatory measures to provide equivalent protection or by removing the hazard (i.e., isolating and depressurizing high-energy piping sections that pose the threat). Therefore, in this case, even after performing a risk assessment in accordance with paragraph 50.65(a)(4) of the maintenance rule and considering compensatory measures, TS requirements that would require an orderly plant shutdown and place specific time limitations on the maintenance activity apply.

Example 4

The licensee must remove the door to the emergency service water (ESW) pump house to facilitate the installation of a design change. The door protects the safety-related equipment in the ESW pump house from possible flooding during a hurricane. Although there are TS requirements that pertain to the ESW system, there are no TS requirements that specifically

apply to the door. To eliminate the threat of flooding, the design change is being implemented during a time of year when a hurricane is not likely to occur.

Consistent with the guidance of GL 91-18, the licensee should use judgment in deciding whether the removal of a barrier is limited by a TS requirement. In this case, since the door will be removed when a hurricane is not a valid threat, the operability of the ESW system will not be affected and the TS requirement for the ESW system do not apply. Therefore, the remaining applicable requirement is paragraph 50.65(a)(4) of the maintenance rule. However, if the door will be removed for more than 90 days while the reactor is operating at power, a 10 CFR 50.59 review should be completed (in addition to the 10 CFR 50.59 evaluation of the design change itself).

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1. Reference is made to [GL 91-18](#) (here and in the attachment) to demonstrate consistency of the regulatory approach; it is not meant to imply that GL 91-18 should be invoked for conditions other than degraded or non conforming conditions that have been discovered.
 2. Temporary modifications that are credited with restoring or maintaining operability of TS equipment should be assessed in accordance with [10 CFR 50.59](#) requirements; implementation of the temporary modifications should be assessed in accordance with the requirements of the maintenance rule.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001
April 15, 2004

**NRC REGULATORY ISSUE SUMMARY 2004-05
GRID RELIABILITY AND THE IMPACT ON PLANT RISK
AND THE OPERABILITY OF OFFSITE POWER**

ADDRESSEES

All holders of operating licenses for nuclear power reactors except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to advise nuclear power plant (NPP) addressees of the requirements of Section 50.65 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.65), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," 10 CFR 50.63, "Loss of all alternating current power," 10 CFR Part 50 Appendix A, General Design Criterion (GDC) 17, "Electric power systems," and plant technical specifications on operability of offsite power. The NRC plans to perform inspections to review these areas following the issuance of this RIS. A temporary instruction (TI) will be issued for these inspections and will be available in advance of the inspections. This RIS does not require any action or written response on the part of an addressee.

BACKGROUND

On August 14, 2003, the largest power outage in the history of the United States occurred in the Northeastern United States and parts of Canada. Nine U.S. NPPs tripped. Eight of these, along with one NPP that was already shut down, lost offsite power. Although the onsite emergency diesel generators (EDGs) functioned to maintain safe shutdown conditions, this event was significant in terms of the number of plants affected and the duration of the power outage. The loss of all alternating current (AC) power at NPPs involves the loss of offsite power (LOOP) combined with the loss of the onsite emergency power supplies (typically EDGs). This is also referred to as a station blackout (SBO). Risk analyses performed for NPPs indicate that the loss of all AC power can be a large contributor to the core damage frequency, contributing up to 74 percent of the overall risk at some plants. Although NPPs are designed to cope with a LOOP event through the use of onsite power supplies, LOOP events are considered to be precursors to SBO. An increase in the frequency or duration of LOOP events increases the risk of core damage.

ML040990550

The NRC has been evaluating the reliability of offsite power for NPPs over the last several years as a result of the changing nature of the surrounding electrical grids. A switchyard degraded voltage condition that occurred at the Callaway nuclear plant on August 11, 1999, was attributed to high grid power flows. The NRC staff has been working with the nuclear power industry on concerns identified in NRC RIS 2000-24 regarding offsite power voltage inadequacies and grid reliability challenges due to the electric power industry deregulation. The August 14, 2003, U.S.-Canadian power outage gave rise to concerns regarding grid operation and its impact on NPPs and their compliance with certain NRC regulations applicable to the condition of offsite power. Some of the concerns involve NPP safety. Many of the matters below were discussed in RIS 2000-24. The regulations discussed will be the focus of the subject TI. General Design Criterion 17 and Plant Technical Specifications (TSs) For NPPs licensed to the GDC in Appendix A to 10 CFR Part 50, the design criteria for onsite and offsite electrical power systems are provided in GDC 17, "Electric power systems". For NPPs not licensed to the GDC in Appendix A, these design criteria are provided in the plant updated final safety analysis report the plant was licensed under. These have criteria similar to GDC 17, which requires an offsite electric power system be provided to power safety equipment necessary to respond to anticipated operational occurrences and postulated accidents. The transmission network (grid) is the source of power to the offsite power system. The final paragraph in GDC 17 requires (along with other provisions) provisions to minimize the loss of power from the transmission network given a loss of power generated by the nuclear power unit. The loss of power generated by the nuclear power unit (trip) is an anticipated operational occurrence. It is therefore necessary that offsite power be designed to be available following a trip of the unit in order to power safety equipment necessary to respond to the event. The trip of an NPP, however, can cause grid changes that could result in a LOOP. Foremost among the grid changes is a reduction in the plant's switchyard voltage as a result of the loss of the reactive supply to the grid from the NPP's generator. If the voltage is low enough, it could actuate the plant's degraded voltage protection with subsequent separation of the plant safety buses from offsite power. A less likely event would be the trip of a nuclear plant causing grid instability and subsequent LOOP due to the loss of the real and/or reactive power support being supplied to the grid from the plant's generator. Plant TSs require the offsite power system to be operable as part of the limiting conditions for operation and specify what actions to take when it is not. Plant operators should therefore be cognizant of the capability of (1) the offsite power system to meet plant safety needs during operation and (2) situations that can result in a LOOP following a trip of the plant. If offsite power is not capable of supporting the NPP safety requirements in either situation, the system should be declared inoperable and pertinent plant TS provisions followed. 10 CFR 50.65 Section 50.65(a)(4) requires that licensees assess and manage the increase in risk that may result from maintenance activities before performing the proposed maintenance activities. These activities include, but are not limited to surveillances, post-maintenance testing, and RIS 2004-05 corrective

and preventive maintenance. The scope of the assessment may be limited to structures, systems, and components (SSCs) that a risk-informed evaluation process has shown to be significant to public health and safety. In NRC Regulatory Guide (RG) 1.182, the NRC endorsed the February 22, 2000, revision to Section 11 of NUMARC 93-01, Revision 2, as providing methods that are acceptable for meeting 10 CFR 50.65(a)(4). The revised Section 11 addressed grid stability and offsite power availability in several areas.

For example:

Section 11.3.2.8 states that “emergent conditions may result in the need for action prior to conduct of the assessment, or could change the conditions of a previously performed assessment. Examples include plant configuration or mode changes, additional SSCs out of service due to failures, or significant changes in external conditions (weather, offsite power availability).”

Additionally, Section 11.3.4 states, in part, that the assessment for removal from service of a single SSC for the planned amount of time may be limited to the consideration of unusual external conditions that are present or imminent (e.g., severe weather, offsite power instability). On this basis, grid reliability evaluations should be performed as part of the maintenance risk assessment required by 10 CFR 50.65 prior to taking a risk-significant piece of equipment (including but not limited to EDG, battery, steam driven pump, alternate AC power source, etc.) out of service for the purpose of performing proposed maintenance activities, including surveillances, post-maintenance testing, and corrective and preventive maintenance. This grid reliability evaluation should be considered, as should other external events, in the maintenance risk assessment, whether quantitatively or qualitatively. If any risk management actions are taken as a result of the maintenance risk assessment, the licensee should consider rescheduling maintenance activities that tend to increase the initiating event frequency for a LOOP or SBO and those that tend to reduce the capability to cope with those occurrences. If there is some overriding need to perform maintenance on risk-significant equipment under conditions of degraded grid stability, then risk management actions should include consideration of alternate equipment protection measures and compensatory actions. With regard to conditions that emerge during a maintenance activity in progress, Section 11.3.2.8 in NUMARC 93-01, Revision 2, states that emergent conditions could change the conditions of a previously performed risk assessment. Offsite power availability is one of the examples provided of an emergent condition that could change the conditions of a previously performed risk assessment. Therefore, in consideration of the fact that worsening grid conditions could impact offsite power availability and change the conditions of a previously performed risk assessment, it is appropriate for a licensee to reassess the plant risk, taking the potential effects of a worsening grid condition into account. However, this reassessment of the risk should not interfere with or delay measures to place and maintain the plant in a safe condition in response to or preparation for those effects.

10 CFR 50.63

Pursuant to 10 CFR 50.63, "Loss of all alternating current power," the NRC requires each NPP licensed to operate be able to withstand an SBO for a specified duration and recover from the SBO. NRC Regulatory Guide (RG) 1.155 provides NRC guidance for licensees to use in developing their approach to compliance with 10 CFR 50.63. The RG has a series of tables that define a set of pertinent plant and plant site parameters that have been found to impact the likelihood of a plant experiencing an SBO event of a given duration. Use of the tables allows a licensee to determine a plant's relative vulnerability to SBO events of a given duration and identify a minimum SBO coping duration for the plant that is acceptable to the NRC. With regard to grid-related losses of offsite power, Table 4 in RG 1.155 indicates that the following plant sites should be assigned to Offsite Power Design Characteristic Group P3: Sites that expect to experience a total loss of offsite power caused by grid failures at a frequency equal to or greater than once in 20 site-years, unless the site has procedures to recover ac power from reliable alternative (nonemergency) ac power sources within approximately one-half hour following a grid failure. The majority of U.S. NPPs fall into the 4-hour minimum required coping capability category. Table 2 in RG 1.155, however, indicates that the typical plant with two redundant EDGs per nuclear unit would be required to have at least an 8-hour minimum coping duration if it fell into the P3 group. Therefore, plants that have experienced a grid-related LOOP since they were evaluated against the SBO guidance in RG 1.155 may no longer be consistent with RG 1.155. Section 2 of RG 1.155 provides guidance on the procedures necessary to restore offsite power, including losses following "grid undervoltage and collapse." Section 2 states: "Procedures should include the actions necessary to restore offsite power and use nearby power sources when offsite power is unavailable." These procedures are a necessary element in minimizing LOOP durations following a LOOP or SBO event.

SUMMARY OF ISSUE

Licensees are required to comply with their plant TSs relative to inoperability of offsite power when the design requirements of GDC 17 (or criteria similar to GDC 17) cannot be met (e.g., when post-trip switchyard voltages will be inadequate or offsite power will unavailable post-trip). Plant TSs contain limiting conditions for operation (LCOs) that require the plant offsite power system to be operable. Maintenance being performed on, and inoperability of, key elements of the plant switchyard and offsite power grid can impact the operability of the offsite power system, particularly during times of high grid load and grid stress. A communication interface with the plant's transmission system operator, together with other local means used to maintain an awareness of changes in the plant switchyard and offsite power grid, is appropriate to determine the impact of these changes on operability of the offsite power system.

Licensees should ensure that offsite power is operable during normal plant operation, as well as during anticipated operational occurrences and postulated accidents (e.g., licensees should be aware of the impact of a plant trip on the availability of offsite power and adequacy of post-trip switchyard voltages). Plant operators should therefore be aware of the offsite power needs of the plant, including minimum required switchyard voltages, and know when these needs cannot be met. (Note: The cooperation of the transmission system operator may have to be enlisted through an appropriate communication interface to ensure that offsite power will be available and switchyard voltages will be adequate following a trip of the plant.) Transmission system operators typically use computer programs such as state estimators and contingency analyzers to periodically verify the condition of the transmission system. When these tools are unavailable to the transmission system operator, the availability and adequacy of offsite power to the nuclear plant, especially following a trip of the plant, may be unknown. Plant operators should be aware of situations, such as the above, that can result in unavailability of systems that could impact operability of offsite power. Analyses for electrical supplies to the plant may take credit for nonsafety devices such as automatic tap changing transformers or reactive load compensation such as capacitor banks. If these devices are degraded or taken out of service, the effect on the operability of offsite power should be evaluated. If these devices are necessary for operability of offsite power, licensees can add information to the bases of the TSs regarding the technical parameters of the devices (e.g., automatic response, minimum rating required) necessary to ensure offsite power operability. In taking any risk management actions as a result of the maintenance risk assessment, the licensee should consider rescheduling maintenance activities that tend to increase the initiating event frequency for a LOOP or SBO and those that tend to reduce the capability to cope with those occurrences. If there is some overriding need to perform maintenance on risk-significant equipment under conditions of degraded grid stability, then risk management actions should include consideration of alternate equipment protection measures and compensatory actions. With regard to conditions that emerge during a maintenance activity in progress, worsening grid conditions could impact offsite power availability and change the conditions of a previously performed assessment. It is therefore appropriate for a licensee to reassess the plant risk taking the potential effects of a worsening grid condition into account. However, this reassessment of the risk should not interfere with or delay measures to place and maintain the plant in a safe condition in response to or preparation for those effects. Pursuant to 10 CFR 50.63, "Loss of all alternating current power," the NRC requires that each NPP licensed to operate must be able to withstand an SBO for a specified duration and recover from the SBO. NPPs that have experienced a grid-related LOOP since they were evaluated against the SBO guidance in RG 1.155 may no longer be consistent with RG 1.155. Specifically, the statement in RG 1.155 under Group P3, ("Sites that expect to experience a total LOOP caused by grid failures at a frequency equal to or greater than once in 20 site years") may now apply to NPPs not originally included in group P3. NPPs should also have procedures available consistent with the guidance in Section 2 of RG 1.155 for restoration of offsite power following a LOOP or SBO event.

BACKFIT DISCUSSION

This RIS requires no action or written response and, therefore, is not a backfit under 10 CFR 50.109. Consequently, the staff has not performed a backfit analysis.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment on this RIS was not published in the *Federal Register* because it is informational.

CONGRESSIONAL REVIEW ACT

The NRC has determined that this RIS is not subject to the Congressional Review Act, 5.U.S.C 801-808, because the RIS does not state a new position.

PAPERWORK REDUCTION ACT STATEMENT

The information collections associated with this Regulatory Issue Summary are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget, approval number 3150-0011.

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB approval number.

If you have any questions about this matter, please contact one of the persons listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

/RA/

William D. Beckner, Chief
Reactor Operations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Technical Contact: James J. Lazevnick

301-415-2782

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Attachment: List of Recently Issued NRC Regulatory Issue Summaries

July 2, 1998

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: PROPOSED REVISION TO 10 CFR 50.65(a)(3) TO REQUIRE
LICENSEES TO PERFORM SAFETY ASSESSMENTS

PURPOSE:

To obtain the Commission's approval to publish a proposed rule in the *Federal Register* that would amend [10 CFR 50.65](#) to require that licensees assess the impact on safety before removing equipment from service for maintenance.

BACKGROUND:

The maintenance rule, 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," was issued on July 10, 1991, and became effective on July 10, 1996. The staff has periodically submitted papers and presented briefings to the Commission on the status of the maintenance rule. On March 4, 1997, the staff submitted [SECY-97-055](#), "Maintenance Rule Status, Results, and Lessons Learned," and briefed the Commission on March 10, 1997, on that subject. The briefing included a discussion of the following provision of §50.65(a)(3): "In performing monitoring and preventive maintenance activities, an assessment of the total plant equipment that is out of service should be taken into account to determine the overall effect on performance of safety functions." The Commission and the staff discussed the fact that this provision of the rule is not a requirement because "should" does not impose an obligation to act. The Commission issued a staff requirements memorandum (SRM) on April 11, 1997, directing the staff to consider whether the language regarding the performance of §50.65(a)(3) safety assessments needs to be clarified. In [SECY-97-173](#), "Potential Revision to 10 CFR 50.65(a)(3) of the Maintenance Rule to Require Licensees to Perform Safety Assessments," dated August 1, 1997, the staff recommended revising §50.65(a)(3) and provided three alternatives for clarifying that paragraph. Those alternatives were to (1) make no change, (2) require the paragraph (a)(3) safety assessments, and (3) make comprehensive revisions to paragraph (a)(3) of the rule.

In response to [SECY-97-173](#), the Commission issued an SRM on December 17, 1997, approving, with comments, the staff's recommendation to develop a proposed rule that would amend the maintenance rule to require that licensees take safety assessments into account before performing maintenance activities. More specifically, the Commission directed the staff to (1) add an introductory sentence to 10 CFR 50.65 to

clarify that the rule applies under all conditions of operation, including normal shutdown; (2) make editorial corrections to the third sentence of paragraph (a)(3); and (3) delete the last sentence of paragraph (a)(3), and create a new paragraph, (a)(4). The new paragraph (a)(4) would change "should" to "shall" regarding the performance of safety assessments; expand the scope of the requirement for performing those assessments to include all planned maintenance activities; specify that the safety assessments are to examine the extant plant condition and the condition expected during the maintenance activity; and specify that the safety assessments are to be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level. Additionally, the Commission directed that extended or protracted regulatory analysis of Alternative 1 is unnecessary and that the regulatory analysis discussion of Alternative 3 be limited.

This paper provides the Commission with the rulemaking package for the proposed rule that would amend 10 CFR 50.65 as directed.

DISCUSSION:

The proposed rule that would revise the maintenance rule to require that licensees perform safety assessments and take them into account before performing maintenance activities was developed as directed by SRM 97-173. The results of the effort are detailed in the proposed *Federal Register* Notice (Attachment 1). The regulatory analysis for this proposed rule (Attachment 2) supports the choice of Alternative 2.

Following the Commission direction in the [SRM on SECY-97-173](#), this proposed rule would:

1. Add an introductory sentence to 10 CFR 50.65 clarifying that the rule applies under all conditions of operation, including normal shutdown. The rule has applied under all conditions, but it did not explicitly so state. As a preamble, before paragraph (a)(1), the following statement would be added: "The requirements of this section are applicable during all conditions of plant operation, including normal shutdown operations."
2. Be silent regarding the change to the third sentence in paragraph (a)(3) because the desired editorial corrections were incorporated in the 1998 edition of the Code of Federal Regulations. The first "preventative" was corrected to "preventing," and the second "preventative" was changed to "preventive" for consistency.
3. Delete the last sentence of paragraph (a)(3) of the rule. This action removes and separates the safety assessment requirement from the more programmatic periodic evaluation requirements of the rule left in paragraph (a)(3).
4. Add a new paragraph (a)(4) that requires the performance of safety assessments. The Industry guidance document, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," NUMARC 93-01, includes the safety assessments in their recommended program. The NRC endorsed that guidance by Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The

industry's practice has been to incorporate the provision for performing safety assessments into their maintenance rule implementation programs, and NRC's intent has been that the safety assessments be performed. However, at present, the NRC cannot ensure that licensees follow their own programs with regard to the safety assessments.

The new paragraph (a)(4) would read as follows: "Before performing maintenance activities on structures, systems, or components within the scope of this section (including, but not limited to, surveillance testing, post-maintenance testing, corrective maintenance, performance/condition monitoring, and preventive maintenance), an assessment of the current plant configuration as well as expected changes to plant configuration that will result from the proposed maintenance activities shall be conducted to determine the overall effect on performance of safety functions. The results of this assessment shall be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level."

5. Specify that the scope of the requirement for performing those assessments is to cover all planned maintenance activities. The NRC's intent is that the performance of safety assessments not be limited to monitoring and preventive maintenance activities. It would be imprudent of the NRC to require the development of a licensee practice for reviewing the safety aspects of most maintenance activities while omitting safety assessments before planned corrective maintenance activities. In fact, many licensees have already voluntarily included in their programs the performance of safety assessments before all planned maintenance activities.
6. Specify that the safety assessments are to examine the existing plant condition and the condition expected during the maintenance activity. The proposed language would be more specific regarding the reviews of (a) actual plant conditions before the planned maintenance activity is begun and (b) plant conditions expected while the activity is in progress. The rule would require the licensee to recognize its plant's capability to perform safety functions both before and after the planned change in plant condition for the performance of the maintenance activity.
7. Specify that the results of the safety assessments are to be used to help the licensee ensure that the plant is not placed in risk-significant configurations, i.e., a configuration for which the incremental contribution to the annual risk is not insignificant or configurations that would degrade safety functions to an unacceptable level. The proposed language would be more specific regarding the purpose of the safety assessments.

In SECY 97-055, the staff informed the Commission on the results of the first 18 maintenance rule baseline inspections. To update the Commission, the following information has been collected from 50 maintenance rule baseline inspections (MRBIs) for which inspection reports had been issued as of April 20, 1998. The staff continued to find that all licensees had developed programs to implement the safety assessment

provision of paragraph (a)(3) of the rule. However, at 5 sites, instances were found in which the licensee had failed to perform paragraph (a)(3) safety assessments called for by their maintenance rule implementation programs. Although the safety significance of the unassessed plant configurations at the 5

sites was not quantitatively determined during the inspections in all cases, it appears that some of the unassessed configurations had resulted in plants that were in a state of substantially greater risk than was realized by the licensees. At 19 other sites, weaknesses were found in their safety assessment programs, but no instances of failures to perform safety assessments were found. No weaknesses were found in the safety assessment programs in place at the other 26 sites. Thus, of the 50 MRBIs, about 50 percent found weaknesses or problems with implementation of the paragraph (a)(3) safety assessments, including instances where licensees did not perform the assessments required by their programs.

The staff has also recognized that the nuclear power industry has changed since the 1991 issuance of the maintenance rule. One significant change is that licensees have increased the frequency and amount of maintenance while at power. This may be due in part to the fact that rate deregulation of the electric utility industry will cause all nuclear power plants to operate more efficiently. One mechanism for increasing efficiency is to shorten refueling outages and reduce or eliminate mid-cycle maintenance outages by performing more maintenance while at power. As discussed in an October 6, 1994 letter from the Director of the Office of Nuclear Reactor Regulation to the Executive Vice President of the Nuclear Energy Institute, NRC senior management became concerned with both the increased frequency and amount of on-line maintenance and the apparent lack of licensees' understanding of its impact on plant safety.

Given that licensees have increased both the amount and frequency of on-line maintenance and that an MRBI review of the safety assessment process examines only a small sample of maintenance activities, the staff considers 5 licensee programs that missed assessments and their apparent risk significance, and 19 programs with weaknesses out of 50 inspected programs, to be a safety concern. If these proposed revisions to the maintenance rule are issued, the staff proposes to revisit a sample of approximately 20 licensees with identified safety assessment weaknesses to perform paragraph (a)(4) implementation inspections.

In its SRM on SECY-97-173, the Commission also indicated that development of the regulatory guidance should not delay issuance of the proposed maintenance rule change. The staff plans to prepare a regulatory guide in conjunction with the development of the final rule and have it ready for issuance 120 days after the publication date of the rule. The Nuclear Energy Institute (NEI), representing the nuclear power industry in a letter dated October 10, 1997, to the NRC Executive Director for Operations, specifically recommended that the word "should" in the last sentence in paragraph (a)(3) be changed to "shall" and be "made immediately effective" and is developing changes to NUMARC 93-01 to implement the revised rule.

In response to further direction from the Commission in its SRM on SECY-97-173, the staff has worked, and will continue to work, to ensure consistency among the efforts to change the maintenance rule, 10 CFR 50.59, and other applicable areas as they arise.

COORDINATION

The Office of the General Counsel has reviewed this proposed rule and has no legal objection to its content. The Office of the Chief Financial Officer has reviewed this proposed rule for resource implications and has no objection to its content. The Office of the Chief Information Officer has reviewed this proposed rule for information technology impacts and has no objections.

RESOURCES:

Resources to develop and implement this rulemaking, including follow-up inspection activities, are budgeted at a total of 3.25 FTE and \$400,000 in contract support.

RECOMMENDATIONS:

That the Commission:

1. Approve the notice of proposed rulemaking ([Attachment 1](#)) for publication in the *Federal Register*.
2. Certify that this rule, if issued, would not have a significant economic impact on a substantial number of small entities to satisfy the requirements of the Regulatory Flexibility Act, 5 U.S.C. 605(b).
3. Note that:
 - a. This rulemaking would be published in the *Federal Register* for a 75-day public comment period;
 - b. The appropriate congressional committees will be informed (see [Attachment 3](#));
 - c. A public announcement ([Attachment 4](#)) will be issued when the proposed rule is filed with the Office of the *Federal Register*;
 - d. The proposed rule contains no new or amended information collection requirements;
 - e. Copies of the *Federal Register* notice of proposed rulemaking will be distributed to all affected Commission licensees. The notice will be sent to other interested parties upon request; and
 - f. Copies of this paper have been sent to the Advisory Committee on Reactor Safeguards and the Committee to Review Generic Requirements. The committees will be briefed before the final rule is issued.

original /s/ by

L. Joseph Callan
Executive Director for Operations

Attachments: 1. *Federal Register* Notice
2. Regulatory Analysis
3. Congressional Letters
4. Public Announcement

Contact: Richard P. Correia
301-415-1009

NUCLEAR REGULATORY COMMISSION

**10 CFR Part 50
RIN 3150-AF95**

Monitoring the Effectiveness of Maintenance at Nuclear Power Plants

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing to amend its power reactor safety regulations to require that licensees assess the cumulative effect of out-of-service equipment on the plant's capability to perform safety functions before beginning any maintenance activity on structures, systems, or components within the scope of the maintenance rule. The amendments would also clarify that the proposed rule applies under all conditions of operation including normal shutdown, that the safety assessments include both the plant conditions before and those expected during planned maintenance activities, and that the safety assessments are to be used to ensure that the plant is not placed in a condition of significant risk or a condition that would degrade the performance of safety functions to an unacceptable level.

DATES: Submit comments by [Insert the date 75 days after publication in the *Federal Register*]. Comments received after this date will be considered if it is practical to do so, but the Commission is able to ensure consideration only for comments received on or before this date.

ADDRESSES: Mail comments to: The Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Attention: Rulemakings and Adjudications Staff.

Deliver comments to: 11555 Rockville Pike, Rockville, Maryland, between 7:30 a.m. and 4:15 p.m. on Federal workdays.

You may also provide comments via the NRC's interactive rulemaking web site through the NRC home page (<http://www.nrc.gov>). From the NRC home page, select "Rulemaking" from the tool bar. The interactive rulemaking website may then be accessed by selecting "[Rulemaking Forum](#)." This site possesses the ability of uploading comments as files (any format) if your web browser supports that function. For information about the interactive rulemaking site, contact Ms. Carol Gallagher, 301-415-5905, e-mail CAG@nrc.gov.

Certain documents related to this rulemaking, including comments received, may be examined at the NRC Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC. These same documents also may be viewed and downloaded electronically via the interactive rulemaking website established by NRC for this rulemaking.

FOR FURTHER INFORMATION CONTACT: Richard P. Correia, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555, 301-415-1009, e-mail rpc@nrc.gov.

SUPPLEMENTARY INFORMATION:

Background

The NRC's Maintenance Team Inspections of all nuclear power plant licensees in the late 1980s found the lack of consideration of plant risk in prioritizing, planning, and scheduling maintenance activities to be a common weakness. To address that weakness, paragraph (a)(3)

of 10 CFR 50.65, the maintenance rule, currently includes the provision that "(I)n performing monitoring and preventive maintenance activities, an assessment of the total plant equipment that is out of service should be taken into account to determine the overall effect on performance of safety functions." The maintenance rule was issued on July 10, 1991.

During plant visits in mid-1994, several NRC senior managers expressed concerns that licensees were increasing both the amount and frequency of maintenance performed during power operation without adequately evaluating safety when planning and scheduling maintenance activities. The NRC Executive Director for Operations (EDO) addressed these concerns regarding the safety implications with performing maintenance while at power to the president of the Institute of Nuclear Power Operations (INPO) in a letter dated October 6, 1994. In this letter, the EDO noted that it appeared that some licensees were either not following INPO guidelines for the conduct of maintenance and management of outages or had adopted only portions of the guidance. The EDO also recommended that INPO support NEI and appropriate utility managers during meetings with NRC senior managers to discuss the concerns they raised during the site visits.

The growing amount of on-line maintenance (i.e., maintenance performed during power operations) being performed by licensees and the inadequate pre-maintenance safety evaluations have raised the Commission's concern.

Discussion

The nuclear power industry has changed since the 1991 issuance of the maintenance rule. Rate deregulation of the electric utility industry will likely cause all nuclear power plants to seek ways to operate more efficiently. One mechanism for increasing

efficiency is shortening refueling and maintenance outages. Licensees have come to realize that performing more maintenance at power can lead to shorter refueling outages and reduction or elimination of mid-cycle maintenance outages.

Licensees have relied upon their individual plant technical specifications to help assure safe operation of the plant when equipment is out of service. However, the removal of multiple pieces of equipment, especially safety-related equipment, from service can undermine the fundamental premise of technical specifications, which is to provide adequate protection against random failures.

During plant visits in mid-1994, several NRC senior managers had concerns with the fact that licensees were increasing both the amount and frequency of maintenance performed during power operations. Some licensees were limiting the planned maintenance to a single train of a system while others would allow multiple equipment in other systems within a single train to be out of service as long as it did not violate the plant's Technical Specifications. However, allowable outage times specified in Technical Specifications are based upon a random single failure in a system and a judgement of a reasonable time to effect repairs before plant shutdown is required. Technical Specifications were not intended to address allowable outage times for multiple equipment being out of service at the same time. Further, it can not be implied that it is acceptable to voluntarily remove equipment from service to perform on-line maintenance on the assumption that such actions are bounded by a worst case single failure which is a plant specific design requirement that is contained in a number of the general design criteria (GDC) in 10 CFR 50, Appendix A. The NRC senior managers also had concerns with the fact that on-shift personnel, planning and scheduling personnel and licensee management lacked an understanding of the relative safety importance of safety systems or combinations of equipment that would have risk significance if taken out of service. It appeared that risk insights from plant specific Individual Plant Examination (IPE) results, whose purpose was to improve licensee understanding of the plant's safety and to address potential vulnerabilities, were not fully utilized in the plant's operational and maintenance decision process. These concerns were addressed in a letter dated October 6, 1994, from the Director of the Office of Nuclear Reactor Regulation to the Executive Vice-President of the Nuclear Energy Institute. The growing amount of maintenance performed during power operations and the underutilization of risk insights in plant operations and maintenance activities have raised the Commission's concern.

In determining the need for the maintenance rule a decade ago, one factor the Commission considered was its belief that there existed "a need to broaden its capability to take timely enforcement action where maintenance activities fail to provide reasonable assurance that safety-significant SSCs [structures, systems, and components] are capable of performing their intended function." Now, the Commission desires to act to help ensure that there is reasonable assurance such that maintenance activities will not place a plant in 1) a configuration that would degrade unacceptably a SSC's capability to perform its intended safety functions or 2) a risk-significant configuration, i.e., a configuration for which the incremental contribution to the annual

risk associated with accidents that result in damage to the reactor fuel or the release of fission products to the environment is not insignificant.

The first 50 NRC maintenance rule baseline inspections (MRBIs) for which inspection reports had been issued as of April 20, 1998, found that all licensees had developed programs to implement the safety assessment provision of paragraph (a)(3). However, at 5 sites, instances were found in which the licensee did not assess the impact on safety of total plant equipment out of service before it entered one or more specific plant configurations for maintenance purposes. At 19 other sites, weaknesses -- the term reserved for situations in which the overall assessment of a licensee program has found the program, or significant aspects of that program, to be particularly ineffective or for individual findings that have either high safety significance or programmatic implications -- were found, among which were paragraph (a)(3) safety assessment tools that did not include all high-safety-significant SSCs.

Although the safety significance of the unassessed plant configurations at the 5 sites was not quantitatively determined during the inspection in all cases, it appears that some of the unassessed configurations had resulted in plants that were in a state of substantially greater risk than was realized by the licensees. Given the concerns raised by NRC senior managers during site visits in 1994, the increased amount of on-line maintenance, the number of missed assessments and their apparent risk significance, in addition to the weaknesses found with the paragraph (a)(3) safety assessment programs, the Commission considers this to be a safety concern. The Commission, therefore, believes it is necessary to explicitly require licensees to perform safety assessments prior to removing equipment from service for maintenance during all conditions of plant operations including normal shutdown.

With regard to the operating conditions under which the proposed rule would apply, extensive interaction among the NRC, the industry, and the public has taken place over the need for regulations governing activities during shutdown conditions (i.e., shutdown as may be defined in each plant's individual technical specifications, but generally considered as a time when all control rods are inserted and the average reactor coolant temperature is below 200F). The question of whether 10 CFR 50.65 applies during shutdown conditions became an issue. The Commission desires to clarify that the rule does apply during shutdown conditions. Regarding which activities would be preceded by a safety assessment, the Commission has recognized that, although definitions regarding maintenance activities are fairly consistent from organization to organization, there is some variation in the definition of corrective maintenance. For example, some definitions bring a time dependency while some others consider the urgency of the repair. To eliminate inconsistency, and to cause more prudent use of the safety assessments, the Commission desires the regulation to cover all planned maintenance activities, rather than only the recommended monitoring and preventive maintenance in the current rule. Each planned non-emergency maintenance activity would now include a safety assessment prior to its being authorized to begin. In fact, many licensees have followed the guidance contained in Regulatory Guide 1.160 and NUMARC 93-01 and have already voluntarily included all planned maintenance activities in the scope of their safety assessment programs.

With regard to the safety assessments themselves, licensee implementation has been inconsistent. The Commission desires to specify that an appropriate safety assessment would include a review the current condition of the plant and the plant condition expected during the planned maintenance activity. Assessing the current plant configuration as well as expected changes to plant configuration that will result from the proposed maintenance activities, as would be called for under paragraph (a)(4) of the proposed rule, is intended to ensure that the plant is not placed in risk-significant configurations, i.e., a configuration for which the incremental contribution to the annual risk is not insignificant, or a configuration that would degrade safety functions to an unacceptable level. These assessments do not necessarily require that a quantitative assessment of probabilistic risk be performed. The level of sophistication with which such assessments are performed is expected to vary, based on the circumstances involved. It should be understood, however, that the contribution to risk of a specific plant configuration depends on both the degree of degradation of the safety functions and the duration for which the plant is in that configuration. Further, assessing the degree of safety function degradation requires that there be an understanding of the impact of removal of the equipment on the capability of the plant to prevent or mitigate accidents and transients. The assessments may range from deterministic judgments to the use of an on-line, living probabilistic risk assessment (PRA).

Additional guidance will be developed and promulgated in Regulatory Guide 1.160, Revision 3 (proposed), to assist licensees in implementing this provision of the proposed rule. The guidance will contain information regarding risk-significant configurations and unacceptable levels of safety function degradation.

Proposed Rule

This proposed rule would make five changes to 10 CFR 50.65:

1. Add an introductory paragraph to 10 CFR 50.65 clarifying that the proposed rule applies under all conditions of operation, including normal shutdown.

Prior to paragraph (a)(1), add the following wording: "The requirements of this section are applicable during all conditions of plant operation, including normal shutdown operations." The intent of this paragraph is to ensure that safety assessments are performed before maintenance activities when the plants are shut down as well as when the plants are at power. The shutdown condition may be defined in a plant's technical specifications, but the intent of this paragraph is that shutdown is generally considered as a time when all control rods are inserted and the average reactor coolant temperature is below 200° F.

2. Delete the last sentence of paragraph (a)(3) and create a new paragraph, (a)(4), that requires the performance of safety assessments.

The proposed rule would remove the last sentence of paragraph (a)(3) and would add a new paragraph, (a)(4), as follows in its entirety: "Before performing maintenance activities on structures, systems, or components within the scope of this section

(including, but not limited to, surveillance testing, post-maintenance testing, corrective maintenance, performance/condition monitoring, and preventive maintenance), an assessment of the current plant configuration as well as expected changes to plant configuration that will result from the proposed maintenance activities shall be conducted to determine the overall effect on performance of safety functions. The results of this assessment shall be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level." Deleting the current last sentence in paragraph (a)(3) will remove the recommendation for performing safety assessments from the paragraph that contains the periodic, programmatic, long-term review considerations of the rule. Creating a new paragraph, (a)(4), specifically for the safety assessment requirements would cause the assessment concept to stand as a separate entity within the maintenance rule.

3. Define in paragraph (a)(4) the scope of the requirement for performing those assessments to be all conditions of operation including normal shutdown.

The proposed rule would add the following in paragraph (a)(4) to define the scope of pre-maintenance safety assessments: "Before performing maintenance activities on structures, systems, or components within the scope of this section (including, but not limited to, surveillance testing, post-maintenance testing, corrective maintenance, performance/ condition monitoring, and preventive maintenance), an assessment . . . shall be conducted . . ." The NRC's intent is that licensees perform safety assessments before all planned maintenance activities that require removing from service equipment that is within the scope of the maintenance rule, as defined in 10 CFR 50.65(b) and (a)(1).

4. Specify in paragraph (a)(4) that the safety assessments are to examine the extant plant condition and the condition expected during the planned maintenance activity.

The proposed rule would include the following wording in paragraph (a)(4): ". . . an assessment of the current plant configuration as well as expected changes to the plant configuration that will result from the proposed maintenance activities . . ." The NRC's intent is that a reasonable safety assessment be performed. The assessment may range from simple and straightforward to complex. However, notwithstanding the degree of sophistication required for the assessment, the NRC intends that the assessment will examine the plant condition existing prior to the commencement of the maintenance activity and examine the changes expected by the proposed maintenance activity.

5. Specify in paragraph (a)(4) that the objective of performing the safety assessments is to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level. The proposed rule would add in paragraph (a)(4) the wording to specify the NRC's expectations regarding the use of each safety assessment, as follows: "The results of this assessment shall be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions

to an unacceptable level." The NRC's intent is to require that each licensee perform a safety assessment before undertaking each planned maintenance activity and be aware of the risk issues associated with that maintenance activity. The guidance to be developed for licensees and promulgated in Regulatory Guide 1.160, Revision 3 (proposed), is expected to assist the industry in implementing this provision of the proposed rule, providing guidance regarding risk-significant configurations and unacceptable levels of safety function degradation.

Finding of No Significant Environmental Impact: Environmental Assessment

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51 that this rule, if adopted, would not be a major Federal action significantly affecting the quality of the human environment and, therefore, an environmental impact statement is not required. The draft environmental assessment that forms the basis for this determination reads as follows:

Identification of the Proposed Action

The Commission is proposing to amend its regulations to require commercial nuclear power plant licensees to perform assessments of the plant's status before performing maintenance activities on structures, systems, and components (SSCs) within the scope of 10 CFR 50.65, the maintenance rule. The rule would be modified by adding an introductory sentence to clarify that the proposed rule would apply under all conditions of operation, including normal shutdown; deleting the last sentence of paragraph (a)(3); and creating a new paragraph, (a)(4). The new paragraph (a)(4) would change "should" to "shall" regarding the performance of safety assessments; define the scope of the requirement for performing those assessments to include all planned maintenance activities; specify that the safety assessments are to examine the extant plant condition and the condition expected during the maintenance activity; and specify that the safety assessments are to be used to ensure that, by the conduct of maintenance, the plant is not placed in risk-significant conditions or safety system performance is not degraded to an unacceptable level.

The Need for the Proposed Action

Paragraph (a)(3) of the maintenance rule, in part, currently recommends that, "(I)n performing monitoring and preventive maintenance activities, an assessment of the total plant equipment that is out of service should be taken into account to determine the overall effect on performance of safety functions." The Commission believes the performance of this type of assessment is prudent. The maintenance rule baseline inspections, being performed at each commercial nuclear power plant site, have found that all inspected licensees have implemented programs to perform the assessments, but about half of the sites inspected had programs with discernable weaknesses in this area, including instances in which, in accordance with the licensee's own programs, safety assessments should have been made but were not. Because of the hortatory nature of the safety assessment provision in §50.65(a)(3), the Commission cannot

ensure that licensees perform the assessments. Moreover, licensees are free to remove the performance of the assessments from their programs as they so desire. This proposed change to the Commission's regulations will permit the Commission to ensure that licensees perform the assessments, as appropriate.

The other changes are clarifications regarding applicability of the rule. During preliminary discussions prior to potential development of a rule on shutdown plant operations, a major question arose regarding whether 10 CFR 50.65 requirements apply during the time a plant is shut down. The Commission concluded that inclusion of a statement to the affirmative would eliminate the doubt.

Removing the provision regarding safety assessments from paragraph (a)(3) and creating for it a new, separate paragraph, (a)(4), would disassociate that new requirement from the more time-dependent requirement for evaluating of the program and the program's effectiveness at maintaining an appropriate balance between reliability and availability for each SSC. In the new paragraph, the requirement for safety assessment performance is stipulated to ensure licensees will perform those assessments. Because there were questions regarding when the assessments were to be performed, what plant conditions are to be evaluated and how they were to be used, the proposed new paragraph (a)(4) describes that the assessments are to be performed before all planned maintenance activities, are to examine pre-maintenance plant conditions and expected changes due to the proposed maintenance activity, and are to be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level.

Environmental Impacts of the Proposed Action

The proposed rule would require that commercial nuclear power plant licensees perform certain assessments of plant equipment status prior to performing all planned maintenance activities. The purpose of the proposed rule is to increase the effectiveness of the maintenance rule by requiring licensees to perform an assessment of plant conditions prior to planned maintenance and changes expected to result from the planned maintenance activity, to ensure that licensees understand the assessments are to be performed when the plant is shut down as well as at power, and to improve licensees' understanding of what conditions to assess and to what use to put the completed assessment. Accordingly, implementation of this proposed rule would not have any significant adverse impact on the quality of the human environment. The Commission believes that proper implementation of the proposed rule will reduce the likelihood of an accidental release of radioactive material caused by imprudently prioritized, planned, or scheduled maintenance.

The determination of this environmental assessment is that there will be no significant offsite impact to the public from this action. The NRC has also committed to complying with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," dated February 11, 1994, in all its actions. The NRC has determined that there are no disproportionate, high, or adverse

impacts on minority or low-income populations. In the letter and spirit of EO 12898, the NRC is requesting public comment on any environmental justice considerations or questions that the public thinks may be related to this proposed rule but somehow were not addressed. Comments on any aspect of the Environmental Assessment, including environmental justice, may be submitted to the NRC as indicated under the ADDRESSES heading.

States Consulted and Sources Used

The NRC has sent a copy of this proposed rule to every State Liaison Officer and requested his or her comments on the Environmental Assessment.

Paperwork Reduction Act Statement

This proposed rule does not contain a new or an amended information collection requirement subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget, approval number 3150-0011.

Public Protection Notification

If an information collection requirement does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

Regulatory Analysis

The Commission has prepared a draft regulatory analysis on this proposed regulation. The analysis examined the costs and benefits of the alternatives considered by the Commission for revising 10 CFR 50.65, the maintenance rule. Those alternatives were to (1) make no change to the rule, (2) require the safety assessments currently recommended in paragraph (a)(3) of the rule, and (3) make comprehensive revisions to paragraph (a)(3) of the rule. The analysis selected Alternative 2 as the preferred course of action. Details of the alternative selection are contained in the draft analysis, which is available for inspection in the NRC Public Document Room, 2120 L Street NW (Lower Level), Washington, D.C. Single copies of the analysis may be obtained from Richard P. Correia, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555, 301-415-1009, e-mail rpc@nrc.gov.

The Commission requests public comments on the draft regulatory analysis. Comments on the draft analysis may be submitted to the NRC as indicated under the ADDRESSES heading.

Regulatory Flexibility Certification

In accordance with the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)), the Commission certifies that this proposed rule will not, if adopted, have a significant

economic impact on a substantial number of small entities. This proposed rule affects only the operation of nuclear power plants. The companies that own these plants do not fall within the scope of the definition of small entities set forth in the Regulatory Flexibility Act or the size standards adopted by the NRC (10 CFR 2.810).

Backfit Analysis

As required by 10 CFR 50.109, the Commission has completed a backfit analysis for this proposed rule. The Commission has determined, on the basis of this analysis, that backfitting to comply with the requirements of this proposed rule provides a substantial increase in protection to the public health and safety or the common defense and security at a cost that is justified by the increased protection.

When the maintenance rule was first promulgated in 1991, the NRC staff did not foresee the significant changes licensees would be making in maintenance practices. To enhance operational efficiency brought about by the rate deregulation of the electric utility industry, licensees are shortening their refueling outages by performing more maintenance while the plant is at power. At-power maintenance practices have evolved to the point that not only are major systems and components taken off line, but also multiple systems and components are taken off line simultaneously. Taking systems and components off line for maintenance could result in an increased likelihood of an accident or transient, compared to risk that occurs from expected random equipment failures.

The objective of this proposed rule is to make mandatory that licensees assess the cumulative impact of out-of-service equipment on the capability of the plant to perform safety functions and that licensees consider the results of the assessment before undertaking maintenance activities at operating nuclear power plants in order to ensure that the plants are not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level. Thus, the proposed rule would state that licensees must perform safety assessments before removing SSCs from service for planned maintenance.

In addition, this proposed rule would (1) add an introductory sentence to 10 CFR 50.65 clarifying that the rule applies under all conditions of operation, including normal shutdown; (2) delete the last sentence of paragraph (a)(3) of the rule and create a new paragraph, (a)(4), that requires the performance of safety assessments; (3) specify that the scope of the requirement for performing those assessments covers all planned maintenance activities; (4) specify that the safety assessments are to examine the extant plant condition and the condition expected during the maintenance activity; and (5) specify that the results of the safety assessments are to be used to help the licensee ensure that the plant is not placed in risk-significant configurations or configurations that would degrade safety functions to an unacceptable level.

The pre-maintenance assessments, along with the clarifications regarding their scope and their use, which the Commission proposes to require are intended to cause licensees to manage this risk and ensure their plants are not placed in risk-significant

conditions or conditions in which the performance of safety functions is not degraded to unacceptable levels.

The details of this backfit analysis have been incorporated in the regulatory analysis.

For the reasons elaborated in the regulatory analysis, which also contains cost information, the Commission concludes that the proposed modification to the maintenance rule will result in a level of safety beyond that currently provided by the Commission's regulations, a substantial increase in the overall protection of public health and safety, and that the net costs of the rule are justified in view of this increased level of safety.

List of Subjects in 10 CFR Part 50

Antitrust, Classified information, Criminal penalties, Fire protection, Intergovernmental relations, Nuclear power plant and reactors, Radiation protection, Reactor siting criteria, Reporting and recordkeeping requirements.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 553, the NRC is proposing to adopt the following amendments to 10 CFR Part 50:

PART 50 -- DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

1. The authority citation for Part 50 continues to read as follows:

AUTHORITY: Secs. 102, 103, 104, 105, 161, 182, 183, 186, 189, 68 Stat. 936, 937, 938, 948, 953, 954, 955, 956, as amended, sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2132, 2133, 2134, 2135, 2201, 2232, 2233, 2236, 2239, 2282); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246, (42 U.S.C. 5841, 5842, 5846).

Section 50.7 also issued under Pub. L. 95-601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Section 50.10 also issued under secs. 101, 185, 68 Stat. 936, 955, as amended (42 U.S.C. 2131, 2235); sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332). Sections 50.13, 50.54(dd), and 50.103 also issued under sec. 108, 68 Stat. 939, as amended (42 U.S.C. 2138). Sections 50.23, 50.35, 50.55, and 50.56 also issued under sec. 185, 68 Stat. 955 (42 U.S.C. 2235). Sections 50.33a, 50.55a, and Appendix Q also issued under sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332). Sections 50.34 and 50.54 also issued under sec. 204, 88 Stat. 1245 (42 U.S.C. 5844). Sections 50.58, 50.91, and 50.92 also issued under Pub. L. 97-415, 96 Stat. 2073 (42 U.S.C. 2239). Section 50.78 also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Sections 50.80-50.81 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Appendix F also issued under sec. 187, 66 Stat. 955 (42 U.S.C. 2237).

2. In §50.65, an introductory paragraph is added, paragraph (a)(3) is revised, and a new paragraph (a)(4) is added, to read as follows:

§50.65 Requirements for monitoring the effectiveness of maintenance at nuclear power plants.

The requirements of this section are applicable during all conditions of plant operation, including normal shutdown operations.

(a) * * *

(3) Performance and condition monitoring activities and associated goals and preventive maintenance activities shall be evaluated at least every refueling cycle provided the interval between evaluations does not exceed 24 months. The evaluations shall be conducted taking into account, where practical, industry-wide operating experience. Adjustments shall be made where necessary to ensure that the objective of preventing failures of structures, systems, and components through maintenance is appropriately balanced against the objective of minimizing unavailability of structures, systems, and components due to monitoring or preventive maintenance.

(4) Before performing maintenance activities on structures, systems, or components within the scope of this section (including, but not limited to, surveillance testing, post-maintenance testing, corrective maintenance, performance/condition monitoring, and preventive maintenance), an assessment of the current plant configuration as well as expected changes to plant configuration that will result from the proposed maintenance activities shall be conducted to determine the overall effect on performance of safety functions. The results of this assessment shall be used to ensure that the plant is not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level.

Dated at Rockville, Maryland, this day of , 1998.

For the Nuclear Regulatory Commission,

John C. Hoyle,
Secretary of the Commission.

**Regulatory Analysis
Amendments to 10 CFR 50.65
Monitoring the Effectiveness of Maintenance
at Nuclear Power Plants**

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Introduction

This regulatory analysis conforms to the guidance as specified in NUREG\BR-0058, "Regulatory Analysis Guidelines of the U. S. Nuclear Regulatory Commission," and, thus, it meets the requirements of the backfit rule and provisions of the charter of the Committee to Review Generic Requirements. This backfit analysis demonstrates that the proposed requirements provide a substantial increase in protection to the public health and safety or the common defense and security at a cost that is justified by the substantial increase. Passages that address the items that must be considered in the backfit analysis have been cross referenced to the appropriate 10 CFR 50.109 citation.

1.0 Statement of the Problem

On July 10, 1991, the U.S. Nuclear Regulatory Commission (NRC) published [10 CFR 50.65](#), "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power

Plants." The Commission took this action because proper maintenance is essential to plant safety and there is a clear link between effective maintenance and safety as it relates to such factors as the number of transients and challenges to safety systems and the associated need for operability, availability, and reliability of safety equipment. Good maintenance is also important in providing assurance that failures of other than safety-related structures, systems, and components (SSCs) that could initiate or adversely affect a transient or an accident are minimized. Minimizing challenges to safety systems is consistent with the Commission's defense-in-depth philosophy. Maintenance is also important in ensuring that design assumptions and margins in the original design basis are maintained and are not degraded. Therefore, nuclear power plant maintenance is clearly important in protecting public health and safety.

In the late 1980s, the NRC's Maintenance Team Inspections found that, although licensees had adequate maintenance programs in place and had shown an improving trend in implementing those programs, a common weakness in those programs was a lack of consideration of plant risk in the prioritization, planning, and scheduling of maintenance activities. This weakness was one of the major reasons for the wording in 10 CFR 50.65(a)(3), which states that "(I)n performing monitoring and preventive maintenance activities, an assessment of the total plant equipment that is out of service should be taken into account to determine the overall effect on performance of safety functions." Because this section uses the word "should" instead of "shall," the legal effect is to serve as a recommendation rather than as a requirement.

During plant visits in mid-1994, several NRC senior managers had concerns with the fact that licensees were increasing both the amount and frequency of maintenance performed during power operations. Some licensees were limiting the planned maintenance to a single train of a system while others would allow multiple equipment in other systems within a single train to be out of service as long as it did not violate the plant's Technical Specifications. However, allowable outage times specified in Technical Specifications are based upon a random single failure in a system and a judgment of a reasonable time to effect repairs before plant shutdown is required. Technical Specifications were not intended to address allowable outage times for multiple equipment being out of service at the same time. Further, it cannot be implied that it is acceptable to voluntarily remove equipment from service to perform on-line maintenance on the assumption that such actions are bounded by a worst case single failure which is a plant specific design requirement that is contained in a number of the general design criteria (GDC) in 10 CFR 50, Appendix A. The NRC senior managers also had concerns with the fact that on-shift personnel, planning and scheduling personnel and licensee management lacked an understanding of the relative safety importance of safety systems or combinations of equipment that would have risk significance if taken out of service. It appeared that risk insights from plant specific Individual Plant Examination (IPE) results, whose purpose was to improve licensee understanding of the plant's safety and to address potential vulnerabilities, were not fully utilized in the plant's operational and maintenance decision process. These concerns were addressed in a letter dated October 6, 1994, from the Director of the Office of Nuclear Reactor Regulation to the Executive Vice President of the Nuclear Energy Institute. The growing amount of maintenance performed during power operations and

the underutilization of risk insights in plant operations and maintenance activities is a safety concern.

In SECY-97-055, "Maintenance Rule Status, Results, and Lessons Learned," dated March 4, 1997, the NRC staff described the challenge of inspecting and the NRC staff's inability to enforce the pre-maintenance safety assessment provision of §50.65(a)(3). The staff notes that, in general, licensees have followed the guidance contained in Regulatory Guide 1.160 and NUMARC 93-01 and thus have voluntarily complied with this provision of §50.65(a)(3) because it is obvious that there is a nexus between safety and having equipment out of service. When the maintenance rule was first promulgated in 1991, the NRC staff did not foresee the significant changes licensees would be making in maintenance practices. Typically, licensees would perform significant amounts of maintenance during refueling outages. To enhance operational efficiency in reaction to rate deregulation of the electric utility industry, licensees are shortening their refueling and maintenance outages by performing more maintenance while the plant is at power. At-power maintenance practices have evolved to the point that not only are major systems and components taken off line, but also multiple systems and components are taken off line simultaneously.

However, in the few cases in which the NRC staff has observed weak implementation or plant configurations for which the licensee did not adequately assess the configuration's safety impact, the NRC staff was unable to take actions to ensure that licensees perform appropriate assessments. Under current enforcement guidance, the NRC staff can involve this provision of paragraph (a)(3) in enforcement actions if the failure to perform an adequate assessment causes an event or contributes to the severity of or complicates recovery from an event. However, such a failure to perform a safety assessment can only be used as an escalating factor in enforcement actions otherwise taken as a result of the event, and it can not be used as a separate violation.

For these reasons, the NRC staff is proposing to amend 10 CFR 50.65(a)(3) to ensure that the total plant equipment out of service does not place the plant in a risk-significant configuration or degrade the plant's safety functions to an unacceptable level. The objective of the proposed rule is to require that the licensee assess the cumulative impact of out-of-service equipment on the capability of the plant to perform safety functions and that the licensee consider the results of the assessment before undertaking maintenance activities at nuclear power plants in order to ensure that the plants are not placed in risk-significant configurations or configurations that would degrade the performance of safety functions to an unacceptable level. **[§50.109(c)(1)]** Additionally, in staff requirements memorandum 97-173, dated December 17, 1997, the Commission approved the staff's recommendation to develop this proposed rulemaking, provided the text for the revisions to 10 CFR 50.65, stated that "extended or protracted regulatory analysis of Alternative 1 (no rule change) is unnecessary," and directed that the regulatory analysis discussion of Alternative 3 (comprehensive rule change) be limited.

2.0 Identification and Preliminary Analysis of Alternative Approaches

2.1 Alternative 1 -- Make No Change to Paragraph (a)(3) in the Rule

The first alternative considered is to maintain the status quo and not revise paragraph (a)(3). As noted in SECY 97-055, licensees have, for the most part, voluntarily incorporated the paragraph (a)(3) safety assessment provision in their maintenance rule implementation programs using the NRC Regulatory Guide 1.160 and NUMARC 93-01, because of the obvious connection between safety and out-of-service equipment. Additionally, some licensees have indicated a willingness to improve their programs to address weaknesses identified during inspections. Thus, the existing codified text could be considered sufficient. When inspections identify deficiencies in the programs of individual licensees, the staff could continue to encourage those licensees to improve their performance.

The obvious advantage of this alternative is that no additional burden would be placed on licensees or on the NRC staff to conduct such a rulemaking.

The disadvantages of Alternative 1 are that (1) licensees could remove the paragraph (a)(3) safety assessment provision in their maintenance rule implementation programs at their own discretion, (2) since the performance of a safety assessment is discretionary and not mandatory, licensees cannot take credit for their safety assessment programs under other risk-informed initiatives (unless they make the safety assessments a requirement through the other initiative), (3) because the safety assessments are not required, some licensees could view any efforts to encourage the safety assessments as a potential backfit, and (4) the NRC staff cannot enforce this provision of the rule.

2.2 Alternative 2 -- Change Paragraph (a)(3) of the Rule to Require Safety Assessments

Under §50.65(a)(4) of the proposed rule, before performing maintenance activities on SSCs within the scope of the rule, licensees would be required to conduct an assessment of the current plant configuration, as well as of expected changes to the plant configuration that will result from the planned maintenance activities, to determine the overall effect on performance of safety functions and would also be required to use the results of the assessment to ensure that the plant is not placed in a risk-significant configuration, i.e., a configuration for which the contribution to the incremental annual risk is not insignificant, or a configuration that would degrade safety functions to an unacceptable level. The SSCs that are subject to the requirements of the rule are those that are safety related, and certain non-safety-related SSCs as defined in §50.65(b) and (a)(1). Licensees have programs in place for meeting the guidance of Regulatory Guide 1.160 and NUMARC 93-01, which accepts the existing paragraph (a)(3) recommendation as part of its program. To comply with this proposed rule and complete this backfit, licensees would need to incorporate the rule changes into their existing programs.

The Commission's direction to the NRC staff for implementing this alternative would (1) add an introductory sentence to 10 CFR 50.65 clarifying that the rule applies under all

conditions of operation, including normal shutdown; (2) delete the last sentence of paragraph (a)(3) of the rule and create a new paragraph (a)(4) that requires the performance of safety assessments; (3) specify that the scope of the requirement for performing those assessments covers all planned maintenance activities; (4) specify that the safety assessments are to examine the extant plant condition and the condition expected during the maintenance activity; and (5) specify that the results of the safety assessments are to be used to help the licensee ensure that the plant is not placed in risk-significant configurations or configurations that would degrade safety functions to an unacceptable level. **[§50.109(c)(2)]**

The advantages of Alternative 2 are that (1) licensees would retain maximum flexibility to operate within configurations allowed by their current license as envisioned when the rule was originally issued; (2) there would be little or no burden on most licensees because licensees already have voluntary programs in place in accordance with NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," which the NRC endorsed by Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and the weaknesses in those programs that led to the failures to perform safety assessments found during the baseline inspections could be corrected relatively easily; (3) if licensees fail to perform a safety assessment (as in the case of 5 of the 50 maintenance rule baseline inspections for which inspection reports had been issued as of April 20, 1998), the NRC staff could use enforcement to require corrective actions that ensure licensees perform the safety assessments in the future; and (4), when appropriate, licensees may be able to take credit for their paragraph (a)(4) safety assessment program in other regulatory initiatives.

The disadvantages of Alternative 2 are that (1) licensees are, in general, exercising their discretion to perform the safety assessments and, thus, the NRC may be unnecessarily expending resources on a rule change mandating the performance of a safety assessment already being performed voluntarily, and (2) it would not address the weaknesses identified during 19 of the 50 baseline inspections pertaining to the quality and technical adequacy of licensees' methods for performing the safety assessments.

2.3 Alternative 3 -- Make Comprehensive Revisions to Paragraph (a)(3) of the Rule

The statements of consideration (SOC) for the maintenance rule noted that the safety assessments would be refined on the basis of technological improvement and experience. Therefore, as the third alternative, the staff considered a comprehensive revision of the paragraph (a)(3) safety assessment provision to incorporate the use of more modern technology and the experience with sophisticated techniques used by some utilities. To remain performance based, the rule would not prescribe a specific approach. Rather, it would provide considerations that assessment methodologies would have to address, while continuing to give licensees the flexibility to develop specific approaches that best suit the needs of each.

The advantages of Alternative 3 are that it would (1) require licensees to evaluate and control maintenance activities through technically advanced methods, (2) provide

specific limits to the risk associated with preventive maintenance activities, and (3) establish a foundation upon which other risk-informed regulation could build. Thus, Alternative 3 would address the weaknesses pertaining to the quality and technical adequacy of licensees' methods for performing the safety assessments identified during the baseline inspections and allow the use of the enforcement policy to require corrective actions for any of the weaknesses.

The disadvantages of Alternative 3 are that (1) such a rule would have a broad impact on other current and future rules and, instead, should be separated from this maintenance rule and developed as a rule that would be used generically for other risk-informed regulation; (2) since it would likely result in the use of probabilistic methods, Alternative 3 would impose a substantial burden on both licensees and the staff; and (3) because of the greater burden on licensees, Alternative 3 may be less likely to have industry support relative to Alternative 2.

3.0 Estimation and Evaluation of Values and Impacts

3.1 Alternative 1 -- Make No Change to Paragraph (a)(3) of the Rule

This alternative is the base case for this regulatory analysis. Therefore, the assumption is made that no licensee performs the pre-maintenance assessments that are recommended in §50.65(a)(3). Thus, there would be no impact upon licensees if this alternative is adopted, and there would be no additional resource burden on the NRC. Likewise, there would be no safety benefit to the public.

3.2 Alternative 2 -- Change Paragraph (a)(3) of the Rule To Require Safety Assessments

3.2.1 Impact of Alternative 2

If this alternative is adopted, all licensees would be required to perform an assessment of the effect that the resulting plant configuration would have on the safe operation of the facility. The degree of complexity of the assessments may differ from plant to plant, as well as from configuration to configuration within a plant. The characterization of the manpower cost to the licensees is complicated by the fact that the complexity of the assessment will depend upon a number of factors. For example, if a licensee is to take only one or two SSCs off line, the assessment required may involve checking to see that the resulting configuration possesses the capability of adequately performing all required safety functions. Conversely, if the licensee plans to perform maintenance on numerous SSCs at the same time, a more complex assessment may be required. The complexity of the assessments to be performed will also be governed by other factors, such as plant type. It is envisioned that licensees will develop strategies to minimize the burden resulting from these assessments. One such strategy might be to develop sets of pre-assessed configurations. Once an assessment has been made of a configuration in which a number of SSCs are to be taken off line and it is shown that this configuration does not unacceptably increase the overall risk or degrade the performance of safety functions to an unacceptable level, this same set of SSCs may be taken off line in future

maintenance outages if it can be shown that the resulting and the pre-assessed configurations are the same.

In Section 2.2 of this regulatory analysis, five modifications to the existing requirements in §50.65 are identified. Because of the nature of these existing requirements and the proposed modifications, the costs and impacts of these amendments are being treated together. For example, item (1), which adds an introductory sentence to the paragraph, specifies that the requirements apply to all conditions of operation, including normal shutdown. Since the existing language of the rule provides only a recommendation and not a requirement, this amendatory language will define the scope of the rule as all modes of operation, as opposed to the base case of no requirement for any mode of operation. Item (2) deletes the last sentence in paragraph (a)(3); however, this sentence does not specify a requirement, so the deletion has no effect. Items (3) and (4) are definitions of the scope of these proposed requirements, and their costs and benefits are included in the analysis to follow. Using the results of the pre-maintenance assessments to ensure that the facility is not placed in a higher than acceptable risk configuration or the capability to perform safety functions is not degraded to an unacceptable level, as required in item(5), will have an impact on plant operations. There will be times that the assessments will reveal that certain maintenance activities cannot be performed simultaneously and, thus, maintenance schedules will need to be modified accordingly. It is difficult, if not impossible, to quantify the effects, if any, of these modified maintenance activities without information concerning the equipment involved. However, the benefit of operating the facility in a risk-averse environment is seen to outweigh the inefficiencies that may be introduced through modified maintenance schedules.

To estimate the burden of this alternative to the industry, two types of costs have been considered: the costs associated with developing the assessment methodologies and the cost of using and maintaining them. This analysis assumes three levels of sophistication for the assessment methodologies. The first would be a basic deterministic type of analysis performed by plant operations, maintenance, or engineering, or one that might involve cross-checking predetermined non-complex matrices of SSCs to ascertain whether the planned maintenance would be detrimental to safety. The second would consider an intermediate level of analysis that would involve small groups of SSCs or equipment. It is possible that these intermediate-level assessments may also be performed in a deterministic fashion but would require far more analysis of the interrelationships between SSCs and the role they play in safety. In the event that larger numbers of SSCs will be taken off line for maintenance, a higher level of assessment, which takes into account the increase, if any, in risk, may be required. This level of assessment may require quantification of risk using probabilistic risk assessment (PRA) techniques. Thus, this regulatory analysis considers the costs associated with three levels of complexity associated with the assessment.

The first cost considered is the one-time⁽¹⁾ cost of developing the methodologies and the procedures for carrying out the various assessments. Estimates received from industry indicate that the cost of developing the basic assessment tools is approximately \$20,000, and the cost of developing the high-complexity, PRA-type approach is

approximately \$300,000.⁽²⁾ For the purpose of this analysis, it is assumed that the costs for the intermediate assessment development are approximately the same as the basic assessment. Another assumption is that each facility initially developed either a basic or an intermediate methodology. Although many facilities appear to be finding a benefit from moving to the high-complexity methodology, an estimate of the number that will move to the high level is difficult to acquire. Therefore, this analysis will develop the upper bound of costs, assuming all licensees will upgrade. Thus, assuming a total of 68 maintenance assessment programs⁽³⁾ will be developed industry-wide at \$320,000 per facility, this activity would incur a one-time cost of \$22 million across the industry.

It is anticipated that the aforementioned methodologies will require some modifications over time because of the possibility of changes in plant equipment and the availability of improved technologies and up-to-date PRA data. Industry estimates to both use and maintain the methodologies are \$50,000 and \$25,000 for the basic and high-complexity assessments, respectively. The higher cost for the basic assessments reflects the need to follow up with PRA-type assessments in the event that a more basic matrix approach is not sufficient. Again, it is assumed that the cost for basic and intermediate assessments is the same. The NRC staff estimates that currently one-third of its licensees use and maintain a high complexity assessment methodology and two-thirds use a basic or intermediate level technique. However, to bound the impacts on the conservative side, this analysis assumes that all 68 facilities will utilize either a basic or intermediate level assessment methodology augmented by a high complexity methodology. Therefore, the use and maintenance cost for each facility would be \$75,000 per program, or \$5.1 million across the industry, annually. If we assume that the average life expectancy of existing nuclear power plants is 20 years per facility, the discounted flow of funds at a 7-percent real discount rate is \$54 million. As an alternative analysis, using a 3-percent discounted rate, the value would be \$75.6 million.

Another impact considered was differences in facility type, design, and age. Facility type and design will have an impact on the amount of maintenance needed and thus the number of pre-maintenance assessments that a facility would be required to perform. The larger or more complex facility designs will have more SSCs and thus require more maintenance. However, these designs also have larger electrical outputs and thus the impact of the differences in plant design and complexity would have a negligible effect when considered across the rate paying population. **[§50.109(c)(8)]**

For the most part, however, these are sunk costs already expended in voluntary compliance with the original version of 10 CFR 50.65 as issued in 1991. The principal cost associated with implementation of this proposed rulemaking would be administrative in nature, dealing with changes to procedures and other documents to indicate the shift to and changes in paragraph (a)(4) and the modest retraining necessary for the appropriate personnel. **[§50.109(c)(5)]**

3.2.2 Value of Alternative 2

Maintenance of plant SSCs is necessary even if a pre-assessment of the resulting configuration is not required. Thus, the value of such a requirement is found in

improvement in safety that results from performing the assessments. If a plant is put in an unsafe configuration because equipment is off line for maintenance, demands may be made on safety and recovery systems that cannot be met. This circumstance may result in damage to the plant and possibly off site releases to the public, or it could cause excessive actuation of safety system SSCs that are rarely called upon.

The proposed rule does not require any change in the design or construction of any nuclear power plant. Neither does the proposed rule apply to activities associated with the planning, design, or installation of plant modifications. Therefore, there will be no plant installation, downtime, or construction costs associated with the proposed rule to be borne by licensees. **[§50.109(c)(5)]**

When the maintenance rule was first promulgated in 1991, the NRC staff did not foresee the significant changes licensees would be making in maintenance practices. To enhance operational efficiency in reaction to the rate deregulation of the electric utility industry, licensees are shortening their refueling and maintenance outages by performing more maintenance while the plant is at power. At-power maintenance practices have evolved to the point that not only are major systems and components taken off line, but also multiple systems and components are taken off line simultaneously. This on-line maintenance could result in an increased likelihood of an accident or transient while the equipment is rendered unavailable, compared to risk that occurs from expected random equipment failures. The pre-maintenance assessments, along with the specifications regarding their scope and their use, which the Commission proposes to require are intended to cause licensees to manage the risk associated with removing SSCs from service to perform maintenance by ensuring their plants are not placed in risk-significant conditions or conditions in which the performance of safety functions are degraded to unacceptable levels. It is this risk avoidance feature of this alternative that provides a significant safety benefit over Alternative 1 and provides the protection to the public health and safety that the NRC is required to maintain.

[§50.109(c)(6)]

Maintenance of plant equipment while the plant is operating at power (i.e., on-line maintenance) has become a common practice in the nuclear power industry. This practice has been caused, in large part, by the licensees' desire to maximize plant availability by minimizing plant refueling and maintenance outage durations. During on-line maintenance activities, the plant risk associated with an accident that would result in damage to the reactor fuel or the release of fission products to the environment will increase because of the unavailability of the equipment taken out of service. Pilot studies by the NRC as well as the industry's maintenance rule implementation assessments have both shown that the risk impact of maintenance activities can vary substantially, depending on the combinations of equipment allowed to be out of service concurrently and the duration of the activities. Since imprudently planned and managed maintenance activities have the potential for subjecting a plant to an unacceptable incremental contribution to the annual risk, it is important that the provisions of this proposed rule be implemented to ensure that on-line maintenance is carefully managed to achieve a balance between the benefits of the on-line maintenance and the potential impacts on safety. Hence, the proposed rule would require that the on-line maintenance

process be carefully evaluated, planned, and executed to avoid risk-significant configurations, or configurations that would degrade safety functions to an unacceptable level, and thereby would ensure an acceptable margin of safety. Furthermore, the proposed rule would focus attention on methods to evaluate, both prospectively and in real time, the risk impacts of plant configurations so that undesirable risk impacts from maintenance are avoided. Since this is a risk-informed and performance-based rule, licensees would have flexibility in their selection of evaluation methods and decision criteria as long as they meet the requirement of the proposed rule that unacceptable risk impacts from maintenance configurations be avoided. However, the staff will provide guidance in Regulatory Guide 1.160 Revision 3 (proposed) that will describe methods acceptable to the staff for meeting the requirements of this proposed rule.

[§50.109(c)(3)]

Similarly, because there is a potential risk to the public from an accidental offsite release of fission products during shutdown operations, maintenance performed during those operations, too, must be carefully managed. Even though the power level in the reactor is essentially zero, used fuel and contaminated materials present a potential hazard.

The maintenance rule does not prescribe the type, frequency, or duration of maintenance activities but rather would only require safety assessments before the performance of the maintenance. However, the safety assessment requirement is expected to greatly reduce the possibility of the plant's being operated in an unsafe configuration. This is likely to result in an overall reduction in occupational exposures.

[§50.109(c)(4)]

In addition to the benefit to public health and safety, other effects such as potential damage to plant SSCs and the possible need for the purchase of replacement energy will be avoided. This would result in a cost savings to the industry that in some measure would offset the increase in costs discussed in Section 3.2.1. While it is impractical to calculate the potential risk benefits of the proposed rule revision because of the variability, frequency, and repetitiveness of maintenance tasks associated with each plant configuration, the staff's qualitative assessment supports the beneficial impacts of the proposed rule change because of risk-aversion strategies resulting from the proposed change.

3.2.3 Impact of Alternative 2 on the NRC

The impact of Alternative 2 on the NRC would be twofold. The first impact would be the cost of implementing a rule change. On average, the NRC estimates that a rule change requires 1 person-year per year for 2 years. Although Alternative 2 appears to be a relatively straightforward amendment, it nonetheless would require about 2.0 NRC staff-years to complete. The deterministic analyses required by the basic and intermediate-complexity assessments should require little additional guidance to the licensees. However, additional guidance in the form of a regulatory guide is planned to provide licensees with insights on NRC's expectations for the high-complexity assessments that may require PRA techniques. There is currently a large body of PRA literature available

to the public, and the development of NRC-approved guidance from this body of literature should not require more than 0.25 staff-years of effort.

The second impact would be the inspection and oversight of the assessments, both of which should be straightforward and require minimum extra resources. In actuality, the inspection of licensees' implementation of the paragraph (a)(3) safety assessments is already part of the NRC resident inspector core inspection program. Therefore, similar to the actual impact on the industry, the principal impact on the NRC would be administrative in nature and would deal with changes to inspection procedures and guidance documents to indicate the shift to, and changes, in paragraph (a)(4) and the modest retraining necessary for the appropriate personnel. Nevertheless, the NRC staff proposes to inspect the implementation of the proposed rulemaking at about 20 licensee sites selected from those licensees that had safety assessment weaknesses during initial inspections of maintenance rule implementation. These approximately 20 proposed inspections would cost 1 staff year and \$400,000 in contractual support.

Thus, the impacts on the NRC are estimated to be a one-time cost for rule and guidance development of 2.25 staff-years plus 1 staff-year and \$400,000 for implementation inspection. These resources have been accounted for in the regional and headquarters budget estimates. **[\$50.109(c)(7)]**

3.3 Alternative 3 -- Make Comprehensive Revisions to Paragraph (a)(3) of the Rule

3.3.1 Impact of Alternative 3

Alternative 3 is derived as a consequence of the original intent of the maintenance rule. The SOC for 10 CFR 50.65 stated that the expectation was that the assessments required by paragraph (a)(3) would be refined on the basis of improvements in technology and experience. Because an approach like this requires the broad use of probabilistic techniques, it is envisioned that the approach would take on a performance-based character. This approach would mandate specific limits on the risk associated with maintenance activities, such as limits on total risk, incremental risk per maintenance outage, or limits on cumulative risk per time period. Because this would be a non-prescriptive approach, it is not feasible to estimate the cost to the industry or to the NRC with any degree of certainty. Licensees will likely take varying approaches to implement such technologies, each requiring sophisticated methodologies and highly trained individuals to perform the assessments.

Although the specific impacts of Alternative 3 have not been quantified, the burden to the licensee is believed to be much greater than Alternative 2. The NRC would promulgate the limits within which the risk of resultant plant configurations could be increased for maintenance activities instead of specifying the probabilistic techniques to be used. The licensee would need to research and evaluate various alternatives and determine which is suitable for its facility. A fair amount of trial and error is expected as various configurations are evaluated and certain maintenance activities are found to exceed NRC-specified limits. This trial and error, in turn may cause delays in maintenance activities and increase the likelihood of component failures.

3.3.2 Value of Alternative 3

Although it is impractical to calculate the potential risk benefits of this alternative, several qualitative values have been considered. Alternative 3 would limit maintenance activities through the use of mostly risk-based criteria and would require licensees to evaluate and control maintenance activities through much more rigorous, technically advanced methods. Also, it would establish a regulatory precedent for other risk-based requirements.

3.3.3 Impact of Alternative 3 on the NRC

The resource burden to the NRC of Alternative 3 is expected to be significantly greater than for the two lower options of Alternative 2. The NRC would need to develop the risk parameters to be used for setting the limits that risk may be increased while continuing to operate the facility safely. The specific limits must be developed, evaluated, and approved. Assessment methodologies used to estimate the change in risk parameters must be evaluated and approved by the NRC staff to assure their accuracy and reliability. Implementation of such a rule is expected to require extensive interactions between the staffs of the licensee and the NRC to fully understand and evaluate each methodology. Further, the burden of inspecting implementation and compliance with the regulation would be likewise complicated. For example, in a time of shrinking resources, Alternative 3 would necessitate extensive PRA training for region-based inspectors. Because the NRC continues to be a fully fee-recoverable agency, the increased burden would be transferred to the licensee.

Because of the burden that such an approach will place upon licensees, it is unlikely that the industry would support such an approach. Thus, the rulemaking process would be greatly affected, which would result in many industry and NRC interactions and many counter proposals by the industry requiring staff evaluation and Commission action. The resources required for such a rulemaking should be balanced against the incremental benefits. The NRC inspection program has demonstrated that, by and large, licensees are complying with an Alternative 2 type approach even though it is recommended and not required.

4.0 Discussion of Voluntary Compliance with the Safety Assessment Provision of 10 CFR 50.65(a)(3)

NRC's Regulatory Analysis Guidelines direct the NRC staff to not consider the cost of voluntary licensee actions as the cost basis for decisions concerning contemplated regulatory actions. However, the guidance indicates that a sensitivity analysis should be performed to estimate the actual incremental burden that would result from the action. All licensees have some form of pre-maintenance safety assessment program as recommended in 10 CFR 50.65(a)(3) and as provided in Regulatory Guide 1.160 and NUMARC 93-01. The first 50 maintenance rule baseline inspections for which reports had been issued as of April 20, 1998, found that approximately half of the licensees either had programs with weaknesses or had failed to perform the recommended safety assessments. This statistic would indicate that the methodologies for performing the

assessments are in place in most facilities; however, the weaknesses in some programs would have to be corrected, and the compliance with 10 CFR 50.65(a)(3) would have to be assured. Thus, the one-time \$320,000 cost per facility for methodology development and the annual \$75,000 per facility for use and maintenance would seem to overstate the actual increase in cost as a result of this rulemaking.

5.0 Decision Rationale

Alternative 2 is judged to present a substantial increase in safety as opposed to Alternative 1. Although Alternative 2 has a non-trivial burden if voluntary compliance is disregarded, its burden is not nearly as great as that of Alternative 3, and the program to be implemented is, in large measure, already in place. Also, the industry is favorably disposed to Alternative 2, and its full implementation should be straightforward. The Nuclear Energy Institute (NEI, successor to NUMARC) supported Alternative 2 and provided proposed draft revisions of NUMARC 93-01 to the NRC on May 1, 1998. Alternative 1, clearly the least burdensome of the choices considered, will not correct the NRC's principal concern, which is that licensees would not perform pre-maintenance safety assessments and remove the paragraph (a)(3) safety assessment provision in their maintenance rule implementation programs at their own discretion. Alternative 3 is the most comprehensive of the alternatives, but it would create a serious increase in the burden to the licensees and the NRC (which would likewise be borne by the industry). Thus, the NRC is publishing Alternative 2 as a proposed rule for public comment and proposes to publish it as a final rule once the public comments have been analyzed and resolved. If published as a final rule, the proposed backfit will be imposed on a final basis. **[§50.109(c)(9)]**

6.0 Implementation

The action evaluated in this regulatory analysis will be implemented through the promulgation of a final regulation, after the public comments have been obtained, evaluated, and resolved. A regulation has been selected as the appropriate mechanism for this implementation because regulatory guides do not constitute requirements and, with NRC orders, the benefit of public participation and comment are not utilized. The notice that publishes the final rule will specify that the rule will be effective 120 days after its publication in the *Federal Register* to coincide with the availability of regulatory guidance.

ATTACHMENT 3

The Honorable Dan Schaefer, Chairman
Subcommittee on Energy and Power
Committee on Commerce
United States House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The NRC has sent the enclosed proposed amendments to the Commission's rules in 10 CFR 50.65 to the Office of the *Federal Register* for publication. This rule, if promulgated, would require commercial nuclear power plant licensees to perform assessments of the cumulative safety impact of out-of-service equipment on the plant's capability to perform safety functions prior to removing equipment from service for undertaking maintenance activities. Although 10 CFR 50.65, the Maintenance Rule, presently addresses those safety assessments, the rule as written states they "should" be performed, the legal effect of which is to serve as a recommendation. This proposed rule would make them a requirement.

In today's environment of rate deregulation of the electric utility industry and the resulting pressure to enhance operational efficiencies and produce power, our nuclear power plant licensees are conducting more of their maintenance activities while at power than ever before. The Commission wants to ensure that these licensees consider risk in the prioritizing, planning, and scheduling of maintenance. A major portion of that consideration is based on the appropriate performance and use of the pre-maintenance safety assessments.

Sincerely,

Dennis K. Rathbun, Director
Office of Congressional Affairs

Enclosure: *Federal Register* Notice

cc: Representative Ralph Hall

The Honorable James M. Inhofe, Chairman
Subcommittee on Clean Air, Wetlands, Private
Property and Nuclear Safety
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The NRC has sent the enclosed proposed amendments to the Commission's rules in 10 CFR 50.65 to the Office of the *Federal Register* for publication. This rule, if promulgated, would require commercial nuclear power plant licensees to perform assessments of the cumulative safety impact of out-of-service equipment on the plant's capability to perform safety functions prior to removing equipment from service for undertaking maintenance activities. Although 10 CFR 50.65, the Maintenance Rule, presently addresses those safety assessments, the rule as written states they "should" be performed, the legal effect of which is to serve as a recommendation. This proposed rule would make them a requirement.

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Sincerely,

Dennis K. Rathbun, Director
Office of Congressional Affairs

Enclosure: *Federal Register* Notice

cc: Senator Bob Graham

NRC PROPOSES TO REQUIRE NUCLEAR POWER PLANTS TO ASSESS SAFETY IMPACT BEFORE TAKING EQUIPMENT OUT OF SERVICE FOR MAINTENANCE

The Nuclear Regulatory Commission is proposing to revise its Maintenance Rule to require that nuclear power plant licensees assess the impact on safety before they take equipment out of service for maintenance. At present, the rule says that licensees "should" do such an assessment, but does not require it.

NRC is taking comments on the proposed rule change. Comments are due 75 days after the amendment is published in the *Federal Register*.

NRC has long been concerned about a trend in the nuclear power industry to take key equipment out of service for maintenance while a plant is on line, without a thorough risk evaluation. Published NRC reports on 50 inspections conducted since the Maintenance Rule was first adopted in 1991 show that all licensees checked have programs in place requiring a review of the safety impact on the plant before equipment is taken out of service for maintenance. But at five sites, licensees had not performed such assessments, and at 19 others safety assessment weaknesses were found.

The present rulemaking results from a directive given the NRC staff by the Commission after it was informed last year that the Maintenance Rule language on safety assessments is permissive, rather than mandatory. Also at the Commission's direction, the proposed amendment specifies that the Maintenance Rule applies during all conditions of plant operations, including normal shutdowns, and that safety assessments are to be performed for all planned maintenance activities.

Comments on the proposed rule should be mailed to the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemakings and Adjudications Staff. They also may be hand-delivered to 11555 Rockville Pike, Rockville, MD, between 7:30 a.m. and 4:15 p.m. on Federal workdays. Comments may be transmitted via the NRC's interactive rulemaking web site through the NRC home page found at <http://www.nrc.gov>.

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1. The recurrent costs of updating the methodologies to account for new information and improved technologies will be accounted for separately.
 2. Unless otherwise noted or assumed, cost estimates are based upon direct staff communications with licensee management.

3. There are approximately 100 operating reactors in the United States. However, many of these units will share maintenance assessment programs because they reside in multiple- reactor sites. The assumption is that only 68 programs will need to be developed.