

March 3, 2000

FOR: The Commissioners
FROM: William D. Travers /RA/
Executive Director for Operations
SUBJECT: FINAL RULE: REVISION OF PART 50, APPENDIX K, "ECCS EVALUATION MODELS"


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PURPOSE:

To obtain the Commission's approval to publish a final rule in the *Federal Register* that amends [10 CFR Part 50, Appendix K](#), "ECCS Evaluation Models." The amendment will facilitate small but cost-beneficial power uprates for some commercial nuclear power plants.

BACKGROUND:


On October 1, 1999 (63 FR 53270), the NRC published a proposed amendment to 10 CFR Part 50, Appendix K, that would change the provision requiring emergency core cooling system (ECCS) performance analyses to assume the reactor to be operating 2 percent above licensed power. The amendment will allow licensees to adopt an alternative power level to the value stated in the rule if the alternative is sufficiently justified.

The 75-day public comment period for the proposed rule expired on December 15, 1999. During this public comment period, comments were received from four utility companies, the Nuclear Energy Institute, and Caldon, Inc., a manufacturer of flow measurement systems. All of the commenters supported the proposed rule, and no changes were made to the rule as a result of the comments. The comments are discussed in the *Federal Register* notice ([Attachment 1](#) ).

DISCUSSION:

A licensee for a light-water nuclear power reactor is required to submit a safety analysis report that contains an evaluation of ECCS performance under postulated loss-of-coolant accident (LOCA) conditions. In § 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," the Commission requires that ECCS performance under LOCA conditions be evaluated and that the estimated performance satisfy certain criteria. Licensees may conduct an analysis that "realistically describes the behavior of the reactor system during a LOCA" (often termed a "best-estimate analysis"), or they may develop a model that conforms to the requirements of Appendix K to 10 CFR Part 50. Most ECCS evaluations are based on Appendix K requirements.

Recent licensing actions and industry plans have shown that owners of nuclear power plants intend to use instrumentation to reduce uncertainties associated with measuring reactor power, thus justifying a reduction in the power level margin assumed in Appendix K ECCS evaluations. On September 30, 1999, the NRC issued a license amendment to allow a 1-percent increase in rated power for Comanche Peak Unit 2. The power level increase was based on the previously approved exemption to the Appendix K requirement for Comanche Peak. Several licensees have indicated that they also plan to seek credit for the reduced analysis margin in ECCS evaluations. The prospect of additional exemption requests provides the impetus for the amendment of the rule.

The current rule unnecessarily restricts operation for licensees that can show that the uncertainties associated with power measurement are less than 2 percent. The revised rule gives licensees the option to use a reduced power level margin for ECCS evaluation. A potential benefit for licensees is the opportunity for power uprate, although licensees could elect to maintain the current margin of 2-percent power. However, the revised rule, by itself, does not allow increases in licensed power levels. Technical specifications include the licensed power level and several ECCS-related parameters. When licensees elect to increase the licensed power level or to make other changes to ECCS-related technical specifications on the basis of the revised rule, they must submit a license amendment request for staff review and approval. The staff considers the assumed power level to be an input parameter of the ECCS evaluation. As discussed in the section-by-section analysis in the attached *Federal Register* notice ([Attachment 1](#) ) , the staff expects the basis for the revised analysis parameter (i.e., the assumed power level) to be included in documentation of the evaluation model, as required by Appendix K, Part II (1)(a). Therefore, the license amendment should show the basis for the modified ECCS analysis, including the justification for reduced power measurement uncertainty, and it should be included in documentation supporting the ECCS analysis.

The 102-percent power requirement (i.e., 2 percent above licensed power) does not appear elsewhere in NRC regulations. However, it has been widely applied in the Standard Review Plan (NUREG-0800), and many safety analyses incorporate the

102-percent power level assumption. In these instances, the power level assumption is associated with power measurement uncertainty and is not expressly relied upon to provide margin to safety limits. As discussed in the regulatory analysis accompanying the rule ([Attachment 2](#)), the staff intends to review affected Standard Review Plan sections and to evaluate the impact of the revised rule on those safety analyses. Further, the staff is considering the need for specific guidance to help licensees appropriately account for power measurement uncertainty in safety analyses. In the absence of specific guidance, the staff expects that power uprate amendment requests based on the revised rule will address the suitability of non-LOCA analyses for operation at proposed higher power levels. The staff does not anticipate the need for inspection guidance based on the rule change because implementation will likely result in power uprates that will require license amendments rather than a specific inspection initiative.

The amended rule addresses three of the four reactor safety performance goals embodied in the Draft Reactor Safety Chapter of the NRC Strategic Plan. The amended rule -

- a. Maintains safety. The intent of Appendix K, to ensure sufficient margin for ECCS performance in the event of a LOCA, continues to be met and plant risk is not significantly affected by the amended rule.
- b. Improves effectiveness and efficiency of reactor oversight. Without the amendment, the staff expects licensees to request exemptions from Appendix K. Granting multiple exemptions to Appendix K would be a less efficient course than amending the rule at this stage.
- c. Reduces an unnecessary regulatory burden. The amended rule offers licensees an option to relax an existing requirement, thereby reducing regulatory burden. Also, the amendment offers licensees the potential for significant financial benefits.

RESOURCES:


Resources to revise any regulatory guidance (approximately a 0.4 full-time-equivalent position) are available from funds currently budgeted for this purpose. Resources to implement the rule are dependent upon the number of plants requesting power uprate, or other technical specification changes.

COORDINATION:

OGC has no legal objection to the rule. ACRS reviewed the rule and has no objection to issuing it in final form. OCFO has reviewed this Commission paper for resource impacts and has no objection to its content. OCIO has reviewed this Commission paper for information technology and information management implications and concurs in it.

RECOMMENDATION:

That the Commission:

1. Approve publication of the attached notice of final rulemaking in the *Federal Register* ([Attachment 1](#) ).
2. Certify that this revised rule does not have a significant impact on a substantial number of small entities under the requirements of the Regulatory Flexibility Act [5 U.S.C. 605 (b)]. This certification is included in the attached *Federal Register* notice.
3. Note:
 - a. The Regulatory Analysis ([Attachment 2](#)) and the Environmental Assessment ([Attachment 3](#)) will be available in the Public Document Room.
 - b. The staff has determined that this action is not a major rule as defined in the Small Business Regulatory Enforcement Fairness Act of 1996 (5 U.S.C. 804 (2)) and has confirmed this determination with the Office of Management and Budget.
 - c. Congressional notifications will be made as required by Section 303 of the Atomic Energy Act of 1954 and the Small Business Regulatory Enforcement Fairness Act of 1996.
 - d. The Chief Counsel for Advocacy, Small Business Administration, will be informed of the certification regarding economic impact on small entities and the reasons for it, as required by the Regulatory Flexibility Act.
 - e. The rule amends information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3519) as discussed in the attached *Federal Register* notice.
 - f. In accordance with the National Technology Transfer Act of 1995, the staff attempted to identify voluntary consensus standards that could be used instead of the revised rule. However, an appropriate standard was not identified.

- g. A press release will be issued.
- h. Copies of the *Federal Register* notice will be distributed to all power reactor licensees and other interested members of the public.

/RA/

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Attachments: 1. [Federal Register notice](#) 
2. [Regulatory Analysis](#)
3. [Environmental Assessment](#)

ATTACHMENT 2

REGULATORY ANALYSIS REVISED 10 CFR PART 50, APPENDIX K

Alternate Power Level Assumption for ECCS Evaluations

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IX. STATEMENT OF THE PROBLEM

Part 50, Appendix K, "ECCS Evaluation Models," contains a requirement that safety analyses used for evaluating the performance of the emergency core cooling system (ECCS) under loss-of-coolant accident (LOCA) conditions be conducted at 102 percent of the licensed power for the plant. The provision appears to have been intended to account for uncertainties attributable to instrumentation error. Licensees have proposed using instrumentation that would reduce the uncertainties associated with measurement of reactor power, thus allowing justification of a reduced margin between the licensed power level and the power level assumed for ECCS evaluations. One licensee has used a reduced ECCS analysis margin to facilitate a small, cost-beneficial increase to licensed power. If the uncertainties associated with power measurement instrumentation errors can be shown to be sufficiently small, then the current rule unnecessarily restricts operation. Therefore, the objective of this rulemaking is to allow the reduction of an unnecessarily burdensome regulatory requirement.

A. Background

A holder of an operating license (i.e., the licensee) for a light-water power reactor is required by regulations issued by the NRC to submit a safety analysis report that contains an evaluation of emergency core cooling system (ECCS) performance under accident conditions. In § 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," the Commission requires that ECCS performance under loss-of-coolant accident (LOCA) conditions be evaluated and that the estimated performance satisfy certain criteria. Licensees may conduct an analysis that "realistically describes the behavior of the reactor system during a LOCA" (often termed a "best-estimate analysis"), or they may develop a model that

conforms with the requirements of Appendix K to 10 CFR Part 50. The majority of ECCS evaluations are based on Appendix K requirements. The opening sentence of Appendix K establishes the requirement to conduct ECCS analyses at a specified power level: "It shall be assumed that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level (to allow for such uncertainties as instrumentation error)." Licensees have proposed utilizing instrumentation that would reduce the uncertainties associated with measurement of reactor power, thus allowing justification of a reduced margin between the licensed power level and the power level assumed for ECCS evaluations. The revised rule changes this provision in Appendix K, thereby allowing licensees the option of using a value lower than 102 percent of the licensed power in their ECCS analyses.

Several licensees have expressed interest in using updated feedwater flow measurement technology (see Section IV, "Calorimetric Uncertainty and Feedwater Flow Measurement") as a basis for seeking exemptions from the Appendix K power level requirement and to implement power uprates. One licensee, TXU Electric Company, has obtained an exemption from the Appendix K requirement for Comanche Peak Units 1 and 2 and has received approval for an increase in licensed power based on more accurate feedwater flow measurement capability. The prospect of additional exemption requests from other licensees provides the impetus for changing the rule.

The amendment gives licensees the option to apply a reduced margin between the licensed power level and the assumed power level for ECCS evaluation, or they could maintain the current margin of 2-percent power. The amendment provides licensees the opportunity to pursue voluntary power uprates without the need to reconsider ECCS evaluations, although the basis for the assumed power for ECCS analysis would change. Some licensees could benefit from the change without increased licensed power through revisions to their ECCS evaluations at a lower assumed power level.

As presented in this regulatory analysis, the industry could realize a significant financial benefit through this relaxation. The intent of the rule, to assure margin to ECCS performance in the event of a LOCA, is still honored and plant risk will not be significantly affected under the amended rule.⁽¹⁾ However, the impact of raising the licensed power level for a plant must be evaluated on a plant-specific basis.

B. Existing Regulatory Framework

Appendix K to 10 CFR Part 50 was written to define conservative analysis assumptions for ECCS performance evaluations during design-basis LOCAs. Large safety margins are provided by conservatively selecting the ECCS performance criteria as well as conservatively establishing ECCS calculational requirements. One conservative calculational requirement is to assume that the reactor is operating at 102-percent power when the LOCA occurs. The first section of Appendix K establishes the requirement to conduct ECCS analyses at a specified power level, along with other heat-source assumptions. As stated parenthetically in the current rule, the power level requirement is imposed to account for uncertainties, including instrument error.

The 102-percent power requirement does not appear elsewhere in NRC regulations, but it has been widely applied in guidance documents. The tables that follow list sections of the Standard Review Plan (SRP) (Reference 2) that contain the 102-percent power requirement. The first table shows SRP sections that incorporate the 102-percent value, but that offer the possibility that a smaller value could be justified. The second table shows those SRP sections that give the 102-percent value without an alternative. The staff intends to review the affected SRP sections and will evaluate the impact of the revised rule on those safety analyses. Further, the staff is considering the need for specific guidance to help licensees appropriately account for power measurement uncertainty in safety analyses

The only regulatory guide containing the 102-percent power requirement is Regulatory Guide 1.49, "Power Levels of Nuclear Power Plants" (Reference 3).

SRP Sections Containing the 102-percent Power Margin With an Option

SRP Section	Title
15.2.6	Loss of Non-emergency AC Power to the Station Auxiliaries
15.2.7	Loss of Normal Feedwater Flow
15.3.1-15.3.2	Loss of Forced Reactor Coolant Flow, Including Trip of Pump and Flow Controller Malfunctions
15.3.3-15.3.4	Reactor Coolant Pump Rotor Seizure and Reactor Coolant Pump Shaft Break
15.4.3	Control Rod Misoperation (System Malfunction or Operator Error)
15.5.1-15.5.2	Inadvertent Operation of ECCS and Chemical and Volume Control System Malfunction That Increases Reactor Coolant Inventory
15.6.1	Inadvertent Opening of a PWR Pressurizer Relief Valve or a BWR Relief Valve
15.6.5	Loss-of-Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary

SRP Sections Specifying the 102-percent Power Requirement

SRP Section	Title
6.2.1.3	Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents
6.2.1.4	Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures
15.1.1-15.1.4	Decrease in Feedwater Temperature, Increase in Feedwater Flow, Increase in Steam Flow, and Inadvertent Opening of a Steam Generator Relief or Safety Valve
15.2.1-15.2.5	Loss of External Load, Turbine Trip, Loss of Condenser Vacuum, Closure of Main Steam Isolation Valve (BWR), and Steam Pressure Regulatory Failure (Closed)
15.4.6	Chemical and Volume Control System Malfunction That Results in a Decrease in Boron Concentration in the Reactor Coolant (PWR)

This amendment is not part of the proposed effort to revise Part 50 on a risk-informed basis, as described in SECY-98-300 (Reference 4). A risk-informed revision of Appendix K requirements, if undertaken, would involve a broad review of all ECCS analysis requirements and acceptance criteria.

II. OBJECTIVE OF THE FINAL RULE

The objective of this rulemaking is to remove an unnecessary regulatory requirement. Appendix K was issued to ensure an adequate performance margin of the ECCS in the event a design-basis LOCA were to occur. The margin is provided by conservative features and requirements of the evaluation models and by the ECCS performance criteria. The existing regulation does not require that the power measurement uncertainty be demonstrated, presupposing that the mandated margin is sufficient to account for uncertainties expected to be involved with measuring reactor power. By allowing a smaller margin for power measurement uncertainty, this amendment does not violate the underlying purpose of Appendix K.

A secondary objective is to avoid unnecessary exemption requests. The staff has previously sought rule changes to avoid the prospect of multiple exemption requests. In SECY-96-147 (Reference 5), the staff took steps to revise regulations that were associated with large numbers of recurring exemption requests. In the cases addressed in SECY-96-147, the rules were being changed as a result of recurrent exemptions, which indicated an inadequacy in a regulation. In the case of this change to Appendix K, the staff is anticipating recurrent exemptions and has determined that revising the rule at this early stage is the best course.

An economic benefit is a strong consideration for licensees. The economic benefit of an increase in licensed power can be considered in terms of replacement energy cost savings for utilities that no longer need to purchase the additional power generated as a result of a power uprate. Of course, plant-specific features and situations change the estimated benefit for any given plant either more or less favorably. Factors influencing the decision of a utility to upgrade a plant vary, and a plant-specific cost-benefit analysis would be required to determine whether a specific facility should pursue the uprate.

Under the final rule, some licensees could realize savings without seeking a power uprate. By revising their ECCS analysis based on a lower assumed power level, licensees could gain margin that could lead to less stringent requirements for LOCA mitigation system (i.e., ECCS) performance or in core thermal limits.

III. ALTERNATIVE APPROACHES

Rulemaking Options

The staff considered the following options:

- No Rule Change

Instead of instituting a rule change, the regulation could be maintained in its current form and multiple exemptions to the existing regulation could be granted under 10 CFR 50.12. A short-term benefit to this approach would be that the NRC would avoid the costs of changing the rule and of implementing the revision. However, in the long term, this is not a satisfactory alternative from the standpoint of regulatory efficiency.

Each exemption request would need to be reviewed in accordance with the criteria of 10 CFR 50.12 in addition to reviewing its technical merits. The exemption request review would be handled as a separate regulatory step from the review of a power uprate request for each application, as is the case with the pending exemption request for Comanche Peak Units 1 and 2. Applying this process to a series of exemption requests would be an unnecessary expenditure of NRC and licensee resources, an expenditure not encountered under an amendment to a rule.

- Option 1

Maintain the provision requiring an analysis margin to account for uncertainty in power measurement, but remove the specification of the 2-percent value for the margin. Licensees would then need to propose and justify the value used for their analysis.

This option is not preferred because it would not meet backfit criteria. Although it could provide relief to licensees that seek to reduce the margin, it would constitute a backfit on those licensees that would not wish a change from the currently required value but would nonetheless be required to justify a value. Because the change is expected to have negligible risk impact, there is no basis for a compliance or adequate protection backfit for this option.

- Option 2

Allow licensees the option to justify a smaller margin between licensed power and the assumed power level for ECCS analysis for their plant or to maintain the current margin now mandated.

This is the preferred option. Making this change to the rule gives licensees the opportunity to benefit from a reduced margin by demonstrating that power measurement uncertainty is sufficiently small. Licensees would pursue a change if there is a sufficient benefit relative to the effort to justify the change in a license amendment request. Licensees could gain benefits from operation at higher power or relax ECCS-related technical specifications. In such cases, licensees would need to justify the reduced power measurement uncertainty as part of the license amendment request. Other licensees may elect to revise the ECCS analyses for their facility and seek benefits without increasing licensed power. Maintaining the current Appendix K requirements is not adverse to safety and should be permitted as an option.

- Option 3

Eliminate the requirement for a margin between power level and assumed power.

This option is not preferred. The staff would need to investigate the feasibility of eliminating the requirement for an assumed power margin for analysis. Without a required analysis margin, licensees could seek benefits without addressing power measurement uncertainties. Justification for this option would involve demonstrating the acceptability of not accounting for any uncertainties behind the 2-percent power analysis margin. The technical effort involved in this option is probably not justifiable since a generic demonstration of the safety implications would be more costly than for option 2, and there is no safety benefit relative to option 2.

- Option 4

Broadly revise Appendix K, addressing several conservative requirements.

The staff considered addressing several of the calculational requirements in Appendix K with the objective of reducing excessive conservatism. This would be a long-term effort, which, if pursued, would not avoid the exemption requests expected in the shorter term. Further, given the existing option in 10 CFR 50.46 for licensees to apply best-estimate methodology to avoid Appendix K conservatism, and the substantial staff resource effort entailed in a broad Appendix K revision, the staff decided that this was not a preferred option.

IV. EVALUATION OF VALUES AND IMPACTS

Since the final rule does not in itself change any plant configurations or operating parameters, the staff evaluated likely benefits that licensees would seek to achieve from the revised rule. Those licensees electing to use the option afforded by the revised rule to pursue licensed power level increases for their plants are likely to realize the largest financial benefits as a result of the revised rule. Therefore, the evaluation that follows emphasizes the costs and savings associated with a small (i.e., approximately 1 percent) increase in licensed power. However, as discussed in the Decision Rationale section, there are only slight differences between the costs and benefits associated with the options evaluated by the staff. Therefore, the main decision criteria became regulatory efficiency impacts of a large number of exemption requests that would be faced without a rulemaking and the desire to complete a timely rulemaking.

In conducting the evaluation, the staff followed the "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," NUREG/BR-0058, Revision 2 (Reference 6), including the use of a 7-percent rate to adjust values to 1999 dollar values. First, benefits and costs are identified for the revised rule, then the overall effect is evaluated for each of the rulemaking alternatives considered. The values and impacts associated with rulemaking option 1 were not evaluated, because it was eliminated from staff consideration in view of backfit ramifications. Therefore, the evaluation that follows covers options 2 through 4 compared to the no-rulemaking alternative. The staff considered the no-rule-change alternative as the base case. In the event the rule was not revised, numerous exemption requests were anticipated that would be similar to the exemption already approved for Comanche Peak.

Previously, the staff concluded that marginal power increases have little risk significance (see Reference 1). Therefore, the staff considered value impact attributes related to health effects and property loss resulting from accidents to be unchanged by the revised rule. Also, the financial benefits under each option evaluated are equivalent. As a result, the attributes contributing to the final selection of a rulemaking alternative are limited to regulatory efficiency implications. When data were readily available, the staff made quantitative approximations for the factors. However, the evaluation was eventually qualitative, since the benefit of regulatory efficiency maintained by avoiding large numbers of exemptions is difficult to quantify.

A. Values

1. Savings to Licensees

Licensees who want to use the option offered by the revised rule could realize a significant economic benefit from an increase in licensed power. The benefit realized by a particular licensee will be influenced by a number of factors, including the market price of electricity, generating costs, and the mix of generating assets within the utility (i.e., types of units: nuclear, fossil, etc.). The staff estimated licensee savings under two sets of assumptions: replacement power cost savings and generation cost savings.

a. Replacement Power Cost Savings

On a purely replacement-power-cost-savings basis, the staff assumed that demand for electricity will increase such that any increase in generation by nuclear units will be purchased. Naturally, the validity of this assumption could be affected by market factors and the particular situation of the utility considered. However, based on the average annual increase in utility electric production from 1990 to 1998 for all sources (about 1.7 percent - see Reference 7) and a generally greater annual increase by nuclear units, use of added nuclear generating capacity of 1 percent appears to be a reasonable assumption. The licensee's benefit is considered on an average-plant basis using 1998 data from Reference 7. The retail price of electricity sold by electric utilities during 1998 averaged 6.74 cents per kilowatt-hour. Using the total amount of electricity produced in 1998 by nuclear generation, 674 billion KWH (reflects an industry-wide capacity factor of 70 percent for 103 operating units) and assuming a typical power increase of 1 percent to be achievable from the revised rule, the annual increase in electrical output for a single unit would be about 65.4 million KWH. Using these values, a unit could save about \$4.4 million annually in replacement power costs, or \$453 million for all operating units. However, increased power generation incurs some additional costs for the utility. The generating cost for nuclear power units during 1995 (Reference 8) was \$19.23 per MWH (this value includes fuel, operation, and maintenance costs). For the average plant being considered, the increased generation would add about \$1.7 million in annual costs (adjusted to 1999 value). Therefore, the net benefit for the average unit would be the difference between the replacement power savings and this additional generation cost, or \$2.7 million. Over the average remaining lifetime of a U.S. nuclear power plant (about 17 years), the savings would be approximately \$26 million (in 1999 dollars). The average lifetime does not account for expected license renewals.

b. Generation Cost Savings

This estimate assumes that a utility would use the increase in nuclear generating capacity gained from a 1-percent power uprate to reduce the amount of power generated by units that are more costly to operate. No benefit from the sale of additional power is included in this scenario because the utility is assumed to sell the same overall amount of electricity after the nuclear unit power uprate. Comparison of power generating costs in Reference 8 shows that gas and oil-fueled units had higher generating costs than nuclear units, while coal-fueled units had the lowest costs. It is reasonable to assume that a utility with units fueled by various means would use increased nuclear generating capacity to reduce more costly means of generation. Therefore, the staff assumed that a utility would apply the increased capacity of the average nuclear unit considered above to reduce the power generation by gas and oil-fueled units. The staff assumed that the reduction would be split evenly between the two types of units. Applying generation cost data from Reference 8, power generation costs from gas and oil-fueled units would decrease by about \$2.7 million, which is offset by the increase in costs of power generated by the nuclear unit of \$1.7 million, yielding a net savings for the utility of about \$1 million annually. Over the average lifetime of a U.S. nuclear power plant (17 years), the savings would amount to \$9.8 million (discounted to 1999).

These scenarios represent a range of the benefits that licensees may expect if they choose to pursue the power uprate afforded by the revised rule. A variety of factors could change the results for any particular utility, but the staff expects that for those licensees in a position to pursue power uprate, the results would fall in the range between the two scenarios considered above, or between \$1 million and \$2.7 million annually.

The magnitude of the benefit from a license change not involving power uprate and the manner by which it would be applied are subject to plant-specific considerations. Licensees may decide to seek a change in technical specifications for ECCS systems based on revised analyses, rather than to increase licensed power. In other cases, licensees might pursue benefits by altering core performance characteristics based on the revised ECCS evaluation. There is a wide range of possible scenarios and such savings would probably only add slightly to the industry savings realized from eventual power uprates. Therefore, the staff did not attempt to quantify the savings for plants that might make changes to their ECCS evaluations but would not seek power uprates.

2. Savings to NRC

The monetary savings realized by the NRC through rulemaking are expected to be modest, in that they lie only in the difference between processing license amendments for power uprates or other license changes associated with the revised rule and processing exemption requests along with similar license amendment requests. The costs of processing amendment requests and exemptions are discussed later.

There is also a benefit from improved regulatory efficiency, because multiple exemption requests need not be considered under the revised rule.

B. Impacts

1. Costs to Licensees

Licensees electing to pursue the benefit offered by the final rule would incur costs of upgrading plant instrumentation that provide the basis for the improved accuracy in power measurement. There are also several costs incurred by those licensees seeking a benefit from the final rule. These include the resource investment to conduct analyses to support a license amendment request, whether it is a power uprate or other technical specification change, and costs associated with submitting the license amendment to the NRC. Finally, there are costs incurred to implement the changes to the plant to allow operation at higher power.

For this evaluation, the staff assumed that the acquisition and installation costs for an ultrasonic flowmeter or for other changes that licensees could make to improve the accuracy of thermal power measurement would be part of the overall power uprate cost. Costs of analyses to support a power uprate amendment request would be approximately \$5 million, based on effort claimed by industry to support other power uprate requests (Reference 9). Some of these expenses could decrease as future applicants will realize efficiencies based on experience gained by earlier applicants. The staff also considered approximate values for both licensee and NRC costs that are available from NUREG/CR-4627 (Reference 10), which presents a cost estimate for a "complicated" technical specification change. For this assessment, the staff assumed that the analysis and submittal to justify a smaller assumed power margin incur costs equivalent to such a "complicated" amendment. Making adjustments for the period since 1988 when NUREG/CR-4627 was published, the licensee's cost to justify a smaller assumed power margin could be about \$75,000. Thus, using these estimates, each licensee would expend at least \$75,000 to use a reduced analysis margin, and those licensees seeking the power uprate would incur costs of about \$5 million.

The staff estimates the licensee's cost of plant modifications to accommodate a small power uprate to be in the range of \$5 million to \$10 million, which accounts for hardware, procedural changes, and personnel training costs. This estimate is based on licensee power uprate cost estimates ranging from \$150/KWe to \$2250/KWe (Reference 11).⁽²⁾ The staff used the higher cost information in the analysis to ensure that licensee costs would not be underestimated.

2. Costs to NRC

NRC realizes costs under any of the scenarios considered in this evaluation. The costs for review and processing of license amendments or exemptions, as well as revisions to guidance documents and rulemaking costs themselves, are considered next.

NRC licensing action costs are based on dollar values, rather than on staff full-time-equivalent positions, given in NUREG/BR-0184 (Reference 12) for the expected NRC staff effort to implement new requirements and on a so-called complicated technical specification amendment review discussed earlier. NUREG/CR-4627 estimates that such a review would entail an NRC cost of \$42,000, adjusted to present value. Assuming that the NRC cost to review the proposed power margin reduction is comparable to that required for a power uprate amendment, the cost for each would be in the range of \$42,000. Thus, the NRC would incur a cost of \$42,000 for each proposed margin reduction, and an additional \$42,000 to process each request for a power uprate.

NRC costs to revise the rule and update review guidance were estimated by the staff. The rulemaking costs vary depending on the scope of the rule revision considered. The costs associated with the current rulemaking activity are not included in the costs for that rulemaking option because those resources have been expended and can not be retrieved. The current rulemaking costs are used only to account for common activities among the options that would be considered completed if another rulemaking alternative were now pursued. Revision of associated guidance documents is estimated to be a one-time cost of about 0.4 FTE, or about \$54,000. To supplement the generic information discussed above, the staff also surveyed the NRC staff resources used for relatively recent licensing actions that might be representative of staff activity associated with the revised rule, such as exemption requests and similar power uprate requests. This survey formed the basis of the staff's assumption that an Appendix K exemption request would require about 7 weeks of staff effort, valued at approximately \$21,000 (assuming \$75 per hour for staff effort).

Savings might be realized as more exemption requests are approved and if generic submittals were made to address those facilities of similar design; however, the staff would need to ensure that plant-specific features for certain facilities did not invalidate the generic assessment. Thus, some review would still be needed for each request.

C. Health, Safety, and Environmental Effects

In the Appendix K exemption recently approved for Comanche Peak, the instrumentation manufacturer (Caldon, Inc.) claims that a safety benefit will be achieved by using the instrument even during operation at a higher power level. The vendor quantified the benefit in terms of the probability that the power level of the plant will exceed the licensed level at the initiation of the accident. Although the staff does not dispute the claim of a safety benefit, the overall safety impact of an increase in licensed power depends on a variety of plant-specific factors.

A slightly higher power level (i.e., about 1 percent) will result in a slight increase in decay heat load, but is not expected to affect the success criteria and required response time of ECCS equipment and the available operator response time following transients and accidents. In NUREG-1230 (Reference 13), the staff considered the risk impact of changes associated with the revised ECCS rules, including power increases, and determined that a power change of 5 percent or less had little risk significance.

In Reference 1, the staff discussed its consideration of the risk impact from BWR extended power uprates, which are much greater than the marginal power change expected under the revised rule. In these cases, the staff concludes that extended

power uprates are expected to only slightly affect the risk profile of a plant. In Reference 1, the staff judged that marginal power uprates, of about 1 percent, were not expected to require an assessment of the risk impact on the plant. However, licensees requesting increased licensed power must demonstrate on a plant-specific basis that deterministic requirements are satisfied (e.g., those based on the general design criteria of Appendix A to Part 50).

D. Comparison of Alternatives

The operating reactor population used for this assessment was 103 units as of December 1998. An assumption common to each option considered is that those licensees wanting to pursue power uprate afforded by an amendment to the rule would do so shortly after issuance of the final rule. Assuming the amendment is issued in final form during 2000, the average remaining plant lifetime is approximately 17 years, not accounting for expected license extensions.

Not all licensees are expected to seek a power uprate under the final rule. As described earlier, some would seek only to revise the ECCS analyses for their facility. For the purpose of this evaluation, the costs and benefits for these licensees are not considered because a large range of options is involved and because the staff found that the final rule was justified by limiting the benefits to those plants seeking power uprate. For this evaluation, the staff assumed an approximately even split of the nuclear plant population between these two categories of 50 plants whose licensees sought a power uprate, and 53 plants whose licensees were not seeking a power uprate. If only 50 plant licensees pursue a marginal power uprate, they would share an annual benefit ranging from \$50 million to \$135 million, based on the two scenarios considered earlier.

The table entitled, "Cost Estimates for Rulemaking Options," located at the end of this section, summarizes the staff's cost estimates used in its comparison of the alternatives. For each alternative, the staff assumed that the costs applied to 50 plants, as indicated in the table. Note that the high estimate for licensee costs for power uprate is used in the table and that the NRC costs comprise salaries, benefits, and contract support.

1. No-Rule-Change Alternative

If the current requirement remains in place and no amendment is permitted, the staff expects that a significant number of licensees will pursue exemption requests, following the example of Comanche Peak. Licensees for at least 19 plants have expressed their interest to NRC in the staff review of the Caldon, Inc. ultrasonic system. It is not clear how many of these licensees, or if others, would eventually pursue exemption requests. The staff assumed that if licensees determined that the relaxation had financial benefits for them, then those licensees would seek the benefit whether or not the rule is amended. The licensee costs to support exemption and amendment requests were discussed earlier. The staff used values of \$75,000 and \$5 million, respectively. Also, costs for implementing the power increase total about \$10 million. The typical NRC cost to review exemption requests were discussed earlier and are estimated to be about \$21,000 per request. Added to this cost is the NRC cost to review the justification for the reduced power level margin of \$42,000. The licensee and NRC costs associated with the power uprate would be the same as those considered for the 1-percent power increase assumed for options 2 and 3, about \$42,000.

2. Option 2

Under option 2, the change is not mandatory. Therefore, each licensee would first determine whether an investment to reduce the analysis margin is justified in light of the potential benefits. Licensees opting to obtain a power uprate or other license amendment must conduct an analysis to justify a reduced assumed power margin, and then prepare license amendments to obtain a power uprate or technical specification change.

The costs for these activities were discussed earlier and are considered the same as in the no- rule-change case, although some savings may be expected because an exemption request is not involved. The NRC would incur a cost of \$42,000 for each proposed margin reduction, and an additional \$42,000 to process each request for a power uprate. The staff estimated that the rulemaking effort for option 2 would require 0.9 FTE or about \$122,000. This cost is not included in the decision rationale to chose a rulemaking option because these resources have been expended at the final rulemaking stage. The value is used to offset the costs of rulemaking activities common among the options to show the actual resource implications at the final rulemaking stage. Once the current regulation is changed, any NRC SRP sections and regulatory guides that use the currently required value for assumed power margin would have to be revised to remain consistent with the regulations. These costs totaling \$54,000 were discussed earlier.

3. Option 3

Under this option, as in option 2, those licensees seeking a higher licensed power level, or other benefit, would incur costs. The costs would be associated with revising plant technical specifications and conducting those analyses necessary to amend the license to operate at a higher power level. These costs are the same as those considered in option 2.

Under this option, the NRC assumes a much greater burden in that the rulemaking to eliminate a requirement, versus its modification, would be expected to entail a significant amount of technical and administrative effort compared to option 2. For instance, the NRC staff would probably use contractor assistance to help develop the technical basis for the revised rule. A protracted review of the revision would be expected and would entail significant staff costs. NRC costs are estimated on the basis of the previous value for the staff review of a licensing- basis revision, or about \$84,000 for each licensee submittal, and a one-time NRC cost of \$1.4 million assumed for the staff analysis of the generic issues and rulemaking involved to eliminate the requirement. This cost would be divided between staff effort and contractor services, as appropriate. Rulemaking costs associated with option 2 of about \$100,000 are not included in the total NRC cost for this option.

4. Option 4

Under this option, the staff would revise several parts of Appendix K, and some plants could then decide to seek higher licensed power levels under the revision. Because a more far-reaching rule change would reduce conservatism by more than just a change to the power measurement conservatism, a greater potential benefit should be expected. Thus, for this option, the staff assumed that plants might realize a 5-percent power uprate if Appendix K were broadly revised. The licensee costs involved with such a power uprate for a facility could be expected to be somewhat more than costs assumed for the 1-percent change. The staff assumed that the costs to support and then implement such a change would roughly double, to about \$10 million and \$20 million per plant, respectively. The NRC rulemaking and review costs for this option are more difficult to estimate, but an increase to about \$5 million for a multi-year rulemaking effort requiring extensive technical support is reasonable. The differential of \$100,000 associated with the option 2 rulemaking is relatively small and is not considered here. The NRC cost to review each more extensive amendment would also roughly double to about \$100,000. Thus, each licensee's cost would total about \$27 million, and the NRC would incur costs of as high as \$10 million for the overall effort involved. This option would also take much longer to implement than the others.

E. Backfit Considerations

The NRC has determined that the backfit rule in 10 CFR 50.109 does not apply to this amended regulation and that a backfit analysis is not required for this change because the revised rule does not involve any provisions that would impose backfits as defined in 10 CFR 50.109(a)(1). This revised rule amends the NRC's regulations by establishing an alternate requirement that licensees may voluntarily adopt.

F. Impacts on Other Programs, Other Agencies

The only potential impact the staff foresees is that further changes to Appendix K could result from the proposed risk-informed review of 10 CFR Part 50, discussed in SECY-98-300.

Cost Estimates for Rulemaking Options (1999 dollars)

Option ¹	No. of Plants	Licensee Costs (per plant)			Licensee Total (each option)	NRC Costs			NRC Total (each option)	OVERALL TOTAL	Rule & Guide Changes
			Request Margin Change	Request Power Uprate		(per plant)		(generic)			
						Effect Power Uprate	Process Margin Change	Process Power Uprate			
No Rule Change	50	\$75K ²	\$5M	\$10M	\$754M	\$63K ²	\$42K	--	\$5.3M	\$759M	
2	50	\$75K	\$5M	\$10M	\$754M	\$42K	\$42K	\$54K	\$4.3M	\$758M	
3	50	\$75K	\$5M	\$10M	\$754M	\$42K	\$42K	\$1.4M	\$5.6M	\$760M	
4	50	--	\$10M	\$20M	\$1.5B	--	\$100K	\$5M	\$10M	\$1.51B	

- Notes:
- Options 2 and 3 consider a 1-percent power uprate; option 4 involves a 5-percent power uprate. Option 1 was not considered in the value-impact analysis.
 - Costs of preparing/reviewing the exemption request are included.

V. DECISION RATIONALE

The safety impact of options 2 and 3 is essentially equivalent to the baseline, or no-rule-change alternative, because licensees for 50 plants are expected to submit exemption requests for the relief offered by the revised rule, if it were not issued. The staff has previously determined that there is negligible risk impact from a marginal increase in licensed power; therefore, public health and safety and common defense and security continue to be adequately protected. Therefore, the staff considered value impact attributes related to health effects and property loss resulting from accidents to be unchanged by the revised rule.

Cost and benefit estimates are summarized in the table that follows. Differences in overall costs between options 2 and 3 and the no-rule-change alternative are small, and these values should be assumed equivalent. Also, the financial benefits under each option evaluated are equivalent. As a result, the attributes contributing to the final selection of a rulemaking alternative were limited to regulatory efficiency implications. When data were readily available, the staff made quantitative approximations for the factors. However, the evaluation was eventually qualitative, since the benefit of regulatory efficiency maintained by avoiding large numbers of exemptions is difficult to quantify.

The preferred rulemaking alternative is option 2. The no-rule-change alternative could not be eliminated on the sole basis of overall cost considerations. The staff then considered NRC precedent for revising rules to eliminate or avoid excessive numbers of exemption requests as a basis for narrowing the choices to options 2, 3, and 4. Although a broad revision to

Appendix K (option 4) could provide greater relief from ECCS analysis requirements (benefits are assumed to increase proportionally compared to the 1-percent power increase), such a change could not be completed in the short term. The NRC is currently prioritizing such a revision along with other changes expected to be pursued to revise Part 50 on a risk-informed basis. Option 3 would take longer to implement than option 2 because of the more involved technical justification that would be required, as discussed earlier. Also, the NRC costs are expected to be somewhat greater for option 3. The anticipated benefits of the two remaining options are the same.

Decision Rationale Summary

Option	No. of Plants	Cost			Benefit	
		Licensees	NRC	Total	Annual	Lifetime
No Rule Change	50	\$754M	\$5.3M	\$759M	\$50M-135M	\$488M-\$1.3B
2	50	\$754M	\$4.3M	\$758M	\$50M-135M	\$488M-\$1.3B
3	50	\$754M	\$5.6M	\$760M	\$50M-135M	\$488M-\$1.3B
4	50	\$1.5B	\$10M	\$1.51B	\$250M-675M	\$2.4B-6.6B

The industry has expressed its intention of submitting numerous requests for exemption from Appendix K to ease the assumed power level requirement. The exemption requests could be avoided or minimized by an expeditious rulemaking. In the interest of regulatory efficiency, the staff is revising the rule now, rather than proposing more involved action that will take much longer to implement. The simple revision contained in option 2 eliminates an unnecessary regulatory burden with little potential for adverse risk impact, and can be achieved relatively quickly.

VI. IMPLEMENTATION

The final rule will become effective 30 days following publication in the Federal Register.

VII. REFERENCES

1. U.S. Nuclear Regulatory Commission, Letter from EDO to ACRS, "Staff Response to ACRS Letter of July 24, 1998 on General Electric Nuclear Energy Extended Power Uprate Program and Monticello Nuclear Generating Plant Extended Power Level Increase Request," September 14, 1998.
2. U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," NUREG-0800, Washington, D.C., July 1981.
3. U.S. Nuclear Regulatory Commission, "Power Levels of Nuclear Power Plants," Regulatory Guide 1.49, Revision 1, Washington, D.C., December 1973.
4. U.S. Nuclear Regulatory Commission, "Options for Risk-Informed Revisions to 10 CFR Part 50--'Domestic Licensing of Production and Utilization Facilities'," SECY-98-300, Washington, D.C., December 23, 1998.
5. U.S. Nuclear Regulatory Commission, "Planning for Pursuing Regulatory Improvement in the Area of Exemptions Granted to Regulations," SECY-96-147, Washington, D.C., July 1, 1996.
6. U.S. Nuclear Regulatory Commission, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," NUREG/BR-0058, Revision 2, Washington, D.C., November 1995.
7. U.S. Department of Energy, Energy Information Agency, "Electric Power Monthly," DOE/EIA-0226(99/04), Washington, D.C., April 1999 (available at www.eia.doe.gov).
8. Utility Data Institute, "1995 Production Costs--Operating Steam-Electric Plants," UDI-2011-96, Washington, D.C., September 1996.
9. "Plant Uprates Seen as Cheap Way to Meet Competitive Pressures," *Nucleonics Week*, Vol. 36, No.38, September 21, 1995.
10. U.S. Nuclear Regulatory Commission, "Generic Cost Estimates," NUREG/CR-4627, Rev. 2, Washington, D.C., February 1992.
11. Westinghouse Corporation, Letter from E.P. Rahe, to Dr. D.F. Ross, NRC, "LOCA Margin Benefits," February 8, 1985.
12. U.S. Nuclear Regulatory Commission, "Regulatory Analysis Technical Evaluation Handbook," NUREG/BR-0184, Washington, D.C., January 1997.

ENVIRONMENTAL ASSESSMENT

REVISED 10 CFR PART 50, APPENDIX K

- [Identification of the Action](#)
- [Need for the Action](#)
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This document examines the environmental impacts of NRC's regulatory actions in accordance with 10 CFR Part 51, for a rulemaking addressing NRC's current emergency core cooling systems (ECCS) evaluation requirements for nuclear power reactors. NRC is modifying these requirements, which are contained in Appendix K to 10 CFR Part 50. The rule provides a voluntary option for licensees to apply a reduced margin between the licensed power level and the assumed power level for ECCS evaluation. The currently required analysis margin is 2 percent of licensed reactor power.

NRC's regulations for implementing Section 102(2) of the National Environmental Policy Act of 1969 (NEPA), as amended, are contained in Subpart A of 10 CFR Part 51. These regulations require that an environmental impact statement or an environmental assessment be prepared for all licensing and regulatory actions that are not classified as "categorical exclusions" in accordance with 10 CFR 51.22(c) and are not identified in 10 CFR 51.22(d) as other actions not requiring environmental review.

This document presents the findings of NRC's environmental assessment of the final rule.

Identification of the Action

A holder of an operating license (i.e., the licensee) for a light-water power reactor is required by regulations issued by the NRC to submit a safety analysis report that contains an evaluation of ECCS performance under accident conditions. Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," requires that ECCS performance under loss-of-coolant accident (LOCA) conditions be evaluated and that the estimated performance satisfy certain criteria. Licensees may conduct an analysis that "realistically describes the behavior of the reactor system during a LOCA" (often termed a "best-estimate analysis"), or they may develop a model that conforms with the required and acceptable features of Appendix K to 10 CFR Part 50. Most ECCS evaluations are based on Appendix K requirements. The opening sentence of Appendix K establishes the requirement to conduct ECCS analyses at a specified power level: "It shall be assumed that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level (to allow for such uncertainties as instrumentation error)."

The final rule gives licensees the option to apply a reduced margin between the licensed power level and the assumed power level for ECCS evaluation. The current margin of 2 percent power may be maintained, if preferred. If licensees can show that the uncertainties associated with power measurement instrumentation errors are less than 2 percent, and a smaller margin can be justified, then the current rule unnecessarily restricts operation of some facilities by limiting their ability to operate at higher power levels, and in other cases by imposing unnecessary requirements on ECCS performance.

Appendix K to 10 CFR Part 50 was written to define conservative analysis assumptions for ECCS performance evaluations during design-basis LOCAs. Large margins for important safety parameters were provided by conservatively selecting the ECCS performance criteria as well as conservatively establishing ECCS calculational requirements. The staff has long recognized that Appendix K incorporated substantial conservatism and previously had considered methods that would acceptably reduce safety margins. The conservatism was necessary when the rule was written because of a lack of experimental evidence at that time. When the NRC adopted changes to 10 CFR 50.46 to allow "best-estimate" modeling, it concluded that experimental evidence gained since the original rule was implemented and analysis advances allowed the consideration of alternative approaches. In the final rule, the staff is extending the application of its understanding of ECCS evaluation conservatism to allow relaxation of one of several conservative analysis features.

The current analytical approach of assuming 102 percent of licensed power for ECCS evaluation is adequate to protect public health and safety; therefore, the NRC does not intend to backfit a change to the regulation on operating reactors. Because the amendment does not constitute a backfit, the bases for current ECCS evaluations must be preserved. Therefore, the provision retains the current requirement as an option for licensees.

Need for the Action

The objective of this rulemaking is to allow the voluntary relaxation of an unnecessarily burdensome regulatory requirement. Appendix K was issued to ensure an adequate performance margin of the ECCS in the event a design-basis LOCA were to

occur. The margin is provided by conservative features and requirements of the evaluation models and by the ECCS performance criteria. By allowing a smaller margin for power measurement uncertainty, the revised rule does not undermine the underlying purpose of Appendix K.

A secondary objective is to avoid unnecessary exemption requests. The staff has previously sought rule changes to avoid the prospect of multiple exemption requests. In the case of this change to Appendix K, the staff is anticipating recurrent exemptions and has determined that revising the rule at this early stage is the best course.

Environmental Impacts of the Action

The final rule modifies an analysis assumption for ECCS evaluation, not actual LOCA effects. Use of a reduced power margin alone cannot affect core damage frequency, the large early release frequency, or actual accident release consequences. The actual accident sequence and progression of a LOCA are not changed unless the licensee modifies its facility. However, the final rule may have indirect effects on the environment by allowing licensees to pursue changes to their facilities such as increases to licensed power.

The most obvious change a licensee might pursue under the final rule is to increase the licensed power of the facility without conducting ECCS evaluations at a higher power level. Licensees requesting higher licensed power levels are required to assess environmental effects of the change. However, the NRC expects only negligible effects on the environment from small power level changes, such as those that are likely to result from the revised rule. The NRC previously considered the effects of small increases in licensed power level and concluded that such changes would present little change in risk. In NUREG-1230 (Reference 2), the staff considered the risk impact of changes associated with the revised ECCS rules allowing best-estimate analyses, including power increases, and determined that a power level increase of 5 percent or less had little risk significance. This conclusion was, in part, based on the staff's estimate that a small power level increase would only slightly increase the fission product inventory. Also, the staff judged that a slightly higher power would not appreciably alter the potential for LOCAs or affect predicted accident progression.

The staff also considered the risk impact from boiling water reactor extended power uprates, which are much greater than the marginal power change expected under the revised rule. In these cases, the staff concluded (Reference 3) that extended power uprates are expected to only slightly affect the risk profile of a plant. The staff also stated that marginal power uprates, of about 1 percent, were not expected to require an assessment of plant risk.

An overall effect of a power uprate for a large number of plants is the possible increase in the amount of spent fuel generated by operating at higher power. For the purposes of this assessment, the staff assumed a linear relationship between power level and amount of fuel discharged, and a 1-percent power level increase for 50 plants. Using information on predicted fuel discharges contained in the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (Reference 4), the staff estimated that a marginal power increase for half the operating plants would amount to a total of approximately 70 additional discharge fuel bundles per year. This is less than the number of fuel bundles discharged during a typical reactor refueling for a plant. There is a potential cumulative effect associated with the anticipated annual increase in discharged fuel. However, it is not considered significant in light of the cumulative level of all fuel discharges during the lifetime of an operating facility.

Under the final rule, some licensees could realize savings without seeking power uprates. By revising their ECCS analysis based on a lower assumed power level, licensees could gain margin that could lead to a relaxation in requirements for LOCA mitigation system (i.e., ECCS) performance or in core operating parameters. Changes to technical specifications requirements for ECCS system performance will require license amendments and licensees will need to determine environmental impacts. In these cases involving relatively small changes to ECCS analyses, the staff expects that no significant environmental impact would result.

The action, as well as its indirect and cumulative effects, would not increase the probability or consequences of accidents; no changes are being made in the types of any effluents that may be released off site; and there is no significant increase in occupational or public radiation exposure. Therefore, there are no significant radiological environmental impacts associated with the change. The action does not involve non-radiological plant effluents and has no other environmental impact. Therefore, there are no significant non-radiological environmental impacts associated with the action.

Alternatives to the Action

As required by Section 102(2)(E) of the NEPA (42 U.S.C.A. 4332(2)(E)), the NRC has considered possible alternatives to the action. The staff considered the following rulemaking options: (1) maintain the provision requiring an analysis margin to account for uncertainty in power measurement but remove the specification of the 2-percent value for the margin and require licensees to assess power measurement uncertainty; (2) eliminate the requirement for a margin between power level and assumed power, disregarding power measurement uncertainty; and (3) broadly revise Appendix K, addressing several conservative parameters.

The alternative of retaining the existing assumed power requirement (i.e., no-action alternative) would essentially have the same environmental impact as rulemaking alternatives 1 and 2 if licensees pursued exemptions from the current Appendix K requirement. Under the no-action alternative, licensees could also consider the more costly alternative of implementing a best-estimate ECCS evaluation under § 50.46. However, fewer licensees are expected to take this course, because if there currently were sufficient benefit, they would have already done so. The potential power increase under a best-estimate evaluation is expected to be greater than the marginal power increase associated with the revised rule. However, the fewer

licensees that would use this option reduces the resulting overall environmental impact. The staff assumed that the environmental impact for either scenario under the no-action alternative would be roughly equivalent.

The environmental effects for the first two alternatives would be roughly equivalent, because about the same number of licensees would seek benefits under any change that would allow a relaxation in the requirement. The main distinction between these alternatives is the course taken to revise the rule. But the end result is the same, in that a marginal power increase would be an indirect result. As discussed earlier, the staff considers marginal power increases to present little risk on a plant-specific basis and the overall effect of increased spent fuel generation is considered small.

The final rulemaking option, to broadly revise Appendix K requirements, could allow greater increases in licensed power for operating plants. However, since there is not a clear understanding of the magnitude of the changes that might result, the staff can only speculate that such a revision would lead to power uprates somewhat greater than those expected under the revised rule. The resulting power increases may be commensurate with those associated with previous changes considered by the staff, such as those discussed in NUREG-1230, which were not considered risk-significant.

Therefore, none of the alternatives considered by the staff is expected to significantly affect the environment.

Agencies and Persons Consulted

The NRC developed the final rule and this environmental assessment. The proposed rule was published in the *Federal Register* for all interested parties to review. The NRC sent this environmental assessment to all State liaison officers for comment. No substantive comments were received.

Finding of No Significant Impact

On the basis of the environmental assessment, the Commission concludes that the action will not have a significant effect on the human environment. Accordingly, the Commission has determined not to prepare an environmental impact statement for the action.

Also, the NRC is committed to following Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," dated February 11, 1994. Since there are no significant offsite impacts on the public from this action, the NRC has determined that there are no disproportionately high and adverse impacts on minority and low-income parties. The NRC uses the following working definition of environmental justice: *Environmental justice* means the fair treatment and meaningful involvement of all people, regardless of race, ethnicity, culture, income, or educational level with respect to the development, implementation and enforcement of environmental laws, regulations, and policies.

References

1. *Code of Federal Regulations*, Title 10, Chapter I, Parts 50 and 51.
2. U.S. Nuclear Regulatory Commission, "Compendium of ECCS Research for Realistic LOCA Analysis," NUREG-1230, Washington, D.C., December 1988.
3. U.S. Nuclear Regulatory Commission, Letter from EDO to ACRS, "Staff Response to ACRS Letter of July 24, 1998 on General Electric Nuclear Energy Extended Power Uprate Program and Monticello Nuclear Generating Plant Extended Power Level Increase Request," September 14, 1998.
4. U.S. Nuclear Regulatory Commission, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, Volume 1, Washington, D.C., May 1996.

1. NRC reviews of extended power uprates for two boiling water reactors (much greater than 1-percent increases) did not identify significant risk increases. The NRC staff has taken the position that risk evaluations are not expected to accompany applications for marginal licensed power increases (Reference 1).

2. The cost values from Reference 3 are in 1985 dollars. The total cost of \$5 million to \$10 million given here is a current value.