U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

14.2.1 GENERIC GUIDELINES FOR EXTENDED POWER UPRATE TESTING PROGRAMS

This Standard Review Plan (SRP) section provides general guidelines for reviewing proposed extended power uprate (EPU) power ascension testing programs. This review provides assurance that the proposed testing programs adequately demonstrate that plant structures, systems, and components (SSCs) important to safety that are affected by the proposed power uprate will perform satisfactorily in service at the proposed uprated power level.

There are three types of power uprates. Measurement uncertainty recapture power uprates involve power increases of less than 2 percent, and are achieved by implementing enhanced techniques for calculating reactor power. Stretch power uprates typically involve power increases of up to 7 percent and do not generally involve major plant modifications. EPUs involve power increases greater than stretch power uprates and have been approved for increases as high as 20 percent. EPUs usually involve significant modifications to major balance of plant (BOP) equipment. A power uprate is classified as an EPU based on a combination of the magnitude of the proposed power increase and the plant modifications necessary to support the requested uprate. This SRP applies only to EPU license amendment requests (LARs).

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of quality assurance

Secondary - Organization responsible for the review of probabilistic risk assessment
Organization responsible for the review of human performance

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Additional secondary review responsibilities are detailed in Table 1, "Typical Steady-State Power Ascension Testing Applicable to Extended Power Uprates," to this SRP section

I. AREAS OF REVIEW

The primary reviewer coordinates the review of the overall power uprate testing program. Secondary review branches are responsible for reviewing EPU applications to provide assurance that the licensee has proposed an EPU testing program that in conjunction with plant operating experience, computer modeling, and analyses, adequately demonstrates that SSCs will perform satisfactorily in service at the requested increased plant power level. Secondary review branches will assist in the review of proposed testing plans and acceptance criteria, as needed. The review of EPU testing programs should be performed in conjunction with staff reviews of other aspects of the EPU LAR.

II. ACCEPTANCE CRITERIA

The EPU test program acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

A. General Design Criterion (GDC) 1, "Quality standards and records," of 10 CFR Part 50 Appendix A, "General Design Criteria for Nuclear Power Plants,", insofar as it applies to the specific plant, requires that SSCs important to safety be tested to quality standards commensurate with the importance of the safety functions to be performed and that a quality assurance program be established and implemented to provide reasonable assurance that these SSCs will satisfactorily perform their safety functions.

B. Criterion XI, "Test Control," of 10 CFR Part 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," insofar as it applies to the specific plant requires establishment of a test program to assure that testing required to demonstrate that SSCs will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents.

C. 10 CFR 50.34, "Contents of applications; technical information," specifies requirements for the content of the original operating license application, including the requirement that the final safety analysis report (FSAR) include plans for preoperational testing and initial operations.

Technical Rationale

This review provides assurance that the proposed EPU test program, along with plant operating experience, computer modeling, and analyses, adequately demonstrates that SSCs will perform satisfactorily at EPU conditions. In particular, the EPU application and supporting justification should provide reasonable assurance that (1) any power-uprate-related modifications to the facility have been adequately constructed and implemented and (2) the facility can be operated at the proposed EPU conditions in accordance with design requirements and in a manner that will not endanger the health and safety of the public.

The following paragraphs describe the technical rationale for application of the above acceptance criteria to the review of EPU test programs:

A. GDC 1 establishes the testing necessary to demonstrate SSCs important to safety function in a manner that provides reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Specifically, GDC 1 requires that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability. Additionally, a quality assurance program (QAP) shall be established to ensure that SSCs will satisfactorily perform their safety functions.

   Application of GDC 1 to the EPU test program (to the extent that GDC 1 is applicable) ensures testing is performed, as necessary, to provide assurance that SSCs meet their design specifications and capabilities. The QAP ensures proper documentation and traceability that applicable testing was accomplished, and codes and standards were satisfied.

   Throughout this SRP section, the term "important to safety" is used to refer to SSCs to which this EPU testing guidance applies. Generic Letter (GL) 84-01, "NRC Use of the Terms 'Important to Safety' and 'Safety Related,'" indicates that "important to safety" generally refers to plant equipment needed to meet the provisions of the GDC. However, as discussed in Section 2.1.5.6 of LIC-100, "Control of Licensing Basis for Operating Reactors," the GDC are not applicable to plants with construction permits issued before May 21, 1971. Each plant licensed before the GDC were formally adopted was evaluated on a plant-specific basis, determined to meet plant-specific principal design criteria (PDC), and licensed by the Commission. For the purposes of the EPU test program review, SSCs should be considered to be important to safety based on the plant-specific PDC.

B. Criterion XI of Appendix B to 10 CFR Part 50 requires that a test program be established to assure that all testing required to demonstrate that SSCs will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. The test program is required to include, as appropriate, proof tests prior to installation, preoperational tests, and operational tests of SSCs. Test procedures are required to include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results are required to be documented and evaluated to assure that test requirements have been satisfied.

   Application of Criterion XI of 10 CFR Part 50, Appendix B, to the EPU test program will provide reasonable assurance that SSC capabilities to perform specified functions are not adversely impacted by increasing the maximum allowed power level. Specifically, the EPU test program, in conjunction with operating experience and design control measures (e.g., computer modeling and analyses), provides reasonable assurance that SSCs important to safety will perform satisfactorily in service following the proposed power uprate. The EPU test program also assures that deficiencies are identified and corrected

and that testing activities are conducted in a manner which minimizes operational reliance on untested safety functions. Regulatory Guide (RG) 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants," Revision 2, describes the general scope and depth of initial test programs that the NRC staff found acceptable during the review of original operating license applications. The SSCs subject to initial testing performed safety functions that included fission product containment; reactivity monitoring and control reactor safe shutdown (including maintaining safe shutdown) core cooling accident prevention and consequence mitigation as specified in the design and credited in safety analyses.

C. 10 CFR 50.34(b)(6)(iii) requires that each application for a license to operate a facility include in the FSAR plans for preoperational testing and initial operations. The initial test program (which includes preoperational testing and testing during initial operation) verifies that SSCs are capable of performing their safety functions as specified in the design and credited in safety analyses.

Application of 10 CFR 50.34(b)(6)(iii) to the EPU test program ensures that the licensee submits adequate information, commitments, and plans demonstrating that the proposed EPU does not invalidate the testing provisions for the original design basis. The preoperational testing and the initial startup testing invalidated by the requested increase in power level are evaluated and repeated as necessary to demonstrate that SSCs are capable of performing their safety functions. This provides assurance that operation at the requested higher power level will be within the bounds of the design and safety analyses and that EPU testing activities will be conducted in a sequence and manner which minimizes operational reliance on untested SSCs or safety functions.

III. REVIEW PROCEDURES

The purpose of this review is to obtain reasonable assurance that the proposed EPU testing program adequately controls the initial power ascension to the proposed EPU power level. The EPU test program should include steady-state and transient performance testing sufficient to demonstrate, in conjunction with plant operating experience, computer modeling, and analyses, that SSCs will perform satisfactorily at the requested power level. The proposed EPU test program should be based on a systematic review of the initial plant test program to identify initial licensing power ascension testing that may be invalidated by the requested EPU. Additionally, the EPU test program should include appropriate testing to demonstrate that EPU-related plant modifications have been adequately implemented. Specific guidance[1] for assessing licensees' justifications for not performing certain tests, including large transient tests, is provided in Section III.C below.

[1]Note: The SRP is not a substitute for the NRC's regulations, and compliance with specific acceptance criteria is not required.

A. Comparison of Proposed EPU Test Program to the Initial Plant Test Program

1. General Discussion

The licensee should compare the proposed EPU testing program to the original test program carried out during initial plant licensing. The scope of this comparison should include (1) all initial power ascension tests performed at a power level of equal to or greater than 80 percent of the original licensed thermal power level; and (2) initial power ascension tests that were performed at lower power levels if the EPU would invalidate the test results. The licensee should either repeat the initial power ascension tests within the scope of this comparison or provide justification for deviations that are proposed.

2. Specific Acceptance Criteria

The primary reviewer, with assistance as necessary from the secondary review branches, will determine if the licensee has adequately identified the following in the EPU LAR:

- all initial power ascension tests performed at a power level of equal to or greater than 80 percent of the original licensed thermal power level;
- all initial test program tests performed at power levels lower than 80 percent of the original licensed thermal power level that would be invalidated by the EPU; and,
- differences between the proposed EPU test program and the portions of the initial test program identified by the previous criteria.

The reviewer should refer to the plant-specific testing identified in FSAR Chapter 14.2, “Initial Plant Test Program” (or the equivalent FSAR section for nonstandard format plants), and startup test reports, if available, to verify that the licensee has adequately identified the scope of the initial plant test program. Additionally, Table 1, “Typical Steady-State Power Ascension Testing Applicable to Extended Power Uprates,” and Table 2, “Typical Transient Testing Applicable to Extended Power Uprates,” to this SRP section provide a generic summary of power ascension tests typically performed at or near full power.

The reviewer should verify that the licensee has identified and adequately justified any proposed differences from or exceptions to the original test program. The reviewer should refer to Section III.C below for guidance on assessing the adequacy of justifications for proposed differences and exceptions.

B. Power Ascension Test Considerations for Plant Modifications

1. General Discussion

EPUs may involve significant modifications to major BOP equipment, in addition to setpoint adjustments and operating parameter changes. Therefore, within its respective technical area, each secondary review branch will assess if the licensee adequately evaluated and established appropriate power ascension testing requirements to address the aggregate impact of EPU plant modifications, setpoint adjustments, and parameter changes on the dynamic response of the plant (including primary and secondary plant response, as well as the response of SSCs important to safety) to anticipated operational occurrences. The objective of this review is to provide assurance that the nature and extent of plant modifications, setpoint adjustments, and parameter changes were adequately considered in the development of the EPU test program.

The power ascension testing described in RG 1.68, Appendix A, Section 5, "Power Ascension Tests," focuses on testing that is necessary to demonstrate that the plant will operate in accordance with design specifications both during normal steady-state conditions and, to the extent practical, during and following anticipated operational occurrences. Anticipated operational occurrences are conditions of normal operation that are expected to occur one or more times during the life of the plant and include events such as loss of all offsite power, tripping of the main turbine generator set, and loss of power to all recirculation pumps.

The reviewer is not expected to evaluate the specific component-and system-level testing provisions for each plant modification, parameter change, or setpoint adjustment. Based on previous experience, testing required by technical specifications (TSs) and existing 10 CFR Part 50, Appendix B, QAPs can be relied upon to adequately demonstrate individual system or component performance characteristics. Therefore, this review is intended to assure that plant equipment important to safety that supports functions that rely on the integrated operation of multiple SSCs following an anticipated operational occurrence are adequately demonstrated prior to extended operation at the requested EPU power level.

2. Specific Acceptance Criteria

Based on the review of the licensee's EPU LAR, the reviewer will determine if the licensee has adequately identified the following:

- plant modifications and setpoint adjustments that are being made and
- changes in primary and secondary system operating parameters (such as reactor coolant temperature, pressure, and flow rate; main steam and main feedwater flow rates; and reactor vessel, pressurizer, and steam generator (SG) levels).

The reviewer should assess if the licensee adequately identified SSCs important to safety that are affected by EPU-related modifications, setpoint adjustments, and

changes in plant operating parameters. In particular, the licensee should have considered the impact of first-of-a-kind plant modifications, the introduction of new system dependencies or interactions, and changes the effects of the steady-state and transient plant response have on the capability of SSCs important to safety to perform their specified functions. To assist in this review, Table 2 lists general acceptance criteria for transient testing for typical anticipated operational occurrences.

The reviewer should verify that the proposed EPU test program adequately demonstrates the performance of SSCs important to safety that meet any of the following criteria: (1) the performance of the SSC is impacted by EPU-related modifications, (2) the SSC is used to mitigate an anticipated operational occurrence described in the plant-specific design basis, and (3) performance of the SSC can be affected by integrated plant operation or transient conditions. Important to safety SSCs that meet any of these criteria should be subject to appropriate testing requirements in the EPU test program to confirm that the SSCs will continue to function in accordance with their design criteria during steady-state and transient operating conditions, adequately tested by overlapping individual component-or system-level tests, or adequately justified as an exception to testing in accordance with the provisions discussed in Section III.C.

C. Justification for Eliminating EPU Power ascension Tests

1. General Discussion

The licensee may establish a test program that does not include some or all of the tests referred to above in Sections III.A and III.B that would normally be performed, provided that proposed exceptions are adequately justified in accordance with the criteria provided in Section III.C.2. Each secondary review branch will verify and document the adequacy of the licensee's justification for test exceptions that are within the branch's technical area of review.

2. Specific Acceptance Criteria

If the licensee proposes not to perform a test (or tests) that would normally be included in the EPU test program pursuant to the criteria contained in Sections III.A and III.B above, the reviewer should provide assurance that sufficient justification has been provided. Pursuant to 10 CFR Part 50, Appendix B, the proposed EPU test program must demonstrate that SSCs will perform satisfactorily in service. The reviewer should consider the following factors when assessing the adequacy of the licensee's justification:

a. Power Uprate Operating Experience

If the licensee proposes to omit a test (or tests) from the EPU testing program based on favorable power uprate operating experience, the reviewer should determine the applicability of the operating experience to the specific plant requesting the EPU. The reviewer should consider similarities in plant design and equipment; uprated power level; plant modifications, setpoint

adjustments and parameter changes; test specifications and methods; and operating pocedures and EOPs. Additionally, the reviewer should verify that the licensee adequately considered operating experience of problems, malfunctions, or other unexpected consequences from previous power uprates.

b. Introduction of New Thermal-Hydraulic Phenomena or Identified System Interactions

The reviewer should provide assurance that the licensee adequately addressed the effects of any new thermal-hydraulic phenomena or system interactions that may be introduced as a result of the EPU.

c. Facility Conformance to Limitations Associated With Computer Modeling and Analytical Methods

If the licensee proposes to omit a test (or tests) from the EPU testing program based on the results of computer modeling and analytical methods (simply referred to as analytical methods for the purposes of this discussion), the reviewer should confirm that plant modifications, setpoint adjustments, and parameter changes that have been or will be made do not tend to invalidate the analytical methods being used. In this case, the licensee is expected to discuss and fully justify the use of analytical methods for this purpose. Considerations include, but are not limited to, the nature, capability, applicability, accuracy, and sensitivity of the analytical methods being used, including sensitivities associated with extrapolating the use of these methods to encompass EPU conditions; conformance to any limitations that apply; the extent that the analytical methods have been updated and corrected to reflect plant behavior following specific plant transients that have occurred; SSCs important to safety that are not modeled and why it is not necessary to include these SSCs in the model to adequately predict transient plant behavior; the impact of plant modifications, setpoint adjustments, and parameter changes on the validity, accuracy, and sensitivity of the analytical methods being used; and measures in the test program that will confirm the validity, accuracy, and sensitivity of the analytical results. Where existing information is insufficient to demonstrate the adequacy and applicability of analytical models and methods that are used for evaluating EPU transient plant behavior, licensees may be able to demonstrate acceptability by performing transient tests that are suitable for addressing the specific analytical shortcomings. Transient tests that are performed for this purpose need not be limited to the tests in the original startup test program.

d. Plant Operator Familiarization With Facility Operation and Trial Use of Operating and Emergency Operating Procedures

Plant modifications, setpoint adjustments, and parameter value changes, in conjunction with the increased decay heat generation associated with higher power operation, can impact the execution of abnormal plant procedures and EOPs. For example, the EPU may change the timing and sequence of significant operator actions that are relied upon in abnormal plant procedures and EOPs, or it could impact the accident mitigation strategies that are credited in abnormal or emergency operating procedures.

For each EPU LAR, the technical branch responsible for operator licensing and human performance should review the impact of the requested power uprate on operator training and human factors in accordance with separate SRP guidance. These reviews should include an evaluation of the changes in operator actions, procedures, and training (including necessary changes to the control room simulator) resulting from the EPU. The initial test program objectives, as described in RG 1.68, Revision 2, included plant staff familiarization with facility operation and trial use of abnormal plant procedures and EOPs. However, based on previous review experience, it is not expected that power ascension testing will normally be performed solely for procedure verification or operator familiarization. Nonetheless, the possibility exists that the review of operator training (including simulator training) and human factors aspects of the EPU could indicate a need to perform power ascension testing for procedure verification or operator familiarization.

e. Minimal Reductions in the Margin of Safety

The licensee's justification for omitting a test (or tests) from the test program may consider the extent of the EPU's impact on the results of the safety analyses and may consider such factors as the amount of remaining margin to SRP acceptance criteria, the sensitivity of the safety analysis results to changes in analysis assumptions, and the capability of transient testing to provide useful confirmatory data. To aid in this review, the information provided in Table 2 to this SRP section includes a reference to the safety analysis SRP sections related to typical power ascension transient tests, as applicable.

Although the initial test program objectives, as described in RG 1.68, Revision 2, included validation of analytical models and verification of assumptions used for predicting plant response to anticipated transients and postulated accidents, transient testing is not required expressly to validate accident analysis codes that are used for EPU license amendment reviews. The applicability and use of accident analysis codes for an EPU is reviewed by the staff in accordance with separate SRP guidance.

f. Guidance Contained in Vendor Topical Reports

The NRC previously reviewed and accepted General Electric (GE) Company Licensing Topical Report, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate" (referred to as ELTR-1), NEDC-32424P-A, Class III, February 1999, as a basis for reviewing EPU LARs. This topical report provided specific guidance on integrated system transient testing at EPU conditions. As described in Section 5.11.9.d and Appendix L.2.4 of ELTR-1, the generator load rejection and the main steam isolation valve (MSIV) closure tests verify that the plant performance is as predicted and projected from previous test data.

On March 31, 2003, the NRC approved the use of GE Licensing Topical Report NEDC-33004P, "Constant Pressure Power Uprate," for constant pressure power uprate (CPPU) EPU LARs. However, as noted in the staff's safety evaluation (SE), the staff did not accept the elimination of large-transient testing (e.g., the MSIV closure and turbine generator load rejection described in NEDC-32424P-A) from the scope of the CPPU test program. The staff noted that the need to conduct large-transient testing for a CPPU would be considered on a plant-specific basis.

For pressurized water reactors (PWRs), Westinghouse report WCAP-10263, "A Review Plan for Uprating the Licensed Power of a Pressurized Water Reactor Plant," provides limited guidance for power uprate testing. Specifically, the document states that the recommended test program for the nuclear steam supply system and the interfacing BOP systems should be developed on a plant-specific basis depending on the magnitude of hardware modifications and the magnitude of the power uprate.

Although the NRC has previously approved certain exceptions to EPU test program requirements, the applicability of these exceptions to a particular plant must be considered and justified on a plant-specific basis as discussed above in Section III.C.2.a.

g. Risk Implications

For cases in which the licensee proposes a risk-informed basis for not performing certain transient tests, SPSB should be consulted to assist in the review. Risk-informed justifications for not performing power ascension tests should be carefully weighed against the potential benefits of performing the tests. In addition to the risks inherent in initiating a plant transient, the review should also consider the benefit of identifying potential latent equipment deficiencies or other plant problems under the controlled circumstances afforded by the test program. In any case, a risk-informed justification should not be used as the sole basis for not performing the power ascension tests that are referred to above in Sections III.A and III.B.

If the licensee provides adequate justification for not performing certain power ascension tests, the staff may conclude that the EPU test program is acceptable without the performance of these tests.

D. Evaluate the Adequacy of Proposed Testing Plans

1. General Discussion

The EPU LAR should include plans for the initial approach to the increased EPU power level and steady-state testing that will be used to verify that the reactor plant operates within the values of EPU design parameters.

2. Specific Acceptance Criteria

For each EPU power ascension test proposed by the licensee, the staff will review the test objectives, the summary of prerequisites and test methods, and specific acceptance criteria to establish that the functional adequacy of SSCs is verified. This review assures that the test objectives, test methods, and acceptance criteria are acceptable and consistent with the design basis for the facility.

Each secondary review branch will review the licensee's plans for the EPU test program within the branch's technical area. The licensee's EPU test program should include the following provisions:

- The initial approach to the uprated EPU power level should be incremental and should include steady-state power hold points to evaluate plant performance above the original licensed full-power level.

- The licensee should propose appropriate testing and acceptance criteria to ensure that the plant responds within design predictions. The predicted responses should be developed using real or expected values of items such as beginning-of-life core reactivity coefficients, flow rates, pressures, temperatures, response times of equipment, and the actual status of the plant, not the values or plant conditions used for conservative evaluations of postulated accidents.

- Contingency plans should be implemented in the event the plant does not respond as predicted.

- The test program should be scheduled and sequenced to minimize the time untested SSCs important to safety are relied upon during operation above the original licensed full-power level. Safety-related SSCs relied upon during operation shall be verified to be operable in accordance with existing TS and QAP requirements.

To assist in this review, Tables 1 and 2 provide generic lists of full-power steady-state and transient tests and related acceptance criteria that are potentially applicable to an EPU test program.

If a power ascension test is needed to demonstrate that SSCs will perform satisfactorily in service at EPU conditions, the reviewer should determine if a license condition is needed to ensure that this testing is performed in a timely and controlled manner.

IV. EVALUATION FINDINGS

When the EPU LAR review is complete and the reviewer has determined that it is satisfactory and in accordance with the acceptance criteria in Section II above, a statement similar to the following should be provided in the staff's safety evaluation.

The NRC staff has reviewed the EPU test program in accordance with SRP Section 14.2.1. This review included an evaluation of (1) plans for the initial approach to the proposed maximum licensed thermal power level, including verification of adequate plant performance; (2) transient testing that is deemed appropriate and necessary to demonstrate that plant equipment will perform satisfactorily at the proposed increased maximum licensed thermal power level; (3) proposed exceptions to the power ascension test referred to in Sections III.A and III.B; and (4) the test program's conformance with applicable regulations. For the reasons set forth above, the NRC staff concludes that the proposed EPU test program provides reasonable assurance that the plant will operate in accordance with the applicable design criteria and that SSCs affected by the EPU or modified to support the proposed power increase will perform satisfactorily in service. On this basis, the NRC staff finds that there is reasonable assurance that the EPU test program satisfies the applicable requirements discussed in Section II of SRP 14.2.1.

V. IMPLEMENTATION

This SRP section will be used by the NRC staff for recommendations of EPU LARs submitted pursuant to 10 CFR 50.90. This SRP is not intended to be used in place of plant-specific design bases to assess the acceptability of an EPU application. The applicability of this SRP is determined on a plant-specific basis consistent with the design basis of the plant.

In addition, where the NRC has approved a specific methodology (e.g., topical report) for the type of power uprate being requested, the licensee should follow the format prescribed for that specific methodology and provide the information called for in that methodology and the NRC's letter and SE approving the methodology. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the NRC staff in evaluating conformance with Commission regulations.

VI. REFERENCES

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

2. SECY-01-0124, "Power Uprate Application Reviews," dated July 9, 2001. The related staff requirements memorandum is dated May 24, 2001.

3. General Electric Company Licensing Topical Report, “Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate,” (ELTR-1), NEDC-32424P-A, Class III, February 1999.

4. General Electric Company Licensing Topical Report, “Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate,” (ELTR-2), NEDC-32523P-A, Class III, February 2000, and Supplement 1, Volumes I and II.

5. General Electric Company Licensing Topical Report, “Constant Pressure Power Uprate,” NEDC-33004P, Revision 1, July 2001.

6. NRC Regulatory Guide 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” Revision 2, August 1978.

7. NRR Office Instruction LIC-100, “Control of Licensing Basis for Operating Reactors.”

8. NRR Office Instruction LIC-101, “License Amendment Review Procedures.”

9. NRR Office Instruction LIC-500, “Processing Requests for Reviews of Topical Reports.”

10. Westinghouse WCAP-10263, “A Review Plan for Uprating the Licensed Power of a Pressurized Water Reactor Power Plant,” January 1983.

11. NRC Inspection Manual, Part 9900, “10 CFR Part 50.59, Changes, Tests, and Experiments,” Change Notice Number 01-008.

12. NRC Information Notice 2002-26, “Failure of Steam Dryer Cover Plate After a Recent Power Uprate,” September 11, 2002.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50.54, which were approved by the Office of Management and Budget, approval number 3150 - 0011.

Public Protection Notification

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 control number.

Table 1: Typical Steady-State Power Ascension Testing Applicable to Extended Power Uprates

Power Ascension Test	Reference	Recommended Initial Conditions	Typical Test Acceptance Criteria	Primary Technical Review Branch
Conduct vibration testing and monitoring of reactor vessel internals and reactor coolant system (RCS) components	RG 1.68, App A 4.s, 5.p	Lowest practical power level	Reactor vessel and RCS component vibration characteristics within design. (See NRC Information Notice 2002-26 and RG 1.20)	RCS components, reactor vessel internals and piping, and mechanical engineering
Measure power reactivity coefficients (PWR) or power vs. flow characteristics (BWR)	RG 1.68, App A 5.a	100% of rated thermal power (RTP)	Characteristics in accordance with design	reactor systems and core performance
Steady-state core performance	RG 1.68, App A 5.b	100% of RTP	Characteristics in accordance with design	reactor systems and core performance
Control rod patterns exchange	RG 1.68, App A 5.c	Power equal to highest power level for rod exchanges allowed at power	Core limits not exceeded	reactor systems and core performance
Control rod misalignment testing	RG 1.68, App A 5.i	100% of RTP Rod misalignment equal to or less than TS limits	Demonstrate ability to detect misalignment	reactor systems and core performance
Failed fuel detection system	RG 1.68, App A 5.q	100% of RTP	Verify proper operation	health physics
Plant process computer	RG 1.68, App A 5.r	100% of RTP	Inputs and calculation are correct	balance-of-plant/ instrumentation and controls
Calibrate major plant control systems	RG 1.68, App A 5.s	100% of RTP	Verify performance	reactor systems and core performance/ balance-of-plant
Main steam and main feedwater system operation	RG 1.68, App A 5.v	100% of RTP	Operate in accordance with design performance requirements	balance-of-plant
Shield and penetration cooling systems	RG 1.68, App A 5.w	100% of RTP	Maintain temperature within design limits	balance-of-plant
Engineered Safety Features auxiliary and environmental systems	RG 1.68, App A 5.x	100% of RTP	Capable of performing design functions	balance-of-plant
Calibrate systems used to determine reactor thermal power	RG 1.68, App A 5.y	100% of RTP	Verify performance	instrumentation and controls
Chemical and radiochemical control systems	RG 1.68, App A 5.a.a	100% of RTP	Control systems function in accordance with design	health physics
Sample RCSs and secondary coolant systems	RG 1.68, App A 5.a.a	100% of RTP	Chemistry limits are not exceeded	chemical engineering

Power Ascension Test	Reference	Recommended Initial Conditions	Typical Test Acceptance Criteria	Primary Technical Review Branch
Radiation surveys	RG 1.68, App A 5.b.b	100% of RTP	Verify shielding adequacy and identify 10 CFR Part 20 high-radiation zones	health physics
Ventilation systems (including primary containment and steamline tunnel)	RG 1.68, App A 4.j and 5.f.f	100% of RTP	Maintain service areas within design limits	containment and ventilation
Acceptability of reactor internals, piping, and component movement, vibrations, and expansions	RG 1.68, App A 1.a.1, 1.a.3, 1.e., and 5.o.o	Lowest practical power level	Parameters within design values	RCS components, reactor vessel internals and piping, and mechanical engineering

Table 2: Typical Transient Testing Applicable to Extended Power Uprates

Transient Test	Reference	Typical Reactor Plant Initial Conditions	Typical Transient Test Acceptance Criteria	Associated Standard Review Plan Accident Analyses Section (as applicable)
Dynamic response of plant to loss of feedwater flow	RG 1.68, App A, Section 5 (Introduction)		Plant performance in accordance with design	15.2.7 Loss of Normal Feedwater Flow
Relief valve testing	RG 1.68, App A 4.p and 5.t Inspection Procedure (IP) 72510	Reactor power level at predetermined power level plateaus All relief valves set in auto Individual valve functional tests at prescribed power level plateaus Individual valve capacity tests at low power (25% of RTP) using bypass valve movement or turbine generator output as a measurement variable	Relief valve rating at a specified pressure setting Delay time between the signal initiating relief valve opening and the start of motion Opening stroke time of the main valve disc and distance Closing stroke time of the main valve piston following release of the pneumatically operated mechanical push rod	15.1.2 Inadvertent Opening of an SG Relief or Safety Valve 15.6.1 Inadvertent Opening of a PWR Pressurizer Pressure Relief Valve or a BWR Pressure Relief Valve
Dynamic response of plant to design load swings	RG 1.68, App A 5.h.h	100% of RTP	Performance in accordance with design	
Dynamic response of plant to limiting reactor coolant pump trips or closure of RCS flow control valves (reactor coolant recirculation pump trip test)	RG 1.68, App A 5.i.i IP 72512	100% of RTP Trip from steady-state power operation Recording of transients following trip and during pump restart Recording of limiting heat transfer parameters Return to two-pump operation in accord with facility operating procedures Trip of a single pump and of both pumps simultaneously	Performance in accordance with design: Instrumentation is adjusted to provide an accurate conversion of individual jet pump Δp values to a summed core flow over the range of two-pump operations Recirculation pump instrumentation is calibrated Loop flow from single-tap and double-tap pumps agrees within 3% Core flow from single-tap and double-tap pumps agrees within 2% Individual jet pump flow variation from average pump flow is limited	15.3.1 (BWR) & 15.3.2 (PWR) Loss of Forced Reactor Coolant Flow Including Trip of Pump Motor
Dynamic response of the plant to loss of feedwater heaters that results in most severe feedwater temperature reduction	RG 1.68, App A 5.k.k	90% of RTP	Performance in accordance with design	15.1.1 Decrease in Feedwater Temperature

Transient Test	Reference	Typical Reactor Plant Initial Conditions	Typical Transient Test Acceptance Criteria	Associated Standard Review Plan Accident Analyses Section (as applicable)
Dynamic response of plant to turbine trip (turbine trip or generator trip)	RG 1.68, App A 5.l.l IP 72580 IP 72514	Trip from steady-state operation at greater than 95% of RTP Initiation of the test by trip of the main generator output breaker Recirculation system flow control mode must be specified	Performance in accordance with design, including: Reactor coolant pumps do not trip Pressurizer spray valve opens and closes at the specified values Reactor pressure remains below the setpoint of the first safety valves; pressurizer safety valves do not lift or weep Pressurizer level within prescribed limits Steam system power actuated pressure relief valve opens and closes at specified values Reactor coolant pressure/temperature relationship remains within defined values SG level remains within prescribed limits, no flooding of the steamlines during the transient, no initiation of emergency core cooling system and MSIV isolation during the transient Turbine bypass system operates to maintain specific pressure (plants with 100% bypass capability shall remain at power without scram during the transient) Plants with select rod insertion shall maintain power without scram from recirculation pump overspeed or cold feedwater effect Reactor protection system (RPS) functions should be verified All safety and emergency core cooling systems such as the RPS, high pressure coolant injection (HPCI), diesel generators (DGs), and reactor core isolation cooling (RCIC) function without manual assistance if called upon Normal reactor cooling systems should maintain adequate cooling and prevent actuation of automatic depressurization system, even though relief valves may function to control pressure Plant electrical loads (transferred as designed) Turbine overspeed criteria met	15.2.1 Turbine Trip
Dynamic response of plant to automatic closure of all MSIVs	RG 1.68, App A 5.m.m IP 72510	Initial power level of 100% of RTP	Performance in accordance with design Acceptance criteria include MSIV closing time	15.2.4 MSIV Closure (BWR)

Transient Test	Reference	Typical Reactor Plant Initial Conditions	Typical Transient Test Acceptance Criteria	Associated Standard Review Plan Accident Analyses Section (as applicable)
Dynamic response of plant for full load rejection (loss of Offsite Power Testing)	RG 1.68, App A 5.n.n IP 72517 IP 72582	100% of RTP with electrical system aligned for normal full-power operation and load rejection method should subject turbine to maximum credible overspeed condition Steady-state plant operations with greater than 10% generator output (IP 72517 & 72582). Trip of the plant with breakers in specified positions so that plant loads will be transferred directly to the DGs following loss of house power Recirculation system flow control mode specified	Performance in accordance with design, including: Automatic transfer of plant loads as designed, automatic start of DGs, automatic load of DGs in the specified sequence Reactor pressure remains below the first safety valve setting. Pressurizer safety valves do not lift All safety systems such as RPS, HPCI, DGs, and RCIC function without manual assistance Normal reactor cooling systems should maintain adequate core temperatures, and prevent actuation of the Automatic Depressurization System; however selected relief valves may function to control pressure Turbine bypass system operates to maintain specified pressure value Steam system power-actuated pressure relief valves open and close at specified value Pressurizer spray valves open and close at specified values. Reactor coolant temperature/pressure relationship remains within prescribed values Pressurizer level is maintained within prescribed limits SG level remains within prescribed limits	15.2.6 Loss of Nonemergency AC Power to the Station Auxiliaries

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