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) testing programs. This review ensures that the proposed testing program adequately verifies that the plant can be operated safely at the proposed uprated power level.

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

REVIEW RESPONSIBILITIES

Primary - Equipment and Human Performance Branch (IEHB)
Secondary - Reactor Systems Branch (SRXB)
Plant Systems Branch (SPLB)
Probabilistic Safety Assessment Branch (SPSB)
Materials and Chemical Engineering Branch (EMCB)
Electrical and Instrumentation & Controls Branch (EEIB)
Mechanical & Civil Engineering Branch (EMEB)

I. AREAS OF REVIEW

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The Equipment and Human Performance Branch coordinates the review of the overall power uprate testing program. Secondary review branches are responsible for reviewing EPU applications to ensure that the licensee has proposed an EPU testing program that demonstrates that structures, systems, and components (SSCs) will perform satisfactorily in service at the requested increased plant power level. Secondary review branches will assist IEHB 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 license amendment request.

II. ACCEPTANCE CRITERIA

Extended power uprate test program acceptance criteria are based on meeting the relevant requirements of the following regulations:

- Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, establishes in Criterion 1, "Quality Standards and Records," as it relates to establishing the necessary testing requirements for SSCs important to safety, such that there is reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. However, as discussed in Section 2.1.5.6 of LIC-100, "Control of Licensing Basis for Operating Reactors," the General Design Criteria (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 be safe, and licensed by the Commission.

- Criterion XI, "Test Control," of Appendix B to10 CFR Part 50, as it relates to 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.

- 10 CFR 50.90, "Application for Amendment of License or Construction Permit," as it relates to an application for an amendment following as far as applicable the form prescribed for original applications. Section 50.34, "Contents of Applications: Technical Information," which specifies requirements for the original operating license application, requires that the Final Safety Analysis Report (FSAR) include plans for preoperational testing and initial operations.

Technical Rationale

This review ensures that the proposed EPU testing program adequately demonstrates that SSCs will perform satisfactorily at EPU conditions. In particular, the EPU test program provides 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:

- Criterion I of Appendix A to 10 CFR Part 50, establishes the necessary testing requirements for SSCs important to safety; that is, SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Also, SSCs important to safety shall 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 shall be established to ensure that SSCs will satisfactorily perform their safety functions.

Application of Criterion 1 of 10 CFR 50, Appendix A, to the EPU test program ensures that the requested power uprate does not invalidate original testing requirements contained in the original licensing basis. This ensures that SSCs continue to meet their original design specifications. Testing is performed, as necessary to provide assurance that SSCs continue to meet their design capabilities. For example, testing could be performed to demonstrate that SSCs functions, as expected, actuate in the intended time period and produce the expected flow rate within the expected time period. Original quality assurance standards and applicable codes and standards would be satisfied. The quality assurance program ensures proper documentation and traceability that applicable testing was accomplished, and codes and standards satisfied.

- 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 requirements 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 ensures that SSC capabilities to perform specified functions are not adversely impacted by increasing the maximum allowed power level. This also ensures that deficiencies are identified and corrected, and that testing activities are conducted in a manner which minimizes operational reliance on untested safety functions. This provides a high degree of assurance of SSC and overall plant readiness for safe operation within the bounds of the design and safety analyses, assurance against unexpected or unanalyzed plant behavior, and assurance against early safety function failures in service. 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.

- 10 CFR 50.90, “Application for Amendment of License or Construction Permit,” requires that each licensee submitting a license amendment request fully describe the changes desired and follow, as far as practicable, the form prescribed for the original application. Section 50.34, “Contents of Applications: Technical Information,” specifies requirements for the original operating license application. In particular, 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 50.90 and 10 CFR 50.34(b)(6)(iii) to the EPU test program ensures that the licensee submits adequate information, commitments, and plans demonstrating 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. This also ensures that preoperational and initial startup testing invalidated by the requested increase in power level are evaluated and reperformed as necessary to demonstrate safe operation of the plant.

III. REVIEW PROCEDURES

The purpose of this review is to ensure that the proposed EPU testing program adequately controls the initial power ascension to the requested EPU power level. The EPU test program shall include sufficient steady-state and transient performance testing to demonstrate 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 sufficient testing to demonstrate that EPU-related plant modifications have been adequately implemented.

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

1. General Discussion

The licensee should provide a comparison of the proposed EPU testing program to the original power-ascension test program performed during initial plant licensing. The scope of this comparison shall include (1) all power-ascension tests initially 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 performed at lower power levels if the EPU would invalidate the test results. The licensee shall either reperform initial power-ascension tests within the scope of this comparison or adequately justify proposed deviations.

2. Specific Acceptance Criteria

Within its associated technical discipline, each secondary branch reviewer will determine if the licensee has adequately identified the following in the EPU license amendment request:

- All power-ascension tests initially performed at a power level of equal to or greater than 80 percent of the original licensed thermal power level.
- All initial power-ascension tests performed at power levels lower than 80 percent of the original licensed thermal power level that would be invalidated by the EPU.

- Differences between the proposed EPU power-ascension test program and the portions of the initial power-ascension program included within the scope of this comparison.

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 non standard 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, Attachment 1, "Steady-State Power Ascension Testing Applicable to Extended Power Uprates," and Attachment 2, "Transient Testing Applicable to Extended Power Uprates," to this SRP section provide a generic summary of power-ascension tests performed at or near full power.

If the licensee's proposed EPU test program does not include performance of testing originally performed during the initial plant test program, the reviewer shall ensure that the licensee adequately justifies all differences. The reviewer should refer to Section III.C, below, for guidance on assessing the adequacy of justifications for proposed differences.

B. Post Modification Testing Requirements for Functions Important to Safety Impacted by EPU-Related Plant Modifications

1. General Discussion

EPUs usually require significant modifications to major balance-of-plant equipment, in addition to setpoint and operating parameter changes. Therefore, within its respective technical area, each secondary review branch will assess if the licensee adequately evaluated the aggregate impact of EPU plant modifications, setpoint adjustments, and parameter changes that could adversely impact the dynamic response of the plant to anticipated initiating events. The objective of this review is to verify that the licensee has proposed a testing program which demonstrates that EPU-related modifications to the facility have been adequately implemented.

The reviewer is not expected to evaluate the specific component- and system-level testing requirements for each plant modification, parameter change, or setpoint adjustment. Based on previous experience, testing required by Technical Specifications and existing 10 CFR 50, Appendix B, quality assurance programs have been adequate to demonstrate individual system or component performance characteristics. Therefore, this review is intended to ensure that functions important to safety 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 review of the licensee's EPU license amendment request, the reviewer will determine if the licensee has adequately identified the following:

- plant modifications and setpoint adjustments necessary to support operation at power uprate conditions, and

- changes in plant operating parameters (such as reactor coolant temperature, pressure, T_{ave}, reactor pressure, flow, etc.) resulting from operation at EPU conditions.

The reviewer should assess if the licensee adequately identified functions 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 safety impact of first-of-a-kind plant modifications, the introduction of new system dependencies or interactions, and changes in system response to initiating events. The review scope can be limited to those functions important to safety associated with the anticipated operational occurrences described in Attachment 2 to this SRP, "Transient Testing Applicable to Extended Power Uprates." To assist in this review, Attachment 2 also includes typical transient testing acceptance criteria and functions important to safety associated with these anticipated events.

The reviewer should verify that the proposed EPU test program adequately demonstrates each function important to safety that meets all of the following criteria: (1) is impacted by EPU-related modifications, (2) is required to mitigate a plant transient listed in Attachment 2, and (3) involves the integrated response of multiple SSCs. If a function important to safety cannot be adequately tested by overlapping individual component- or system-level tests, the licensee should propose suitable system functional testing.

C. Use of Evaluation To Justify Elimination of Power-Ascension Tests

1. General Discussion

In certain cases, the licensee may propose an EPU test program that does not include all of the power-ascension testing that would normally be required by the review criteria of Sections III.A and III.B above. The licensee shall provide an adequate justification for each of these normally required power-ascension tests that are not included in the EPU test program. For each proposed test exception within its technical area, each secondary review branch will verify the adequacy of the licensee's justification.

2. Specific Acceptance Criteria

If the licensee proposes to not perform a power-ascension test that would normally be required by the review criteria contained in Sections III.A and III.B, above, the reviewer should ensure that the licensee provides an

adequate justification. The proposed EPU test program shall be sufficient to adequately 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. Previous Operating Experience

If the licensee proposes not to perform a required transient test based on operating experience, a review should be conducted to determine the applicability of the operating experience to the specific plant configuration and test requirements. If the licensee references industry operating experience, the reviewer should consider similarity in plant design and equipment; operating power level; and operating and emergency operating procedures.

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

The reviewer should ensure 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 Analytical Analysis Methods

The licensee's justification for not performing specific power-ascension testing should include consideration of the facility conformance to limitations associated with analytical analysis methods. These limitations may include, but are not limited to, plant operating parameters, system configuration, and power level.

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

Plant modifications and parameter changes, in conjunction with increased decay heat generation associated with higher power operation, can impact the execution of abnormal and emergency operating procedures. For example, the EPU may change the timing and sequence of significant operator actions used in abnormal and emergency operating procedures, or could impact accident mitigation strategies in abnormal or emergency operating procedures.

For each EPU license amendment request, IEHB reviews the impact of the requested power uprate on operator training and human factors in accordance with separate EPU review standard guidance. These reviews include an evaluation of the changes in operator actions, procedures, and training (including necessary changes to the control room simulator) resulting from the EPU. Although the initial power-ascension test program objectives, as

described in Reference 8, included plant staff familiarization with facility operation and trial use of plant abnormal and emergency operating procedures, the EPU review standard adequately addresses the operator training and human factors aspects of the EPU. Therefore, it is not expected that power-ascension testing would normally be required for the purposes of procedure verification or operator familiarization.

e. Margin Reduction in Safety Analysis Results for Anticipated Operational Occurrences

The licensee's justification for not performing a particular power-ascension test should include a consideration of the change in the associated safety analysis results due to the proposed EPU. To aid in this review, the information provided in Attachment 2 to this SRP section includes a reference to the safety analysis SRP sections related to each transient test, if applicable. For safety analysis acceptance criteria that can be quantitatively measured (e.g. peak reactor coolant system pressure), a reduction in available margin by less than approximately 10 percent would normally be considered to be a minimal change in consequences. The available margin is the difference between the standard review plan accident analysis acceptance criterion of interest and the plant-specific value calculated at EPU conditions. For larger reductions in available margin, the licensee may consider such factors as the amount of remaining margin; the sensitivity of the results to changes in analysis assumptions; and the capability of transient testing to provide useful confirmatory data.

Although the initial power-ascension test program objectives, as described in Reference 8, 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 for the purposes of analytical code validation for EPU license amendment reviews. The applicability and validation of accident analysis analytical codes is reviewed by the staff in accordance with separate EPU review standard 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 an acceptable basis for BWR EPU amendment requests. This topical report provided specific guidance for the performance of 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) tests verify that the plant performance is as predicted and projected from previous test data.

For 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 interfacing balance-of-plant systems 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 power-ascension testing requirements, the reviewer should assess the licensee's proposed justifications on a plant-specific basis.

g. Risk Implications

For cases where 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 transient tests should be carefully weighed against the potential benefits of performing the testing. 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 controlled circumstances during transient testing. In any case, a risk-informed justification should not be used as the sole basis for not performing transient testing.

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 Transient Testing Plans

1. General Discussion

The EPU amendment request 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 design parameters.

2. Specific Acceptance Criteria

For each EPU power-ascension test proposed by the licensee to demonstrate that the plant can be safely operated at EPU conditions, the staff will review the test objectives, summary of prerequisites and test methods, and specific acceptance criteria for each test to establish that the functional adequacy of SSCs is verified. This review assures that the test objectives, test methods, and the acceptance criteria are acceptable and consistent with the licensing basis for the facility.

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

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

- The licensee should propose appropriate testing and acceptance criteria that 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, and response times of equipment and the actual status of the plant, and not the values or plant conditions used for conservative evaluations of postulated accidents.

- Contingency plans should be implemented if the predicted plant response is not obtained.

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

To assist this review, Attachments 1 and 2 to this SRP section provide a generic listing 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 required to demonstrate that the plant can be operated safely at EPU conditions, the reviewer shall determine if a license condition should be imposed to ensure that this testing is performed in a timely and controlled manner.

IV. EVALUATION FINDINGS

When the review of the information in the EPU amendment application 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 Report (SER):

"The staff has reviewed the EPU test program information provided in the license amendment request in accordance with SRP Section 14.2.1 and relevant guidance provided in the EPU Review Standard. 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 requirements necessary to demonstrate that the plant can be operated safely at the proposed increased maximum licensed thermal power level, and (3) the test program's conformance with

applicable regulations. The staff finds that there is reasonable assurance that the applicant's EPU testing program satisfies the requirements of Criterion XI, 'Test Control,'of 10 CFR Part 50, Appendix B, and is therefore acceptable."

V. IMPLEMENTATION

This SRP section will be used by the staff when performing safety evaluations of EPU license amendment applications submitted pursuant to 10 CFR 50.90. This SRP is not intended to be used in place of plant-specific licensing bases to assess the acceptability of an EPU application. Applicability of this SRP is determined on a plant-specific basis consistent with the licensing 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, licensees should follow the format prescribed for that specific methodology and provide the information called for in that methodology and the NRC's letter and safety evaluation approving the methodology. Except in those cases in which 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 staff in its evaluation of conformance with Commission regulations.

VI. REFERENCES

1. 10 CFR Part 52, §52.47 "Contents of Applications."

2. 10 CFR Part 50, Appendix B, Criterion XI, "Test Control."

3. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor," Volumes 1 and 2, July 1994.

4. SECY-01-0124, "Power Uprate Application Reviews," dated July 9, 2001. The related Staff Requirements Memorandum is dated May 24, 2001.

5. 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.

6. 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.

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

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

9. NRR Office Instruction LIC-100, "Control of Licensing Basis for Operating Reactors."

10. NRR Office Instruction LIC-101, "License Amendment Review Procedures."

11. NRR Office Instruction LIC-500, "Processing Requests for Reviews of Topical Reports."

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

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

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

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 components	Regulatory Guide (RG) 1.68, App A 4.s, 5.9	lowest practical power level	reactor vessel and reactor coolant system component vibration characteristics within design. See NRC Information Notice 2002-26 and RG 1.20.	EMEB
Measure power reactivity coefficients (PWR) or power vs. flow characteristics (BWR)	RG 1.68, App A 5.a	100% of RTP	characteristics in accordance with design	SRXB
Steady-state core performance	RG 1.68, App A 5.b	100% of RTP	characteristics in accordance with design	SRXB
Control rod patterns exchange	RG 1.68, App A 5.c	power equal to highest power level that rod exchanges will be allowed at power	core limits not exceeded	SRXB
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	SRXB
Failed fuel detection system	RG 1.68, App A 5.q	100% of RTP	verify proper operation	IEHB
Plant process computer	RG 1.68, App A 5.r	100% of RTP	inputs and calculation are correct	SPLB/EEIB
Calibrate major or principal plant control systems	RG 1.68, App A 5.s	100% of RTP	verify performance	SRXB/SPLB
Main steam and main feedwater system operation	RG 1.68, App A 5.v	100% of RTP	operate in accordance with design performance requirements	SPLB
Shield and penetration cooling systems	RG 1.68, App A 5.w	100% of RTP	maintain temperature within design limits	SPLB
ESF auxiliary and environmental systems	RG 1.68, App A 5.x	100% of RTP	capable of performing design functions	SPLB
Calibrate systems used to determine reactor thermal power	RG 1.68, App A 5.y	100% of RTP	verify performance	EEIB
Chemical and radiochemical control systems	RG 1.68, App A 5.a.a	100% of RTP	control systems function in accordance with design	IEHB
Sample reactor coolant system and secondary coolant systems	RG 1.68, App A 5.a.a	100% of RTP	chemistry limits are not exceeded	EMCB

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	shielding adequacy and identify 10 CFR Part 20 high-radiation zones	IEHB
Ventilation systems (including primary containment and steam line tunnel)	RG 1.68, App A 4.j and 5.f.f	100% of RTP	maintain service areas within design limits	SPLB
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	EMEB

Transient Testing Applicable to Extended Power Uprates

Transient Test	Reference	Typical Reactor Plant Initial Conditions	Typical Transient Test Acceptance Criteria and Associated Functions Important to Safety	Applicable Accident Analyses (SRP Section)
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 a Steam Generator 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	
Reactor core isolation cooling functional test	IP 72512	Steady-state reactor operations at rated temperature and pressure RCIC aligned for standby operation Reactor power at approximately 25% of RTP	Startup from hot standby conditions and discharge of rated flow into the reactor vessel at rated pressure and temperature within a specified time Verification of maximum rated flow isolation trip Verification of overspeed trip Turbine gland seal condenser system shall prevent steam leak to atmosphere	
Dynamic response of plant to limiting reactor coolant pump trips or closure of reactor coolant system 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 and Associated Functions Important to Safety	Applicable Accident Analyses (SRP Section)
Dynamic response of plant to loss of feedwater flow	RG 1.68, Appendix A, Section 5 (Introduction)		plant performance in accordance with design	15.2.7 Loss of Normal Feedwater Flow
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 diesel generators 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 diesel generators, automatic load of diesel generators 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, diesel generators, 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 Steam generator level remains within prescribed limits	15.2.6 Loss of Nonemergency AC Power to the Station Auxiliaries

Transient Test	Reference	Typical Reactor Plant Initial Conditions	Typical Transient Test Acceptance Criteria and Associated Functions Important to Safety	Applicable Accident Analyses (SRP Section)
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 steam generator level remains within prescribed limits, no flooding of the steam lines during the transient, no initiation of ECCS 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 functions should be verified all safety and ECCS systems such as RPS, HPCI, diesel generators, and 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 main steam isolation valves	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 Main Steam Isolation Valve Closure (BWR)