

POLICY ISSUE INFORMATION

May 20, 2009

SECY-09-0078

FOR: The Commissioners

FROM: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

SUBJECT: STATUS REPORT ON POWER UPRATES

PURPOSE:

This information paper summarizes the power uprate program accomplishments and challenges since the last update in SECY-08-0078, "Status Report on Power Uprates," dated June 3, 2008. This paper does not address any new commitments or resource implications.

BACKGROUND:

The staff provides the Commission with an annual update of significant power uprate activities, in accordance with the staff requirements memorandum dated February 8, 2002 (SRM-M020129).

DISCUSSION:

Since the last update, the U.S. Nuclear Regulatory Commission (NRC) staff has approved five plant-specific power uprates. The staff is currently reviewing ten power uprates. Over the next 5 years, the staff expects that licensees will submit an additional 38 power uprate applications. The enclosed status report provides detailed information on the power uprates approved since June 3, 2008; applications under review; applications expected in the future; accomplishments; operating experience; and program performance.

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The staff met its timeliness goals for two of the five power uprates approved since June 3, 2008 (the Comanche Peak Units 1 and 2 stretch power uprates). The staff exceeded the 6-month review goal for the Cooper measurement uncertainty recapture power uprate by 10 days due to a combination of insufficient licensee responses to NRC questions, the need to re-ask for information, and the availability of the NRC staff when the final supplemental response was provided. The staff exceeded the 9-month review goal for the Millstone Unit 3 stretch power uprate by 4 weeks due to the licensee's late responses to NRC questions. The staff's review of the Davis-Besse measurement uncertainty recapture power uprate (duration of about 14 months) was also delayed due to the licensee's late responses to NRC questions.

Two independent industry topical reports have been submitted and are under review, which should ultimately provide the industry with two independent integrated evaluation approaches and acceptance criteria for steam dryers. Upon evaluation and approval of the reports by the NRC, the staff expects improvements in the timeliness of future boiling water reactor extended power uprate reviews.

On March 28, 2008, the Office of the Inspector General (OIG) issued Audit Report OIG-08-A-09, "Audit of NRC's Power Uprate Program." The recommendations in the report identified that the NRC's power uprate program could be enhanced in areas of the power uprate inspection procedure documentation and implementation, the circulation and written quality of safety evaluations, and the power uprate coordinating function. The staff addressed the OIG recommendations by revising Inspection Procedure 71004, "Power Uprate" on July 1, 2008, and on February 2, 2009, and by issuing a new internal office instruction, LIC-112, "Power Uprate Process," on February 17, 2009.

The continuing goal is for the staff to conduct timely power uprate reviews of appropriate scope and depth for each of the technical areas while ensuring that safety is maintained.

COORDINATION:

The Office of the General Counsel reviewed this report and has no legal objection.

/RA/

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Enclosure:
Power Uprate Program Status Report

**Power Uprate Program Status Report
May 2009**

Power uprates are categorized based on the magnitude of the power increase and the methods used to achieve the increase. Measurement uncertainty recapture (MUR) power uprates result in power-level increases of less than 2 percent and are achieved by implementing enhanced techniques for calculating reactor power. Stretch power uprates (SPUs) typically result in power-level increases of up to 7 percent and generally do not involve major plant modifications; extended power uprates (EPUs) result in greater power-level increases than SPUs and usually require significant modifications to major plant equipment. The U.S. Nuclear Regulatory Commission (NRC) has approved EPUs for increases as high as 20 percent.

Power Uprates Approved Since June 2008

Power uprates approved since June 3, 2008, have added 630 megawatts thermal (MWt) or approximately 210 megawatts electric (MWe) to the Nation's electric generating capacity. This brings the total number of power uprates approved since 1977 to 124, resulting in a combined increase of about 16,919 MWt (5,640 MWe) in the Nation's electric generating capacity. Table 1 provides information on the power uprates approved since June 3, 2008; details on program performance versus established goals for these approved power uprates appear later in this enclosure.

Table 1 - Power Uprates Approved Since June 3, 2008

No.	Plant	% Uprate	MWt	Application Date	Approval Date	Type
1	Comanche Peak 1	4.5	154	08/28/2007	06/27/2008	SPU
2	Comanche Peak 2	4.5	154	08/28/2007	06/27/2008	SPU
3	Cooper	1.6	38	11/19/2007	06/30/2008	MUR
4	Davis-Besse	1.6	45	04/12/2007	06/30/2008	MUR
5	Millstone 3	7	239	07/13/2007	08/12/2008	SPU
		Total	630			

Power Uprate Applications Currently under Staff Review

As noted in Table 2, power uprates currently under review could add an additional 2,399 MWt or 800 MWe to the Nation's electric generating capacity, if approved.

Table 2 - Power Uprate Applications under Review

No.	Plant	% Uprate	MWt	Submittal Date	Projected Completion Date	Type
1	Browns Ferry 2	15	494	06/25/2004	To Be Determined	EPU
2	Browns Ferry 3	15	494	06/25/2004	To Be Determined	EPU
3	Browns Ferry 1	15	494	06/28/2004	Summer 2009	EPU
4	Calvert Cliffs 1	1.4	37	08/29/2008	August 2009	MUR
5	Calvert Cliffs 2	1.4	37	08/29/2008	August 2009	MUR
6	Monticello	12.9	229	11/05/2008	December 2009	EPU
7	North Anna 1*	1.6	47	03/26/2009	To Be Determined	MUR
8	North Anna 2*	1.6	47	03/26/2009	To Be Determined	MUR
9	Point Beach 1*	17	260	04/07/2009	To Be Determined	EPU
10	Point Beach 2*	17	260	04/07/2009	To Be Determined	EPU
		Total	2,399			

* These applications are currently undergoing NRC acceptance review.

Expected Power Uprate Applications

Table 3 estimates future power uprate applications based on a survey of all licensees conducted in October 2008.

Table 3 - Projected Future Power Uprate Applications

Fiscal Year	Power Uprates Expected	MUR Power Uprates	SPUs	EPUs	MWt	MWe
2009	6	4	0	2	1,066	355
2010	20	12	1	7	2,880	960
2011	10	2	0	8	3,127	1,042
2012	1	0	0	1	522	174
2013	1	0	0	1	470	157
Total	38	18	1	19	8,065	2,688

Accomplishments Since June 3, 2008

The NRC staff accomplishments since June 3, 2008, are as follows:

- Approved five plant-specific power uprates, specifically two MUR power uprates (Cooper and Davis-Besse) and three SPUs (Comanche Peak Units 1 and 2 and Millstone Unit 3).
- Participated in the Nuclear Energy Institute EPU workshop on December 2-3, 2008, in New Orleans, LA and presented a "Regulatory Perspective" on power uprates.
- Issued acceptance letters for the MUR power uprate applications for Calvert Cliffs Units 1 and 2, and the resubmitted EPU application for Monticello.
- Presented information on the Millstone Unit 3 SPU application to the Advisory Committee on Reactor Safeguards (ACRS) and the ACRS Subcommittee on Power Uprates.
- Revised Inspection Procedure (IP) 71004, "Power Uprate," with regard to the use of the inspection procedure, the tracking of other inspection procedures related to power uprates, and the documentation of inspection activities related to power uprates.
- Issued a new internal office instruction entitled "Power Uprate Process" that strengthens the coordination of all aspects of power uprate activities and identifies roles and responsibilities for headquarters and regional points of contact for power uprates.

Operating Experience Related to Power Uprates

Potential Adverse Flow Effects

At power uprate conditions, nuclear power plants can experience significant increases in steam flow velocities. Plant experience has shown that as the higher main steamline flow passes over branch lines, it can create an acoustic resonance in the steamlines that can vary greatly from one plant to another, depending on the routing of the main steamlines and the steam dryer vintage and geometry. The acoustic resonance can create pressure waves that strike the steam dryer in boiling-water reactors (BWRs) with sufficient force to cause the stress in the steam dryer to exceed the material fatigue limits, which may result in steam dryer cracking. The acoustic resonance can also cause excessive vibration that may damage steamline components, such as relief valves and piping.

To address this issue, BWR EPU applicants have provided a steam dryer analysis to demonstrate the structural integrity of the steam dryers at the uprated power level. However, the challenge of providing an acceptable steam dryer analysis delayed the EPU review for Hope Creek (approved in 2008) and continues to delay the EPU reviews for Browns Ferry Units 1, 2, and 3.

The reviews for Browns Ferry Units 1, 2, and 3 were delayed because the licensee introduced several new refinements to the analytical methods, which had not been used in previous EPU applications (e.g., noise subtraction methodology, sub-modeling techniques, and crediting

perforated plate damping). The delay also stemmed from the staff's identification of an issue with the licensee's acoustic circuit model with respect to under-prediction of loads on the dryer within a specific frequency range. The licensee submitted supplemental information to address these issues on March 11, 2009. The staff is currently reviewing this information to complete its safety evaluation for Unit 1. The Unit 2 review is suspended pending the licensee development of steam dryer modifications needed to address a signal filter issue in the relief valve resonance frequency range. The Unit 3 review is suspended because strain gauge failures at the plant have resulted in a lack of data needed for the steam dryer analysis.

Two independent industry topical reports have been submitted and are under review, which should ultimately provide the industry with two independent integrated evaluation approaches and acceptance criteria for steam dryers. GE Hitachi Nuclear Energy submitted NEDC-33436P, "GEH Boiling Water Reactor Steam Dryer - Plant Based Load Evaluation," on November 7, 2008. The Electric Power Research Institute submitted BWRVIP-194, "Methodologies for Demonstrating Steam Dryer Integrity for Power Uprate," on October 31, 2008. The NRC will review these topical reports and subject to approval, develop plant-specific items that licensees will need to address if they reference the topical reports. Upon approval of the reports by the NRC, the staff expects improvements in the timeliness of future boiling water reactor extended power uprate reviews.

Containment Accident Pressure Credit

Extended power uprates result in an increase in the temperature of the sump water (in pressurized water reactors) and suppression pool water (in BWRs) during certain postulated accident scenarios and/or abnormal events. This can have an adverse impact on the performance of the emergency core cooling system (ECCS) pumps taking suction from these water sources. In some cases, licensees have proposed use of containment accident pressure to ensure acceptable performance of the ECCS pumps. The ACRS has detailed its concerns with this practice in a letter to the Executive Director for Operations, dated March 18, 2009. The staff is preparing a response to the ACRS and is working with the ACRS to resolve these issues.

Program Performance versus Established Goals

The established performance goals are: 6 months for reviewing MUR power uprate applications, 9 months for reviewing SPU applications, and 12 months for reviewing EPU applications.¹ The staff will continue to ensure that protection of public health and safety is not compromised through its efforts to meet these timeliness goals. Individual applications may require more or less review time, depending on the nature of the technical issues.

The staff met its timeliness goals for two of the five power uprates approved since June 3, 2008 (the Comanche Peak Units 1 and 2 SPUs). The staff exceeded the 6-month review goal for the Cooper MUR power uprate by 10 days due to a combination of insufficient licensee responses to NRC questions, the need to re-ask for information, and the availability of the NRC staff when the final supplemental response was provided. The staff exceeded the 9-month review goal for

¹ These goals do not include the duration of the staff's acceptance review, which the staff conducts upon receipt of the initial application.

the Millstone Unit 3 SPU by 4 weeks due to the licensee's late responses to NRC questions. The staff's review of the Davis-Besse MUR power uprate (duration of about 14 months) was also delayed due to the licensee's late responses to NRC questions.

The delays in the Browns Ferry EPU reviews, due to staff concerns with their steam dryer analysis, have been discussed previously in the operating experience section of this paper. In addition, taking credit for containment accident pressure to ensure acceptable performance of the ECCS pumps, is an area of discussion between ACRS and the staff, and it is a potential challenge to completing the Browns Ferry EPU reviews.

The Calvert Cliffs Units 1 and 2 MUR power uprate reviews have been delayed due to the licensee's late responses to NRC questions. In addition, the staff has concerns with the proposed installation of the ultrasonic flow meters and the associated uncertainty calculations.

Office of the Inspector General Audit Report on Power Uprates

On March 28, 2008, the Office of the Inspector General (OIG) issued Audit Report OIG-08-A-09, "Audit of NRC's Power Uprate Program." The recommendations in the report identified that the NRC's power uprate program could be enhanced in areas of the power uprate inspection procedure documentation and implementation, the circulation and written quality of safety evaluations, and the power uprate coordinating function.

The staff addressed the OIG recommendations by revising Inspection Procedure (IP) 71004, "Power Uprate" on July 1, 2008, and on February 2, 2009, and by issuing a new internal office instruction, LIC-112, "Power Uprate Process," on February 17, 2009.

The NRC revised IP 71004 to (1) provide more specificity with regard to the use of the inspection procedure, (2) require that all planned team inspections that are selected to support completion of IP 71004 sample requirements be annotated as such in the Regional Reactor Program System, and (3) revise documentation requirements so that inspection activities related to power uprates are easily identified.

The new internal office instruction, LIC-112, strengthens the coordination of all aspects of power uprate activities, identifies roles and responsibilities for headquarters and regional points of contact for power uprates, and focuses on detailed staff guidance that is unique to processing power uprate applications. The guidance also includes enhancements to improve the distribution of safety evaluations supporting the power uprate and the awareness of certain sections within the safety evaluations, with internal NRC stakeholders. The guidance also includes enhancements to improve the written quality of safety evaluations.

On April 1, 2009, the OIG updated its September 24, 2008, analysis and status of the staff's response to the OIG recommendations. The OIG has concluded that all recommendations related to OIG-08-A-09 are now resolved and closed.