

POLICY ISSUE INFORMATION

June 3, 2008

SECY-08-0078

FOR: The Commissioners

FROM: R. W. Borchardt
Executive Director for Operations

SUBJECT: STATUS REPORT ON POWER UPRATES

PURPOSE:

This information paper summarizes the power uprate program accomplishments and challenges since the last update in SECY-07-0090, Status Report on Power Uprates," dated June 4, 2007. 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 staff has approved six plant-specific power uprates. The staff is currently reviewing nine power uprates. Over the next 5 years, the staff expects that licensees will submit an additional 25 power uprate applications. The enclosed status report provides detailed information on the power uprates approved since June 4, 2007; applications under review; applications expected in the future; accomplishments; operating experience; and program performance.

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The staff essentially met its timeliness goals for five of the six power uprates approved so far in Fiscal Year 2008 (the Crystal River Unit 3 and Vogtle Units 1 and 2 measurement uncertainty recapture (MUR) power uprates, and the Susquehanna Units 1 and 2 extended power uprates (EPU)). The staff exceeded the 12 month review goal for the Susquehanna EPUs by four weeks because it needed additional time to consider Advisory Committee on Reactor Safeguards' recommendations. The staff's review of the Hope Creek EPU (duration of about 20 months) was delayed because the licensee changed its steam dryer analysis methodology in mid-2007.

By the end of 2008, the staff expects to receive two independent topical reports which will provide an integrated evaluation of adverse flow effects. Upon evaluation and approval of the reports by the U.S. Nuclear Regulatory Commission (NRC), the staff expects improvements in the timeliness of future boiling water reactor EPU reviews.

The staff has completed its reevaluation of the generic approvals of ultrasonic flow meters (UFMs) used for MUR power uprates. This resulted in the withdrawal of approval of the Westinghouse Crossflow UFM for power uprate or power recovery. The staff notified Westinghouse Electric Company by letter of the suspension of the staff's approval of Westinghouse topical report on the Crossflow UFM for new and future use in power uprate applications. Industry was notified of this withdrawal of approval in Regulatory Issue Summary 2007-24, "NRC Staff Position on Use of the Westinghouse Crossflow Ultrasonic Flow Meter for Power Uprate or Power Recovery," dated September 27, 2007.

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

COORDINATION:

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

/RA Bruce S. Mallett for/

R. W. Borchardt
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for Operations

Enclosure:
Power Uprate Program Status Report

**Power Uprate Program Status Report
May 2008**

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 2006

Power uprates approved since June 4, 2007, have added an additional 1589.2 megawatts thermal (MWt) or approximately 530 megawatts electric (MWe) to the Nation's electric generating capacity. This brings the total number of power uprates approved since 1977 to 119, resulting in a combined increase of about 16,289 MWt (5,430 MWe) in the Nation's electric generating capacity. Table 1 provides information on the power uprates approved since June 4, 2007; details on program performance versus established goals for these approved power uprates are discussed later in this enclosure.

Table 1 - Power Uprates Approved Since June 2007

No.	Plant	% Uprate	MWt	Application Date	Approval Date	Type
1	Crystal River 3	1.6	41	04/25/2007	12/26/2007	MUR
2	Susquehanna 1	13	463	10/11/2006	01/30/2008	EPU
3	Susquehanna 2	13	463	10/11/2006	01/30/2008	EPU
4	Vogtle 1	1.7	60.6	08/28/2007	02/27/2008	MUR
5	Vogtle 2	1.7	60.6	08/28/2007	02/27/2008	MUR
6	Hope Creek	15	501	09/18/2006	05/14/2008	EPU
		Total	1589.2			

Power Uprate Applications Currently under Staff Review

Power uprates currently under review could add an additional 2,207 MWt or 736 MWe to the Nation's electric generating capacity if approved, as noted in Table 2.

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	December 2008	EPU
2	Browns Ferry 3	15	494	06/25/2004	December 2008	EPU
3	Browns Ferry 1	15	494	06/28/2004	December 2008	EPU
4	Davis-Besse	1.6	45	04/12/2007	09/30/2008	MUR
5	Millstone 3	7.0	239	07/13/2007	08/15/2008	SPU
6	Comanche Peak 1	4.5	154	08/28/2007	07/08/2008	SPU
7	Comanche Peak 2	4.5	154	08/28/2007	07/08/2008	SPU
8	Cooper	1.6	38	11/19/2007	06/20/2008	MUR
9	Monticello	5.4	95	03/31/2008	06/01/2009	EPU
		Total	2207			

Expected Power Uprate Applications

Table 3 describes intended future power uprate applications based on a survey of all licensees conducted in April 2007.

Table 3 - Projected Future Power Uprate Applications

Fiscal Year	Power Uprates Expected	MUR Power Uprates	SPUs	EPUs	MWt	MWe
2008	2	2	0	0	52	17
2009	11	5	0	6	2366	789
2010	7	1	0	6	1405	468
2011	5	0	0	5	1451	484
2012	0	0	0	0	0	0
TOTAL	25	8	0	17	5274	1758

Accomplishments Since June 4, 2007

- Approved six plant-specific power uprates, specifically three MUR power uprates (Crystal River Unit 3, and Vogtle Units 1 and 2) and three EPUs (Susquehanna Units 1 and 2 and Hope Creek).
- Issued letter to Westinghouse Electric Company (WEC) suspending the NRC approval of the Crossflow Ultrasonic Flow Meter (UFM) topical report on September 26, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071650263).

- Issued Regulatory Issue Summary 2007-24 (ADAMS Accession No. ML063450261), "NRC Staff Position on Use of the Westinghouse Crossflow Ultrasonic Flow Meter for Power Uprate or Power Recovery," on September 27, 2007 to inform addressees that the NRC had written a letter to WEC suspending NRCs approval of the WEC topical report on the Crossflow UFM for new and future use.
- Approved General Electric (GE) Topical Report (TR) 33173P, "Applicability of GE Methods to Expanded Operating Domains," on January 17, 2008 (ADAMS Accession No. ML073340231) for referencing in licensing applications for GE-designed boiling water reactors (BWRs), subject to certain limitations. Topical Report 33173P evaluates the impact of operation at the higher void conditions characteristic of EPUs.
- Issued acceptance letters for the MUR power uprate application for Cooper, and the SPU applications for Millstone Unit 3 and Comanche Peak Units 1 and 2.
- Presented information on the Susquehanna Units 1 and 2 and the Hope Creek EPU applications to the Advisory Committee on Reactor Safeguards (ACRS) and the ACRS Subcommittee on 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 the higher main steamline flow can create an acoustic resonance in the steamlines as the flow passes over branch lines that can vary greatly from one plant to another depending on the routing of the main steam lines and steam dryer vintage and geometry. The acoustic resonance can create pressure waves that strike the steam dryer in 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, providing an acceptable steam dryer analysis has been a challenge and has resulted in delays in EPU reviews for Vermont Yankee (approved in 2006) and Browns Ferry and Hope Creek EPU reviews. The steam dryers at Susquehanna will be replaced before EPU implementation.

The Browns Ferry and Hope Creek reviews were delayed because the licensees changed their analysis methodologies in mid-2007. This change involved a revised acoustic circuit model analysis as well as a revised frequency-domain finite element analysis. The NRC staff asked licensees to address agency questions about these analyses since they had not been used previously in EPU applications. The licensee for Hope Creek has addressed these questions and that application review was recently completed. The licensee for Browns Ferry is still addressing these questions.

Industry and vendors plan to submit two independent topical reports to provide an integrated evaluation of adverse flow effects. On March 14, 2008 GE Hitachi Nuclear Energy submitted one report, titled "Applicability of Topical Report NEDC-33408P, 'ESBWR Steam Dryer – Plant Based Load Evaluation Methodology,' to Current Plants." The other report, which is expected by the end of 2008, will address the revised analysis methodologies noted above.

In response to nuclear plant operating experience, the NRC staff and its contractors have been performing more detailed reviews and inspections of plant performance and power uprate license amendment requests with respect to adverse flow effects on plant structures, systems, and components. The NRC staff has also updated Standard Review Plan (SRP) Sections 3.9.2 and 3.9.5 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," and Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing," to provide additional guidance for NRC staff reviewers and the nuclear industry on the evaluation of potential adverse flow effects at operating plants considering power uprates and at new nuclear power plants.

Ultrasonic Flow Meter Instrumentation

Another operating experience issue relates to abnormalities in UFM instrumentation. The staff completed its review of industry evaluations of a problem at plants using a UFM of the type employed for MUR power uprates. This problem has led to unexpected but small differences in power-level indications at some plants.

Two vendors, Caldon and WEC, currently supply UFM's to nuclear power plants. The staff completed its reevaluation of the generic approvals previously granted for these UFM's. By letter to Caldon dated July 5, 2006, the staff's reevaluation concluded that the performance of the Caldon Check and CheckPlus UFM's is consistent with previous NRC reviews and therefore is acceptable.

The staff completed its reevaluation of the WEC Crossflow UFM. By letter dated September 26, 2007, the NRC suspended its approval of the Crossflow UFM topical report for new and future use in power uprate applications or in future evaluations of changes to support power recovery covered by Title 10, Section 50.59, "Changes, tests, and experiments," of the *Code of Federal Regulations* (10 CFR 50.59). This withdrawal of approval, published in Regulatory Issue Summary 2007-24 on September 27, 2007, resulted in the NRC denial of the Fort Calhoun MUR power uprate application on September 27, 2007 and the licensee's withdrawal of the Calvert Cliffs Units 1 and 2 MUR power uprate application on September 27, 2007.

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 the goal of protecting public health and safety is not compromised to meet these timeliness goals. Individual applications may require more or less review time depending on the nature of the technical issues.

¹ These goals do not include the duration of the staff's acceptance review, which the staff conducts upon receipt of the initial application. On May 2, 2008, the staff issued a new Office Instruction, LIC-109, Acceptance Review Procedures, to provide specific guidance for acceptance reviews. The staff plans to issue a regulatory summary with LIC-109 as an enclosure to inform licensees and the public of the staff's procedures governing acceptance reviews.

These goals are a simplification of the goals established and last documented in SECY-07-0090, dated June 4, 2007. The metric goals have not changed; the change involves removing caveats with the intent of increasing efficiency in reporting program performance.

NRC essentially met its timeliness goals for the five of the six power uprates approved so far in FY 2008 (the Crystal River Unit 3 and Vogtle Units 1 and 2 MUR power uprates, and the Susquehanna Units 1 and 2 EPU). The staff exceeded the 12 month review goal for the Susquehanna EPUs by four weeks as it needed additional time to consider the Advisory Committee on Reactor Safeguards recommendations. The Hope Creek EPU review took about 20 months because the licensee changed its analysis methodologies in mid-2007, including a revised acoustic circuit model analysis and a revised frequency-domain finite element analysis. The licensee needed additional time to address NRC questions on these analysis methodologies as they have not been used in previous EPU applications.

In SECY-07-0090, the 2007 "Status Report on Power Uprates," the staff informed the Commission that the Tennessee Valley Authority (TVA) was unable to provide its revised steam dryer analysis for Browns Ferry Units 1, 2, and 3, by the licensee's committed-to date of early April 2007. The staff went on to say that they would "reestablish the review schedule when the licensee provides a revised schedule for submitting the steam dryer analysis." On July 27, 2007, TVA provided its revised analysis. Based on the staff's preliminary review of the revised analysis, additional information was needed from TVA for the staff to assess the structural integrity of the steam dryers at the uprated power level. Since August 9, 2007, the staff has met with TVA on several occasions, conducted numerous telephone conversations, including discussions with Senior TVA management, and issued formal requests for additional information to support the review of the revised analysis. On April 17, 2008, TVA informed the staff that needed information would be submitted in June 2008. The staff believes the EPU for Units 1, 2, and 3 can be issued in December 2008 assuming TVA successfully responds to all requests for information in June.

Office of Inspector General (OIG) Audit Report on Power Uprates

On March 28, 2008, the OIG issued Audit Report OIG-08-A-09, "Audit of NRC's Power Uprate Program." 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 evaluation, and the power uprate coordinating function.

The staff has reviewed the OIG report and the eight recommendations. As indicated in Appendix D of that report, the staff agreed with most of the OIG recommendations, but does not agree that inspection procedures should cross reference back to the power uprate inspection procedure nor with the extent of additional training for writing or contributing to a safety evaluation. The staff will be working with the OIG to resolve all of the recommendations.