

# POLICY ISSUE INFORMATION

May 20, 2010

SECY-10-0070

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-09-0078, "Status Report on Power Uprates," dated May 20, 2009. 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, entitled "Briefing on Status of Nuclear Reactor Safety" (SRM-M020129).

## DISCUSSION:

Since the last update, the U.S. Nuclear Regulatory Commission (NRC) staff has approved four plant-specific power uprates. The staff is currently reviewing 16 power uprates. Over the next 5 years, the staff expects that licensees will submit an additional 39 power uprate applications. The enclosed status report provides detailed information on the power uprates approved since May 20, 2009; applications under review; applications expected in the future; accomplishments; challenges associated with power uprates; and program performance.

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The staff met its timeliness goals for two of the four power uprates approved since May 20, 2009, (the North Anna Units 1 and 2 measurement uncertainty recapture power uprates). The staff exceeded the 6-month review goal for the Calvert Cliffs Units 1 and 2 measurement uncertainty recapture power uprates by 4 months due to the licensee's late responses to NRC questions.

The use of containment accident pressure credit in the safety analyses of some extended power uprate applications continues to be an area of discussion between the Advisory Committee on Reactor Safeguards and the staff. This issue has delayed two reviews: Browns Ferry and Monticello. During recent meetings with the ACRS, they provided recommendations that could raise policy issues. The staff will include our proposed path forward in our response to the ACRS recommendations.

Two independent industry topical reports have been submitted and are under review, which could 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.

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.

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Eric J. Leeds, Director  
Office of Nuclear Reactor Regulation

Enclosure:  
Power Uprate Program Status Report

**Power Uprate Program Status Report  
May 2010**

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 (EPU) 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 EPU for increases as high as 20 percent.

Power Uprates Approved since May 2009

Power uprates approved since May 20, 2009, have added 168 megawatts thermal (MWt) or approximately 56 megawatts electric (MWe) to the Nation's electric generating capacity. This brings the total number of power uprates approved since 1977 to 129, resulting in a combined increase of about 17,179 MWt (5,726 MWe) in the Nation's electric generating capacity. Table 1 provides information on the power uprates approved since May 20, 2009; details on program performance versus established goals for these approved power uprates appear later in this report.

**Table 1 - Power Uprates Approved since May 20, 2009**

No.	Plant	% Uprate	MWt	Application Date	Approval Date	Type
1	Calvert Cliffs 1	1.4	37	08/29/2008	07/22/2009	MUR
2	Calvert Cliffs 2	1.4	37	08/29/2008	07/22/2009	MUR
3	North Anna 1	1.6	47	03/26/2009	10/22/2009	MUR
4	North Anna 2	1.6	47	03/26/2009	10/22/2009	MUR
		<b>Total</b>	<b>168</b>			

Power Uprate Applications Currently under Staff Review

As illustrated in Table 2, power uprates currently under review could add 3,436 MWt or approximately 1,145 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	14.3	494	06/25/2004	To Be Determined	EPU
2	Browns Ferry 3	14.3	494	06/25/2004	To Be Determined	EPU
3	Browns Ferry 1	14.3	494	06/28/2004	To Be Determined	EPU
4	Monticello	12.9	229	11/05/2008	To Be Determined	EPU
5	Point Beach 1	17	260	04/07/2009	November 2010	EPU
6	Point Beach 2	17	260	04/07/2009	November 2010	EPU
7	Nine Mile Pt. 2	15	521	05/27/2009	September 2010	EPU
8	Prairie Island 1	1.6	27	12/28/2009	August 2010	MUR
9	Prairie Island 2	1.6	27	12/28/2009	August 2010	MUR
10	Surry 1	1.6	41	01/27/2010	September 2010	MUR
11	Surry 2	1.6	41	01/27/2010	September 2010	MUR
12	LaSalle 1	1.6	57	01/27/2010	September 2010	MUR
13	LaSalle 2	1.6	57	01/27/2010	September 2010	MUR
14	Limerick 1	1.6	57	03/25/2010	November 2010	MUR
15	Limerick 2	1.6	57	03/25/2010	November 2010	MUR
16	St. Lucie 1*	11.9	320	04/16/2010	To Be Determined	EPU
		<b>Total</b>	<b>3,436</b>			

\* This application is 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 December 2009.

**Table 3 - Projected Future Power Uprate Applications**

<b>Fiscal Year</b>	<b>Power Uprates Expected</b>	<b>MUR Power Uprates</b>	<b>SPUs</b>	<b>EPUs</b>	<b>MWt</b>	<b>MWe</b>
2010	4	0	0	4	1,603	534
2011	20	13	1	6	2,511	837
2012	8	5	0	3	1,308	436
2013	4	3	0	1	591	197
2014	3	0	0	3	1,245	415
<b>Total</b>	<b>39</b>	<b>21</b>	<b>1</b>	<b>17</b>	<b>7,258</b>	<b>2419</b>

Accomplishments since May 20, 2009

The NRC staff accomplishments since May 20, 2009, are as follows:

- Approved four plant-specific power uprates, specifically four MUR power uprates (Calvert Cliffs Units 1 and 2, and North Anna Units 1 and 2).
- Issued acceptance letters (or notifications) for the MUR power uprate applications for Prairie Island Units 1 and 2, Surry Units 1 and 2, LaSalle Units 1 and 2, and Limerick Units 1 and 2; and for the EPU applications for Point Beach Units 1 and 2, and Nine Mile Point Unit 2.
- Issued acceptance letters for two industry topical report applications that present two independent integrated evaluation approaches and acceptance criteria for steam dryers.
- Revised Inspection Procedure 71004, "Power Uprate," to clarify the approval process for a site-specific power uprate inspection plan.

Challenges Associated with 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 velocity 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 significant force. This force could 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 and feedwater line components, such as relief valves and piping.

To address this issue, BWR applicants for EPU applications have provided complex steam dryer analyses to demonstrate the structural integrity of the steam dryers at uprated power levels. However, it has been challenging for licensees to provide acceptable steam dryer analyses and this has significantly contributed to the delays in the EPU reviews for several BWR plants. Reasons for these delays typically include: licensees introducing new refinements to analytical methods not used in previous EPU applications, the NRC identifying new issues with licensees' acoustic circuit models, licensees needing to make steam dryer modifications to address analysis issues, and lack of adequate plant measurement data needed for the steam dryer analyses.

To address this issue, two independent industry topical reports have been submitted to the NRC for review and approval. These reports present 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 resubmitted BWRVIP-194, "Methodologies for Demonstrating Steam Dryer Integrity for Power Uprate," on December 18, 2008. By letters dated June 30, 2009, and September 15, 2009, the NRC accepted topical reports BWRVIP-194 and NEDC-33436P, respectively, for a detailed technical review. However, the NRC letters also identified the need for complementary or related topical reports, as well as additional information, to continue its review. The topical report applicants have kept the NRC informed on their progress in providing this supplemental information. If the NRC ultimately approves these topical reports, licensees referencing them will only need to provide the plant-specific items (which the NRC will develop) for the NRC's review. This process should improve the review timeliness of future requests that involve evaluation of potential adverse flow effects on steam dryers.

#### Containment Accident Pressure Credit

EPU applications result in an increase in the temperature of the sump water (in pressurized-water reactors) and suppression pool water (in BWRs) during certain postulated accidents or abnormal events. This could affect the performance of the emergency core cooling system (ECCS) pumps taking suction from these water sources. In some cases, licensees have included containment accident pressure in their safety analyses to demonstrate acceptable performance of the ECCS pumps. The Advisory Committee on Reactor Safeguards (ACRS) recommended changes with this practice in a letter to the Executive Director for Operations (EDO) dated March 18, 2009.

The staff responded to the ACRS by letter dated June 4, 2009. The staff informed ACRS that it was carefully reviewing the recommendations of the March 18, 2009, letter and would brief ACRS on the results of its review. The staff response also stated that it would consider delaying approval of licensing actions that included the use of containment accident pressure.

In September and October 2009, the NRC informed two licensees for EPU applications (Browns Ferry and Monticello), which take credit for containment accident pressure and are currently undergoing NRC staff review, that the agency needs more time to develop additional regulatory guidance to ensure the technical adequacy of their applications. This resulted in delays in the staff's review of these applications.

The staff has now developed draft guidance for this issue. By letters dated March 1 and 24, 2010, the NRC provided the draft guidance to the Boiling Water Reactor Owners Group (BWROG) and the Pressurized Water Reactor Owners Group, respectively, and requested that they meet with the staff to discuss it. The staff discussed the draft guidance with the BWROG on April 14, 2010, and presented it to the ACRS Power Uprate Subcommittee and ACRS full committee on April 23 and May 6, 2010, respectively. The ACRS made recommendations in a letter to the EDO dated May 19, 2010, which could raise policy issues. The staff is evaluating those recommendations and will include our proposed path forward in our response to those ACRS recommendations. Once all issues are resolved, the staff plans to incorporate this guidance into a regulatory guide.

### 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.<sup>1</sup> 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 four power uprates approved since May 20, 2009 (the North Anna Units 1 and 2 MUR power uprates). The staff exceeded the 6-month review goal for the Calvert Cliffs Units 1 and 2 MUR power uprates by 4 months due to the licensee's late responses to NRC questions, as documented in the NRC's letter dated January 27, 2009.

The Browns Ferry Units 1, 2, and 3, and Monticello EPU reviews have been delayed primarily due to staff concerns with the licensees' steam dryer analyses and analyses that take credit for containment accident pressure. The Nine Mile Point Unit 2 EPU review may also be delayed in order to resolve staff concerns with the licensee's steam dryer analyses. Discussion of these issues appeared previously in the "Challenges Associated with Power Uprates" section of this report.

The Point Beach Units 1 and 2 EPU review schedule has been delayed primarily due to the EPU's dependence on approval of the alternative source term (AST) amendment application, which is a separate application that is linked to the EPU application. According to the Office of Nuclear Reactor Regulation's publicly available Office Instruction LIC-109, "Acceptance Review Procedures," the staff should not, in general, accept a license amendment application for NRC review until the agency has reviewed and approved all prerequisite license amendment applications. In consideration of LIC-109 and the licensee's history with AST applications, the staff decided to defer the EPU review until the NRC was able to accurately assess the viability of the AST application. However, the staff did begin working on, separately from the EPU, two portions of the EPU submittal that contained safety-significant modifications (auxiliary feedwater

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

modifications and revisions to non-conservative setpoints). The NRC's letters dated June 29, August 25, and October 19, 2009, document the staff's acceptance review progress and concerns. Subsequently, the licensee addressed the staff's acceptance review concerns and by letter dated November 4, 2009, the NRC accepted the Point Beach Units 1 and 2 EPU applications.