

POLICY ISSUE (Information)

June 2, 2005

SECY-05-0098

FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations /RA/

SUBJECT: STATUS REPORT ON POWER UPRATES

PURPOSE:

To provide the Commission an update on the status of power uprate activities. This Commission paper summarizes the staff's accomplishments and challenges since the last update in SECY-04-0104, dated June 24, 2004. The staff will continue to keep the Commission informed of the status of power uprate activities by providing annual status reports and by other means as appropriate. Status reports on the power uprate program are generated in response to a staff requirements memorandum dated February 8, 2002.

SUMMARY:

Since the last status update, the staff has made progress in reviewing plant-specific power uprates, stayed abreast of operating experience with potential effects on power uprate reviews, continued to monitor performance related to the effectiveness and efficiency measures established for power uprate reviews, and continued to look for ways to improve the power uprate process. Details of the staff's progress are provided in this Commission paper and the attachments.

CONTACT: John F. Stang, NRR/DLPM
(301) 415-1345

BACKGROUND:

Power uprates are categorized according to power increases and the methods used to achieve the increase. A MUR power uprate results in a power level increase that is less than 2 percent and is achieved by implementing advanced techniques for calculating reactor power. SPUs usually result in power level increases that are up to 7 percent and generally do not involve major plant modifications. EPU's result in larger power level increases than SPUs and usually

require significant modifications to major plant equipment. The NRC has approved EPU for increases as high as 20 percent.

This status report is written in response to a staff requirements memorandum dated February 8, 2002. The staff provided its last update in SECY-04-0104, dated June 24, 2004. This update summarizes the staff's accomplishments and challenges since the last update.

To date, the staff has completed the following actions:

- approved five plant-specific power uprates (one extended power uprate (EPU), three stretch power uprates (SPUs), and one measurement uncertainty recapture (MUR) power uprate);
- issued acceptance review letters for the Indian Point Unit 3, Beaver Valley Units 1 and 2, Browns Ferry Units 1, 2, and 3, Calvert Cliffs Units 1 and 2, and Fort Calhoun power uprate applications;
- continued to use Review Standard (RS)-001, "Review Standard for Extended Power Uprates," for EPU reviews;
- conducted additional reviews of Exelon Generating Company, LLC's (Exelon's) evaluations of the causes of flow-induced vibration (FIV) issues at Dresden and Quad Cities;
- continued to hold discussions regarding FIV issues with General Electric Nuclear Energy (GENE) and the Boiling Water Reactor Owners Group (BWROG)
- met with industry on September 17, 2004, to discuss ongoing ultrasonic flow meters (UFMs) issues;
- performed a pilot engineering inspection at Vermont Yankee with focus on the power uprate application;
- discussed the approval of the Indian Point Units 2 and 3, and Seabrook SPUs with external stakeholders, including Congressional delegates and their staff, through public meetings and correspondence;
- presented information on the Waterford EPU application to the Advisory Committee on Reactor Safeguards (ACRS), and the ACRS Subcommittee on Thermal-Hydraulic Phenomena;
- discussed the power uprate program at a panel session during the 2005 NRC Regulatory Information Conference (RIC);
- met with the State of New Jersey to discuss EPU reviews;
- visited Switzerland and Sweden in June 2004 to discuss the NRC's Power Uprate Program and gathered information on lessons learned with international power uprate programs;
- briefed a Japanese delegation on NRC's Power Uprate Program; and
- provided input on power uprates for the 2005 U.S. National Report for the Convention on Nuclear Safety.

The staff will continue to keep the Commission informed of the status of power uprate activities by providing annual status reports and by other means as appropriate.

DISCUSSION:

Power Uprate Applications

Approved Power Uprates

This status update covers power uprates approved since June 24, 2004 (Attachment 1). During this period, the staff approved power uprates for five nuclear power plant units, resulting in a combined increase of 735 megawatts thermal (MWt) or approximately 245 megawatts electric (MWe). This brings the total number of power uprates approved since 1977 to 105, resulting in a combined increase of approximately 13250 MWt or 4417 MWe to the Nation's electric generating capacity.

Ongoing Reviews of Power Uprates

The staff is currently reviewing power uprates for 11 nuclear power plant units (three MUR power uprates, two SPUs, and six EPU's (Attachment 2)). If approved, these power uprates will result in 2714 MWt or 905 MWe added to the Nation's electric generating capacity. The staff has given the review of power uprates a high priority, as previously directed by the Commission.

Expected Power Uprates

In January 2005, the staff surveyed all licensees to obtain information on whether they planned to submit power uprate applications over the next 5 years (Attachment 3). Based on this survey and information obtained since the survey, licensees plan to request power uprates for 28 nuclear power plant units over the next 5 years. If approved, these power uprates will result in an increase of about 4139 MWt or approximately 1379 MWe. Based on the results of the January 2005 survey and the staff's models for reviewing power uprates, approximately 24 full-time equivalent staff will be used to review power uprate applications expected over the next 5 years. These resources are budgeted and the staff does not anticipate needing additional resources for power uprate reviews.

Vermont Yankee EPU Review

On September 10, 2003, Entergy Nuclear Northeast (Entergy) submitted an EPU application for Vermont Yankee. Entergy requested a 20-percent (310 MWt) EPU. Some of the technical issues associated with the power uprate include: (1) steam dryer cracking, (2) FIV issues, (3) flow-accelerated corrosion, and (4) use of containment overpressure for calculating net positive suction head for emergency core cooling system pumps.

The NRC has received numerous stakeholder comments, questions, and concerns regarding this proposed EPU (from members of the public, intervenor groups, the State and Congress).

Based on the public's interest and the amount of correspondence associated with the Vermont Yankee EPU review, the staff established a communications team and developed a communication plan for Vermont Yankee.

On August 30, 2004, the Vermont Department of Public Service (DPS) and the New England Coalition (NEC) filed requests for hearings in connection with the proposed EPU. The NRC established an Atomic Safety Licensing Board (ASLB) panel of three NRC administrative judges to review the requests. The ASLB found that each of the petitioners has standing to intervene. Currently, the only contentions that have been admitted by the ASLB and that will be argued during the hearing are two contentions from DPS related to the use of containment overpressure and two contentions from NEC related to large transient testing and the structural integrity of the cooling towers. The ASLB has not yet set a date for the hearing. The date will be set after the NRC staff provides a revised EPU schedule to the ASLB.

As discussed in the NRC's letter to Entergy dated October 15, 2004, the Vermont Yankee EPU review schedule is being impacted primarily due to concerns about the steam dryer analysis. On April 5, 2005, Entergy submitted a supplement to the EPU application. This submittal is the last in a series of supplements to address the concerns in the October 15, 2004, letter. The NRC staff is currently reviewing these submittals and is reassessing the review schedule. Once the reassessment is complete, the information will be provided to the ACRS so that the subcommittee and full committee meeting can be scheduled. The schedule information will also be provided to the ASLB so that a date for the hearing on the proposed EPU can be set as noted above. The staff will not approve the EPU license amendment until all outstanding technical issues have been resolved to the staff's satisfaction, to ensure that after approval and implementation of the EPU an adequate safety margin is maintained. The staff's timeliness goal of completing the review within one year or by the licensee's need date of the fall of 2005 likely will not be met. The staff is making every effort to meet the goal, however the staff will not sacrifice safety to meet the goal.

Operating Experience Related to Power Upgrades

Attachment 7 to this memorandum provides details about power upgrade operating experience issues over the last year.

Staff Performance vs. Established Goals

Established Goals

Maintaining safety remains the staff's highest priority in reviewing power upgrade applications and the staff intends to ensure that safety is maintained. The staff has established performance goals of 6 months and 960 staff-hours for reviewing MUR power upgrade applications, 9 months and 1800 staff-hours for reviewing SPU applications, and 12 months and 3900 staff-hours for reviewing EPU applications. The staff will continue to ensure that the goal of maintaining safety is not compromised in order to meet these timeliness and resource expenditure goals.

The timeliness and resource expenditure goals assume that licensees' submittals are consistent with established guidelines; that licensees' submittals do not include other non-power

uprate related requests; that licensees' submittals do not result in substantive requests for additional information (RAIs); and that licensees respond to RAIs within established schedules. In establishing the above goals, the staff recognized that in some cases, licensees' plans for implementing power uprates are more flexible than the timeliness goals described above. As a result, the staff can meet its timeliness goals by either completing the reviews according to the numerical goals or by completing the reviews in time to support licensees' proposed implementation schedules, whichever is longer. This flexibility allows the staff to utilize its resources to better support other high-priority activities.

Staff Performance

Since the staff, at the direction of the Commission, established timeliness and resource expenditure goals for power uprate reviews, the staff has met the timeliness goals for all power uprate reviews. Specifically, for the five power uprate applications approved since June 2004, the Indian Point Units 2 and 3 SPUs were issued within the 9 months goal. The Waterford EPU, Seabrook SPU and Palisades MUR power uprate were all approved before the licensees' need dates.

However, the staff only met the hourly goal for completing power uprate reviews for 2 of the 5 power uprate applications approved since June 2004. The goal hours were met for the power uprate reviews of the Palisades MUR (948 hours) and Indian Point Unit 3 SPU (1660 hours). For the Seabrook (2883 hours) and Indian Point Unit 2 (2800 hours) SPU reviews, and the Vermont Yankee (5995 hours) currently under review, and Waterford (7344 hours) EPU reviews, the staff has exceeded the hourly goals for the reviews. Attachments 4, 5, and 6 summarize the hours charged by the staff for the power uprate reviews recently completed, and for the power uprate applications currently under review.

The key reason the staff exceeded the hourly goals is the quality of the power uprate applications. The applications lacked sufficient technical information to allow the staff to decide that safe plant operation will continue after the proposed power uprate. The staff had to request additional information from the licensees resulting in several supplements to the original applications. The original Waterford EPU application lacked so much technical information that 32 supplements were needed to provide the information required by the staff.

To address the hourly-goal issue, the staff is using the Office of Nuclear Reactor Regulation (NRR) Work Planning Center (WPC) to control and monitor all power uprate applications. The WPC monitors the timeliness and hourly goals for power uprates. The staff is also developing additional guidance for power uprate reviews. The guidance is intended to provide project managers with a comprehensive set of directions on how to process a power uprate license amendment. The guidance will emphasize a pre-application review of each power uprate starting approximately 1 year before the power uprate application is submitted. This will initiate a dialogue between the staff and the licensee to ensure that sufficient technical information is included in each application. The guidance will also focus on a timely and thorough acceptance review of each power uprate application. The guidance is scheduled to be issued by the end of 2005.

The staff will continue to closely monitor power uprate reviews and keep the Commission informed when the performance goals are not met.

Review Standard for EPU

RS-001 was issued in December 2003. RS-001 is a first-of-a-kind document that provides a comprehensive process and technical guidance for NRC EPU reviews. The document also provides useful information to licensees for EPU applications. The development of RS-001 was a significant process improvement effort and involved all divisions within NRR. The final RS fully addressed the public comments received on the draft RS and was endorsed by the ACRS as an "excellent review standard." In previous memoranda to the Commission, the staff stated that it would ask the Committee To Review Generic Requirements (CRGR) to endorse the final version of RS-001. After discussing the matter with the staff, the CRGR chairman determined that a CRGR formal review was not required.

The staff is currently using RS-001 for reviewing EPU. The staff used RS-001 for the first time to review the Waterford EPU application, which was approved on April 15, 2005. RS-001 was developed to improve the effectiveness and efficiency of EPU reviews. The staff exceeded the review hours goals in the Waterford and Vermont Yankee reviews. The staff is performing lessons learned reviews to determine why the hourly goals were exceeded. The staff is also reviewing operating experience at plants which have implemented EPU. The staff will make changes to RS-001 based on these reviews and operating experience insights.

Interactions With Internal and External Stakeholders

ACRS Briefings on the Waterford EPU

The staff briefed the ACRS Subcommittee on Thermal-Hydraulic Phenomena on January 26, 2005, and the ACRS Full Committee on February 10-11, 2005, on the Waterford 8-percent EPU. The ACRS questioned the staff about boron precipitation during long-term cooling after a loss-of-coolant accident, large transient testing, and the effects of FIV on components as a result of the EPU.

The ACRS complimented the staff on the review of the Waterford EPU as being comprehensive. In addition, the ACRS indicated that the rationale for the staff's decisions in the safety evaluation was clear. The ACRS attributed the high quality of the staff's review to RS-001.

Power Uprate Presentation at the 2005 NRC Regulatory Information Conference

The NRC chaired a power uprate panel at the 2005 RIC. The panel included several distinguished industry representatives and external and internal stakeholders. The discussion focused on the challenges and operating experience of plants with approved power uprates. The session was a great success and was well attended by over 250 people. There was a frank and open exchange of information between the panel and audience.

States Activities

In February 2005, NRR management met with representatives of the State of New Jersey, and made a presentation on the NRC's Power Uprate Program. The presentation focused on how the staff reviews and approves an EPU. The presentation included details on RS-001 and the interface between States and the NRC during an EPU review.

International Activities

The staff is continuing its dialogue with international regulatory counterparts on power uprates and technical challenges. The staff visited Switzerland and Sweden in June 2004 to discuss the NRC's Power Uprate Program and gathered information on lessons learned from international power uprate programs. The staff provided input on power uprates for the 2005 U.S. National Report for the Convention on Nuclear Safety. The input included a description of the NRC's Power Uprate Program and details of staff activities related to operating experience issues in plants that have implemented power uprates.

In September 2005, NRR management briefed a Japanese delegation on the status of the NRC's Power Uprate Program, and the operating experience of plants which have implemented power uprates.

Challenges

The staff continues to be challenged by various FIV issues at Quad Cities and Dresden, and by issues associated with EPUs currently under review. Based on these challenges, the staff is evaluating the need to modify guidance for future power uprate reviews, and the need to revisit previous reviews of power uprates. The staff is monitoring operating experience issues related to power uprates to ensure that review guidance is updated and is focused on reactor safety. The staff also continues to monitor its performance related to power uprate reviews, especially the hourly goals for completing power uprate reviews.

Due to extensive public interest and correspondence from stakeholders, the staff continues to be challenged with activities related to the Vermont Yankee EPU review. The staff has dedicated resources to deal with these issues.

COMMITMENTS:

Listed below are the actions or activities committed to by the staff in the paper:

1. Perform lessons learned reviews concerning the use of RS-001;
2. Update power uprate guidance documents as necessary;
3. Continue to monitor operating experience at plants that are operating at uprate power levels;
4. Continue to interface with owners groups;
5. Continue international exchange of information and operating experiences; continue to monitor effectiveness and efficiency goals; and

6. Review the inspection activities related to the power uprate program and incorporate the Vermont Yankee inspection lessons learned as appropriate. This issue will be reported to the Commission in a separate Commission paper as required in staff requirements memorandum dated December 23, 2004.

/RA/

Luis A. Reyes
Executive Director
for Operations

- Attachments:
1. Table 1 - Power Uprates Approved Since June 2004
 2. Table 2 - Power Uprate Applications Currently Under Staff Review
 3. Table 3 - Expected Power Uprate Applications
 4. MUR Hourly Charges Through April 2005
 5. SPU Hourly Charges Through April 2005
 6. EPU Hourly Charges Through April 2005
 7. Operating Experience Related to Power Uprates

TABLE 1 - Power Uprates Approved Since June 2004

NO.	PLANT	% UPRATE	MEGAWATTS THERMAL	APPLICATION DATE	APPROVAL DATE	TYPE
1	Palisades	1.4	34	06/18/2003	06/23/2004	MUR
2	Indian Point 2	3.26	101.6	01/29/2004	10/27/2004	SPU
3	Seabrook	5.2	176	03/17/2004	02/28/2005	SPU
4	Indian Point 3	4.85	148.6	06/03/2004	03/24/2005	SPU
5	Waterford	8	275	11/13/2003	04/15/2005	EPU
	TOTAL		735.2			

Power uprates approved since June 2004 have added an additional 735.2 MWt or approximately 245 MWe to the Nation's electric generating capacity.

TABLE 2 - Power Uprate Applications Currently Under Staff Review

Boiling Water Reactor (BWR)
 Pressurized Water Reactor (PWR)

NO	PLANT	RX TYPE	% UPRATE	MWt	SUBMITTAL DATE	PROJECTED COMPLETION DATE	TYPE
POWER UPRATES UNDER REVIEW							
1	Vermont Yankee	BWR	20	319	09/10/2003	TBD*	EPU
2	Browns Ferry 2	BWR	15	494	06/25/2004	TBD*	EPU
3	Browns Ferry 3	BWR	15	494	06/25/2004	TBD*	EPU
4	Browns Ferry 1	BWR	20	659	06/28/2004	TBD*	EPU
5	Palo Verde 1	PWR	2.9	114	07/09/2004	06/30/2005	SPU
6	Palo Verde 3	PWR	2.9	114	07/09/2004	06/30/2005	SPU
7	Beaver Valley 1	PWR	8	211	10/04/2004	TBD*	EPU
8	Beaver Valley 2	PWR	8	211	10/04/2004	TBD*	EPU
9	Calvert Cliffs 1	PWR	1.3	37	01/31/2005	08/01/2005	MUR
10	Calvert Cliffs 2	PWR	1.3	37	01/31/2005	08/01/2005	MUR
11	Fort Calhoun	PWR	1.6	24	03/31/2005	10/01/2005	MUR
	TOTAL			2714			

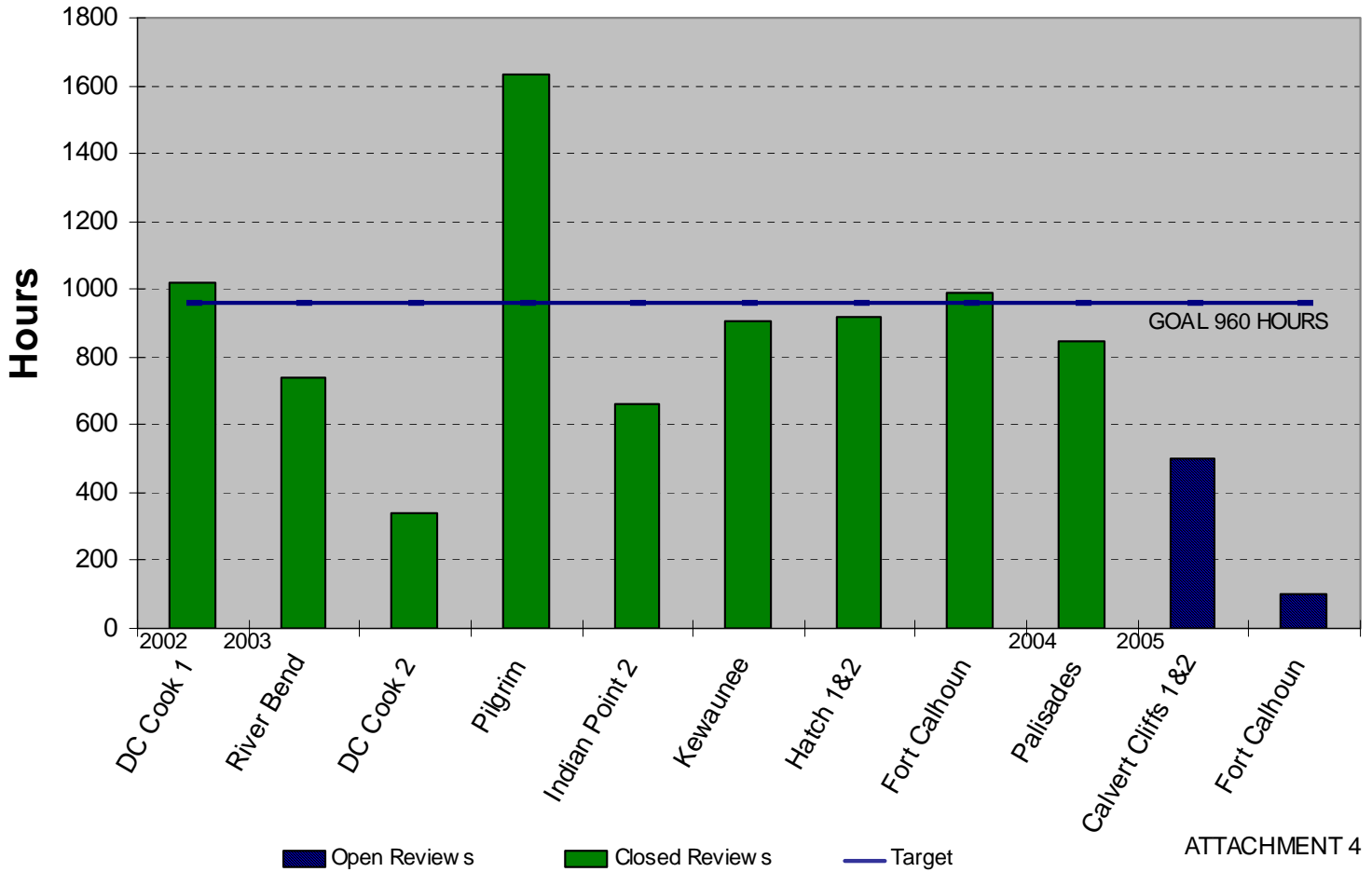
Power uprates currently under review could add an additional 2714 MWt or approximately 905 MWe to the Nation's electric generating capacity if approved.

* The projected completion date is uncertain.

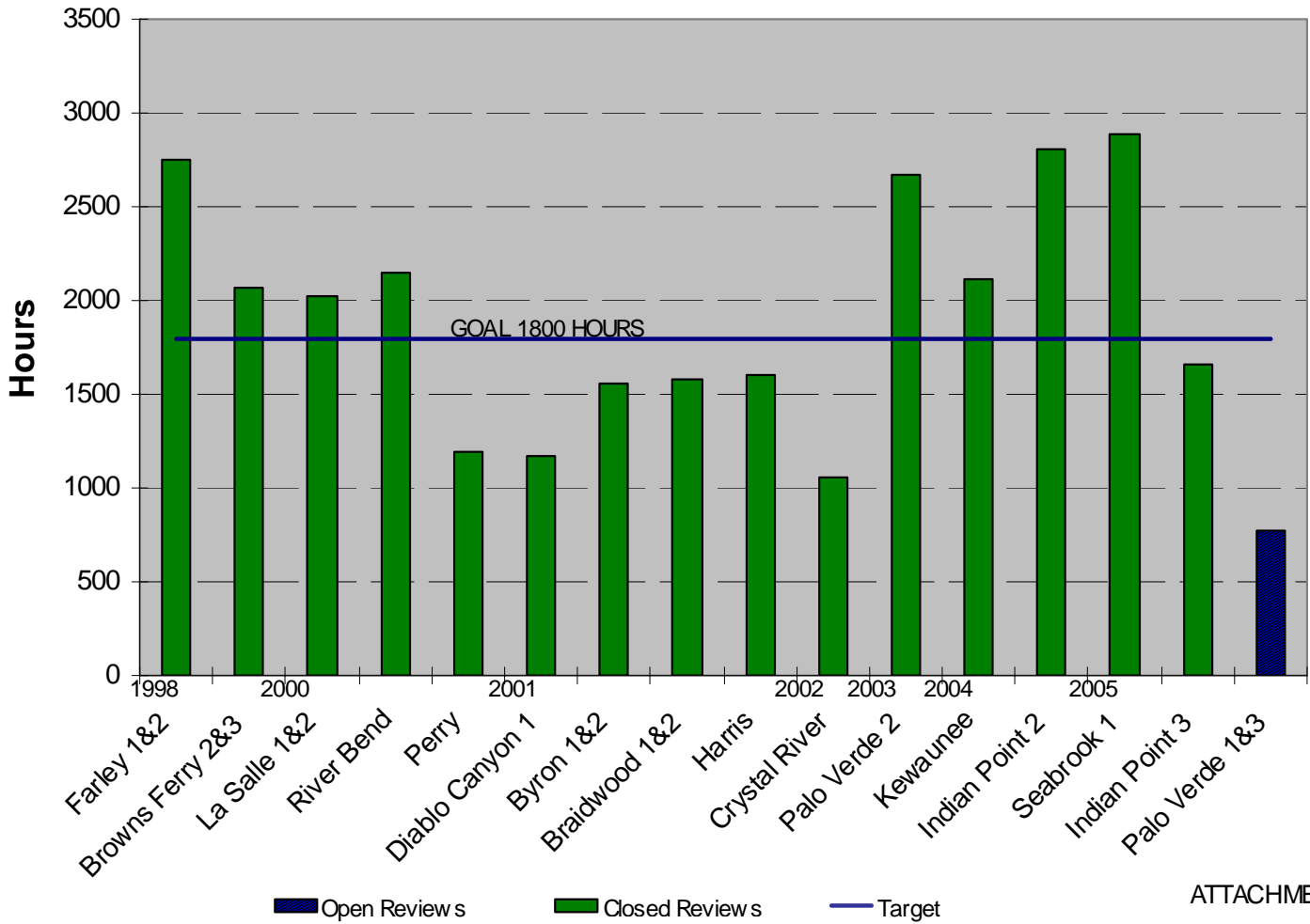
TABLE 3 - Expected Power Uprate Applications

Fiscal Year	Power Uprates Expected	MUR Power Uprates	SPUs	EPUs	MWt	MWe
2005	7	5	0	2	959	320
2006	9	7	0	2	1177	392
2007	3	0	1	2	386	129
2008	5	0	0	5	1309	436
2009	2	0	2	0	232	77
2010	2	2	0	0	76	25
TOTAL	28	14	3	11	4139	1379

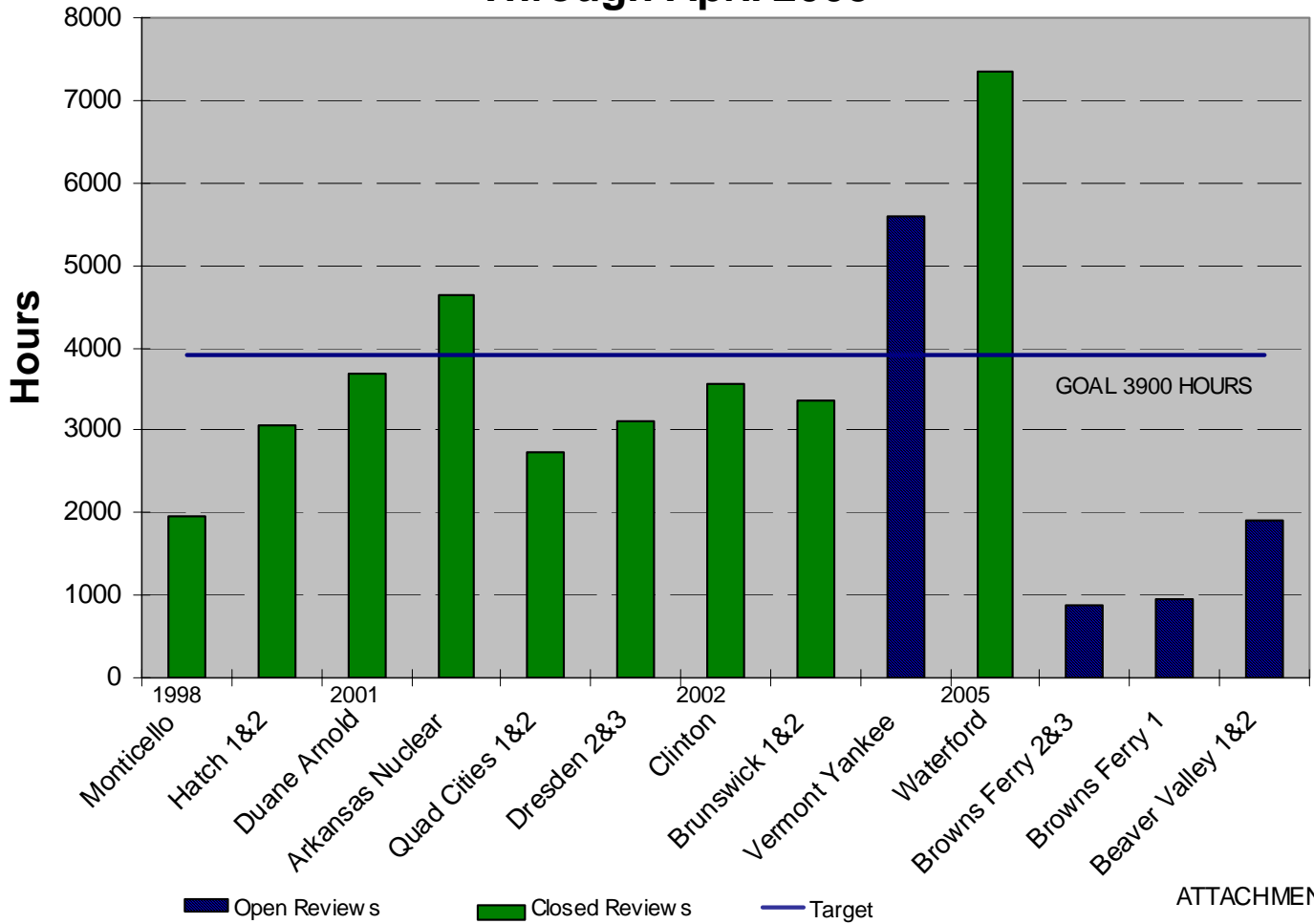
Measurement Uncertainty Power Uprate Hourly Charges Through April 2005



Stretch Power Uprate Hourly Charges Through April 2005



Extended Power Uprates Hourly Charges Through April 2005



ATTACHMENT 6

OPERATING EXPERIENCE RELATED TO POWER UPRATES

Flow-Induced Vibration Issues

The commercial nuclear industry has experienced several incidents of steam dryer cracking and FIV issues at nuclear power plants operating at EPU conditions. The NRC staff continues to closely monitor plant-specific actions and the industry's generic response to this issue. Based on its review, the staff will consider the need for additional regulatory actions.

In June 2002 and again in June 2003, Quad Cities Unit 2 experienced failures of its

ATTACHMENT 7

steam dryer during 17 percent EPU operation. Similarly, the steam dryer in Quad Cities Unit 1 failed during 17 percent EPU operation in November 2003. During a March 2004 refueling outage, Exelon discovered additional cracks in the steam dryer in Quad Cities Unit 2. Exelon identified less significant cracks in the steam dryers in Dresden Units 2 and 3 during their outage inspections. Exelon repaired the damaged steam dryers at Quad Cities and Dresden to improve their structural capability following each instance of steam dryer degradation. In addition to steam dryer cracking, FIV contributed to failures of feedwater sampling probes at Dresden Units 2 and 3, the inoperability of an electromatic relief valve, and degradation of other main steam components and pipe supports at Quad Cities Unit 1.

In response to the adverse flow effects at Quad Cities Units 1 and 2 and subsequent analyses, Exelon committed to maintain those units at pre-EPU power levels, except for limited EPU testing, until the NRC staff is satisfied that the FIV issue is resolved. During the Quad Cities Unit 1 refueling outage in March 2005, Exelon identified cracks in its steam dryer similar to those found in other BWRs operating at uprated power conditions (as well as non-uprated power conditions). The licensee evaluated the structural capability of the modified steam dryers in Dresden Units 2 and 3, and has returned those units to EPU operation. The staff does not consider the FIV issue to pose safety concerns. However, steam dryers and other internal main steam and feedwater components must maintain structural integrity to avoid generating loose parts.

Exelon is planning to install new steam dryers with an improved design in Quad Cities Units 1 and 2 in 2005. The enhanced features of the new steam dryers include thicker outer hoods and cover plates, curved edges to reduce FIV, and slanted outer hood plates. In addition, the new steam dryer in Quad Cities Unit 2 will be instrumented to obtain direct data about the FIV loads acting on the dryer during EPU operation. Over the past 6 months, the staff has conducted numerous public meetings with Exelon to discuss the licensee's FIV analyses for the Dresden and Quad Cities steam dryers and other components, and its extent of condition review of EPU FIV issues. The staff also observed the fabrication of the Quad Cities replacement steam dryers, and installation of the instrumentation on the Quad Cities Unit 2 replacement steam dryer. The staff is currently reviewing the licensee's design and analysis of the replacement steam dryers for Quad Cities Units 1 and 2 to demonstrate its structural capability for EPU conditions, and the startup test procedure for Quad Cities Unit 2 following the steam dryer replacement. The staff expects Exelon to request NRC approval to return Quad Cities Units 1 and 2 to EPU power following replacement of their steam dryers. Entergy has modified the steam dryer at Vermont Yankee to increase its structural capability in support of its request to operate the plant at EPU conditions. The licensee recently submitted an analysis of the structural capability of the modified steam dryer at Vermont Yankee. The staff is currently reviewing the licensee's analysis.

The staff monitors the inspection results of steam dryers in BWR plants during refueling outages for potential adverse flow effects. For example, licensee inspections of the slanted hood steam dryer at LaSalle Unit 2 in the spring of 2005 found only indications on the lug support bracket only after several years of operation at 5 percent power uprate conditions. Further, licensee inspections of the slanted hood steam dryer at Brunswick Units 1 and 2 in the spring of 2005 following several years of EPU operation found several fatigue and stress corrosion cracks that the licensee has resolved by

repair or analysis.

The BWROG is leading the industry's efforts in assessing the generic implications of potential adverse flow effects of power uprate operation, and has several initiatives underway to address this issue. The BWROG issued a lessons learned report in November 2004 to help licensees avoid adverse flow effects of EPU operation. General Electric also revised its steam dryer inspection guidelines in November 2004 in response to industry experience with adverse flow effects under EPU conditions. The staff has provided comments to the BWROG on its EPU lessons learned report and the revised General Electric steam dryer inspection guidelines. The staff will continue to hold public meetings with the BWROG to discuss industry activities to resolve this issue.

The Office of Nuclear Reactor Regulation (NRR) is working with the Office of Nuclear Regulatory Research (RES) on the long-term resolution of potential adverse flow effects of power uprate operation. RES has assisted NRR during reviews of steam dryer analyses presented by licensees at public meetings. NRR is assisting RES in compiling an operating experience report on adverse flow effects of EPU operation at BWR plants. The BWROG has several initiatives to assess industry-wide operating experience with post-EPU FIV issues. NRR is also working with RES in assessing the industry's resolution of the issues.

Abnormalities in Ultrasonic Flow Meter Instrumentation

The staff is following the industry's evaluations of a problem at plants that use an ultrasonic flow meter of the type used for MUR power uprates. This problem has led to unexpected but small differences in power level indications at some plants. The staff is closely monitoring this issue to identify information relevant to the use of feedwater measurement techniques in power uprate applications. The staff is also clarifying the safety evaluation basis for feedwater measurement techniques in power uprate applications, based on the operating experience. After completing the evaluation of pending MUR power uprate applications, the staff will determine whether a generic communication or updating staff review guidance is needed.