UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 24, 2017

LICENSEE: PSEG Nuclear LLC

FACILITY: Hope Creek Generating Station

SUBJECT: SUMMARY OF DECEMBER 21, 2016, MEETING WITH PSEG NUCLEAR LLC REGARDING POTENTIAL MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE (CAC NO. MF8874)

On December 21, 2016, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) and representatives of PSEG Nuclear LLC (PSEG, the licensee) at the NRC Headquarters, One White Flint North, 11555 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to discuss a potential future measurement uncertainty recapture (MUR) power uprate license amendment request (LAR) for the Hope Creek Generating Station (Hope Creek). The meeting notice and agenda, dated December 5, 2016, are available in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML16340A081. A list of attendees is enclosed.

Background

Nuclear power plants are licensed to operate at a specified maximum core thermal power, often called rated thermal power (RTP). Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix K, "ECCS Evaluation Models," formerly required licensees to assume that the reactor had been operating continuously at a power level at least 1.02 times the RTP level when performing loss-of-coolant accident (LOCA) and emergency core cooling system (ECCS) analyses. This requirement was included to ensure that power measurement uncertainties were adequately accounted for in the safety analyses. In practice, many of the design bases analyses assumed a 2 percent power uncertainty, consistent with 10 CFR Part 50, Appendix K.

A revision to 10 CFR Part 50, Appendix K, effective on July 31, 2000, allowed licensees to use a power level less than 1.02 times the RTP for the LOCA and ECCS analyses, but not less than the RTP, based on the use of state-of-the art feedwater flow instrumentation that reduces the degree of uncertainty associated with the feedwater flow measurement. The reduced uncertainty provides a more accurate calculation of the thermal power level. Licensees can use a lower uncertainty in the LOCA and ECCS analyses, provided the licensee has demonstrated that the proposed value adequately accounts for the instrumentation uncertainties. Because there continues to be substantial conservatism in other Appendix K requirements, sufficient margin to ECCS performance in the event of an LOCA is preserved.

However, the final rule, by itself, did not allow increases in licensed power levels. Because the licensed power level for a plant is contained in the plant's operating license, proposals to raise the licensed power level must be reviewed and approved under the license amendment process. MUR power uprate license amendments increase the licensed power level by less than 2 percent. They are achieved by implementing improved techniques for calculating reactor power by using more accurate feedwater flow measurement instrumentation.

Discussion

The licensee presented information as shown in the slides provided at the meeting (ADAMS Accession No. ML16355A499).

The licensee noted the following during its presentation:

1. Hope Creek was originally licensed at a power level of 3,293 megawatts thermal (MWt). Hope Creek has been previously approved for a MUR and extended power uprate (EPU). The current power level is 3,840 MWt. The proposed MUR would increase the licensed power by about 1.6 - 1.7 percent. The resulting power level will be between 3,902 – 3,906 MWt, which is about 118.6 percent above original licensed thermal power.

2. The 2008 EPU restored the 2 percent power level margin assumptions. The current analysis assumes a 2 percent uncertainty on the RTP measurement.

3. Hope Creek is currently using the originally installed Venturi Flow Meters. The licensee installed CE Nuclear Power Crossflow Ultrasonic Flow Meters as part of the 2001 MUR. These flow meters are still installed; therefore, the data from these meters is available. The proposed new MUR would use a Cameron CheckPlus Leading Edge Flow Meter (LEFM) and would credit the increased accuracy of the LEFM in order to justify an increase in power level.

4. The licensee stated that the proposed MUR LAR will be submitted in accordance with applicable NRC guidance and will be consistent with recent MUR LAR submittals.

5. The licensee plans to propose three LEFM operational modes: normal, maintenance, and fail. This approach was last approved for use by the NRC at Shearon Harris Nuclear Power Plant in 2012.

6. Modifications to the high pressure turbine and installation of the LEFMs are the only major plant equipment modifications the licensee is anticipating. The LEFMs underwent full scale testing (not full flow), mirroring the actual plant piping configuration for the installation location.

7. The licensee intends to implement the proposed MUR concurrent with a Power Range Neutron Monitor (PRNM) digital upgrade in the Spring 2018 outage. The licensee's PRNM LAR[1] is currently under review with the NRC staff. The PRNM LAR and the proposed MUR would impact some of the same technical specification (TS) reactor trip function and control rod block function instrumentation setpoints. The licensee intends to submit the MUR request prior to approval of the PRNM LAR. The licensee will base the requested MUR TS changes on the approval and implementation of the PRNM LAR, linking the two applications. The licensee intends to provide a license condition in the proposed MUR LAR stating that the Hope Creek MUR implementation is conditioned on the PRNM LAR approval and implementation. Any plant computer changes needed for the proposed Hope Creek MUR will be implemented concurrently with the plant computer changes for the PRNM LAR.

[1] ADAMS Accession No. ML15323A268

8. Hope Creek is in the process of transitioning from GE14 to GNF2 fuel.

9. The licensee stated that the current safety analyses remain bounding for the proposed power level, including the Chapter 15, "Updated Final Safety Analysis," events.

10. A stress analysis of the Hope Creek steam dryer was completed in 2008 to support the EPU. The minimum alternating stress ratio (MASR) was determined to be greater than 2.0 at that time. Subsequently, an error was identified in the acoustic circuit model, which reduced the MASR to 1.07. The NRC staff reviewed this reduction and determined that there was reasonable assurance that the Hope Creek steam dryer would maintain structural integrity for continued operation at EPU conditions.[2] Preliminary analysis shows that the MASR at the proposed MUR condition would be approximately 1.04 at the same two locations that currently have an MASR of 1.07. All other locations would maintain an MASR greater than or equal to 1.10. PSEG is proposing to increase inspection of the two locations that would have an MASR of 1.04 during the first two refueling outages, and assuming the inspections went well, would then follow the NRC-approved inspection guidelines in BWRVIP-139P-A: BWR Vessel and Internals Project, "Steam Dryer Inspection and Flaw Evaluation Guidelines."[3]

11. The licensee is planning on submitting a LAR to adopt maximum extended load line limit analysis plus (MELLLA+) with a planned implementation of 2019. This request would also impact the steam dryer, and those impacts will need to be considered at the time of the request.

12. The licensee stated that they do not anticipate any impacts on human factors evaluations associated with the proposed MUR LAR.

13. The licensee stated that there will be no changes to the direct current loads, and changes to the alternating current loads are expected to be minor and within the capabilities of the existing system (i.e. within the calculation margins).

14. PSEG forecasts submittal of the MUR LAR early second quarter of 2017 and would request NRC review and approval by March 2018. Amendment implementation is planned for April 2018. The plant equipment modifications would need to be done during an outage; however, the implementation of the MUR can be done online if the modifications have already been completed.

The NRC staff made the following comments:

1. The NRC staff noted that several MUR submittals have not requested maintenance mode reduced accuracy operation. Approval of this mode of operation adds complexity and will require additional NRC staff review.

2. The NRC staff found an MASR of 1.07 acceptable for continued operation at EPU conditions based on operating experience and the more complete testing PSEG has

[2] ADAMS Accession No. ML16288A589
[3] ADAMS Accession No. ML101270123

done of the Hope Creek steam dryer at EPU conditions. An MASR of 1.07 is not necessarily acceptable if the operating conditions change (i.e., for the proposed MUR operating conditions). The NRC staff currently finds that an MASR of 2.0 provides protection of the steam dryer from any unknown conditions. Therefore, all locations with an MASR below 2.0 under the proposed MUR operating conditions may need to be looked at through additional inspections, not just the areas with an MASR below 1.07.

3. The NRC staff has found audits to be a useful tool when reviewing LARs and may wish to conduct in audit during review of the proposed MUR LAR.

4. The NRC staff reminded PSEG that both direct current and alternating current loads need to be evaluated for the proposed MUR operating conditions. Previous MUR LAR submittals have been lacking in detail in this area.

Members of the public were in attendance. Public meeting feedback forms were not received.

Please direct any inquiries to me at 301-415-1603 or by e-mail to Carleen.Parker@nrc.gov.

Sincerely,

Carleen J. Parker, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosure:
List of Attendees

cc w/enclosure: Distribution via Listserv

LIST OF ATTENDEES

DECEMBER 21, 2016, MEETING WITH PSEG NUCLEAR LLC

HOPE CREEK GENERATING STATION

POTENTIAL FUTURE MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE

LICENSE AMENDMENT REQUEST

Name	**Organization**
Carleen Parker	U.S. Nuclear Regulatory Commission (NRC)
Eric Oesterle	NRC
Jennifer Whitman*	NRC
Chakrapani Basavaraju	NRC
Ian Tseng	NRC
Andrew Johnson	NRC
Rossnyev Alvarado	NRC
Shavon Edmonds	NRC
Nadim Khan	NRC
Victoria Huckabay	NRC
Rick Ennis	NRC
Richard Stattel	NRC
Elijah Dickson*	NRC
Brian Thomas	PSEG Nuclear LLC (PSEG)
Larry King	GE-Hitachi Nuclear Energy (GEH)
James Boyer	PSEG
Paul Lindsay	PSEG
Larry Curran	PSEG
Lisa Schichlein	GEH
Harold Trenka	PSEG
Paul Duke	PSEG
David Mannai	PSEG
David Heinig	Sargent and Lundy, LLC
Robert Gallaher Jr.	PSEG
William Kopchick	PSEG
Mike Cook*	GEH
Hoa Hoang*	GEH
George Paptzun*	GEH
Mike McAuliffe*	Platts

* by telephone

Enclosure

3. The NRC staff has found audits to be a useful tool when reviewing LARs and may wish to conduct in audit during review of the proposed MUR LAR.

4. The NRC staff reminded PSEG that both direct current and alternating current loads need to be evaluated for the proposed MUR operating conditions. Previous MUR LAR submittals have been lacking in detail in this area.

Members of the public were in attendance. Public meeting feedback forms were not received.

Please direct any inquiries to me at 301-415-1603 or by e-mail to Carleen.Parker@nrc.gov.

Sincerely,

/RA/

Carleen J. Parker, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosure:
List of Attendees

cc w/enclosure: Distribution via Listserv

DISTRIBUTION:
PUBLIC
LPL1 R/F
RidsACRS_MailCTR Resource
RidsNrrDorlLpl1 Resource
RidsNrrLALRonewicz Resource
RidsRgn1MailCenter Resource
AJohnson, NRR
SEdmonds, NRR
VHuckabay, NRR
RStattel, NRR
JWhitman, NRR
RidsNrrPMHopeCreek Resource
JBowen, OEDO
TWertz, NRR
EOesterle, NRR
CBasavaraju, NRR
ITseng, NRR
RAlvarado, NRR
NKhan, NRR
REnnis, NRR
EDickson, NRR

ADAMS Accession No.: ML16362A202

OFFICE	DORL/LPL1/PM	DORL/LPL1/LA	DORL/LPL1/BC(A)	DORL/LPL1/PM
NAME	CParker	LRonewicz	SKoenick	CParker
DATE	01/23/2017	12/28/2016	01/23/2017	01/24/2017

OFFICIAL RECORD COPY