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Nuclear L.L.C.

10 CFR 50.90

LR-N08-0286
LAR H08-01, RAI

JAN 07 2009

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: **Response to RAI, License Amendment Request - Hydrogen Water Chemistry Low Power Restriction**

Reference (1) Letter from PSEG to NRC: "License Amendment Request - Hydrogen Water Chemistry Low Power Restriction, Hope Creek Generating Station," dated April 25, 2008

In Reference 1, PSEG Nuclear LLC (PSEG) submitted a license amendment request to revise the requirements for operation of the Hope Creek Generating Station (HCGS) Hydrogen Water Chemistry (HWC) system. The proposed change would remove restrictions on operation of the HWC system at low power (thereby increasing the time that it is in service) while maintaining required Main Steamline Radiation Monitor (MSLRM) functions.

The NRC provided PSEG a Request for Additional Information (RAI) on the license amendment request. The response to the RAI is provided in Attachment 1 to this submittal.

No regulatory commitments are contained in this submittal.

If you have any questions or require additional information, please do not hesitate to contact Mr. Jeff Keenan at (856) 339-5429.

A001
NRR

JAN 07 2009

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 1/7/09
(Date)

Sincerely,

George P. Barnes

George P. Barnes
Site Vice President
Hope Creek Generating Station

Attachments (1)

S. Collins, Regional Administrator - NRC Region I
R. Ennis, Project Manager - USNRC
NRC Senior Resident Inspector - Hope Creek
P. Mulligan, Manager IV, NJBNE
PSEG Corporate Commitment Manager
Hope Creek Commitment Manager

REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

HYDROGEN WATER CHEMISTRY LOW POWER RESTRICTION

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

By application dated April 25, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML081430002), PSEG Nuclear LLC (PSEG or the licensee) submitted a license amendment request for the Hope Creek Generating Station (HCGS). The proposed amendment would revise the Technical Specifications (TSs) to remove the current restriction on operation of the hydrogen water chemistry (HWC) system at low power levels.

The Nuclear Regulatory Commission (NRC) staff has reviewed the information the licensee provided that supports the proposed amendment and would like to discuss the following issues to clarify the submittal.

1) Sections 3.0 and 5.1 of Attachment 1 of PSEG's application dated April 25, 2008, indicate that the consequences of a postulated control rod drop accident (CRDA) are only of concern, with respect to potential fuel failure, below 10% of rated thermal power (RTP). Based on review of Section 3.1 of General Electric (GE) Report NEDO-10567, "Rod Drop Accident Analysis for Large Boiling Water Reactors," dated March 1972 (ADAMS Accession No. ML010870249); HCGS Updated Final Safety Analysis Report (UFSAR) Sections 7.7.1.1.5 and 15.4.9; and TS 3/4.1.4, "Control Rod Program Controls," and its Bases, it appears that the 10% of RTP value correlates to the low power setpoint (LPSP) associated with the rod worth minimizer. Specifically, as discussed in Bases for TS 3/4.1.4, when thermal power is greater than the LPSP, there is no possible rod worth which, if dropped at the design rate of the velocity limiter, could result in a peak enthalpy greater than 280 calories/gram (which is the fuel design limit as discussed in NEDO-10567 and UFSAR Section 15.4.9).

   The HCGS extended power uprate amendment (Amendment No. 174 dated May 14, 2008 (ADAMS Accession No. ML081230540)) changed the LPSP from 10% of RTP to 8.6% of RTP. As such, please confirm that, for HCGS, a postulated design basis CRDA is only of concern below 8.6% of RTP (i.e., instead of the 10% value cited in the application).

RESPONSE To RAI #1

The EPU license change (Amendment 174) maintained the same thermal power (MWth) basis for the CRDA which is now 8.6% of rated thermal power (RTP), versus the pre-EPU value of 10%. As discussed in the Amendment 174 SE, the LPSP was changed to 8.6%, as documented in TS Bases 3/4.1.4.

2) The tripping of the mechanical vacuum pumps (MVPs) on a main steam line radiation monitor (MSLRM) high-high signal is credited to mitigate the radiological consequences of a CRDA as described in UFSAR Section 15.4.9. As shown in TS Table 3.3.2-2, the MSLRM high-high setpoint is required to be set at ≤ 3 times the full power background radiation levels. In accordance with footnote ### in this table, below 20% of RTP, the setpoint is based on normal full power operation without the HWC system in operation. Please provide the following information related to the CRDA mitigation function provided by the MSLRMs:

a) What are the expected dose rates near the MSLRMs for a postulated CRDA?

b) What are the typical normal full power background radiation levels (without the HWC system in operation) in the vicinity of each of the MSLRMs?

RESPONSE To RAI #2

(a) There is no calculated dose rate near the MSLRMS for a postulated CRDA. For a postulated CRDA, the expected dose rates near the MSLRMs will be several times the normal full power background levels, as discussed below.

Figure 5 of GE Topical Report NEDO-31400[1], "Safety Evaluation For Eliminating the Boiling Water Reactor Main Steam Line Isolation Valve Closure Function and Scram Function of Main Steam Line Radiation Monitor," provides a graphical relationship of various release rates in orders of magnitude. The figure shows that the noble gas release rate corresponding to a MSRLM trip at 3 times background is about 1000 curies/sec. Figure 5 also shows the normal full power N-16 activity at the MSLRM detectors to be about 100 curies/sec, and the average noble gas release rate associated with a CRDA (flow blockage leading to fuel melt) to be about 6000 curies/sec. The figure indicates that there is considerable margin between the MSLRM trip setpoint and the release rate corresponding to a design-basis CRDA.

(b) The following table provides MSLRM measurements at full power (post-EPU) without HWC in operation:

MSLRMS CHANNEL	DOSE RATE WITHOUT HWC (mR/hr) 96.8% RTP* (actual data)	DOSE RATE WITHOUT HWC (mR/hr) 100% RTP # (extrapolated data)
A	35	36.1
B	38	39.3
C	37.6	38.8
D	38	39.3

* Data was electronically recorded at 96.8% power
\# Extrapolated from 96.8% data

3) The original HWC system hydrogen injection rates caused significant increases in the main steam line (MSL) background radiation levels. As discussed in the licensee's

[1] Reference NRC Safety Evaluation on NEDO-31400, dated May 15, 1991; and Hope Creek Amendment 53, dated August 17, 1992 (ADAMS ML011760514)

application dated September 28, 1988, associated with HCGS Amendment No. 23, the normal full power background radiation levels at that time ranged from 33 to 45 millirem/hour (mR/hr) for the four MSLs. During a hydrogen injection test, with an injection rate of 18 to 20 standard cubic feet per minute, the full power MSL background radiation levels increased to approximately 75 to 80 mR/hr. Since the MSLRMs setpoints were established at 3 times normal full power background (i.e., 99 to 135 mR/hr), sufficient margin was not afforded for any occasional radiation spiking or inherent instrument inaccuracies or drift to justify HWC operation at power levels where a CRDA may be of consequence. As such, as part of HCGS Amendment No. 23, HWC system operation was prohibited below 20% of rated thermal power. Provide the following information regarding the potential impact of the proposed use of the HWC system operation at low power levels:

a) What are the expected background radiation levels with the HWC system in operation for 0 to 20% of rated thermal power in the vicinity of each of the MSLRMs?

b) For 0 to 20% of rated thermal power, quantify the margin to inadvertent MSLRM alarms, tripping of the MVPs, and reactor water sample valve closure taking into consideration: (1) increased background radiation levels due to HWC system operation; (2) instrument uncertainties (e.g., accuracy, drift, etc.); and (3) any other uncertainties (e.g., radiation spiking).

RESPONSE To RAI #3

(a) With HWC in operation between 0 to 20% rated thermal power (RTP), the expected background radiation levels near the MSLRMs are expected to be no more than 1.87 mR/hr, as discussed below.

HWC will be operated at 2.2 scfm hydrogen flow from approximately 5% RTP, when it is first placed in service, to 20% RTP at which point the system will increase H_2 injection linearly from 20 to 100% RTP to a final value of 11 SCFM. The background radiation levels in the vicinity of each of the MSLRMs are expected to be only slightly higher than without HWC in service between 5 and 20% RTP.

The non-HWC radiation levels in the vicinity of each of the MSLRMs recorded during a recent plant start-up were 1.0 mr/hr from 0 to 14% power and increased to an average of 1.69 mR/hr at 20% RTP. The average increase in MSLRM reading at 100% RTP and maximum H_2 injection is 10.7%. Main steam line radiation levels drop approximately in proportion to H_2 injection rate. However, a conservative estimate with HWC in service would be to multiply the 20% RTP value of 1.69 mR/hr by the 10.7% increase experienced at 100% power (refer to RAI#4 response below) which would yield 1.87 mR/Hr. This increase is negligible compared to full power values.

Also note that the original EPU plan was to operate HWC at approximately 9 SCFM at 111.5% of the pre-EPU power level. It was subsequently determined, through discussion with GE-Hitachi, that the post-EPU HWC injection rate would be approximately 11 SCFM. This change was made to support the increase to 111.5%. Based on discussion with GE-Hitachi, no further increase was required following the EPU increase to 115.0% power.

(b) HWC will not be operated when the MVPs are in service so there is no possibility of inadvertent MVP trips due to HWC and therefore margin is not applicable. The MSLRMs can trip the reactor water sample valves at all power levels. The MSLRM alarm setpoints are 1.5 times the normal full power background (NFPB) value. The MSLRM trip setpoints are 3.0 times the NFPB value with an allowable value of 3.6 times NFPB. These setpoints do not change with power level.

The total loop uncertainty for the MSLRM is +/- 20.69% of signal. The setpoints are calculated from post-EPU MSLRMS readings taken at RTP without HWC in service so instrument uncertainty is eliminated. The instruments employ digital filtering and do not normally exhibit spiking. Loop drift is 4.28% of signal. The background radiation levels drop with power level. The average radiation level is estimated to be 1 to 1.87 mR/hr in the 5 to 20 % RTP range. Margins to alarm and trip setpoints are substantially increased in the 0 to 20% RTP range from those at 100% RTP and are listed below.

SETPOINT	SETPOINT VALUE * (mR/hr)	LOOP DRIFT (mR/hr)	20% READING ** (mR/hr)	MARGIN *** (mR/hr)
MSLRM Alarm	52.5	2.25	1.87	48.4
Reactor Water Sample Valve Closure Trip	105	4.5	1.87	98.6

* Lowest of four channels ** Conservative estimate
*** Setpoint minus drift minus reading

4) Please provide a response to address the following comment on the proposed amendment from the State of New Jersey, Department of Environmental Protection, Bureau of Nuclear Engineering (letter to NRC from Mr. Patrick Mulligan dated December 3, 2008):

> Hope Creek should provide verification that the implementation of the power uprate in 2008 did not result in a significant increase in Main Steam Line background radiation at full power with HWC in service and that the power uprate did not have any adverse impact on the operation of the HWC system at low power.

RESPONSE To RAI #4

Dose rates measured by each MSLRM channel at RTP with HWC in service, are as follows:

MSLRMS CHANNEL	Pre-EPU DOSE RATE WITH HWC (mR/hr)	Post-EPU DOSE RATE WITH HWC (mR/hr)
A	37	41.2
B	39.4	42.8
C	38.5	41.2
D	39.1	44.7

The average difference in dose rates is 9.3%. This is not considered to be significant since the total loop accuracy is 20.69% and the alarm setpoint is at 150% of NFPB.

The HWC system was operated successfully from 30% to 100% RTP after all EPU modifications were implemented. The EPU did not make physical changes to the BOP systems that interface with HWC other than increased flow rates in the feedwater/condensate systems at 100% RTP which will have no impact on HWC operation below 20% RTP. An evaluation of post-EPU HWC low power operation, based on EPRI BWRVIP -156 guidelines, has determined that there will be no adverse impacts. This evaluation is part of the design change that is in final development to implement low power HWC and will be further validated as part of the final design change approval process. The design change that implemented the EPU determined that there were no adverse effects on HWC operation.

JAN 07 2009

(The bcc list should not be submitted as part of the DCD submittal - remove this page prior to submittal and make the bcc distribution accordingly.)

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