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Dominion®

December 18, 2008

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Serial No. 08-0017A
NLOS/GDM R3
Docket No. 50-305
License No. DPR-43

DOMINION ENERGY KEWAUNEE, INC. (DEK)
KEWAUNEE POWER STATION
NRC GENERIC LETTER 2004-02 UPDATED SUPPLEMENTAL RESPONSE
POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

In a letter dated September 13, 2004, the NRC issued Generic Letter (GL) 2004-02, *Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors*. This GL was issued to resolve NRC Generic Safety Issue (GSI) 191, *Assessment of Debris Accumulation on PWR Sump Performance*. GL 2004-02 identified a potential susceptibility of recirculation flow paths and sump screens to debris blockage. GL 2004-02 requested that addressees perform an evaluation of the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions in light of the information provided in the letter and, if appropriate, take additional actions to ensure system function. Additionally, addressees were requested to submit the information specified in the letter to the NRC.

By letters dated March 7, 2005, July 6, 2005, September 1, 2005, and February 29, 2008, DEK responded to the GL. By letter dated May 21, 2008, an additional update was provided when requesting an extension for completing GL activities. The required date for completion of the GL 2004-02 corrective actions for Kewaunee Power Station (Kewaunee) was extended from the due date of December 31, 2007 to May 31, 2008 by NRC letter dated December 13, 2007 (ADAMS ML073450594), to June 30, 2008 by NRC letter dated May 29, 2008 (ADAMS ML081490572), and finally to September 30, 2008 by NRC letter dated July 1, 2008 (ADAMS ML 081830247). This letter provides Kewaunee's updated supplemental response to GL 2004-02 following resolution of the topics of downstream effects and chemical effects.

If you have any questions regarding this GL response, please contact Mr. Jack Gadzala at (920) 388-8604.

Sincerely,

J. Alan Price
Vice President – Nuclear Engineering

Summary of Commitments

1. Kewaunee will reassess its reactor vessel core cooling downstream effects evaluation upon issuance of an NRC-approved safety evaluation report for WCAP-16793-NP, Revision 0 (or subsequent revision).

The following commitment made by letter dated November 8, 2004 (Reference 1), is being withdrawn as indicated in Section 3.Q of this letter:

2. The compensatory measure initiated in response to Bulletin 2003-01 to provide sump clogging training for the Emergency Response Organization Emergency Directors is no longer required.

Attachment

Updated Supplemental Response to Generic Letter 2004-02

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mr. J. Alan Price, who is Vice President – Nuclear Engineering of Dominion Energy Kewaunee, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 18th day of December, 2008.

My Commission Expires: 4/30/2009

Ginger L Alligood
Notary Public

GINGER LYNN ALLIGOOD
Notary Public
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310847
My Commission Expires Apr 30, 2009

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ATTACHMENT

UPDATED SUPPLEMENTAL RESPONSE TO GENERIC LETTER 2004-02

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION

UPDATED RESPONSE TO GENERIC LETTER 2004-02
KEWAUNEE POWER STATION

By letter dated February 29, 2008 (Reference 15), Dominion Energy Kewaunee, Inc. (DEK) provided a summary of the resolution approach for Generic Letter (GL) 2004-02. The letter included a summary for each of the following topics:

1. Statement of Overall Compliance
2. Description of Corrective Actions and Schedule
3. Methodology for Demonstrating Compliance
   - 3.A Break Selection
   - 3.B Debris Generation / Zone of Influence
   - 3.C Debris Characteristics
   - 3.D Latent Debris
   - 3.E Debris Transport
   - 3.F Head Loss and Vortexing
   - 3.G Net Positive Suction Head
   - 3.H Coatings Evaluation
   - 3.I Debris Source Term
   - 3.J Screen Modification Package
   - 3.K Sump Structural Analysis
   - 3.L Upstream Effects
   - 3.M Downstream Effects - Components and Systems
   - 3.N Downstream Effects - Fuel and Vessel
   - 3.O Chemical Effects
   - 3.P Licensing Basis

This letter provides an update to the February 29, 2008 supplemental response.

UPDATED RESPONSE:

1. STATEMENT OF OVERALL COMPLIANCE

This response supersedes the Overall Compliance information included in the supplemental response to GL 2004-02 dated February 29, 2008.

Kewaunee's Emergency Core Cooling System (ECCS) is capable of providing long term cooling of the reactor core following a Loss of Coolant Accident (LOCA).

The evaluation of the ECCS as required by GL 2004-02 is complete.

The completed activities include the following major activities:

- Analyses to determine the post-accident debris source term and the quantity of debris potentially able to transport to the ECCS recirculation strainer.
- Evaluations to determine the type and quantity of chemical precipitants that can form in the post-accident sump pool.
- Evaluations to determine the impact on the ECCS and Internal Containment Spray (ICS) System from long term operation with debris laden fluid (downstream effects).
- Replacement of the ECCS recirculation sump strainer.
- Safety related strainer flume testing to confirm the adequacy of the replacement strainer design and to resolve the issue of chemical effects.
- Programmatic enhancements to ensure the assumed post-accident debris load and evaluated conditions are not invalidated by future activities.

2. DESCRIPTION OF CORRECTIVE ACTIONS AND SCHEDULE

This response supersedes the Description of Corrective Actions and Schedule information in the supplemental response to GL 2004-02 dated February 29, 2008.

By letter dated February 29, 2008, DEK indicated that Kewaunee had two outstanding activities to complete the corrective actions required to address the issues identified in GL 2004-02. Those activities were to update the ECCS recirculation strainer performance documentation to integrate flume and fiber

erosion tests performed in 2007, and to update downstream effects evaluations to incorporate the evaluation guidance changes provided in WCAP-16406-P, Revision 1, Evaluation of Downstream Sump Debris Effects in Support of GSI-191.

By letter dated May 21, 2008 (Reference 16), DEK notified the NRC that Kewaunee's downstream effects evaluation revisions were complete. That letter also indicated that a computational fluid dynamics (CFD) analysis was being performed for Kewaunee to analyze the post-LOCA flow streams and velocities in the containment sump pool. Consequently, it was decided that performing additional strainer flume tests would be appropriate to resolve the issue of chemical effects.

The update provided in Section 3.O below confirms that: 1) additional strainer head loss flume tests have been completed, 2) the results are acceptable, and 3) the strainer performance documentation has been updated.

The update provided in Section 3.N below notes that a safety evaluation report is pending for WCAP-16793-NP, Evaluation of Long Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid, Revision 0. Kewaunee used WCAP-16793-NP, Revision 0, to evaluate long term core cooling with chemical precipitants in the recirculation fluid. Upon receipt of a NRC safety evaluation for WCAP-16793-NP, Kewaunee will review its long term core cooling evaluation and determine if any additional analysis or corrective actions are required. There are currently no other outstanding activities for GL 2004-02 resolution.

3. METHODOLOGY FOR DEMONSTRATING COMPLIANCE

3.A BREAK SELECTION

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.B DEBRIS GENERATION / ZONE OF INFLUENCE

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

In Kewaunee's February 29, 2008, GL response, the quantity of debris generated from the postulated worst debris-generating LOCA pipe rupture was presented in Table 3.B-1. After the completion of insulation repairs, the maximum debris load was recalculated and reduced for the categories of fiberglass pipe cover and Thermobestos (calcium silicate bonded with asbestos fibers) insulations. The qualified coating inventory was also revised by implementing a Zone of Influence

(ZOI) equal to 4D for select coating systems, as described in the February 29, 2008, letter, Section 3.H.

Refer to Table 3.E-1 in this letter for the revised debris inventory.

3.C DEBRIS CHARACTERISTICS

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.D LATENT DEBRIS

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.E DEBRIS TRANSPORT

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

As indicated by letter dated May 21, 2008 (Reference 16), Kewaunee performed a CFD analysis of the containment sump pool. The CFD analysis provides the flow direction and flow velocities in the sump pool. The flow direction and flow velocities, in concert with the incipient tumbling velocities for the various debris types, were used to determine the quantity of each debris type that is postulated to arrive at the strainer or the strainer debris interceptor areas. The debris transport information submitted in Table 3.E-1 in the February 29, 2008 response to the GL is superseded by the following data in revised Table 3.E-1:

TABLE 3.E-1

DEBRIS TYPE	QUANTITY GENERATED	DEBRIS SIZE (Note 4)	INCIPIENT TUMBLING VELOCITY OF DEBRIS (FT/SEC)	QUANTITY AT DEBRIS INTERCEPTOR AREA OR SUMP STRAINER	QUANTITY TESTED DURING CHEM EFFECTS HL TESTS AUG 2008
Reflective Metal	31,660 ft2	Foils (fines) 1/4" x 1/4" 1/2" x 1/2" 1" x 1"	Notes 1, 2	0 ft2	0 ft2 Note 2
	18,133 ft2	Large/Intact	Note 1	0 ft2	
TempMat	41.2 ft3	Small	0.20	9.896 ft3	6.5 ft3 (fines) 5.4 ft3 (small)
		Large	0.90	0 ft3	0 ft3
Fiberglass Pipe Cover	2.44 ft3	Fines	Note 3	0.488 ft3	0.88 ft3
		Small	0.06	1.7 ft3	3.12 ft3

TABLE 3.E-1 - CONTINUED

DEBRIS TYPE	QUANTITY GENERATED	DEBRIS SIZE (Note 4)	INCIPIENT TUMBLING VELOCITY OF DEBRIS (FT/SEC)	QUANTITY AT DEBRIS INTERCEPTOR AREA OR SUMP STRAINER	QUANTITY TESTED DURING CHEM EFFECTS HL TESTS AUG 2008
Fibrous - cable insulation	0.6 ft3	Small	0.06	0.509 ft3	0.56 ft3
		Large	0.12	0 ft3	0 ft3
Thermobestos	0.9 ft3	Small	0.25	0.49 ft3	0.54 ft3
		Large	0.30	0 ft3	0 ft3
Latent debris - fiber & particulate	11.3 lbm	Fine/Small	Note 3	11.3 lbm	115 lbm
Coating - inorganic zinc	0.4077 ft3	Particulate	Note 3	Note 3	0.8424 ft3
Coating - phenolic epoxy	1.654 ft3	Chips	0.66	0 ft3	1.3 ft3 particulate 0.09 ft3 chips
Coating - enamel	2.0383 ft3	Particulate	Note 3	2.0383 ft3	3.3783 ft3
Coating - factory coatings	1.09 ft3	Particulate	Note 3	1.09 ft3	
Miscellaneous Debris (tape, tags, etc.)	60 ft2	Various	Note 2	0 ft2	0 ft2 Note 2
Chemical debris - sodium aluminum silicate	5.674 kg 8.286 mg/L	N/A	N/A	Note 3	11.348 kg

Note 1: Reflective Metal Insulation (RMI) was not included in the CFD analysis. Rather, a debris transport test was performed. See Note 2.

Note 2: A material transport test was conducted during the August 2008 flume tests. The material settled in the flume and did not transport to the debris interceptor or strainer area. Therefore, these materials were not added to the flume during the maximum debris load head loss tests. This was a conservative measure as the non-transporting debris could collect other debris types and prevent the maximum quantity of transportable debris from reaching the strainer.

Note 3: Assumed 100% transportable.

Note 4: Debris size is in accordance with NEI 04-07, unless otherwise noted.

Note 5: Unqualified coatings outside the Zone of Influence failing as chips are assumed to be 1/64 - 1/32 inch in size as they would be more easily transportable than chips the size or larger than the strainer perforation size (0.066 inch).

The results of the most recent strainer head loss flume tests conducted in August 2008 are described in Sections 3.F and 3.O below.

3.F HEAD LOSS AND VORTEXING

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

By receipt of Licensing Amendment 184 for Kewaunee in June 2005, Kewaunee's licensing basis was revised to no longer require use of Internal Containment Spray (ICS) in the containment sump recirculation mode. The license amendment approval occurred during GL 2004-02 resolution activities for Kewaunee. Consequently, the initial recirculation strainer head loss evaluations conservatively used a flow rate through the recirculation strainer of 4,000 gpm, equivalent to the combined design flow rate from two Residual Heat Removal (RHR) pumps (2,000 gpm per pump). As a result of the license amendment change, and as described in our February 29, 2008, letter, only one RHR pump is used in the containment sump recirculation mode in response to the design basis event. Running a second RHR pump for recirculation spray is not required to respond to the design basis event. The maximum design basis flow rate through the strainer in the recirculation mode was calculated as 1870 gpm. A 1920 gpm flow rate through the strainer was conservatively used in the August 2008 strainer head loss tests and when updating the strainer performance documentation (Section 3.O below).

In response to a commitment made in the February 29, 2008, letter, Kewaunee revised the LOCA minimum containment sump water level calculation (see Section 3.G below). The calculation determines the lowest possible water level at the onset of recirculation. Consequently, the revised minimum sump water level is now higher than the original calculated value that was used when designing the replacement recirculation strainer. This results in additional strainer submergence at the start of recirculation. The strainer height is 37.25 inches above the containment basement floor. The calculated minimum sump water level at the onset of recirculation is 43.44 inches above the floor, which results in a minimum of 6.19 inches of submergence.

Kewaunee contracted with Performance Contracting, Inc. (PCI) to update the air ingestion, vortex, and void formation evaluation for Kewaunee. For conservatism, the calculation used the original 40.5 inch minimum sump level (instead of 43.44 inches) when evaluating the strainer's performance. The evaluations were performed using standard hydraulic principles and equations. The acceptance criteria for the evaluations were taken from Regulatory Guide 1.82, Revision 3, and the safety evaluation for NEI 04-07, Pressurized Water Reactor Sump Performance Evaluation Methodology. Acceptable results were achieved for all three issues evaluated.

Additional recirculation strainer head loss tests were conducted in August 2008 to resolve the outstanding issue of chemical effects for Kewaunee. The flume test results are provided below in Section 3.O.

3.G NET POSITIVE SUCTION HEAD (NPSH)

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

Kewaunee's response dated February 29, 2008, describes Kewaunee's minimum LOCA containment sump level calculation. As stated in Section 3.F above, this calculation determines the minimum sump water level at the time recirculation is initiated. The water level is calculated to determine the strainer submergence level and the NPSH available to the RHR pumps in the recirculation mode. The water level was also used to determine the water level for testing the replacement recirculation strainer for head loss effects.

Kewaunee recently revised the minimum containment sump water level calculation created in response to GL 2004-02 to specifically include additional holdup volumes, such as, filling the normally empty ICS piping to the containment spray nozzles, containment spray water droplets that have not reached the sump, condensate layer on heat sinks, water holdup on horizontal surfaces, and water vapor in the atmosphere.

Two limiting Reactor Coolant System (RCS) breaks that bound both the small and large break LOCA scenarios were analyzed by the calculation. A portion of the time to perform the manual operator actions to align the RHR/Safety Injection (SI) train to the recirculation sump is credited in the calculation to more accurately reflect the sump water level at the time the RHR pump is started in the recirculation mode. Kewaunee's switchover to containment sump recirculation is performed by a series of manual actions. Operator timing validations for performing the switchover to recirculation function were reviewed and a conservative (shorter) time value was chosen for the calculation to ensure the time to perform the switchover will not occur faster than the time value assumed in the calculation. The volume of water from the safety injection accumulators discharging is credited in one of the scenarios analyzed. The end result of the revised calculation shows that the minimum containment sump water level is higher than shown in the original sump level calculation. The original calculation identified a minimum containment sump water level of at least 40.5 inches above the containment basement floor at the time recirculation is initiated. The revised calculation revealed additional sump level margin and indicates the minimum containment sump water level is at least 43.44 inches at the time recirculation is initiated. The recirculation strainer height is 37.25 inches. The recirculation strainer remains fully submerged at the onset of recirculation.

The NPSH evaluation for the RHR pumps in the recirculation mode was revised to reflect the updated minimum containment sump water level result (43.44 inches). The maximum allowable 10 feet of strainer head loss, which is in excess of the head loss identified during flume testing (see Section 3.O below), is

still used as a conservative input in the revised NPSH calculation. With the higher calculated sump level at the onset of recirculation, the NPSH margin for the RHR pumps in the recirculation mode increased. Therefore, the information submitted in Table 3.G-1 in the February 29, 2008 response to GL 2004-02 is revised as follows:

TABLE 3.G-1

PARAMETER	HEAD (FT OF WATER)	COMMENT
NPSH Available	24.108	Total water height at the onset of recirculation, minus piping friction losses
Maximum allowable debris laden strainer head loss	10	Includes clean strainer head loss and debris laden strainer head loss combined
NPSH required	8	At design flow rate 2000 gpm/pump
NPSH margin	6.108	

3.H COATINGS EVALUATION

Refer to February 29, 2008 supplemental response for the resolution of this item. See also Sections 3.B and 3.E in this response.

3.I DEBRIS SOURCE TERM

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.J SCREEN MODIFICATION PACKAGE

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.K SUMP STRUCTURAL ANALYSIS

Refer to February 29, 2008 supplemental response for the resolution of this item.

3.L UPSTREAM EFFECTS

Refer to February 29, 2008 supplemental response for the resolution of this item. Refer to Section 3.G in this response for changes to the minimum containment sump water level calculation.

3.M DOWNSTREAM EFFECTS - COMPONENTS AND SYSTEMS

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

As indicated by letter dated May 21, 2008, Kewaunee performed a revision to the downstream effects evaluations for the components in the SI, RHR and ICS systems using WCAP-16406-P, Revision 1. In the February 29, 2008, letter, it was stated that the SI, RHR and ICS pumps were evaluated for 60 days operation in the recirculation mode. With the revised evaluations, the acceptable operating times are adjusted as indicated in Table 3.M-1, below.

Table 3.M-1

PUMP	EVALUATION		RESULT
RHR Pump	Evaluated for 60 day operating time with acceptable results	Hydraulic Performance	• No flow blockage. • Debris induced wear will not significantly degrade the pump performance.
		Mechanical Seal	• No blockage. • Seal failure will not occur.
		Vibration	• Not applicable to single stage pumps.
SI Pump	Acceptable operating time equal to at least 30 days when also considering SI system orifice wear	Hydraulic Performance	• No flow blockage. • Debris induced wear will not significantly degrade the pump performance.
		Mechanical Seal	• No blockage. • Seal failure will not occur.
		Vibration	• Acceptable; does not exceed the acceptance criteria for wear over 60 days.
ICS Pump	No operating time evaluated for recirculation spray Recirculation spray is not required for Kewaunee	Hydraulic Performance	• No flow blockage. • Debris induced wear will not significantly degrade the pump performance.
		Mechanical Seal	• Failure of seals due to spring clogging will not occur. • The Dametallic seal and safety bushing require additional evaluation if the ICS pumps are to be credited for recirculation spray in the future.
		Vibration	• Not applicable to single stage pumps.

3.N DOWNSTREAM EFFECTS - FUEL AND VESSEL

This response supplements the previous response to Generic Letter 2004-02 for Kewaunee submitted on February 29, 2008.

In Kewaunee's February 29, 2008 response, a commitment was made to reassess the downstream effects evaluations for the reactor vessel internals and nuclear fuel due to the issuance of WCAP-16406-P, Evaluation of Downstream Sump Debris Effects in Support of GSI-191, Revision 1, and WCAP-16793-NP, Evaluation of Long Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculation Fluid, Revision 0. As a result of this commitment, the evaluation guidance in WCAP-16406-P, Revision 1, was reviewed and it was determined that Kewaunee's original downstream effects evaluation prepared by Westinghouse using WCAP-16406-P, Revision 0, remains valid.

A new downstream effects evaluation was performed using the guidance in WCAP-16793-NP. The evaluation assesses the impact of chemical precipitants in the recirculation fluid that are postulated to plate-out on the fuel cladding. The plate-out results in a potential reduction in the ability of the coolant to remove decay heat from the core. The downstream effects evaluation results for Kewaunee are acceptable. The evaluation shows the maximum-specified fuel clad temperature is not exceeded. The evaluation complies with the Draft Limitations and Conditions issued by NRC in January 2008 for WCAP-16793-NP, Revision 0. Upon issuance of the NRC SER for WCAP-16793-NP, Kewaunee will reassess the reactor vessel core cooling downstream effects evaluation to determine if additional analyses or corrective actions are required.

3.O CHEMICAL EFFECTS

This response supplements the previous response to Generic Letter 2004-02 for Kewaunee submitted on February 29, 2008.

Kewaunee's resolution of the issue of chemical effects was accomplished by:

- determining the types and quantities of generated debris that could reach the recirculation strainer or strainer debris interceptors,
- determining the type and quantity of chemical precipitants generated using WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191," Revision 0, and its associated NRC SER, and WCAP-16785-NP, "Evaluation of Additional Inputs to the WCAP-16530-NP Chemical Model," and
- performing integrated strainer head loss flume tests with transportable debris in the flume, including chemical debris.

As stated in Section 3.E above, Kewaunee performed a CFD analysis of the containment recirculation sump pool. The CFD analysis determined the potential for each debris type to transport towards the strainer or strainer debris interceptor areas. Subsequent to performing the CFD analysis, recirculation strainer flume testing was conducted for several days in August 2008.

The August 2008 flume tests were performed to determine the maximum strainer head loss with the transportable post-LOCA debris load in the flume. The debris used during the tests included an improved chemical surrogate over that used in the February 2006 flume tests. The chemical surrogate used in the August 2008 tests, aluminum oxyhydroxide, was generated and introduced into the flume using the guidance in WCAP-16530-NP, WCAP-16785-NP, and PWROG Letter OG-07-270 (Reference 9). The chemical materials were generated in mixing tanks and introduced into the test flume within the parameters provided in PWROG Letter OG-07-270. The quantity of chemical debris was scaled to the flume volume.

One full-size strainer module was used during the August 2008 flume tests, as compared to a small-scale module used in February 2006. For conservatism, the original calculated 40.5 inch recirculation sump level was used.

The strainer head loss test results validated the Kewaunee recirculation strainer design and are summarized in Table 3.O below.

Table 3.O

TEST (Note 1)	TEMP-CORRECTED CLEAN HEAD LOSS (FT OF WATER)	DEBRIS BED HEAD LOSS (FT OF WATER)	TEMP-CORRECTED DEBRIS BED HEAD LOSS (FT OF WATER)	TOTAL TEMP-CORRECTED LOSSES (FT OF WATER)
Maximum design basis debris load including chemical debris, with margin (Note 2)	0.365	0.51	0.83	1.10
Maximum design basis debris load including chemical debris, with additional debris load margin (Note 3)	0.365	1.67	3.01	3.28

Note 1: Test results are temperature-corrected, where noted, to 65 deg. F.
Note 2: The first head loss test in August 2008 included the following debris load margin:
a. TempMat test quantity included 10% margin above the transported quantity.
b. Fibrous cable insulation included 10% margin.
c. Thermobestos/calcium silicate insulation included 10% margin.
d. Latent debris included 785% margin.
e. Inorganic zincs included 107% margin.

f. Phenolic Epoxies included 7% margin.
g. Enamel and factory coatings included 8% margin.

Note 3: A supplemental head loss test was conducted. The debris load margin was increased as follows (see Table 3.E-1 above):
a. TempMat test quantity included 20% margin above the transported quantity.
b. Chemical debris was doubled, providing 100% margin.
c. Fiberglass pipe cover included 83% margin.
d. Latent debris included 918% margin.

The maximum measured head loss across the debris-laden recirculation strainer, 3.28 ft of water, which includes debris load margin and clean strainer losses, is significantly less than the maximum allowable strainer head loss of 10 ft of water.

Following completion of the flume tests and test results report, Kewaunee's recirculation strainer performance documentation was updated. The updated documents include revisions to the air ingestion and vortex evaluation, clean strainer head loss calculation, strainer total head loss calculation (debris bed losses plus clean strainer losses), and the strainer qualification report. The qualification report summarizes all of the strainer design documents prepared by PCI for Kewaunee.

3.P LICENSING BASIS

This response supplements the previous supplemental response to GL 2004-02 for Kewaunee submitted on February 29, 2008.

As indicated in Kewaunee's February 29, 2008, response, previous updates to the Kewaunee Updated Safety Analysis Report (USAR) revised the description of the recirculation sump strainer, revised the NPSH available to the RHR pumps in the recirculation mode, and added the evaluation guidance used to analyze the ECCS and ICS systems for GSI-191 concerns.

Following completion of the most recent strainer head loss flume tests in August 2008, a USAR update was made. The update included:

- A description of containment recirculation sump holdup areas, i.e., water volumes inaccessible for recirculation,
- A more detailed description of the recirculation strainer and the recirculation sump pit maintenance hatch strainer,
- An improved description of the recirculation strainer debris load,
- An overview of the recirculation sump CFD analysis,
- An improved description of the chemical debris evaluation,
- A description and the results of the August 2008 recirculation strainer head loss tests,
- An improved description of the downstream effects evaluations, and

- A new USAR Table that displays the Zone of Influence sizes for the various debris types used in the Kewaunee analyses.

3.Q OTHER ITEM - WITHDRAWAL OF COMMITMENT

The following commitment related to resolution of GSI-191 is being withdrawn.

In response to NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors, Kewaunee implemented a new Emergency Operating Procedure, ECA-1.3, Containment Sump Blockage, and a sump clogging training module for licensed operators, shift technical advisors and the Emergency Response Organization Emergency Directors. This is documented in Kewaunee's response to Bulletin 2003-01, dated November 8, 2004 (Reference 1), and Generic Letter 2004-02 Request for Extension letter dated November 15, 2007 (Reference 11).

Procedure ECA-1.3 provides guidance to identify and respond to a cavitating RHR pump, including steps for re-establishing recirculation or injection flow.

After analyzing the ECCS and ICS systems in response to Generic Letter 2004-02, and after installing an improved recirculation strainer design, the potential for sump blockage at Kewaunee has been eliminated. However, as a conservative measure, procedure ECA-1.3 will be maintained. Because maintaining this procedure is considered optional, it may be deleted in the future if it seems prudent to do so. In the interim, the licensed operator training and requalification programs will continue to provide training on procedure ECA-1.3 for licensed operators and shift technical advisors. The compensatory measure to provide sump clogging training for the Emergency Response Organization Emergency Directors is considered unnecessary and will not continue.

References

1. Letter from Thomas Coutu (NMC) to Document Control Desk (NRC), NMC Response to NRC Request for Additional Information Regarding Response to Nuclear Regulatory Commission (NRC) Bulletin 2003-01, dated November 8, 2004, (ADAMS Accession No. ML043220343)

2. Letter from Edward J. Weinkam (NMC) to Document Control Desk (NRC), Nuclear Management Company 90-Day Response to Generic Letter 2004-02, 'Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors', dated March 7, 2005, (ADAMS Accession No. ML050670014).

3. Letter from Carl F. Lyon (NRC) to Michael G. Gaffney (NMC), Kewaunee Nuclear Power Plant - Issuance of Emergency Amendment Regarding Containment Spray Flow Path (TAC NO. MC7335), dated June 21, 2005 (ADAMS Accession No. ML051710039)

4. Letter from Michael G. Gaffney (NMC) to Document Control Desk (NRC), Generic Letter 2004-02: Potential Impact of Debris Blockage on Emergency Recirculation During Design-Basis Accidents at Pressurized-Water Reactors - Response to Request for Additional Information, dated July 6, 2005, (ADAMS Accession No. ML051940428).

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