September 3, 1998

Mr. M. L. Marchi
Site Vice President - Kewaunee Plant
Wisconsin Public Service Corporation
P.O. Box 19002
Green Bay, WI 54307-9002

SUBJECT: KEWAUNEE NUCLEAR POWER PLANT, SUPPLEMENTAL SAFETY EVALUATION ASSOCIATED WITH AMENDMENT NO. 132 (TAC NO. M99937)

Dear Mr. Marchi:

On May 7, 1997, the Commission issued Amendment No. 132 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment changed the technical specifications in response to your application dated July 18, 1996, as supplemented on January 29, 1997. The amendment modified requirements for containment integrity during refueling periods to allow the containment personal air lock to remain open during irradiated fuel movement, subject to specified conditions. Subsequently, during telecon discussions, your staff provided comments regarding assumptions used in the staff's confirmatory dose calculation described in the safety evaluation.

The staff recalculated the postulated radiological consequences of a fuel handling accident inside containment. Also, you submitted a revised analysis by letters dated April 7, 1998, August 13, 1998, and August 24, 1998. Based on the consistency of these revised analyses, the staff has issued a supplemental safety evaluation. Our response to the your initial comments and the supplemental safety evaluation are enclosed.

If you have any questions regarding this matter, please contact me at (301) 415-3026.

Sincerely,

Original signed by:

William O. Long, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures: As stated

cc w/encl: See next page

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

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M. L. Marchi
Wisconsin Public Service Corporation

Kewaunee Nuclear Power Plant

cc:

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P. O. Box 7854
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STAFF RESPONSES TO LICENSEE'S COMMENTS ON
SAFETY EVALUATION FOR KEWAUNEE NUCLEAR POWER PLANT AMENDMENT 132

1. Licensee Comment: Credit can be taken for filtration of radioactive iodine if the accident occurs in the spent fuel pool. Credit may be taken because TS 3.8.a.9.A requires the spent fuel pool sweep system, including the charcoal absorbers be in service during fuel handling. However, if the accident occurs in containment the iodine may not necessarily pass through the charcoal absorbers.

   Staff Response: The staff agrees with this comment. The postulated radioactivity release from the containment air lock could be exhausted by the spent fuel pool sweep system. However, there are roll-up doors in these areas that could be open during refueling. While the sweep system would be expected to exhaust releases of radioactivity from the spent fuel pool during a FHA in the pool, a release from the air lock might not be collected and filtered. The staff's re-analysis does not assume iodine filtration.

2. Licensee Comment: In Table 1, Calculated Radiological Consequences, the dose to the control room operators thyroid is given as >1 rem. I question if this should be <1 or if a specific number could be given.

   Staff Response: This was a typographical error. Table 2 in the revised safety evaluation contains the revised postulated dose.

3. Licensee Comment: In Table 2 of the original SE, the release fraction of iodine is stated as 12%. Reg Guide 1.25 (Safety Guide 25) dated 3/23/72 identifies the fraction of iodine released as 10%.

   Staff Response: The staff agrees that Safety Guide 25 identifies the fraction of core inventory of iodine in the gap to be 10%. Footnote 1 on page 25.2 of the guide identifies the fuel conditions that the Safety Guide assumptions were based upon. A generic safety evaluation performed for extended burn up fuel concluded that the assumptions would be appropriate to extended burn up fuel, if the gap fraction of Iodine-131 were increased to 12%. The current KNPP core contains some assemblies with enrichments as high as 4.5%. While the current fuel burn up may not exceed a peak value of 45,000 MWD/MTU, it is likely that this value may be exceeded in subsequent cycles. Since this amendment is not limited to the current cycle, the staff assumption of 12% iodine-131 is appropriate.

4. Licensee Comment: In Table 2, the exclusion area boundary atmosphere relative concentration, X/Q, is stated as 2.9×10^{-4} sec/m^3. KNPP USAR Section 14.2.1 identifies the value as 2.23×10^{-4} sec/m^3.

   Staff Response: The staff agrees that 2.23×10^{-4} sec/m^3 value is the design basis value.

5. Licensee Comment: In Table 2, the filter efficiency for organic iodine is identified as 70%. KNPP's Updated Control Room Habitability Study 1989 identifies organic iodine filter efficiency as 90%.

Staff Response: This comment is now irrelevant since filtration credit was not taken in the revised analysis.

6. Licensee Comment: In Table 2, the control room atmospheric relative concentration, X/Q, is identified as 2.2×10^{-4} sec/m^3. KNPP's Updated Control Room Habitability Study 1989, identifies X/Q as 2.93×10^{-3} sec/m^3.

   Staff Response: The staff agrees that the Table 2 value is in error.

7. Licensee Comment: In Table 2, the control room volume is identified as 1.3×10^5. KNPP's Updated Control Room Habitability Study 1989 identifies control room volume as 1.276×10^5.

   Staff Response: The staff rounded the licensee's value prior to use.

8. Licensee Comment: In Table 2, control room unfiltered inleakage is identified as 10 ft^3/min. KNPP's Updated Control Room Habitability Study identifies this value as 200.

   Staff Response: The staff agrees that the 200 ft^3/min value is appropriate.

9. Licensee Comment: KNPP's USAR identifies an iodine decontamination factor due to water above the fuel as 500. (Ref. KNPP USAR 14.2.1.)

   Staff Response: Safety Guide 25 provides for a pool decontamination factor of 100. The pool DF is effectively limited by the assumed organic iodine gap fraction of 0.25% A pool DF of 500 is inconsistent with this assumption.

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

SAFETY EVALUATION SUPPLEMENT

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO

AMENDMENT NO. 132 TO FACILITY OPERATING LICENSE NO. DPR-43

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

KEWAUNEE NUCLEAR POWER PLANT

DOCKET 50-305

INTRODUCTION

By letters dated July 18, 1996, and January 29, 1997, Wisconsin Public Service Corporation (WPSC) submitted a request for changes to the Kewaunee Nuclear Power Plant (KNPP) Technical Specification (TS). The proposed changes would allow the containment personnel airlock (PAL) doors to be open during fuel movement and core alterations, provided one airlock door is capable of being closed and the water level in the refueling pool is maintained.

On May 7, 1997, the Commission issued Amendment No. 132 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant, changing the technical specifications in response to this application. Subsequently, during telecon discussions, WPSC questioned some of the inputs used in the dose calculation attached to the staff's safety evaluation. The staff determined that several of the comments were valid and that the staff analysis should be re-performed. The staff re-analysis of the dose calculation indicated that control room dose criteria could be exceeded. In response to these concerns, WPSC agreed to re-analyze the offsite and control room dose consequences of a fuel handling accident inside containment using the guidance of Regulatory Guide 1.25. By letter dated November 25, 1997, WPSC agreed not to implement the airlock provisions of the amendment until the NRC issued a revised safety evaluation. By letters dated April 7, 1998, August 13, 1998, and August 24, 1998, WPSC described their re-analysis.

This supplemental safety evaluation (SSE) updates the information provided in the earlier SE to reflect the changes in the dose calculations and the supporting assumptions.

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EVALUATION

Prior to the subject amendment, TS Section 3.8, "Refueling Operation," of the KNPP TS required that a minimum of one airlock door, as well as other containment penetrations, be closed during fuel movement and core alterations. This requirement was intended to prevent the release of radioactive material in the event of a fuel handling accident (FHA). The revised TS would allow both doors of the containment airlock to be open during fuel movement and core alterations, provided one airlock door is capable of being closed and the water level in the refueling pool is maintained as required. The TS require that administrative controls ensure that:

a. Appropriate personnel are aware that both personnel air lock doors are open,

b. A specified individual(s) is designated and available to close the air lock following a required evacuation of containment, and

c. Any obstruction(s) (e.g., cables and hoses) that could prevent closure of an open air lock can be quickly removed.

The licensee's analysis, described in the August 13, 1998 letter, was based on the guidance in Regulatory Guide 1.25 and NUREG/CR-5009. The analysis assumed a core inventory decayed for 100 hours following shutdown after extended operation at 104% of rated power. In performing this re-analysis, WPSC opted to assume a more conservative core peaking factor (1.70) than is typically assumed (1.65). The higher peaking factor is consistent with a modified fuel assembly design that WPSC has proposed in a pending separate amendment request. Of the decayed core inventory, 12% of the I-131, 30% of the Kr-85, and 10% of other nobles gases and halogens, were assumed to be in the fuel gap. The analysis assumes that all of the gap activity in the fuel rods (179) in a single fuel assembly would be instantaneously released from the fuel into the spent fuel pool and into the containment atmosphere. It is assumed that 99% of the iodine released from the fuel rods would be retained by the spent fuel pool water. No retention of noble gases by the spent fuel pool was assumed. The activity released from the pool is assumed to be completely mixed in 1,000,000 ft^3 of the containment volume. A mixing and holdup credit of 50% is assumed. At 10 seconds into the event, the control room ventilation alignment is changed as a result of a radiation monitor alarm. After isolation, an unfiltered infiltration rate of 200 cfm is assumed. The control room atmosphere is filtered by the recirculation filters at a flow rate of 2500 cfm with an assumed charcoal filter efficiency of 90%. ICRP-30 dose conversion factors were used. The licensee's analysis calculated the thyroid doses to be 24.4 rem at the exclusion area boundary and 4.4 rem for the low population zone. The control room dose was estimated to be 26.1 rem.

The staff reviewed the WPSC analysis assumptions and compared them to those provided in Regulatory Guide 1.25 and the SRP, and performed a confirmatory analysis. The staff's analyses provided results comparable to those of the licensee. The staff's analyses confirms the licensee's assertion that the thyroid dose was limiting. Standard Review Plan (SRP) 15.7.4 allows the radiological consequences of a FHA to be reduced by the degree of mixing and dilution occurring in containment prior to containment isolation. The containment cooling fans (one train) provide 82,000 cfm of recirculation flow to all areas of the containment, a total free

volume of 1,320,000 ft^3. Prior to isolation via radiation monitor alarm the purge supply fan flow of 33,000 cfm and the purge exhaust fan flow of 33,000 cfm provide additional mixing. The entire containment volume is turned over every 16 minutes. The licensee conservatively reduced the containment volume to 1,000,000 ft^3 prior to its use in determining the containment mixing credit. The staff concludes that there is reasonable assurance that adequate mixing will occur to reduce the release concentrations.

The fuel handling accident does not result in significant pressurization of the containment. Although the containment is ventilated by a purge and exhaust system at a rate of 33,000 cfm during refueling, the containment penetration dampers (two trains) automatically close on high radiation in the containment. With the fans stopped, there is no significant driving force to cause the radioactivity to exit the containment via the personnel air lock. The licensee conservatively selected a projected release flow rate of 6000 cfm. In the postulated 2-hour release period, 720,000 ft^3 out of the assumed 1,000,000 ft^3 would be released. Expressed exponentially, 0.485 of the activity in the containment would be released. The staff finds the licensee's 0.5 containment retention factor acceptable. No credit is given in the dose analysis for timely isolation of the air lock as provided for in the amended technical specification. This is conservative. The offsite doses calculated by WPSC are within the NUREG-0800 Standard Review Plan (SRP) criteria of 75 rem to the thyroid and are acceptable. The control room doses meet the criteria of 10 CFR Part 50, Appendix A, GDC 19, and NUREG-0800.

CONCLUSION

In conclusion, the staff has reviewed the licensee's analysis and has performed an independent assessment of the radiological consequences resulting from a fuel handling accident during refueling operations with the containment air locks open. The staff concludes that there is reasonable assurance that the radiological consequences associated with a fuel handling accident inside containment with the air lock open to the environment are within the acceptance criteria set forth in 10 CFR Part 100 and NUREG-0800 section 15.7.4, and that the control room operator dose criteria specified in 10 CFR Part 50, Appendix A, GDC-19, and NUREG-0800 Section 6.4.

Principal Contributor: S.F. LaVie

Date: September 3, 1998

TABLE 1

ASSUMPTIONS USED FOR CALCULATING RADIOLOGICAL CONSEQUENCES

Parameters	Quantity
Power Level (Mwt)	1721
Number of Fuel Rods Damaged	179
Total Number of Fuel Rods	21659
Shutdown Time, hours	100
Power Peaking Factor	1.7
Reactor Cavity Iodine Decontamination Factor	100
Assumed Containment Volume, ft^3	1.0E6
Assumed Containment Release, cfm	6000
Containment Retention Factor	0.5
Fission Product Release Duration	2 hours
Release Fractions*	
Iodine	12%
Noble Gases	10%
Krypton Gas	30%
Iodine Forms	
Elemental	75%
Organic	25%

Core Fission Product Inventories per TID-14844

Receptor Point Variables

Atmosphere Relative Concentration	χ/Q (sec/M^3)
Exclusion Area Boundary 0-2 hours	2.232E-4
Low Population Zone, duration	3.977E-5

Control Room

Atmospheric Relative Concentration, χ/Q (sec/m^3)	2.93E-3
Control Room Volume, cubic feet	127,600
Recirculation Flow, ft^3/min	2500
Unfiltered inleakage, ft^3/min	200
Isolation delay, seconds	10
Charcoal Efficiency	0.9

Note: Dose conversion factor from ICRP-30 were utilized for all calculations.

TABLE 2

RADIOLOGICAL CONSEQUENCES PROJECTED BY STAFF, REM

	Whole Body	**Skin**	**Thyroid**
Exclusion Area Boundary, 0-2 hours	0.053	0.17	21.2
Low Population Zone, duration	0.009	0.031	3.77
Criterion	*6.0*	*6.0*	*75.0*
Control Room	0.033	2.44	27.6
Criterion	*5.0*	*30.0*	*30.0*