

September 22, 1998

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

SUBJECT: AMENDMENT NO. 138 TO FACILITY OPERATING LICENSE NO. DPR-43,
KEWAUNEE NUCLEAR POWER PLANT (TAC NO. MA1977)

Dear Mr. Marchi:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 138 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment revises the license in response to your application dated June 1, 1998, supplemented by letter dated July 14, 1998, which requested changes to the Technical Specifications. The changes revise the F* and elevated F* (EF*) criteria in Section 4.2.b. The F* and EF* repair criteria are used to disposition indications in the roll expansion joint of degraded steam generator (SG) tubes within the tubesheet. The changes are being made because the primary-to-secondary pressure differential has increased, as a result of extensive tube plugging and sleeving, and two minor errors were found in the original analysis.

A copy of the Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

William O. Long

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: 1. Amendment No. 138 to License No. DPR-43
- 2. Safety Evaluation

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DOCUMENT NAME: G:KEWAUNEE\PA156.AMD

OFFICE	PD33:PM	E	PD33:LA	E	OGC	PD33:D	E
NAME	WLong <i>w</i>		EBarnhill <i>EB</i>		<i>Utter</i>	RBellamy <i>RB</i>	
DATE	8/25/98		8/25/98 <i>8/25/98</i>		9/14/98 <i>9/14/98</i>	9/12/98 <i>9/12/98</i>	

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Sincerely,

William O. Long, Sr. Project Manager
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DATE	8/25/98		8/25/98		9/1/98	9/12/98	

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changes to SE
made

M. L. Marchi
Wisconsin Public Service Corporation

Kewaunee Nuclear Power Plant

cc:

Foley & Lardner
ATTN: Bradley D. Jackson
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Madison, WI 53701-1497

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Kewaunee, WI 54216

Harold Reckelberg, Chairman
Kewaunee County Board
Kewaunee County Courthouse
Kewaunee, WI 54216

Attorney General
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Madison, WI 53702

U.S. Nuclear Regulatory Commission
Resident Inspectors Office
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Kewaunee, WI 54216-9511

Regional Administrator - Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4531

James D. Loock, Chief Engineer
Public Service Commission
of Wisconsin
P. O. Box 7854
Madison, WI 53707-7854



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

September 22, 1998

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

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KEWAUNEE NUCLEAR POWER PLANT (TAC NO. MA1977)

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A copy of the Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

A handwritten signature in cursive script that reads "William O. Long".

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: 1. Amendment No. 138 to
License No. DPR-43
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cc w/encls: See next page



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

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

DOCKET NO. 50-305

KEWAUNEE NUCLEAR POWER PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 138
License No. DPR-43

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Wisconsin Public Service Corporation, Wisconsin Power and Light Company, and Madison Gas and Electric Company (the licensees) dated June 1, 1998, as supplemented by letter dated July 14, 1998, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-43 is hereby amended to read as follows:

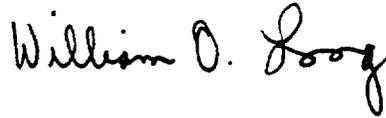
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(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 138 , are hereby incorporated in the license. The licensees shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance, and is to be implemented within 30 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



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

Attachment: Changes to the Technical
Specifications

Date of Issuance: September 22, 1998

ATTACHMENT TO LICENSE AMENDMENT NO. 138

FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

REMOVE

TS 4.2-3
TS 4.2-4
TS 4.2-10
TS B4.2-7

INSERT

TS 4.2-3
TS 4.2-4
TS 4.2-10
TS B4.2-7

F* Distance is the distance of the expanded portion of a tube which provides a sufficient length of undegraded tube expansion to resist pullout of the tube from the tubesheet. The F* distance is equal to 1.11 inches (plus an allowance for NDE uncertainty) and is measured downward from the bottom of the uppermost roll transition. The F* distance applies to roll expanded regions below the midpoint of the tubesheet.

F* Tube is a tube with degradation below the F* distance, equal to or greater than 50% throughwall, and has no indications of degradation within the F* distance.

EF* Distance is the distance of the expanded portion of a tube which provides a sufficient length of undegraded tube expansion to resist pullout of the tube from the tubesheet. The EF* distance is equal to 1.51 inches (plus an allowance for NDE uncertainty) and is measured downward from the bottom of the uppermost roll transition. The EF* distance applies to roll expanded regions above the midpoint of the tubesheet.

EF* Tube is a tube with degradation below the EF* distance, equal to or greater than 50% throughwall, and has no degradation within the EF* distance.

1. Steam Generator Sample Selection and Inspection

The in-service inspection may be limited to one steam generator on a rotating schedule encompassing the number of tubes determined in TS 4.2.b.2.a provided the previous inspections indicated that the two steam generators are performing in a like manner.

2. Steam Generator Tube Sample Selection and Inspection

The tubes selected for each in-service inspection shall:

- a. Include at least 3% of the total number of nonrepaired tubes, in both steam generators, and 20% of the total number of repaired tubes in both steam generators. The tubes selected for these inspections shall be selected on a random basis except as noted below and in TS 4.2.b.2.b.

Indications left in service as a result of application of the tube support plate voltage-based repair criteria shall be inspected by bobbin coil probe during all future REFUELING outages.

- b. Concentrate the inspection by selection of at least 50% of the tubes to be inspected from critical areas where experience in similar plants with similar water chemistry indicates higher potential for degradation.

- c. Include the inspection of all non-plugged tubes which previous inspections revealed in excess of 20% degradation. The previously degraded tubes need only be inspected about the area of previous degradation indication if their inspection is not employed to satisfy TS 4.2.b.2.a and TS 4.2.b.2.b above.

Implementation of the steam generator tube/tube support plate repair criteria requires a 100% bobbin coil inspection for hot leg and cold leg tube support plate intersections down to the lowest cold leg tube support plate with known outside diameter stress corrosion cracking (ODSCC) indications. The determination of the lowest cold-leg tube support plate intersections having ODSCC indications shall be based on the performance of at least a 20% random sampling of tubes inspected over their full length.

- d. In addition to the sample required in TS 4.2.b.2.a through TS 4.2.b.2.c, all tubes which have had the F*, or EF*, criteria applied will be inspected each in-service inspection in the uppermost tubesheet roll expanded region. These tubes may be excluded from TS 4.2.b.2.c provided the only previous wall penetration of >20% was located below the F* or EF* distance. F* and EF* tubes will be inspected for a minimum of 2 inches below the bottom of the uppermost roll transition. The results of F* or EF* tube inspections are not to be used as a basis for additional inspection per Table TS 4.2-2 or Table TS 4.2-3.
- e. In addition to the sample required in TS 4.2.b.2.a through TS 4.2.b.2.c, all laser weld repaired sleeved tubes will be inspected at the first in-service inspection following the repair. Subsequent inspections will include a minimum sample size consistent with TS 4.2.b.2.a.

During the first in-service inspection and each subsequent in-service inspection, at least 20% of the laser weld repaired sleeved tubes will be inspected using an ultrasonic inspection technique. The laser weld repaired tubes inspected with the ultrasonic technique shall be selected on a random basis. Actions based on the results of the ultrasonic inspection shall be as described in Table TS 4.2-3.

- f. The second and third sample inspections during each in-service inspection may be less than the full length of each tube by concentrating the inspection on those areas of the tubesheet array and on those portions of the tubes where tubes with imperfections were previously found.

6. F* and EF* Tubesheet Crevice Region Plugging Criteria

The following criteria are to be used for disposition or repair of steam generator tubes experiencing degradation in the tubesheet crevice region.

- a. Tubes with indications of degradation within the roll expanded region below the midpoint of the tubesheet may remain in service provided the distance from the bottom of the uppermost roll transition to the tip of the crack is greater than 1.11 inches (plus an allowance for NDE uncertainty). This criteria is called the F* criteria and applies to the factory roll expansion, or to additional roll expansions formed as an extension of the original roll. Any degradation existing below the F* (plus an allowance for NDE uncertainty) is acceptable for continued service.
- b. Indications of degradation not repairable by TS 4.2.b.6.a may be repaired using the EF* criteria. The EF* region is located a minimum of 4 inches below the top of the tubesheet, and is formed by an additional roll expansion of the tube in the originally unexpanded length. Tubes with indications of degradation within the EF* region may remain in service provided the distance from the bottom of the uppermost roll transition to the tip of the crack is greater than 1.51 inches (plus an allowance for NDE uncertainty). Any degradation existing below EF* (including uncertainty) is acceptable for continued service.

7. Reports

- a. Following each in-service inspection of steam generator tubes, if there are any tubes requiring plugging or repairing, the number of tubes plugged or repaired shall be reported to the Commission within 30 days. This report shall include the tubes for which the F* or EF* criteria were applied.
- b. The results of the steam generator tube in-service inspection shall be included in the Annual Operating Report for the period in which this inspection was completed. This report shall include:
 1. Number and extent of tubes inspected.
 2. Location and percent of wall-thickness penetration for each indication of a degradation.
 3. Identification of tubes plugged.
 4. Identification of tubes repaired.

Technical Specification 4.2.b.6

Tubes with indications of degradation in either the original factory roll expansion in the tubesheet or the unexpanded portion of tube within the tubesheet may be dispositioned for continued service or repaired through application of the F* or EF* criteria. The F* and EF* criteria are described in WCAP-14677.⁽¹⁰⁾ The F* and EF* criteria are established using guidance consistent with RG 1.121. Neither the F* or EF* criteria will significantly contribute to offsite dose following a postulated main steam line break such that contributions from these sources need to be included in offsite dose analyses. Inherent to these criteria is the ability to perform an additional roll expansion of the tube, either as an extension of the original factory roll expansion, in which case F* criteria applies, or in the area starting approximately 4 inches below the top of the tubesheet, in which case EF* criterion apply. The additional roll expansion procedure can be applied over existing degradation, provided the F* or EF* requirements for non-degraded roll expansion lengths of 1.11 inches (plus an allowance for NDE uncertainty) and 1.51 inches (plus an allowance for NDE uncertainty), respectively, are satisfied. The NDE uncertainty applied to the F* and EF* distance is a function of the eddy current probe and technique used. Current state-of-the art inspection technology will be used with implementation of the F* and EF* criteria. The uncertainty in such inspections has been shown to be as small as 0.06 inches, however, for field application, an eddy current uncertainty of 0.20 inches will be applied. Any and all indications of degradation existing below the F* or EF* distance is acceptable for continued service.

Technical Specification 4.2.b.7

Category C-3 inspection results are considered abnormal degradation to a principal safety barrier and are therefore reportable under 10 CFR 50.72(b)(2)(i) and 10 CFR 50.73(a)(2)(ii).

TS 4.2.b.7.d implements several reporting requirements recommended by GL 95-05 for situations which NRC wants to be notified prior to returning the steam generators to service. For TS 4.2.b.7.d.3 and 4, indications are applicable only where alternate plugging criteria is being applied. For the purposes of this reporting requirement, leakage and conditional burst probability can be calculated based on the as-found voltage distribution rather than the projected end-of-cycle voltage distribution (refer to GL 95-05 for more information) when it is not practical to complete these calculations using the projected EOC voltage distributions prior to returning the steam generators to service. Note that if leakage and conditional burst probability were calculated using the measured EOC voltage distribution for the purposes of addressing GL Sections 6.a.1 and 6.a.3 reporting criteria, then the results of the projected EOC voltage distribution should be provided per GL Section 6.b(c) criteria.

⁽¹⁰⁾WCAP 14677, Revision 1, F* and Elevated F* Tube Alternate Repair Criteria for Tubes With Degradation Within the Tubesheet Region of the Kewaunee Steam Generators, May 1998 (Proprietary).



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATING TO AMENDMENT NO. _____ 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 NO. 50-305

1.0 INTRODUCTION

By application dated June 1, 1998, as supplemented by letter dated July 14, 1998, Wisconsin Public Service Corporation submitted a license amendment request to revise the F* and elevated F* (EF*) repair criteria specified in Section 4.2.b of the Kewaunee Technical Specifications (TS). The F* and EF* repair criteria are used to disposition indications of possible degradation within the tubesheet of steam generator (SG) tubes. The licensee requested the change because the normal operating primary-to-secondary pressure differential has increased. Also, two minor errors were found in the original analysis. The proposed change was based on the Westinghouse report, WCAP-14677, Revision 1, "F* and Elevated F* Tube Alternate Repair Criteria for Tubes with Degradation in the Tubesheet Region of the Kewaunee Steam Generator (Proprietary)." The July 14, 1998 letter provided supplemental information which did not change the staff's no significant hazards finding or expand the scope of the amendment with respect to the original *Federal Register* notice.

2.0 BACKGROUND

General Design Criterion (GDC) 14 of Appendix A of 10 CFR Part 50 requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. Regulatory Guide (RG) 1.121 provides guidance on acceptable minimum structural safety margins. Kewaunee TS 4.2.b, "Steam Generator Tubes," identifies criteria used to assure the integrity of the steam generator tubes that are a part of the primary coolant pressure boundary. If a tube is found to be defective, the TS requires that the tube either be plugged, which eliminates it from the pressure boundary, or be repaired (by sleeving), which restores its integrity.

RG 1.121 recommends that the margin of safety against tube rupture (or pullout from the tubesheet) under normal operating conditions should not be less than three at any tube location where defects have been detected. For postulated accidents, RG 1.121 recommends that the

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margin of safety against failure be consistent with the margin of safety determined by the stress limits in NB-3225 of Section III of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers (ASME). Structural loads imposed on the tube-to-tubesheet joint primarily result from the differential pressure between the primary and secondary sides of the tubes. The peak postulated loading occurs during a main steam line break due to the large reduction of the secondary side pressure. However, normal operating loads, cyclic loading from transients and potential thermal expansion loads can also be significant.

Outside diameter stress corrosion cracking and primary water stress corrosion cracking have occurred in the portion of the tubes in the tubesheet in Model 51 SGs. When crack indications are found, through eddy current inspection of the tubes, the F* and EF* criteria may be used to disposition those indications. The basis for F* and EF* criteria is that any tube defects located in a portion of a tube that is not relied upon to provide a pullout resisting force do not degrade the pressure integrity boundary with respect to tube pullout or rupture. A tube's pullout resisting force is provided by the tight fit between the tube and tubesheet. The F* and EF* criteria specify a minimum length of undegraded hardroll in the tube in the tubesheet, necessary to resist tube pullout during normal operation, test, upset, or faulted conditions. The F* criterion requires a minimum undegraded length, the F* distance, of the partial expansion joints. The normal operating pressure differential sets the F* distance, since faulted conditions result in tighter tube-tubesheet engagement. For degradation occurring in the tube above the mid-section of the tubesheet, the minimum length applies to a new field-installed hardroll, and is referred to as the elevated F*(EF*) distance. The EF* criterion reflects the potential effect of tubesheet bowing during faulted conditions. In the current TS, the F* and EF* distances are specified as 1.12 inches and 1.44 inches, respectively. Application of F* and EF* criteria allows tubes to remain in service that might otherwise require plugging or sleeving.

Kewaunee has two Westinghouse Model 51 SGs, A and B. The SG tubes are fabricated of mill annealed alloy 600 and have partial-expansion roll joints in the tubesheet. The average lengths of the roll joints in the hot leg side of A and B SGs are about 1.25 inches and 2.5 inches, respectively.

3.0 EVALUATION

The original F* and EF* criteria were the result of an amendment application dated July 3, 1996. The original criteria were based on an analysis documented in Westinghouse report, WCAP-14677, Revision 0, "F* and Elevated F* Tube Alternate Repair Criteria for Tubes with Degradation in the Tubesheet Region of the Kewaunee Steam Generator," (proprietary). By Amendment No. 129 issued on October 2, 1996, the staff approved the original F* and EF* repair criteria. The licensee did not apply the F* and EF* criteria to applicable indications found during the subsequent refueling outage, but instead plugged and/or repaired those tubes due to potential leakage concerns.

The total amount of SG tube plugging and sleeving performed during the 1996/97 outage was sufficient to cause the secondary side pressure to decrease. As a result of the decrease in secondary side pressure, the differential pressure under normal operating conditions increased from 1565 psi, which was used in the original analysis, to 1600 psi. The original pressure differential of 2650 psi under the faulted condition was not affected by the tube plugging in

1996. The proposed changes to the F* and EF* distance are result of the 35 psi increase in the normal operating primary-to-secondary pressure differential and errors discovered in the original analysis. The methodology and assumptions for calculating the original and proposed F* and EF* distances for the normal operating conditions are the same. The methodology satisfies the safety margins recommended in RG 1.121. In both original and revised analyses , the F* and EF* distances were derived from the friction force between the tube and tubesheet. This includes contact force due to internal pressure, differential thermal expansion between the tube and the tubesheet, residual preload from the hardroll process, and loss of contact pressure due to tubesheet bending above the neutral axis (for EF* distance only). The change in normal operating pressure differential causes changes in the contact pressures due to internal pressure and tubesheet bending.

The licensee stated that the application of the F* and EF* criteria in the current TS will not be changed (only the minimum distances). Also, the eddy current technique that will be used for the nondestructive examination (NDE) of the tubes and NDE uncertainty of 0.20 inches that will be added to the F* and EF* distances will not be changed.

The licensee identified two errors while revising the original analysis. One error was related to incorrect application of secondary pressure to the tubesheet bore hole surface. The other error was caused by absence of the secondary pressure in the calculations for the contact pressures in the tubesheet hole above the neutral bending axis. Without the errors, the F* distance would decrease from 1.12 inches to 1.10 inches and EF* distance would increase from 1.44 inches to 1.49 inches. The staff judges that the impact of the errors to the F* and EF* distances is minimal.

The revised analysis indicates that F* and EF* distances should be 1.11 and 1.51 inches, respectively. The staff finds that the revised F* and EF* distances are acceptable because the revised distances were calculated based on staff approved methodology and satisfies the safety margins recommended in Regulatory Guide 1.121. The new F* and EF* distances reflect the change in plant pressure differential conditions and correct previous errors.

4.0 CHANGES TO TECHNICAL SPECIFICATIONS

TS 4.2.b In the definition of F* Distance and EF* Distance, the F* and EF* distances are revised to 1.11 inches and 1.51 inches, respectively.

TS 4.2.b.6 Under F* and EF* Tubesheet Crevice Region Plugging Criteria, the F* and EF* distances are revised to 1.11 and 1.51 inches, respectively.

Bases TS 4.2.b.6 The F* and EF* distances are revised to 1.11 inches and 1.51 inches, respectively

The above changes are acceptable because they are consistent with the proposed F* and EF* criteria and are supported by the analysis in WCAP-14677, Revision 1.

5.0 SUMMARY

Based on a review of the licensee's submittal, the staff concludes that the proposed changes to F* and EF* distances in TS 4.2.b are consistent with the supporting technical basis documented in WCAP-14677, Revision 1, and are, therefore, acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Wisconsin State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes a surveillance requirement. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluent that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding (63 FR 35996). Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

6.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: J. Tsao

Date: September 22, 1998