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

Docket File

January 25, 1996

50-352

Mr. George A. Hunger, Jr.
Director-Licensing, MC 62A-1
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Nuclear Group Headquarters
Correspondence Control Desk
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SUBJECT: INCREASE ALLOWABLE MAIN STEAM ISOLATION VALVES (MSIVs) LEAK RATE AND DELETION OF MSIV LEAKAGE CONTROL SYSTEM (LCS) - LIMERICK GENERATING STATION, UNIT 1 (TAC NO. M88609)

Dear Mr. Hunger:

The Commission has issued the enclosed Amendment No. 107 to Facility Operating License No. NPF-39 for the Limerick Generating Station (LGS), Unit 1. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated January 14, 1994, as supplemented by letters dated August 1, October 25, December 13, December 22, 1994 (two submittals), and February 7, 1995.

The amendment for LGS, Unit 1, permits an increase in the allowable leak rate for the MSIVs and deletes the MSIV LCS. The main steam drain lines and the main condenser will be used as the alternate MSIV leakage treatment method.

The enclosed Safety Evaluation (SE) applies to both units; however, the enclosed amendment applies only to Unit 1. The staff issued an amendment for Unit 2 on February 16, 1995, utilizing the same SE.

DF01 /1

Also enclosed is the Notice of Issuance which has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/S/

Frank Rinaldi, Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-353

Enclosures: 1. Amendment No. 107 to License No. NPF-39
2. Safety Evaluation
3. Notice

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Also enclosed is the Notice of Issuance which has been forwarded to the Office of the Federal Register for publication.

Sincerely,

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Office of Nuclear Reactor Regulation

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

PHILADELPHIA ELECTRIC COMPANY

DOCKET NO. 50-352

LIMERICK GENERATING STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 107
License No. NPF-39

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Philadelphia Electric Company (the licensee) dated January 14, 1994, as supplemented by letters dated August 1, October 25, December 13, December 22, 1994 (two submittals) and February 7, 1995, 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. NPF-39 is hereby amended to read as follows:

   Technical Specifications

   The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 107 , are hereby incorporated into this license. Philadelphia Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented prior to startup in Cycle 7.

FOR THE NUCLEAR REGULATORY COMMISSION

John F. Stolz

John F. Stolz, Director
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the
Technical Specifications

Date of Issuance: January 25, 1996

<u>ATTACHMENT TO LICENSE AMENDMENT NO. 107</u>

<u>FACILITY OPERATING LICENSE NO. NPF-39</u>

<u>DOCKET NO. 50-352</u>

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change.

<u>Remove</u>	<u>Insert</u>
xii	xii
3/4 6-2	3/4 6-2
3/4 6-3	3/4 6-3
3/4 6-7	3/4 6-7
3/4 6-19	3/4 6-19
3/4 6-31	3/4 6-31
B 3/4 6-1	B 3/4 6-1

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

PRIMARY CONTAINMENT LEAKAGE

LIMITING CONDITION FOR OPERATION

3.6.1.2 Primary containment leakage rates shall be limited to:

a. An overall integrated leakage rate of less than or equal to L_a, 0.500 percent by weight of the containment air per 24 hours at P_a, 44.0 psig.

b. A combined leakage rate of less than or equal to 0.60 L_a for all penetrations and all valves listed in Table 3.6.3-1, except for main steam line isolation valves* and valves which are hydrostatically tested per Table 3.6.3-1, subject to Type B and C tests when pressurized to P_a, 44.0 psig.

c. *Less than or equal to 100 scf per hour through any one main steam isolation valve not to exceed 200 scf per hour for all four main steam lines, when tested at P_t, 22.0 psig.

d. A combined leakage rate of less than or equal to 1 gpm times the total number of containment isolation valves in hydrostatically tested lines which penetrate the primary containment, when tested at 1.10 P_a, 48.4 psig.

APPLICABILITY: When PRIMARY CONTAINMENT INTEGRITY is required per Specification 3.6.1.1.

ACTION:

With:

a. The measured overall integrated primary containment leakage rate exceeding 0.75 L_a, or

b. The measured combined leakage rate for all penetrations and all valves listed in Table 3.6.3-1, except for main steam line isolation valves* and valves which are hydrostatically tested per Table 3.6.3-1, subject to Type B and C tests exceeding 0.60 L_a, or

c. The measured leakage rate exceeding 100 scf per hour through any one main steam isolation valve, or exceeding 200 scf per hour for all four main steam lines, or

d. The measured combined leakage rate for all containment isolation valves in hydrostatically tested lines which penetrate the primary containment exceeding 1 gpm times the total number of such valves,

restore:

a. The overall integrated leakage rate(s) to less than or equal to 0.75 L_a, and

*Exemption to Appendix J of 10 CFR Part 50.

ACTION: (Continued)

b. The combined leakage rate for all penetrations and all valves listed in Table 3.6.3-1, except for main steam line isolation valves* and valves which are hydrostatically tested per Table 3.6.3-1, subject to Type B and C tests to less than or equal to 0.60 L_a, and

c. The leakage rate to ≤11.5 scf per hour for any main steam isolation valve that exceeds 100 scf per hour, and restore the combined maximum pathway leakage to ≤200 scf per hour, and

d. The combined leakage rate for all containment isolation valves in hydrostatically tested lines which penetrate the primary containment to less than or equal to 1 gpm times the total number of such valves,

prior to increasing the reactor coolant system temperature above 200°F.

SURVEILLANCE REQUIREMENTS

4.6.1.2 The primary containment leakage rates shall be demonstrated at the following test schedule and shall be determined in conformance with the criteria specified in Appendix J of 10 CFR Part 50 using the methods and provisions of ANSI 45.4-1972 and BN-TOP-1 and verifying the result by the Mass Point Methodology described in ANSI N56.8-1981:

a. Three Type A Overall Integrated Containment Leakage Rate tests shall be conducted at 40 +/- 10 month intervals during shutdown at P_a, 44.0 psig, during each 10-year service period. The third test of each set shall be conducted during the shutdown for the 10-year plant inservice inspection.**

b. If any periodic Type A test fails to meet 0.75 L_a, the test schedule for subsequent Type A tests shall be reviewed and approved by the Commission. If two consecutive Type A tests fail to meet 0.75 L_a, a Type A test shall be performed at least every 18 months until two consecutive Type A tests meet 0.75 L_a, at which time the above test schedule may be resumed.

c. The accuracy of each Type A test shall be verified by a supplemental test which:

1. Confirms the accuracy of the test by verifying that the difference between the supplemental data and the Type A test data is within $0.25L_a$. The formula to be used is: $[L_o + L_{am} - 0.25\ L_a] \le L_c \le [L_o + L_{am} + 0.25\ L_a]$ where L_c = supplemental test result; L_o = superimposed leakage; L_{am} = measured Type A leakage.

2. Has duration sufficient to establish accurately the change in leakage rate between the Type A test and the supplemental test.

3. Requires the quantity of gas injected into the containment or bled from the containment during the supplemental test to be between 0.75 L_a and 1.25 L_a.

* Exemption to Appendix "J" to 10 CFR Part 50.

** The interval between the second and third Overall Integrated Leakage Rate tests of the first 10-year service period will be extended to the sixth Unit 1 refueling outage. As a result, the duration of the first 10-year service period will be extended to the end of the sixth Unit 1 refueling outage.

MSIV LEAKAGE ALTERNATE DRAIN PATHWAY

LIMITING CONDITION FOR OPERATION

3.6.1.4 The MSIV Leakage Alternate Drain Pathway shall be OPERABLE.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 3.

ACTION:

With the MSIV Leakage Alternate Drain Pathway inoperable, restore the pathway to OPERABLE status within 30 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.4 The MSIV Leakage Alternate Drain Pathway shall be demonstrated OPERABLE:

a. In accordance with 4.0.5, by cycling each motor operated valve, required to be repositioned, through at least one complete cycle of full travel.

TABLE 3.6.3-1

PART A - PRIMARY CONTAINMENT ISOLATION VALVES

PENETRATION NUMBER	FUNCTION	INBOARD ISOLATION BARRIER	OUTBOARD ISOLATION BARRIER	MAX.ISOL. TIME.IF APP. (SEC)(26)	ISOL. SIGNAL(S), IF APP. (20)	NOTES	P&ID
003B	CONTAINMENT INSTRUMENT GAS SUPPLY - HEADER 'B'	59-1005B (CK)		NA			59
			HV59-129B	7	C,H,S		
003D-2	CONTAINMENT INSTRUMENT GAS SUPPLY TO ADS VALVES E & K	59-1112(CK)		NA			
			HV59-151B	45	M		59
007A(B,C,D)	MAIN STEAM LINE 'A'(B,C,D)	HV41-1F022A (B,C,D)		5*	C,E,F,P,Q	6	41
			HV41-1F028A (B,C,D)	5*	C,E,F,P,Q	6	
008	MAIN STEAM LINE DRAIN	HV41-1F016		30	C,E,F,P,Q	4	41
			HV41-1F019	30	C,E,F,P,Q		
009A	FEEDWATER	41-1F010A(CK)		NA			41
			HV41-1F074A(CK)	NA			
			41-1036A(CK)	NA			
			HV41-130B	45			
			HV41-133A	45			
			HV41-109A	NA		32	
			HV41-1F032A(CK)	NA			
			HV55-1F105	30		7	
			HV44-1F039(CK) (X-9B)	NA			
			41-1016(X-9B, X-44)	NA		31	

TABLE 3.6.3-1 (Continued)

PART B - PRIMARY CONTAINMENT ISOLATION EXCESS FLOW CHECK VALVES

PENETRATION NUMBER	FUNCTION	INBOARD ISOLATION BARRIER	OUTBOARD ISOLATION BARRIER	MAX.ISOL. TIME.IF APP. (SEC)(26)	ISOL. SIGNAL(S), IF APP. (20)	NOTES	P&ID
003A-1	INSTRUMENTATION - 'D' MAIN STEAM LINE FLOW	--	XV41-1F070D XV41-1F073D			1	41
003A-2	INSTRUMENTATION - 'A' RECIRC PUMP SEAL PRESSURE	--	XV43-1F003A			1	43
003C-1	INSTR. - HPCI STEAM FLOW	--	XV55-1F024A			1	55
003C-2	INSTR. - HPCI STEAM FLOW	--	XV55-1F024C			1	55
003D-1	INSTR. - 'A' MAIN STEAM LINE FLOW	--	XV41-1F070A XV41-1F073A			1	41
007A(B,C,D)	INSTR. - 'A'(B,C,D) MAIN STEAM LINE PRESSURE	(HV41-1F022A(B, C,D) SEE PART A THIS TABLE)	(HV41-1F028A (B,C,D)	5* 5*	C,E,F,P,Q C,E,F,P,Q	6 6	41
020A-1	INSTR - RPV LEVEL	--	XV42-1F045B			1	42
020A-2	INSTR - 'B' LPCI DELTA P	--	XV51-102B			1	51
020A-3	INSTR - 'D' LPCI DELTA P	--	XV51-103B			1	51
020B-1	INSTR - RPV LEVEL	--	XV42-1F045C			1	42
020B-2	INSTR - 'C' LPCI DELTA P	--	XV51-102C			1	51

BASES

3/4.6.1 PRIMARY CONTAINMENT

3/4.6.1.1 PRIMARY CONTAINMENT INTEGRITY

PRIMARY CONTAINMENT INTEGRITY ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the safety analyses. This restriction, in conjunction with the leakage rate limitation, will limit the SITE BOUNDARY radiation doses to within the limits of 10 CFR Part 100 during accident conditions.

3/4.6.1.2 PRIMARY CONTAINMENT LEAKAGE

The limitations on primary containment leakage rates ensure that the total containment leakage volume will not exceed the value calculated in the safety analyses for the peak accident pressure of ≤ 44 psig, P_a. As an added conservatism, the measured overall integrated leakage rate is further limited to less than or equal to 0.75 L_a during performance of the periodic tests to account for possible degradation of the containment leakage barriers between leakage tests.

Operating experience with the main steam line isolation valves has indicated that degradation has occasionally occurred in the leak tightness of the valves; therefore the special requirement for testing these valves.

The surveillance testing for measuring leakage rates is consistent with the requirements of Appendix J of 10 CFR Part 50 with the exception of exemptions granted for leak testing of the main steam isolation valves, the airlock and TIP shear valves.

3/4.6.1.3 PRIMARY CONTAINMENT AIR LOCK

The limitations on closure and leak rate for the primary containment air lock are required to meet the restrictions on PRIMARY CONTAINMENT INTEGRITY and the primary containment leakage rate given in Specifications 3.6.1.1 and 3.6.1.2. The specification makes allowances for the fact that there may be long periods of time when the air lock will be in a closed and secured position during reactor operation. Only one closed door in the air lock is required to maintain the integrity of the containment.

3/4.6.1.4 MSIV LEAKAGE ALTERNATE DRAIN PATHWAY

Calculated doses resulting from the maximum leakage allowances for the main steamline isolation valves in the postulated LOCA situations will not exceed the criteria of 10 CFR Part 100 guidelines, provided the main steam line system from the isolation valves up to and including the turbine condenser remains intact. Operating experience has indicated that degradation has occasionally occurred in the leak tightness of the MSIVs such that the specified leakage requirements have not always been continuously maintained. The requirement for the MSIV Leakage Alternate Drain Pathway serves to reduce the offsite dose.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 107 TO FACILITY OPERATING

LICENSE NO. NPF-39

PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION, UNIT 1

DOCKET NO. 50-352

1.0 INTRODUCTION

By letter dated January 14, 1994 , as supplemented by letters dated August 1, October 25, December 13, December 22, 1994 (two submittals) and February 7, 1995, the Philadelphia Electric Company (the licensee) submitted a request for changes to the Limerick Generating Station (LGS), Units 1 and 2, Technical Specifications (TSs). The requested changes would permit an increase in the allowable MSIV leakage rate from 11.5 standard cubic feet per hour (scfh), to 100 scfh for any MSIV, and a combined maximum pathway leakage rate of 200 scfh for all four main steam lines. The requested amendment also would delete TS 3/4.6.1.4 requirements for the currently installed MSIV leakage control system (LCS), and replace them with requirements for an MSIV Alternate Drain Pathway.

Specifically, the licensee requested that:

1. Allowable leakage rate specified in TS 3.6.1.2 be modified from the current 11.5 scfh for any one MSIV when tested at 22.0 psig to 100 scfh for any one MSIV with a total maximum pathway leakage of 200 scfh through all four main steam lines when tested at 22.0 psig;

2. TS 3/4.6.1.4 and its Bases be amended to permit the deletion of the MSIV LCS from the TS and replace them with requirements and Bases for the MSIV Leakage Alternate Drain Pathway. The licensee proposes these changes as an alternative to Regulatory Guide (RG) 1.96, "Design of Main Steam Isolation Valve Leakage Control Systems for Boiling Water Reactor Nuclear Power Plants," by utilizing the main steam lines and condenser as an alternate method for MSIV leakage treatment.

3. TS Table 3.6.3-1 be amended to permit the deletion of the MSIV LCS valves from the TS.

In its application, PECO proposed that the amendment apply to both units. The staff issued an amendment for Unit 2 on February 16, 1995. This safety evaluation applies to both units.

The proposed changes are the result of extensive work performed by the Boiling Water Reactor Owners Group (BWROG) in support of the resolution of Generic Issue C-8, "MSIV Leakage and Leakage Failure." In addition to the licensee's submittals, Generic Electric (GE) Report NEDC-31858P, Revision 2, "Increasing Main Steam Isolation Valve Leakage Rate Limits and Elimination of Leakage Control Systems," dated September 1993, also provided technical justification for the proposed changes.

2.0 BACKGROUND

The main steam lines (MSLs) contain dual quick-closing MSIVs. These valves function to isolate the reactor system in the event of a break in a steam line outside the primary containment, a design basis loss-of-coolant accident (LOCA), or other events requiring containment isolation. Although the MSIVs are designed to provide a leak-tight barrier, it is recognized that some leakage through the valves will occur. Operating experience at various BWR plants has indicated that degradation has occasionally occurred in the leak-tightness of MSIVs, and the specified low leakage has not always been maintained.

Because of recurring problems with excessive leakage of MSIVs, RG 1.96 recommended the installation of a supplemental LCS to ensure that the isolation function of the MSIVs complies with specified limits. To meet this requirement, the licensee installed a safety-related MSIV LCS that is designed to eliminate the release of fission products. This is accomplished by developing a negative pressure in the sections of the MSLs between the inboard and outboard MSIVs, and between the outboard MSIVs and the turbine stop valves. This negative pressure is developed by a series of blowers that discharge the leakage to an area where it is treated by the standby gas treatment system (SGTS).

Due to design limitations, the LCS would be unavailable if the MSIV leak rate greatly exceeds the allowable TS value. Hence, Generic Issue C-8 was initiated in 1983 to assess (1) the causes of MSIV failures, (2) the effectiveness of the LCS and alternative leakage paths, and (3) the need for regulatory action to limit public risk. The resolution of C-8 (see NUREG-1372, Regulatory Analysis for the Resolution of Generic Issue C-8, "Main Steam Isolation Valve Leakage and LCS Failure" dated June 1990) concluded that no backfit requirements were warranted and that no action should be taken. However, one of the alternative resolutions of C-8 showed that several non-seismic Category I paths resulted in lower offsite doses than the LCS and could handle larger MSIV leak rates.

In a parallel effort the BWROG formed the MSIV Leakage Committee in 1982 to identify and resolve the causes of high MSIV leakage rates. The BWROG then formed a follow-on MSIV Leakage Closure Committee to address alternate actions to resolve on-going but less severe MSIV leakage problems and to address the limited capability of the LCS. The results of these committee activities were submitted to the NRC in several GE proprietary reports, the latest of which is NEDC-31858P, Revision 2 (September 1993), titled, "Increasing Main Steam Isolation Valve Leakage Rate Limits and Elimination of Leakage Control Systems." This report concludes that the proposed increase of the MSIV leakage limit will reduce radiation exposures to maintenance personnel, reduce outage durations, and extend the effective service life of the MSIVs. The report also concludes that the proposed elimination of the LCS will similarly reduce exposures to maintenance personnel, reduce outage durations, and that the LCS can be replaced with an alternate method for MSIV leakage treatment using the MSLs and condenser. The licensee referred to this report as a basis to delete the TS requirements for the MSIV LCS and requested a substantially higher (100 scfh per MSIV and a total of 200 scfh for all four MSLs) MSIV leak rate limit.

The proposed alternative treatment method recommended in the BWROG report, and as proposed by the licensee, takes advantage of the large volume in the main steam lines and main condenser to provide hold-up and plate-out of fission products that may leak through closed MSIVs. This method uses the main steam drain lines to direct leakage to the main condenser. In this approach, the main steam piping, the bypass/drain piping, and the main condenser are used to mitigate the consequences of an accident that could result in potential offsite exposures comparable to 10 CFR Part 100. Therefore, as required by Appendix A to Part 100, the components and piping systems used in the alternative treatment path must be capable of performing their function during and following a safe shutdown earthquake (SSE). The BWROG report and the licensee's submittals provide the technical justification for the seismic capability of the alternate treatment path and also provide the dose calculations to demonstrate the acceptability of the system.

3.0 <u>EVALUATION</u>

The staff evaluation consists of a radiological assessment, a seismic adequacy evaluation, a plant systems evaluation, and a summary conclusion, as follows:

3.1 Radiological Assessment

To demonstrate the adequacy of the LGS engineered safety features designed to mitigate the radiological consequences of the design-basis-accidents (DBAs) with a maximum MSIV total leak rate of 200 scfh from four main steam lines and without the MSIV Leakage Control System, the licensee assessed the offsite and control room radiological consequences that could result from the occurrence of a postulated LOCA and presented the results of the offsite dose calculations in its submittal.

During the initial licensing review of LGS, the staff assessed the offsite radiological consequences of a LOCA using 46 scfh MSIV total leak rate from four MSLs and the MSIV LCS. The calculated results were shown in Table 15.1 of NUREG-0991, "Safety Evaluation Report related to the Operation of Limerick Generating Station, Units 1 and 2 (August 1983)." (OL-SER) In the OL-SER, the staff considered the following sources and radioactivity transport paths to the environment following a postulated LOCA:

(1) containment leakage
(2) main steam isolation valve leakage
(3) post-LOCA leakage from engineered safety features outside containment

In this evaluation, the staff recalculated the radiological consequences resulting from the same radioactivity transport paths as above. The procedures used in the staff's recalculation of offsite and control room radiological consequences were based on (1) the current TID-14844 source term which is consistent with the guidelines provided in the Standard Review Plan (SRP, NUREG-0800) and the applicable Regulatory Guides, and (2) the assumptions and parameters used in the LGS OL-SER, with the following two deviations: (1) the staff has provided a credit for radioactive iodine removal in the MSLs and main condenser by holdup for decay and deposition, and accepted deletion of the TS requirements for the MSIV LCS; and (2) the staff has provided a suppression pool decontamination factor of 10 in accordance with SRP Section 6.5.5 (issued subsequent to the LGS OL-SER) in its radiological consequence assessment. The staff's recalculated offsite and control room operator doses resulting from a postulated LOCA and the parameters and assumptions used in the staff's recalculation are given in Tables 1 and 2 of this safety evaluation (SE), respectively.

The current assumption used by the staff for operating plants in calculating radiological consequences of potential DBAs is based upon a conservative assumption that the leakage limit allowed by the TS is released directly into the environment. No credit is currently taken for the integrity and leaktightness of the main steam piping and condenser to provide holdup and plateout of fission products. The proposal developed by the BWROG and adopted by the licensee would allow higher leakage limits (200 scfh total from four steam lines) and delete the TS requirements for the main steam LCS.

3.1.1 Iodine Release Pathways

Following a LOCA, three potential release pathways exist for main steam leakage through the MSIVs:

(1) Main steam drain lines to the condenser, with delayed release to the environment through the low pressure turbine seals.

(2) Turbine bypass lines to the condenser, with delayed release to the environment through the low pressure turbine seals.

(3) MSLs through the turbine stop and control valves, and high pressure

turbine seals to the environment, bypassing the condenser.

The consequences of leakage from pathways 1 and 2 will be essentially the same because the condenser is used to process MSIV leakage. The condenser's iodine removal efficiency will vary depending on the inlet location of the bypass or drainline piping, but in either case, iodine will be removed. For pathway 3, MSIV leakage through the closed turbine stop and control valves will not be processed via the condenser. For this case, the high-pressure turbine (having a large internal surface area associated with the turbine blades) will remove iodine.

The staff believes that as long as either the turbine bypass or drainline leakage pathway is available, MSIV leakage through the closed turbine stop and control valves (pathway 3) will be negligible. Essentially all of the releases will be through the main condenser, because there will be no differential pressure between the MSIVs and the MSL downstream of MSIVs following closure of the valves.

Furthermore, MSIV leakage through pathway 3, if any, will have been subjected to the same iodine-removal processes in the MSLs (up to turbine stop valves) as the other pathways. The leakage will be further subjected to iodine removal by deposition on internal piping surfaces. Removal by the main condenser is not applicable to pathway 3.

The licensee has selected to utilize pathway 1 to mitigate the radiological consequences of an accident that could result in potential offsite exposures comparable to the dose reference values specified in 10 CFR Part 100. The staff has accepted the licensee's proposed pathway. In the calculation of the contribution to the LOCA dose, the staff assumed that one of the inboard isolation MSIVs failed to close, thus allowing contaminated steam to travel to the outboard valve. The leakage through this outboard valve and the valve pairs in the other three steamlines were assumed to have a total leak rate of 200 scfh.

3.1.2 Iodine Transport Model

Basic chemical and physical principles predict that gaseous iodine and airborne iodine particulate material will deposit on surfaces. Several laboratory and in-plant studies have demonstrated that gaseous iodine deposits by chemical adsorption and particulate iodine deposits through a combination of sedimentation, molecular diffusion, turbulent diffusion, and impaction. Gaseous iodine exists in nuclear power plants in several forms: elemental (I_2), hypoiodous (HOI) acid, organic (CH_3I), and particulate. In accordance with RG 1.3, the staff assumed 91 percent of iodine is in the elemental form (includes hypoiodous acid), 5 percent in the particulate form, and 4 percent in the form of organic iodides.

Each of these forms deposits on surfaces at a different rate, described by a parameter known as the deposition velocity. The elemental iodine form, being the most reactive, has the largest deposition velocity, and organic iodide has the smallest. Further, studies of in-plant airborne iodine show that iodine (elemental and particulate) deposited on the surface undergoes both physical and chemical changes and can either be resuspended as an airborne gas or become permanently fixed to the surface. The data also show that the iodine can change its form so that iodine deposited as one form (usually elemental) can be resuspended in the same or in another form (usually organic). Conversion can be described in terms of resuspension rates that are different for each iodine species. Chemical surface fixation can similarly be described in terms of a surface fixation rate constant.

The transport of gaseous iodine in elemental and particulate forms has been studied for many years and several groups have proposed different models to describe the observed phenomena (References 1 through 5). The staff used the model specifically developed by an NRC contractor (Reference 6) for iodine removal in BWR MSLs and the main condenser following a LOCA.

The staff model treats the MSIV leakage pathway as a sequence of small segments for which instantaneous and homogeneous mixing is assumed and the mixing computed for each segment is passed along as input to the next segment. The number of segments depends upon the parameters of the line and flow rate and can be as many as 100,000 for a long, large-diameter pipe having a low flow rate. Each line segment is divided into five compartments that represent the concentrations of the three airborne iodine species, the surface that contains iodine available for resuspension, and surface iodine that has reacted and is fixed on the surface.

The staff's model considers three iodine species: elemental, particulate, and organic. A fourth species, hypoiodous acid, was considered for the purpose of the staff's model to be a form of elemental iodine. All iodine in each segment undergoes radioactive decay. The resulting concentration from each segment's deposition compartment serves as the input to the next segment.

The GE model, as well as the one developed and used by the staff, is based on time-dependent temperature adsorption phenomena, with instantaneous and perfect mixing in a given volume. Both models use the same MSIV leakage pathways. They differ, however, in the treatment of buildup of iodine in the MSLs and condenser. GE assumed steady state iodine in equilibrium in a large volume, while the staff model assumed transient buildup of iodine in a finite number of small volumes. The staff does not consider these differences to be significant, because it finds that the resulting iodine deposition and removal rates in the MSLs and condenser are in good agreement.

The staff's transport model also assumed iodine transport through the condenser as a dilution flow rather than plug flow as in the steam lines. The staff assumed that the iodine input into the condenser mixes instantaneously with a volume of air in the condenser and that the diluted air exhausts at the same time and same rate as the input air (MSIV leakage) flows into the condenser.

The staff developed the equations for iodine deposition velocities, resuspension rates, and surface fixation rates as a function of temperature using published data found in the literature. The equations and data are contained in the contractor's report (Reference 6). The equation for the deposition velocity of elemental iodine is based on the least-squares fit to the available data. Deposition velocity equations for HOI acid and organic iodine are based on their values at 30 °C. Due to the lack of data at elevated temperatures, their temperature dependence is assumed to be similar to elemental iodine. Resuspension and fixation equations as a function of temperature are based on measurements available in the literature at ambient temperature. The staff assumed that resuspension and fixation rates will increase with increasing temperature.

The technical references, and the GE and staff models indicate that particulate and elemental iodine would be expected to deposit on surfaces with rates of deposition varying with temperature, pressure, gas composition, surface material, and particulate size. Therefore, the staff believes that an appropriate credit for the removal of iodine in the MSLs and main condensers should be provided in the radiological consequence assessment following a DBA. Consequently, the staff accepted the licensee's proposed elimination of the LCS and allowed a higher MSIV leakage providing an appropriate credit for the removal of iodine in the MSLs and condenser.

Sections III(c) and VI of Appendix A to 10 CFR Part 100 require that structures, systems, and components necessary to ensure the capability to mitigate the radiological consequences of accidents that could result in exposures comparable to the dose guidelines of Part 100 be designed to remain functional during and after a SSE. Thus, the MSL, portions of its associated piping, and the main condenser are required to remain functional if credit is taken for deposition of iodine and if an SSE occurs. In addition, Appendix A to 10 CFR Part 100 requires that the engineering method used to ensure that safety functions are maintained during and after an SSE involve the use of either a suitable dynamic analysis or a suitable qualification test.

For the purpose of providing a credit for iodine holdup and plateout, the staff's model requires that the main steam piping (including its associated piping to the condenser) and the condenser remain structurally intact following an SSE, so they can act as a holdup volume for fission products. By the term "structurally intact," the staff assumes the steam line will retain sufficient structural integrity to transport the relatively low flow rate ($\leq 2\ ft^3/min$) of MSIV bypass leakage through the steam lines to the condenser. In its radiological consequence assessment, the staff considers that the condenser is open to the atmosphere via leakage through the low pressure turbine seals. Thus, it is only necessary to ensure that gross structural failure of the condenser will not occur.

The staff finds, however, that the current design and operation of LGS requires the main steam drain valves be normally closed and remain closed following a LOCA, but that these valves are remotely operable from the main control room via non-safety related power source. Therefore, the staff's acceptance of the licensee's proposed amendment is contingent upon four plant design modifications and two procedural changes proposed by the licensee in Section VI-A of Attachment 3 to the licensee's letter dated January 14, 1994. Briefly, these are: provide Class IE power to valve HV-041-2F021; change internals of valve HV-C-0401-2F020 to increase the size of the opening, reroute subject drain lines to the main condenser; modify pipe supports for 4-inch lines EBD-208; write new stroke test procedures for boundary and flow pathway valves; and revise Plant Emergency Operating Procedures to establish the MSIV leakage alternate drain pathway.

3.1.3 Control Room Habitability

The control rooms for LGS, Units 1 and 2 are housed in a shared facility. The control room habitability systems are designed to serve the combined control room facility of both units. During normal operation, the control room is maintained at a slightly positive pressure with respect to the adjacent turbine building. During an emergency, the LGS control room emergency filtration system supplies outside air to pressurize the control room. The system is designed to maintain the control room at 1/8-inch water gauge positive pressure relative to adjacent areas. The pressurization is accomplished by introducing 525 cfm of outside air, which is mixed with 2475 cfm of control room return air before entering the control room emergency filtration unit. The filtration unit is an engineered safety feature system and has a redundant subsystem. Both trains contain, among other things, a 2-inch deep charcoal adsorber.

The staff has previously evaluated control room operator doses following a postulated LOCA and found the calculated doses were within the guidelines of SRP Section 6.4 (OL-SER Section 6.4). In this evaluation, the staff considered the fission product releases from the low pressure turbine seal due to MSIV leakage (up to 200 scfh total) through the MSIV drain lines and the main condensers. The staff assumed a ground level release of airborne fission products from the turbine building as a fission product diffusion source and the control room emergency air intake as a single point receptor.

The staff's recalculated control room operator doses following a postulated LOCA are listed in Table 3. The staff finds that the recalculated whole-body and equivalent organ doses (thyroid) are still within the guidelines of SRP Section 6.4. The staff's conclusions stated in OL-SER Section 6.4 are not affected and remain the same.

3.1.4 Conclusion - Radiological Assessment

Several technical references (Reference 1 - 5) including an NRC contractor's report (Reference 6) indicate that particulate and elemental iodine would be expected to deposit on surfaces with rates of deposition varying with temperature, pressure, gas composition, surface material, and particulate size. The staff, therefore, concludes that an appropriate credit for the removal of iodine in the MSLs and main condensers should be provided in the radiological consequence assessment following a DBA. The amount of iodine removal credit for LGS MSLs and the main condensers is shown in Table 2.

The staff has reviewed the licensee's analysis and has performed an independent reassessment of the radiological consequences resulting from the MSIV leakage transport pathway described in this SE. The calculated thyroid and whole-body dose are listed in the revised Table 1. Based on the above evaluation and the calculated radiological consequences shown in Table 1, the staff concludes that the MSIV leak rate limit of 200 scfh total from four MSLs and the proposed deletion of the TS requirements for the MSIV LCS are acceptable.

The staff further concludes that the existing distances to the exclusion area and to the low population zone boundaries of the LGS, in conjunction with the remaining engineered safety features provided in the LGS, remain sufficient to provide reasonable assurance that the radiological consequences of a postulated LOCA will be within the dose reference values set forth in 10 CFR Part 100 and the control room operator dose limits specified in GDC-19 of Appendix A to 10 CFR Part 50.

3.1.5 References

1. Vapor Deposition Velocity Measurements and Consolidation for I_2 and CsI,' NUREG/CR-2713, S.L. Nicolosi and P. Baybutt, May 1982.

2. Fission Produce Deposition and Its Enhancement Under Reactor Accident Condition: Deposition on Primary-system Surfaces, BMI-1863, J.M. Genko et. al., May 1969.

3. Transmission of Iodine Through Sampling Lines, 18th DOE Nuclear Airborne Waste Management and Air Cleaning Conference, P.J. Unrein, C.A. Pelletier, J.E. Cline and P.G. Voillequè, October 1984.

4. Deposition of ^{131}I in CDE Experiments, IN-1394, Nebeker et. al., 1969.

5. In-Plant Source Term Measurements at Prairie Island Nuclear Generating Station, NUREG/CR-4397, J.W. Mandler, A.C. Salker, S.T. Croney, D.W. Akers, N.K. Bihl, L.S. Loret and T.E. Young, September 1985.

6. MSIV Leakage Iodine Transport Analysis, J.E. Cline and Associates, Inc., 1991.

Table 1 Radiological Consequences of Loss-of-Coolant Accident

Parameter	Value (rem)		Value (rem)	
	EAB*		LPZ**	
	Thyroid	Whole Body	Thyroid	Whole Body
Containment Leakage				
00- 02 hours	8.3	1.0		
02- 08 hours			1.4	0.4
08- 24 hours			0.5	0.3
24- 96 hours			1.3	0.2
96-720 hours			1.4	0.1
Total containment leakage	8.3	1.0	4.6	1.0
ECCS component leakage	19.2	0.1	10.8	0.1
MSIV leakage	17	15.8	38	6.4
Total	44.5	16.9	53.4	6.5

*EAB: Exclusion Area Boundary
**LPZ: Low Population Zone

Table 2 Assumptions Used to Evaluate the Loss-of-Coolant Accident

Parameter	Value
Power level	3458 Mwt
Fraction of core inventory released	
Noble gases	100%
Iodine	50%
Iodine initial plate-out fraction	50%
Iodine chemical species	
Elemental	91%
Particulate	5%
Organic	4%
Suppression pool decontamination factor	
Noble gas	1
Organic iodine	1
Elemental iodine	10
Particulate	10
Iodine dose conversion factors	ICRP-30
Iodine deposition decontamination factor	10
MSIV leak rate (total)	200 SCFH
Iodine partition factor for ECCS leak	10
ECCS leak rate	5 gpm
Standby gas treatment system	
Filter efficiency	99%
Flow rate	1250 ft^3/min
Drawdown time	5 minutes
Primary containment free volume	4.0E+5 ft^3
Secondary containment free volume	1.8E+6 ft^3
Secondary containment mixing efficiency	50%
Dose conversion factors and breathing rates	ICRP-30

Table 3 Assumptions and Estimates of the Radiological Consequences to Control Room Operators following a LOCA

Parameter	Value	
Control room free volume	1.26E+5 ft^3	
Recirculation Rates		
Filtered Intake	525 CFM	
Unfiltered Intake	0.0	
Filtered Recirculation	2475 CFM	
Filter Efficacy (2 inch charcoal)	95%	
Unfiltered control room infiltration rate (assumed)	50 CFM	
Duration of accident	30 days	
Breathing rate of operators in control room for the course of the accident	3.47×10^{-4} m^3/sec	
Meteorology (wind speeds for all sectors)		
00 - 08 hours	3.46×10^{-4} sec/m^3	
08 - 24 hours	2.04×10^{-4} sec/m^3	
24 - 96 hours	1.30×10^{-4} sec/m^3	
96 - 720 hours	5.71×10^{-5} sec/m^3	
Iodine protection factor	38.5	
Iodine Dose Conversion Factors*	ICRP-30	
Control Room Operator Occupational Factors		
00 - 08 hours	1	
08 - 24 hours	1	
24 - 96 hours	0.6	
96 - 720 hours	0.4	
Doses to control room operators	Thyroid dose* (rem)	Whole body dose** (rem)
	13	<1

*unweighted dose equivalent
**unweighted dose equivalent (red bone marrow) due to immersion in an infinite cloud

3.2 Seismic Adequacy Evaluation

PECo has performed evaluations and seismic verification walkdowns to demonstrate that the main steam system piping and components comprising the alternate drain pathway are seismically rugged and are able to perform the required function of the MSIV leakage treatment system.

The proposed changes to the TS are supported by work performed by the BWROG, with the licensee's participation. This work, as documented in GE Report, NEDC-31858P, Rev. 2, entitled "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control Systems," (BWROG Report) serves as a generic basis of the acceptability of the above LGS, Units 1 and 2 proposal. Although the BWROG report has not yet been approved by the staff, the staff relied upon portions of the earthquake experience data, piping data and main condenser data in preparing this SE. The staff also determined during its review that additional information was required from the licensee to demonstrate that the system meets the seismic functionality requirement of Appendix A to 10 CFR Part 100. This additional information was provided by the licensee's letters dated August 1 and December 13, 1994.

It should be noted that there are no provisions in the LGS Final Safety Analysis Report (FSAR) or the staff's SE associated with the facility operating license that would permit the use of experience data as a means of seismic qualification for piping systems and components. However, requiring the non-seismically analyzed portions of the main steam system piping and components to meet Seismic Category I requirements would not be practical, because modifications required to upgrade the system to Seismic Category I requirements cannot be justified from a cost-benefit standpoint.

The BWROG has retained Earthquake Engineering, Inc. (EQE) as a consultant to conduct a review of the earthquake experience data on the performance of facility piping and condensers. The review summarized the data on the performance of main steam system piping and condensers in non-nuclear power plants that experienced strong motion earthquakes. In addition, it compared these piping systems and condensers with the piping systems and condensers typically used in GE BWRs in the United States. The review appears to support the BWROG contention that main steam piping and condensers employed in GE BWRs would maintain their pressure boundary integrity during a SSE. According to EQE, based on past earthquake experiences, welded steel piping and condensers designed and constructed to normal industrial practices (e.g., ANSI B31.1 and Heat Exchange Institute (HEI) Standard) have been found to be seismically rugged and not susceptible to a primary collapse mode of failure as a result of the seismic vibratory motions experienced at sites examined in the earthquake database. The report notes that a relatively small number of seismically-induced piping failures have occurred due to excessive relative support movements or seismic interactions.

The proposed alternate treatment method uses a number of piping pathways to direct leakage steam from the MSIVs to the main condenser for treatment. The most important of these pathways (the primary pathway) originates in the steam tunnel just downstream of the MSIVs, incorporates line EBD-208, and terminates at the main condenser at elevation 211 ft. There are several "backup" pathways. One backup pathway originates from the MSLs in the turbine building just upstream of the main turbine stop valves (MTSVs), incorporates line EBD-214, and terminates at the main condenser at elevation 239 feet. Another backup pathway originates at the seat drains on the MTSVs, incorporates line EBD-215, and discharges into the main condenser at elevation 239 feet. The condenser forms a boundary for all primary and backup pathways. Boundaries upstream of the main condenser were established using the valves in each primary and backup pathway (i.e., HV-208, 209, 211, and 250, and the MTSVs and main turbine bypass valves (MTBVs)), and define the extent of the seismic verification walkdowns.

3.2.1 Seismic Verification Walkdowns

The primary and backup pathways consist of the main steam piping beyond the outboard MSIVs, the steam drain lines, the main condenser, and interconnected piping. The primary and backup pathways are not seismically analyzed because this analysis was not required in the original licensing basis of either unit at LGS.

To confirm the functional capability of the alternate treatment system, the licensee has performed seismic verification walkdowns for LGS, Unit 2, in accordance with the Limerick Generating Station Walkdown Plan, Modification P-00017. The results of the walkdowns will be applicable to Unit 1. The purpose of the walkdowns is to ensure that the alternate treatment system falls within the bounds of the design characteristics of the seismic experience database as discussed in Section 6.7 of the BWROG Report. Specifically, the walkdowns were performed to (1) verify that LGS features have attributes similar to those in the earthquake experience database that have demonstrated good seismic performance, (2) verify general conformance of pipe support spans to the requirements of ANSI B31.1, and (3) examine the alternate treatment system from the outboard MSIVs to the condenser to identify potential seismic vulnerabilities considering those structural details and causal factors that resulted in component damage at database plants.

The walkdowns focused on Seismic Category II lines that were not seismically analyzed. Seismic Category I and IIA lines, which are seismically analyzed, also were walked down to identify any anomalies that may have gone undetected during the original design and construction. The potential vulnerabilities that were to be identified as "outliers" include support failure, falling of non-seismically designed plant features (II/I), proximity impact, and differential seismic anchor motion on piping systems. The licensee's January 14, 1994,submittal presents a complete list of the "outliers" identified during the walkdowns and actions taken for their resolution.

These "outliers" have been either evaluated or analyzed by the licensee to demonstrate acceptability as-is, or plant modifications initiated to resolve the concerns. As a result of the walkdowns and subsequent evaluations, the licensee summarized the actions needed for the following components in its letter of August 1, 1994:

(1) Modify piping supports (EBD-208-H23, 24, 25, 26, 27 and 28) on 4-inch EBD-208 line in the turbine building with added lateral restraints to prevent potential pipe slide and fall-off;

(2) Remove the redundant beam clamp support on 2-inch EBD-214 line in the turbine building;

(3) Relocate Valve HV-204 to prevent potential seismic interaction caused by the movement of a nearby large steam line.

The licensee has committed to make the above modifications to LGS, Unit 2, prior to the restart of the plant following the 1995 refueling outage. Similarly, the licensee will make the required modification to LGS, Unit 1 during the planned January 1996 refueling outage.

3.2.2 Additional Earthquake Performance Data

During a December 10, 1993, meeting at NRC Headquarters concerning a similar Georgia Power Company (GPC) request to eliminate the MSIV leakage control system at Plant Hatch, EQE - acting as a consultant to GPC - presented the survey results for EQE data and open literature for 18 strong-motion earthquakes covering 29 sites and 96 power plants. The 18 earthquakes range in Richter magnitude from 5.4 to 8.1. The EQE estimates of the average peak ground accelerations (PGAs) from these earthquakes were in the range of 0.1g to 0.85g. The survey found no precedent for failure of the main steam piping pressure boundary and condenser shell. The survey did, however, find damage to piping insulation, valve operators, and piping supports, as well as condenser tubes. The EQE database covers facilities with underlying foundations varying from soft soil to rock. Also included was a substantial number of diverse structures and designs that house a wide variety of pipe runs, cable trays, conduits, tubing, and related components. The database also contained numerous records of equipment installation, from vintage 1930 to new.

The staff found the earthquake data provided in the BWROG report to be insufficient to apply pipes of smaller sizes (1 inch to 10 inches in diameter). The staff therefore requested that GPC submit additional earthquake data to cover these smaller pipes sizes. The supplemental and updated earthquake performance data, which included 24 earthquakes at about 126 sites, were subsequently provided in the GPC submittal of January 6, 1994. This same additional database was referenced in the licensee's August 1, 1994 submittal, in response to the staff's request for additional information (RAI) dated May 26, 1994. The measured or estimated horizontal ground accelerations for these updated database sites range from 0.15g to 1.0g, with the majority of the sites having estimates of peak ground acceleration of 0.3g or higher. The duration of strong motion (on the order of 0.10g or greater) was estimated to range from 5 seconds to more than 50 seconds. The staff determined that the supplemental data on small piping serve to expand the original piping database provided in the BWROG report, and envelop the LGS primary and backup pathway piping.

3.2.3 Alternate Drain Pathway (ADP)

As indicated in the January 14, 1994 submittal, the main steam system piping (including supports) up to and including all boundary valves, except the MTSVs and the MTBVs, is Seismic Category I and will be maintained as Seismic Category I. This piping and all its branch lines 2.5 inches in diameter and larger up to and including the first valve (including restraint), has been designed to withstand OBE and SSE design loads in combination with other appropriate loads, and satisfies the limits specified for ASME Section III Code Class 2 piping.

As stated by the licensee, line EBD-208 inside the steam tunnel is Seismic Category I up to valve HV-C-2F020, Seismic Category IIA up to the turbine building, and Seismic Category II within the turbine building. In addition, line EBD-214 downstream of the MSLs, line EBD-215, and interconnected lines are Seismic Category II.

The piping identified as Seismic Category IIA was originally analyzed for Seismic Category I loading and constructed to the requirements of ANSI B31.1. Piping identified as Seismic Category II, however, is non-safety related and is composed of welded steel piping and standard support components. This piping generally is analyzed by rule and approximate methods, without consideration of seismic loads.

In its August 1, 1994, submittal, the licensee states that the Seismic Category II lines are bounded in diameter and diameter-to-thickness ratio by those installed in the earthquake experience database plants, as evidenced in the BWROG report and the supplemental and updated earthquake performance data discussed above. The licensee also states that upon completion of all related modifications, piping position retention and pressure boundary integrity will be maintained by deadweight supports under normal and earthquake loadings.

The licensee states that the overall size (in terms of heat transfer area) of the main condenser is generally enveloped by the condensers in the earthquake experience database and the anchorage capacity-to-seismic demand ratios for the LGS main condenser are higher than those at the database sites. The determination of anchorage adequacy was based on the evaluation of the shear area of the main condenser's anchorage and its capability to resist the design basis SSE loading, thus ensuring that the condenser remains stationary and performs its necessary function following an SSE. Therefore, based on an acceptable anchorage evaluation in conjunction with the experience database evidence, the staff concludes that the position retention and overall operability of the LGS condenser would be maintained under SSE loading.

In response to the above staff's RAI of May 26, 1994, the licensee provided its seismic margin evaluations of a representative and highly loaded support design for both lines EBD-208 and 214. The methodology used to demonstrate the seismic margin is called Conservative Deterministic Failure Margin (CDFM), as described in EPRI Report EPRI NP-6041, dated August 1991. Although this methodology has not been approved by the NRC staff for licensing reviews involving Seismic Category I systems, the staff concludes that in consideration of the available safety margins demonstrated by the licensee, its employment to demonstrate the functional capability of the alternate treatment system to be reasonable. As a result, the staff determined that the highly loaded representative supports of primary and backup piping pathways are adequately designed.

As indicated in the BWROG report, all valves in the primary and backup pathway that are required to open during an accident, will be supplied with Class 1E power. Currently, normally closed isolation valves HV-041-1(2)F021 are not supplied by Class 1E power. As stated in the licensee's letter of January 14, 1994, a modification will be performed to supply Class 1E power to these valves. The licensee also states that with the exception of the MTSVs and the MTBVs, all boundary valves required to operate are Seismic Category I and will be maintained as such. The hydraulically operated main turbine stop and control valves, although not classified as Seismic Category I and not powered from a Class 1E source, have been previously evaluated and are documented in the LGS UFSAR to be capable of functioning during and following an SSE. Specifically, these valves are designed to fail shut in the event of a loss of power.

In its August 1, 1994 letter, the licensee further proposes that primary and backup pathways be added to the LGS TS. The new specifications will require that the isolation valves HV-041-1(2)F021 and boundary valve, HV-208, HV-209, HV-211, and HV-250 be tested in accordance with the inservice testing (IST) program. In addition, valves HV-041-1(2)F021 will be added to the Generic Letter 89-10 Motor Operated Valve Program.

A highly reliable power source, in combination with required testing for the valves, as discussed above, provides a high degree of confidence that the subject valves will remain functional. This is acceptable to the NRC staff.

Based on the above, the staff determines that the LGS non-seismically analyzed main steam system piping and condenser that will be used for the alternate treatment system compares well with the earthquake experience database, and that the seismic verification walkdowns of the system and subsequent evaluations have addressed characteristics associated with the limited component damage situations observed at the database facilities. The staff also determines that the licensee has taken proper measures to ensure resolution for all of the identified "outliers," and has analytically demonstrated adequate margins of safety for piping supports. In addition, the staff also determines that the licensee has taken proper measures to ensure the capability of the ADP valves to perform their functions under design basis loadings.

3.2.4 Bounding Seismic Analysis

To corroborate the January 14, 1994, TS change request and provide additional confirmation of the BWROG seismic methodology, the NRC staff requested that the licensee analytically demonstrate that the proposed ADP piping system will maintain its functionality under an LGS SSE. In a December 9, 1994, telephone conference with the staff, the licensee agreed to provide the results of a confirmatory dynamic seismic analysis performed in accordance with NRC-approved licensing criteria and methodology, on a representative and bounding non-seismic portion of the proposed primary and backup pathways piping system.

A dynamic seismic analysis for a portion of line EBD-208 was performed by application of appropriate floor response spectra developed from the LGS SSE, and by using Bechtel Computer Code ME-101. The results of the analysis were provided by the licensee in its December 13, 1994 letter, which indicated that the pipe stresses are within the allowable limit of 2.4 S_h. Supports were also evaluated and found to be within the allowable limits, with a majority of expansion anchors having a safety factor of 4 and a few supports having a safety factor of 3. In its original request for this license amendment, the licensee addressed the main condenser anchorage capacity, and stated that it meets the 0.15g design basis SSE seismic loading. The design of the alternate treatment system pathway is based on static load design, dynamic load analysis, and actual demonstrations of the survivability of the piping and main condenser in actual power plants that have experienced earthquakes. The main condenser was evaluated utilizing the results of an acceptable main condenser anchorage evaluation in conjunction with the results of the experience database. The staff found these seismic analysis results acceptable as providing confirmation of the seismic adequacy of the alternate treatment system that was established on the basis of the earthquake database.

3.2.5 Structural Engineering Evaluation

The licensee dynamically analyzed the turbine building to determine its capability to withstand an SSE, as documented in the LGS UFSAR. The staff concludes that the turbine building would not collapse and render the housed alternate treatment system incapable of maintaining its functionality under an SSE.

In a December 19, 1994, telephone conference, the NRC staff requested information from the licensee on the adequacy of the masonry wall adjacent to the main steam pressure transmitters. The licensee stated that the wall had been analyzed and the results indicated that the wall would not collapse during an SSE. The masonry wall is 11-feet high, 22-feet wide, and 8-inches thick. The wall is reinforced with #5 steel bars at 2-feet intervals both vertically and horizontally. The wall is supported at the top with a steel beam. The analysis assumed that the wall is simply supported at the top and bottom. The licensee stated that the ultimate moment capacity of the wall exceeded the maximum induced moment during an SSE and, therefore, the wall would withstand an SSE. The staff considered the assumptions used in the analysis to be conservative and acceptable, and thus, concurred with the licensee's determination concerning the seismic adequacy of the masonry wall.

3.2.6 Conclusion - Seismic Adequacy Evaluation

Based on the above evaluation, the NRC staff concludes that upon completion of the plant modifications necessary for the identified "outliers", and incorporation of ADP valves in the LGS IST program and Generic Letter 89-10, Motor Operated Valve program, there is reasonable assurance that the LGS MSLs, main steam drain lines, condenser, and associated interconnected piping and supports will be seismically adequate for the proposed MSIV leakage alternate treatment system. The staff's conclusion is based on (1) the LGS main condenser is generally enveloped by the condensers in the earthquake experience database and acceptable anchorage evaluation, (2) the Seismic Category I and Category IIA portions of the main steam system piping were seismically analyzed as part of the initial design of the plant, (3) the remaining primary and backup pipes are represented by those in the earthquake experience database that demonstrated good seismic performance, and (4) adequate margins of safety under SSE loading as demonstrated by the confirmatory dynamic bounding seismic analysis of a portion of line EBD-208 as a representative sample of the ADP piping in item 3 above. The staff, therefore, concludes that the licensee's proposed alternate treatment system is seismically adequate to withstand the LGS safe shutdown earthquake and maintain its functionality, and hence, meets the requirements of GDC 2 of Appendix A to 10 CFR Part 50 and Appendix A to 10 CFR Part 100.

It should be noted that the NRC staff's consideration of the experience-based methodology as presented by the BWROG and the licensee, is restricted to its application for ensuring the pressure boundary integrity and functionality of the alternate drain pathway associated with the MSIV leakage treatment system. The staff's consideration of the methodology for this application is not an endorsement for the use of the experience-based methodology for other applications at LGS. The staff's conclusion was based on the static load method and confirmatory dynamic analyses, in conjunction with consideration of the experience database relating to alternate ADP.

3.3 Plant Systems Evaluation

There are two motor operated valves (MOVs) in series in the primary pathway between the MSLs and the main condenser. Both valves must be open to establish the required alternate leakage path. The first (upstream) MOV, HV-C-1(2)020, is normally open and will fail "as-is" on a loss of power. The second (downstream) MOV, HV-041-1(2)F021, is normally closed, but has a small bypass orifice around it to allow drainage during normal operation and is required to be opened following the DBA LOCA to establish a drain path to support the radiological analysis. Both valves are powered from Class IE sources. The staff requested the licensee to address the failure of this downstream valve to open on demand, due to a valve or power supply failure.

In its August 1, 1994, submittal, the licensee stated that the downstream valve is powered from a bus that is supplied from two independent offsite sources and a highly reliable diesel generator. To increase the reliability of the MOV itself, proposed TS 3/4.6.1.4 requires the subject valve (HV-041-1(2)F021) to be tested in accordance with the inservice test program for valves. Further, the licensee evaluated the effects of a failure of the valve to open and demonstrated that other adequate flow paths would still be available.

The licensee verified there are two different pathways that are included in the boundary of the MSIV leakage alternate drain pathway that would be available to convey MSIV leakage to the condenser if the downstream valve fails to open. Neither of these drain paths require the opening of any valves. These "backup" drain paths provide orificed flow pathways, which ensure that even with the failure of a valve in the primary flow path, flow will be directed to the main condenser at the same elevation as that assumed in the radiological dose calculation. The radiological analysis did not take credit for these open pathways. Therefore, these backup pathways will ensure sufficient flow to the main condenser and will act to reduce the radiological impact to within the regulatory limits. Furthermore, the licensee has noted two additional pathways, each with a motor operated valve not supplied with Class IE power (hence not credited in the radiological analysis), but that will open on a turbine trip to provide a flow pathway of equal or greater flow area than is assumed in the dose calculations. Consequently, if the primary downstream MOV (HV-041-1(2)F021) fails to open as required, adequate backup drain paths would be available to convey MSIV leakage to the main condenser. All four of these paths will convey essentially all of the MSIV leakage to the main condenser. Consequently, the radiological dose assessment for these four pathways would be at least equivalent to the dose assessment for the primary path. Additionally, the licensee has committed to update the Operating and Emergency Operating Procedures as necessary to address the alternate and backup leakage treatment methods. Based on the above, the staff concludes that the proposed design provides a reliable leakage treatment method that satisfies the single failure criterion of GDC 41, "Containment Atmosphere Cleanup." The staff therefore concludes the proposed design is acceptable.

The licensee further proposed new requirements in the LGS TS Section 3.6.1.2 related to restoration of acceptable leak rates if any of the proposed limits are exceeded. The new requirements state that if any MSIV leakage rate exceeds 100 scfh, the valve will be repaired and retested to meet a leak rate limit of 11.5 scfh (the current criterion for leakage). The maximum total leak rate will be restored to less than or equal to 200 scfh whenever the 200 scfh limit is exceeded. The staff concludes that these new requirements will restore the leakage rates to values that are consistent with the revised radiological analysis and are therefore acceptable.

3.4 Evaluation - Overall Conclusions

Based on its evaluation as described above, the staff concludes that:

(1) The proposed increase in allowable MSIV leakage rates will avoid unnecessary dose exposure to maintenance personnel, reduce outage durations, extend the effective service life of the MSIVs, and has the potential to significantly reduce recurring valve leakage caused by repairs. In addition, the proposed alternate treatment method will be able to handle larger leakage rates than could be accommodated by the existing LCS due to its design limitations. The resulting doses remain well within the guidelines of 10 CFR Part 100 for the offsite radiological doses and 10 CFR Part 50, Appendix A (GDC 19) for the control room doses.

(2) The design of the alternate treatment path, including piping, structures and components meet the requirements of 10 CFR Part 100,

Appendix A with respect to performing its safety function following a design basis seismic event, and

(3) The design of the alternate treatment method also meets the requirements of GDC 41 with respect to performing its safety function with and without offsite power and assuming a single active failure.

The staff therefore concludes that design of the alternate leakage path, and the proposed changes to the TS to increase MSIV leak rates limits and eliminate the LCS are acceptable.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact have been prepared and published in the Federal Register on February 7, 1995 (60 FR 7226). Accordingly, based upon the environmental assessment, the staff has determined that the issuance of the amendments will not have a significant effect on the quality of the human environment.

6.0 CONCLUSION

The Commission 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 the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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Date: January 25, 1996

UNITED STATES NUCLEAR REGULATORY COMMISSION

PHILADELPHIA ELECTRIC COMPANY

DOCKET NO. 50-352

NOTICE OF ISSUANCE OF AMENDMENT TO

FACILITY OPERATING LICENSE

The U.S. Nuclear Regulatory Commission (Commission) has issued Amendment No. 107 to Facility Operating License No. NPF-39 issued to Philadelphia Electric Company, which revised the Technical Specifications (TSs) operation of the Limerick Generating Station, Unit 1, located in Montgomery County, Pennsylvania. The amendment is effective as of the date of issuance. The amendment modified the TSs to permit an increase in the allowable leak rate for main steam isolation valves (MSIV), and delete the MSIV leakage control system (LCS). The main steam drain lines and the main condenser would be utilized as an alternate MSIV leakage treatment system.

The application for the amendments complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment.

Notice of Consideration of Issuance of Amendments and Opportunity for Hearing in connection with this action was published in the FEDERAL REGISTER on September 26, 1994 (59 FR 49089). No request for a hearing or petition for leave to intervene was filed following this notice.

The Commission has prepared an Environmental Assessment related to the action and has determined not to prepare an environmental impact statement. Based upon the environmental assessment, the Commission has concluded that the issuance of the amendment will not have a significant effect on the quality of the human environment (60 FR 7226).

For further details with respect to the action see (1) the application for amendments dated January 14, 1994, and supplemented by letters dated August 1, October 25, December 13, December 22, 1994 (two submittals), and February 7, 1995 (2) Amendment No. 107 to License No. NPF-39, (3) the Commission's related Safety Evaluation, and (4) the Commission's Environmental Assessment. All of these items are available for public inspection at the Commission's Public Document Room, the Gelman Building, 2120 L Street NW., Washington, DC, and at the local public document room located at the Pottstown Public library, 500 High Street, Pottstown, PA.

Dated at Rockville, Maryland, this 25th day of January 1996.

FOR THE NUCLEAR REGULATORY COMMISSION

Frank Rinaldi

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