June 8, 1989

Docket No.: 50-352

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Mr. George A. Hunger, Jr.
Director-Licensing
Philadelphia Electric Company
Correspondence Control Desk
P. O. Box 7520
Philadelphia, Pennsylvania 19101

Dear Mr. Hunger:

SUBJECT: STANDBY LIQUID CONTROL SYSTEM (TAC NO. 72630)

RE: LIMERICK GENERATING STATION, UNIT 1

The Commission has issued the enclosed Amendment No. 22 to Facility Operating License No. NPF-39 for the Limerick Generating Station, Unit 1. This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated February 22, 1989.

This amendment revises the Technical Specifications (TSs) related to the Standby Liquid Control System to ensure compliance with paragraph (c)(4) of the Anticipated Transient Without Scram Rule, 10 CFR 50.62, and to simplify and improve the TS requirements for the system.

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

Sincerely,

Original signed by
Richard J. Clark

Richard J. Clark, Project Manager
Project Directorate I-2
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 22 to License No. NPF-39
2. Safety Evaluation

cc w/enclosures:
See next page

DFo1
1/1

Previously concurred*

PDI	PDI-2/PM*	OGC	PDI-2/D	SRXB/DEST
MO'Brien	RClark	MYoung	WButler	MWHodges
/89	05/22/89	6/1/89	6/8/89	5/24/89

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

June 8, 1989

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License No. NPF-39
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cc w/enclosures:
See next page

cc:

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

PHILADELPHIA ELECTRIC COMPANY

DOCKET NO. 50-352

LIMERICK GENERATING STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 22
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 February 22, 1989, 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. 22 , 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.

FOR THE NUCLEAR REGULATORY COMMISSION

/S/

Walter R. Butler, Director
Project Directorate I-2
Division of Reactor Projects I/II

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 8, 1989

PDI-2/PM
MO'Brien
6/8/89

PDI-2/PM
RClark:
05/22/89

OGC
6/1/89

PDI-2/D
WButler
6/8/89

3. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Walter R. Butler

Walter R. Butler, Director
Project Directorate I-2
Division of Reactor Projects I/II

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 8, 1989

ATTACHMENT TO LICENSE AMENDMENT NO. 22

FACILITY OPERATING LICENSE NO. NPF-39

DOCKET NO. 50-352

Replace the following pages of the Appendix A Technical Specifications with the attached page. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change. Overleaf pages are provided to maintain document completeness.*

Remove	Insert
v	v
vi	vi*
3/4 1-19	3/4 1-19
3/4 1-20	3/4 1-20
3/4 1-21	3/4 1-21
3/4 1-22	3/4 1-22
B 3/4 1-3	B 3/4 1-3*
B 3/4 1-4	B 3/4 1-4
-	B 3/4 1-5
-	-

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3/4.1.5 STANDBY LIQUID CONTROL SYSTEM

LIMITING CONDITION FOR OPERATION

3.1.5 The standby liquid control system consisting of a minimum of two pumps and corresponding flow paths, shall be OPERABLE.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 5*

ACTION:

a. In OPERATIONAL CONDITION 1 or 2:

1. With only one pump and corresponding explosive valve OPERABLE, restore one inoperable pump and correspondng explosive valve to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours.

2. With the standby liquid control system otherwise inoperable, restore the system to OPERABLE status within 8 hours or be in at least HOT SHUTDOWN within the next 12 hours.

b. In OPERATIONAL CONDITION 5*:

1. With only one pump and corresponding explosive valve OPERABLE, restore one inoperable pump and corresponding explosive valve to OPERABLE status within 30 days or insert all insertable control rods within the next hour.

2. With the standby liquid control system otherwise inoperable, insert all insertable control rods within 1 hour.

SURVEILLANCE REQUIREMENTS

4.1.5 The standby liquid control system shall be demonstrated OPERABLE:

a. At least once per 24 hours by verifying that;

1. The temperature of the sodium pentaborate solution is within the limits of Figure 3.1.5-1.

2. The available volume of sodium pentaborate solution is at least 4537 gallons.

3. The heat tracing circuit is OPERABLE by determining the temperature of the pump suction piping to be greater than or equal to 70°F.

*With any control rod withdrawn. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2.

SURVEILLANCE REQUIREMENTS (Continued)

b. At least once per 31 days by:

1. Verifying the continuity of the explosive charge.

2. Determining by chemical analysis and calculation* that the available weight of sodium pentaborate is greater than or equal to 5389 lbs; the concentration of sodium pentaborate in solution is less than or equal to 13.8% and within the limits of Figure 3.1.5-1 and; the following equation is satisfied:

$$\frac{C}{13\% \text{ wt.}} \times \frac{Q}{86 \text{ gpm}} \geq 1$$

where

C = Sodium pentaborate solution (% by weight)
Q = Two pump flowrate, as determined per surveillance requirement 4.1.5.c.

3. Verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. Demonstrating that, when tested pursuant to Specification 4.0.5, the minimum flow requirement of 41.2 gpm per pump at a pressure of greater than or equal to 1190 psig is met.

d. At least once per 18 months during shutdown by:

1. Initiating at least one of the standby liquid control system loops, including an explosive valve, and verifying that a flow path from the pumps to the reactor pressure vessel is available by pumping demineralized water into the reactor vessel. The replacement charge for the explosive valve shall be from the same manufactured batch as the one fired or from another batch which has been certified by having one of that batch successfully fired. All injection loops shall be tested in 3 operating cycles.

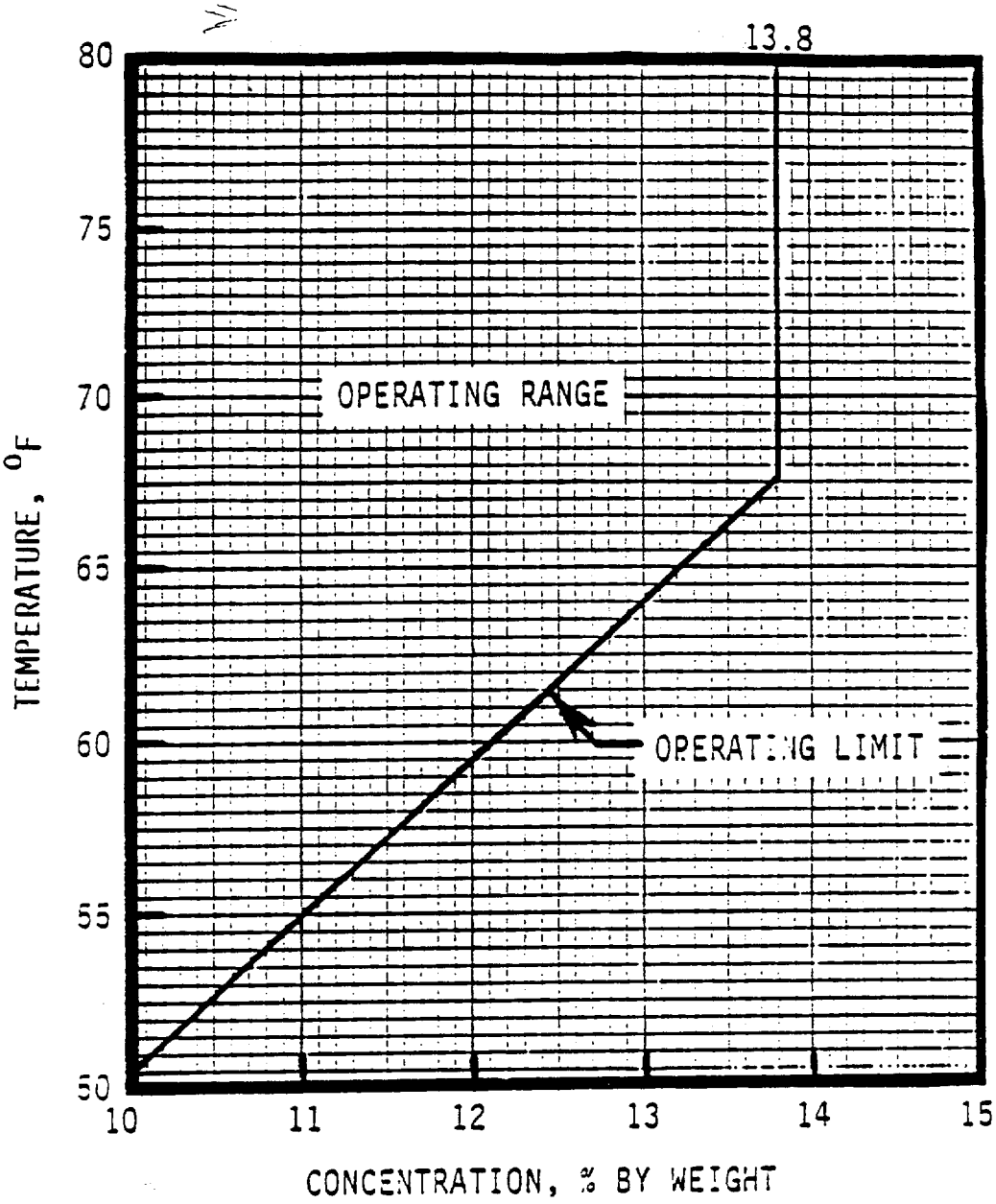
2. **Demonstrating that all heat traced piping is unblocked by pumping from the storage tank to the test tank and then draining and flushing the piping with demineralized water.

3. Demonstrating that the storage tank heaters are OPERABLE by verifying the expected temperature rise of the sodium pentaborate solution in the storage tank after the heaters are energized.

---

*This test shall also be performed anytime water or boron is added to the solution or when the solution temperature drops below 70°F.

**This test shall also be performed whenever all three heat tracing circuits have been found to be inoperable and may be performed by any series of sequential, overlapping or total flow path steps such that the entire flow path is included.



SODIUM PENTABORATE SOLUTION
TEMPERATURE/CONCENTRATION REQUIREMENTS

FIGURE 3.1.5-1

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CONTROL RODS (Continued)

Control rod coupling integrity is required to ensure compliance with the analysis of the rod drop accident in the FSAR. The overtravel position feature provides the only positive means of determining that a rod is properly coupled and therefore this check must be performed prior to achieving criticality after completing CORE ALTERATIONS that could have affected the control rod coupling integrity. The subsequent check is performed as a backup to the initial demonstration.

In order to ensure that the control rod patterns can be followed and therefore that other parameters are within their limits, the control rod position indication system must be OPERABLE.

The control rod housing support restricts the outward movement of a control rod to less than 3 inches in the event of a housing failure. The amount of rod reactivity which could be added by this small amount of rod withdrawal is less than a normal withdrawal increment and will not contribute to any damage to the primary coolant system. The support is not required when there is no pressure to act as a driving force to rapidly eject a drive housing.

The required surveillance intervals are adequate to determine that the rods are OPERABLE and not so frequent as to cause excessive wear on the system components.

3/4.1.4 CONTROL ROD PROGRAM CONTROLS

Control rod withdrawal and insertion sequences are established to assure that the maximum insequence individual control rod or control rod segments which are withdrawn at any time during the fuel cycle could not be worth enough to result in a peak fuel enthalpy greater than 280 cal/gm in the event of a control rod drop accident. The specified sequences are characterized by homogeneous, scattered patterns of control rod withdrawal. When THERMAL POWER is greater than 10% of RATED THERMAL POWER, there is no possible rod worth which, if dropped at the design rate of the velocity limiter, could result in a peak enthalpy of 280 cal/gm. Thus requiring the RWM to be OPERABLE when THERMAL POWER is less than or equal to 10% of RATED THERMAL POWER provides adequate control.

The RWM provides automatic supervision to assure that out-of-sequence rods will not be withdrawn or inserted.

The analysis of the rod drop accident is presented in Section 15.4.9 of the FSAR and the techniques of the analysis are presented in a topical report, Reference 1, and two supplements, References 2 and 3. Additional pertinent analysis is also contained in Amendment 17 to the Reference 4 topical report.

The RBM is designed to automatically prevent fuel damage in the event of erroneous rod withdrawal from locations of high power density during high power operation. Two channels are provided. Tripping one of the channels will block erroneous rod withdrawal to prevent fuel damage. This system backs up the written sequence used by the operator for withdrawal of control rods.

BASES

3/4.1.5 STANDBY LIQUID CONTROL SYSTEM

The standby liquid control system provides a backup capability for bringing the reactor from full power to a cold, Xenon-free shutdown, assuming that the withdrawn control rods remain fixed in the rated power pattern. To meet this objective it is necessary to inject a quantity of boron which produces a concentration of 660 ppm in the reactor core and other piping systems connected to the reactor vessel. To allow for potential leakage and improper mixing, this concentration is increased by 25%. The required concentration is achieved by having available a minimum quantity of 4,537 gallons of sodium pentaborate solution containing a minimum of 5,389 lbs of sodium pentaborate. This quantity of solution is a net amount which is above the pump suction shutoff level setpoint thus allowing for the portion which cannot be injected. The pumping rate of 41.2 gpm provides a negative reactivity insertion rate over the permissible solution volume range, which adequately compensates for the positive reactivity effects due to elimination of steam voids, increased water density from hot to cold, reduced doppler effect in uranium, reduced neutron leakage from boiling to cold, decreased control rod worth as the moderator cools, and xenon decay. The temperature requirement ensures that the sodium pentaborate always remains in solution.

With redundant pumps and explosive injection valves and with a highly reliable control rod scram system, operation of the reactor is permitted to continue for short periods of time with the system inoperable or for longer periods of time with one of the redundant components inoperable.

The SLCS system consists of three separate and independent pumps and explosive valves. Two of the separate and independent pumps and explosive valves are required to meet the minimum requirements of this technical specification and, where applicable, satisfy the single failure criterion.

The SLCS must have an equivalent control capacity of 86 gpm of 13% weight sodium pentaborate in order to satisfy 10 CFR 50.62 (Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants). This equivalency requirement is fulfilled by having a system which satisfies the equation given in 4.1.5.b.2.

The upper limit concentration of 13.8% has been established as a reasonable limit to prevent precipitation of sodium pentaborate in the event of a loss of tank heating, which allow the solution to cool.

STANDBY LIQUID CONTROL SYSTEM (Continued)

Surveillance requirements are established on a frequency that assures a high reliability of the system. Once the solution is established, boron concentration will not vary unless more boron or water is added, thus a check on the temperature and volume once each 24 hours assures that the solution is available for use.

Replacement of the explosive charges in the valves at regular intervals will assure that these valves will not fail because of deterioration of the charges.

1. C. J. **Paone**, R. C. Stirn and J. A. Woolley, "Rod Drop Accident Analysis for **Large BWR's**," G. E. Topical Report NEDO-10527, March 1972.

2. C. J. Paone, R. C. Stirn, and R. M. Young, Supplement 1 to NEDO-10527, July 1972.

3. J. M. Haun, C. J. Paone, and R. C. Stirn, Addendum 2, "Exposed Cores," Supplement 2 to NEDO-10527, January 1973.

4. Amendment 17 to General Electric Licensing Topical Report NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel".

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 22 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 February 22, 1989, Philadelphia Electric Company (the licensee) requested an amendment to Facility Operating License No. NPF-39 for the Limerick Generating Station, Unit 1. The proposed amendment would revise the Technical Specifications (TSs) related to the Standby Liquid Control System (SLCS) to ensure compliance with paragraph (c)(4) of the Anticipated Transient Without Scram Rule, 10 CFR 50.62, and to simplify and improve the TS requirements for the system. Specifically, the proposed TS change would revise the Surveillance Requirements and associated Figure related to SLCS to 1) assure compliance with the ATWS Rule, 2) incorporate the latest design specification data from General Electric Company (GE), 3) simplify and improve the specifications to make them easier to understand and determine when action might be required and 4) to correct a discrepancy between the TSs and the Final Safety Analysis report (FSAR).

2.0 DISCUSSION

The Final ATWS Rule requires that the SLCS for BWRs have an equivalent control capacity of 86 gpm of 13 weight percent sodium pentaborate solution. The Limerick design to meet this requirement provides for utilizing two of the three installed SLCS pumps operating at a flow rate of greater than or equal to 41.2 gpm with corresponding solution concentration to meet the above equivalency requirement. Operation at this minimum requirement requires a solution concentration of not less than 13.6%. Maintaining concentration less than 13.6% at the minimum flow rate would result in noncompliance with the SLCS control capacity requirements of the Rule. This design was previously reviewed and found acceptable (Letter, Richard J. Clark, NRC to Edward G. Bauer, Jr., PECo, dated November 3, 1987, Subject: Compliance With ATWS Rule 10 CFR 50.62). Surveillance Requirement (SR) 4.1.5.b.2 will specify this requirement as a function of available solution concentration and two pump flow rate as determined by SR 4.1.5.c. The subject application also revises SR 4.1.5.b.2 to specify the minimum available weight of sodium pentaborate must be at least 5389 lbs. This weight provides for the design required shutdown capability plus 25 percent excess allowance for potential leakage, imperfect mixing and allowances based on level instrumentation accuracies. The current value of 5500 lbs. is overly conservative.

To simplify and improve the presentation of the Technical Specification, Figure 3.1.5-2 will be deleted and the requirements relocated to other SRs. Also, the LCO will be revised to more explicitly describe the minimum operability requirements of at least two pumps and their corresponding flow paths.

The testing requirements of SR 4.1.5.d.1 will be revised to require that all three injection loops be tested within three operating cycles rather than each 36 months, thus allowing one loop to be tested during each refueling outage.

In addition, the proposed changes revise Figure 3.1.5-1 to provide a more conservative operating limit of sodium pentaborate temperature versus concentration. This new limit will provide for consistency with FSAR Figure 9.3-7 which properly depicts the operating limit.

3.0 EVALUATION

The proposed equivalency equation in SR 4.1.5.b.2, which is similar to that approved for Peach Bottom, Units 2 and 3 (Letter from Richard J. Clark, NRC to Edward G. Bauer, Jr., PECo dated June 2, 1987 transmitting Amendment Nos. 122 and 126 to Facility Operating License Nos. DPR-44 and DPR-56), provides a calculational method to ensure the minimum requirements of the ATWS Rule are met. This represents an additional requirement where none existed before. This will improve the reliability of the SLCS to perform its intended function. Revising the minimum available weight of sodium pentaborate from 5500 lbs. to 5389 lbs. maintains the design requirement for a 25 percent excess allowance for potential leakage and imperfect mixing plus allowances based on accuracies associated with the level instrumentation. The latest design specification from General Electric defines a new minimum weight of 4389 lbs. based on actual level instrumentation accuracies at the Limerick Generating Station. The 4620 gallon volume requirement of Figure 3.1.5-2 is also revised to 4537 gallons to correspond to this new minimum weight requirement. Since the 25 percent excess allowance will be maintained, the proposed change will not adversely affect safety.

SR 4.1.5.a.2, which currently requires the volume limits of Figure 3.1.5-2 to be met, is revised to require only the minimum volume (see above). The maximum concentration limit of 13.8 percent is retained in the revised Figure 3.1.5-1. The minimum sodium pentaborate solution concentration will be governed by the equivalency equation of SR 4.1.5.b.2 and will be a function of SLCS two pump flow rate. The "margin" and "overflow volumes" of the current Figure 3.1.5-2 are not significant solution parameters and therefore can be deleted. These values were provided for information only, and are available in the appropriate Surveillance Tests. Operation with a solution volume up to the tank overflow nozzle is acceptable from a safety perspective as long as the chemistry requirements of the solution are met. The impact on

safety of deleting Figure 3.1.5-2 was examined. The parameters important to safety have been preserved by relocating them to other SRs. The relocated parameters are checked and maintained at frequencies consistent with those currently in place; therefore the deletion of Figure 3.1.5-2 and incorporation of the proposed specifications will not adversely affect safety.

The proposed change to add minimum operability requirements to the LCO provides specifics on what these requirements are, since none are currently stated. This change is administrative, since the proposed minimum operability requirements are the same as those described in the Technical Specification bases and the design bases.

Although not required to meet system performance requirements, the SLCS design for the Limerick Generating Station includes a third SLCS pump. Technical Specifications SR 4.1.5.d.1 currently requires that one SLCS loop be tested in the reactor vessel injection mode every 18 months, and that all loops be tested within 36 months. To comply with the current loop testing requirements, two of the three loops must be tested every other refueling outage. In addition, the 36 month limit does not allow for variations in the length of an operating cycle or the intervening refueling outage, or for test scheduling flexibility within a given refueling outage (i.e., performance at the end versus the beginning of the outage). It is possible that circumstances could require testing of all three loops during a single outage or could require plant shutdown to meet the test interval requirements. The typical BWR has two SLCS pumps with the requirement that both injection loops be tested in 36 months. This results in one loop being tested during each outage. Due to the increased redundancy of the Limerick design, SR 4.1.5.d.1 is to be revised to allow one SLCS loop to be tested every 18 months such that all three loops are tested in three operating cycles.

Quarterly testing required by SR 4.1.5.c verifies operability of each SLCS pump and associated components and the flow path within the test loop. Eighteen month testing required by SR 4.1.5.d verifies the suction flow path for all three pumps, and verifies the common discharge flow path for all three loops. Thus, at the end of each eighteen month cycle, only the explosive valves and short segments of associated discharge piping may remain untested for two of three loops.

The short segments of discharge piping are not filled with the sodium pentaborate solution. This piping is only briefly exposed to the solution during suction flow path testing and is normally exposed to demineralized water used in injection tests and flushing of the system and therefore does not provide a significant possibility of becoming blocked by crystallization of sodium pentaborate. The Limerick Probabilistic Risk Assessment confirms this position by showing that the availability of the short segments of discharge piping is primarily dependent on the reliability of the explosive valves.

Reliability of the explosive valves is primarily dependent on the explosive actuators, which have a shelf life of five years. Limerick Generating Station Surveillance Test (ST) procedure ST-3-048-320-1 requires verification every eighteen months that the expiration date of all three explosive actuators will not be reached during the following operating cycle. Actuators that are approaching expiration are replaced with actuators from a successfully tested batch. Thus, the viability of all three explosive actuators is verified during each eighteen month testing interval.

In consideration of the above discussion, by revising the test frequency of SR 4.1.5.d.1 to require all three injection loops be tested within three operating cycles, rather than 36 months, the high reliability of the SLCS system will be maintained and the Limerick specific SLCS design will be more appropriately reflected in the Technical Specifications. Therefore, incorporation of the proposed changes will not adversely affect safety.

Based on the above, the staff has determined that the proposed changes to the TSs are acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change to a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes to surveillance requirements. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents 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. 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 nor environmental assessment need be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

The Commission made a proposed determination that the amendment involves no significant hazards consideration which was published in the Federal Register (54 FR 18952) on May 3, 1989 and consulted with the State of Pennsylvania. No public comments were received and the State of Pennsylvania did not have any comments.

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, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and the security nor to the health and safety of the public.

Principal Contributor: Dick Clark

Dated: June 8, 1989