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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-11 AND

AMENDMENT NO. 96 TO FACILITY OPERATING LICENSE NO. NPF-18

COMMONWEALTH EDISON COMPANY

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 50-374

1.0 INTRODUCTION

By letter dated January 18, 1996, as supplemented by letters dated March 1, March 22, March 26, and April 3, 1996, Commonwealth Edison Company (ComEd, the licensee) proposed several changes to the technical specifications (TS) for the LaSalle County Station, Units 1 and 2. The licensee proposed to change the setpoints for the automatic primary containment isolation on Main Steam Line Tunnel Differential Temperature-High and to delete the automatic primary containment isolation on Main Steam Line Tunnel Temperature-High. In addition, the proposed TS will permit an allowed outage time (AOT) of 12 hours for the Main Steam Line Tunnel Differential Temperature-High isolation signal upon loss of the Reactor Building Ventilation System (RBVS) which provides cooling to the main steam tunnel. The March 1, March 22, March 26, and April 3,1996, submittals provided additional clarifying information that did not change the initial proposed no significant hazards consideration determination.

Attachment F to the January 18, 1996, letter briefly describes the problems which have occurred at both LaSalle units due to inadequate margin between the present setpoints for the Main Steam Line Tunnel Differential Temperature-High and Main Steam Line Tunnel Temperature-High isolations and the thermal conditions in the main steam tunnel during operation. Attachment F also discusses past licensee actions to address this issue. In response to staff questions, by letter dated March 22, 1996, the licensee supplied additional information on the history of problems with these isolation signals and attempts to solve these problems.

The most recent event was an August 16, 1995, trip of Unit 1 due to a Group I isolation caused by an inadvertent actuation of the Main Steam Line Tunnel Temperature-High isolation signal. This was followed by operation of Unit 2 on September 9 and 10, 1995, with temperature differentials in the main steam tunnel very close to the isolation setpoint.

Following these events, the licensee developed a proposal to eliminate this problem - supported by engineering analyses and applicable data. The January 18, 1996, letter contains the licensee's proposal.

2.0 BACKGROUND

The main steam tunnel houses the main steam lines and feedwater lines as they exit containment until they enter the turbine building. The outboard main steam isolation valves (MSIV) are located in the main steam tunnel. Because of the heat transferred from the main steam lines and the feedwater lines, it is necessary to provide cooling in the main steam tunnel. The RBVS is designed so that most of its exhaust flow is directed through the main steam tunnel just prior to release from the vent stack.

The differential temperature between the main steam tunnel supply air and exhaust air is a function of several things. These include (1) operation of the Station Heat Recovery System, which heats the RBVS supply air, (2) electric heaters in the RBVS, (3) dampers on the RBVS, (4) outside air temperature and humidity, and (5) operation of other ventilation systems which communicate with the RBVS (such as the Standby Gas Treatment System). In addition, such factors as heavy snows and dust from planting of crops in nearby fields affect the operation of the RBVS.

Regulatory guidance for the design of reactor coolant pressure boundary leakage detection is provided in Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems" and Standard Review Plan (SRP), Section 5.2.5, "Reactor Coolant Pressure Boundary Leakage." These documents do not provide specific guidance for the Main Steam Line Tunnel Temperature-High and Main Steam Line Tunnel Differential Temperature-High isolations. General Electric Company's Design Specification "Leak Detection System" 22A2870 provides guidance on leakage limits for alarm and isolation in terms of volumetric leakage to be used as the basis for temperature setpoints.

In accordance with the General Electric Company's Design Specification "Leak Detection System" 22A2870 the Main Steam Line Tunnel Temperature-High and Main Steam Line Tunnel Differential Temperature-High isolations will trigger an alarm if their respective setpoints are exceeded. These setpoints are based on a steam leak from the main steam line of 5 gpm.[1] A main steam line leak corresponding to 25 gpm will initiate a main steam line isolation (which will result in a reactor trip).

LaSalle's Updated Final Safety Analysis Report (UFSAR), Section 7.6.2, describes main steam line leak detection as a portion of the Reactor Coolant Pressure Boundary Leakage Detection System. The UFSAR states that main steam line leak detection consists of three types of monitoring circuits. The first of these monitors the Main Steam Line Tunnel Differential Temperature-High and Main Steam Line Tunnel Temperature-High isolations. The other two are the high mass flow rate through the steam lines and low reactor water level.

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[1] The amount of steam leakage is expressed in gallons per minute. One gpm of steam leakage is equivalent to the mass flow rate of one gpm of water with a density of 62.4 lb/ft^3.

The Main Steam Line Tunnel Differential Temperature-High and Main Steam Line Tunnel Temperature-High isolation functions are important for two reasons. First, they serve as an early warning of main steam line degradation which could result in rupture of a main steam line. While the safety analysis of the steam system pipe break outside containment in the LaSalle UFSAR shows that the consequences are within the SRP acceptance criteria, these two isolation signals provide defense-in-depth by providing an indication of an impending problem. These isolation signals are also important because even small leakage from the main steam line would result in the release of radiation which may not be readily detected by other means. A small leak could go undetected for some time. High main steam line flow and reactor vessel level are insensitive to small leaks in the main steam lines. Thus, a leak small enough so that it would not be detected by the high steam line flow or low reactor vessel level could potentially result in unnecessary radiation doses.

Both LaSalle units have had continuing problems since they were licensed with closure of the MSIVs or events in which closure of the MSIVs was narrowly avoided due to spurious isolation signals from these two isolation functions. The licensee's March 22, 1996, letter lists five scrams and 17 events in which ventilation was lost, but scram was avoided by timely operator intervention. It is clear from this experience that the existing setpoints do not provide sufficient margin to prevent spurious trips.

Spurious closure of the MSIVs while at power is undesirable. It eliminates the preferred heat sink (the main condenser) and challenges the safety/relief valves. In addition, since the transient is so rapid, the entire system is significantly stressed (though within its design capabilities).

In order to prevent putting the reactor through such a transient unnecessarily, the licensee developed the practice (see Unit 1 LER 85-011) of manually "jumpering out" the isolation signals during such circumstances as when securing the RBVS or when the RBVS fails. While this procedure may prevent the plant from undergoing an unnecessary transient, it is undesirable for an operator to make a rapid decision as to whether or not a safety function should go to completion and to make what is essentially a modification to the primary containment isolation instrumentation rapidly and under stressful conditions. NRC Inspection Report 50-373/95007 and 50-374/95007 discussed this problem in relation to a Unit 1 trip on August 16, 1995. A Reactor Protection System (RPS) bus was lost which caused a breaker to open. This, in turn, caused isolation of the RBVS. Loss of the RBVS caused the setpoint for Main Steam Line Tunnel Temperature-High isolation signal to be exceeded which caused the MSIVs to shut and, consequently, the reactor to trip. In this case the operators installed jumpers bypassing the affected train of the leak detection system and reset the Primary Containment Isolation System (PCIS) logic in approximately 2 minutes. These efforts were unsuccessful in preventing the isolation. (The licensee's explanation of this is given in the licensee's March 22, 1996, letter to the NRC staff.)

In order to eliminate these problems, the licensee has proposed to eliminate the Main Steam Line Tunnel Temperature-High isolation signal and to change the Main Steam Line Tunnel Differential Temperature-High setpoint. Specifically, the licensee has proposed the following.

- The Main Steam Line Tunnel Temperature-High isolation signal would be removed from the technical specifications by deleting item A.1.d Main Steam Line Tunnel Temperature-High and associated requirements from Table 3.3.2-1 "Isolation Actuation Instrumentation", Table 3.3.2-2 "Isolation Actuation Instrumentation Setpoints", Table 3.3.2-3 "Isolation Actuation Instrumentation Response Time", and Table 4.3.2.1-1 "Isolation Actuation Instrumentation Surveillance Requirements".

- The setpoint for the Main Steam Line Tunnel Differential Temperature-High in Technical Specifications Table 3.3.2-1, item 1.A.e would be revised to ≤ 65 degrees Fahrenheit with an Allowable Value of ≤ 70 degrees Fahrenheit.

- Note (j) for trip function A.1.e in Table 3.3.2-1 is revised to add the underlined words:

  Both channels of each trip system may be placed in an inoperable status for up to 12 hours <u>due to loss of reactor building ventilation or</u> for performance of Surveillance Requirement 4.6.5.1.c, without placing the system in the tripped condition.

In addition to these changes, the licensee will retain Note (i) in Table 3.3.2-1 for Trip Function A.1.e. This note states:

> Both channels of each trip system may be placed in an inoperable status for up to 4 hours for required reactor building ventilation system corrective maintenance, filter changes, damper cycling and surveillance tests, other than Surveillance Requirement 4.6.5.1.c, without placing the trip system in the tripped condition.

The licensee's March 1, 1996, letter discusses seven design changes that will be made in parallel with the proposed TS changes. Among these, the common alarm window that currently annunciates on both the Main Steam Line Tunnel Differential Temperature-High and Main Steam Line Tunnel Temperature-High will be replaced by separate alarm windows to provide independent annunciation for each condition. In addition, keylock bypass switches will be installed for each channel of the high differential temperature trip logic.

3.0 <u>EVALUATION</u>

3.1 <u>Elimination of the Main Steam Line Temperature-High Isolation</u>

The licensee submitted calculation NED-P-MSD-086 in the March 1, 1996, response to a staff request for additional information. NED-P-MSD-086 calculates the critical crack size and the resultant leakage in order to demonstrate margin between the 100 gpm value selected by the licensee as the basis for the Main Steam Line Tunnel Differential Temperature-High setpoint and the calculated leakage rate from the critical crack (1290 gpm). Such calculations have a large uncertainty.

The staff has reviewed this calculation and finds that it does not meet all the criteria that would be necessary for a Leak-Before-Break calculation in terms of loads to be considered and margin between calculated leakage and flow through the critical crack (Federal Register Vol. 52, No. 167, p. 32626). However, the staff considers this deficiency insignificant for safety considerations since, for this application, no safety equipment is being removed based on this calculation (as is the case in Leak-Before-Break). The purpose of the calculation is only to demonstrate margin. The Main Steam Line Tunnel Differential Temperature-High isolation is anticipatory. In addition, no credit is taken for this isolation function in any Final Safety Analysis Report (FSAR) accident analyses. Therefore, should there be less margin than the licensee calculated, there are other, diverse, safety-related isolation signals to provide protection if a main steam line rupture occurs. Finally, Leak Before Break is only applied to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1 and 2 piping or its equivalent. The main steam line piping downstream of the outboard MSIVs is not safety-related.

After establishing 100 gpm as the basis for establishing the Main Steam Line Tunnel Differential Temperature-High setpoint, the licensee then calculated main steam tunnel temperatures for a range of steam leaks and supply air temperatures. These calculations are discussed in Attachment G, Section 2, of the licensee's January 18, 1996, letter and the calculation (BSA-L-95-05 Revision 0, dated January 13, 1996) which was included in the licensee's March 1, 1996, response to staff questions.

These calculations were performed using the GOTHIC computer code. The GOTHIC computer code was adopted by the Electric Power Research Institute (EPRI) to provide nuclear utilities with an efficient, state-of-the-art containment analysis computer code. GOTHIC can model flows of vapor and non-condensible gases, continuous liquids and liquid droplets. It is capable of modelling non-equilibrium temperatures and can model a variety of geometric shapes and mechanical components. It has undergone extensive validation and has been approved by the NRC for two unrelated applications. Figure 3 of calculation BSA-L-95-05 provides a benchmark of predictions by the licensee's main steam tunnel GOTHIC model with operating data. The figure shows that the predictions agree well with operating data.

The licensee chose two different supply air temperatures, 65 degrees Fahrenheit and 110 degrees Fahrenheit to bound seasonal variations and a value of 95 degrees Fahrenheit as a nominal value of the supply air temperature. The reactor building ventilation flow rates are based on plant data and are given in Attachment G of the licensee's January 18, 1996, letter.

The staff has reviewed the licensee's temperature calculations and finds them acceptable.

The licensee's March 22, 1996, letter to the NRC staff provides a detailed explanation of why it is necessary to delete the Main Steam Line Tunnel Temperature-High isolation function. The licensee's calculations show that assuming a leakage rate of 100 gpm and the lower air supply temperature of 65 degrees Fahrenheit (in order for the setpoint to cover all possible conditions), the calculated peak temperature is 151 degrees Fahrenheit. Setting the value of the Main Steam Line Tunnel Temperature-High isolation at this value would not preclude an isolation on loss of the RBVS and, when setpoint uncertainties are included, would leave very little margin to normal operating conditions. In addition, data supplied by the licensee in the March 22, 1996, letter show that the temperature would increase at such a fast rate that the operators would still be required to act in a very short time to bypass this isolation signal before actuation. In order to avoid this situation, a much higher leakage flow would have to be permitted to provide a sufficiently high temperature setpoint. The staff considers this to be undesirable because of the higher temperatures and radiation doses which would result, and the decrease in margin to the critical crack size.

The staff also requested that the licensee address possible engineering solutions to this problem that were considered and the reasons they were rejected. The licensee discussed these solutions in the March 22, 1996, letter. These solutions were either only partial solutions or were impractical.

Therefore, the staff concurs with the licensee's conclusion that it is necessary to eliminate the Main Steam Line Tunnel Temperature-High isolation.

3.2 Increased Setpoint for Main Steam Line Tunnel Differential Temperature-High Isolation Signal

Based on the assumed air flow and inlet air temperatures and assuming a leak of 100 gpm, the licensee calculated an increased setpoint for the Main Steam Tunnel Differential Temperature-High setpoint. These calculations show that with a 110 degrees Fahrenheit supply air temperature and a 100 gpm leak in the lower portion of the main steam tunnel, the temperature differential would reach a value of 72.5 degrees Fahrenheit. The licensee states that "over 99% of the year the [temperature of the supply air to the main steam tunnel] will be less than 100 degrees Fahrenheit. With the [air supply inlet temperature] less than 110 degrees Fahrenheit, the setpoint will actually be isolating the main steam lines on a leak of less than 100 gpm."

Based on these calculations, the licensee proposed raising the setpoint of the Main Steam Line Tunnel Differential Temperature-High isolation signal to ≤ 65 degrees Fahrenheit with an Allowable Value of ≤ 70 degrees Fahrenheit. The present values are ≤ 36 degrees Fahrenheit and ≤ 42 degrees Fahrenheit, respectively.

Licensee calculations to determine the setpoint values used methods based on two ComEd reports, ComEd TID-E/I&C-20, "Basis for Analysis of Instrument Channel Set-Point Error & Loop Accuracy," Revision 0, dated April 6, 1992, and ComEd TID-E/I&C-10, "Analysis of Instrument Channel Setpoint Error and Instrument Loop Accuracy," Revision 0, dated April 6, 1992. The staff had previously reviewed these methods. The results of this review are given in NRC Inspection Report 50-237/94016; 50-249/94016. The staff concluded that the methods were technically sound and consistent with the ISA standard endorsed by Regulatory Guide 1.105. The licensee did not take any exceptions to the Regulatory Guide for the setpoint methodology. The staff review of the Main Steam Line Tunnel Differential Temperature-High instrumentation setpoint error analysis, calculation NED-I-EIC-0208, dated January 16, 1996, found the proposed nominal trip setpoint and the associated allowable value sufficiently addressed all uncertainties identified in the ISA standard. There is adequate margin between the proposed nominal trip setpoint and the allowable value for normal operating conditions and between the analytical limit and the limiting safety system settings (nominal trip setpoint and the allowable value) for accident conditions. The staff, thus, concludes that there is sufficient justification to believe that the main steam line tunnel differential temperature instrumentation will perform its safety function without exceeding the analytical limit under normal or accident conditions.

3.3 Environmental Qualification

The licensee also addressed the environmental qualification of safety related equipment in the main steam tunnel. The temperature in the main steam tunnel with the RBVS in operation will not exceed 175 degrees Fahrenheit (110 degrees Fahrenheit upper bound supply air inlet temperature plus the 65 degrees Fahrenheit differential for isolation). This is below the environmental qualification temperature (200 degrees Fahrenheit) for the LaSalle main steam tunnel. With the RBVS inoperable, the temperature will be monitored and an engineering evaluation will be performed if the temperature exceeds 200 degrees Fahrenheit. The staff finds this to be acceptable.

3.4 Dose Assessment

The proposed change does not affect calculated doses from the design basis accidents (DBAs). Therefore, the DBA calculations were not reassessed.

The proposed change has some potential for affecting the doses from normal operations so these doses were reevaluated. The licensee's analyses showed that the plant could operate with a large (100 gpm) leak in the main steam tunnel without exceeding the short-term limits for offsite doses and concentrations. Staff calculations confirmed the licensee's conclusions. The licensee recognizes that long-term operation with such leakage would be unacceptable and staff calculations indicate that operation with 100 gpm leakage should not exceed two months because of thyroid dose by the cow-milk pathway, calculated in accordance with the LaSalle Offsite Dose Calculation Manual (ODCM). The radioactive material released to the main steam tunnel will be exhausted through the stack (an elevated release point), which is monitored and sampled as a part of the effluent control program. This will enable the licensee to keep offsite doses within the constraints of 10 CFR Part 50, Appendix I, as required by the ODCM, after making the proposed changes. These changes, therefore, are acceptable.

3.5 Effect on Safe Shutdown Capability

A July 10, 1987 licensee submittal provided a risk assessment of the removal of both the Main Steam Line Tunnel Differential Temperature-High and Main Steam Line Temperature-High isolation signals. The study was not as broad in scope as this review. The primary safety concern examined was the effect of the removal of these isolation signals on the ability to bring the plant to a safe shutdown during a small steam leak before it propagated to a larger break. The analysis demonstrated that there was no significant increase in MSIV closure unavailability by removing these isolation signals and the frequency of spurious MSIV closures was reduced. Consequently, the risk reduction from decreased scrams more than offset any risk increase from small steam line leaks in the main steam tunnel that quickly propagate to large breaks. While staff rejected this analysis as a sole basis for removing both isolation signals (see staff SER dated February 8, 1988), it does provide support for the licensee's present proposal.

3.6 Allowed Outage Time for Inoperable Reactor Building Ventilation System

The licensee also proposed a 12 hour AOT for the Main Steam Line Tunnel Differential Temperature-High upon loss of the RBVS before being required to shut down the reactor. This time is reasonable since (1) the licensee is taking some actions to improve the reliability of the RBVS (see licensee's March 1, 1996, letter to the NRC staff), (2) enhanced monitoring will be in effect while the RBVS is out of service (approved in a March 21, 1991, letter from the NRC to ComEd), and (3) the licensee's probabilistic risk assessment (PRA) study discussed above shows that the increased risk of a pipe break is small even if the isolation signal is permanently removed. Additionally, the current TS allows placing both channels of the main steam line tunnel differential temperature instrumentation in an inoperable status for up to 12 hours for performing certain surveillance tests. The staff finds the same 12 hours AOT applicable to this instrumentation channel when RBVS is inoperable.

3.7 Conclusions

The licensee's proposal to change the setpoints for the Automatic Primary Containment Isolation on Main Steam Line Tunnel Differential Temperature-High and to delete the Automatic Isolation Function on Main Steam Line Tunnel Temperature-High is acceptable. The staff also found the proposed extension of AOT for both channels of main steam line tunnel differential temperature instrumenta-tion acceptable. The staff has found that sufficient capability to detect small leaks in the main steam tunnel remains and that these changes will make a positive contribution to safety by eliminating spurious isolations.

The effect on offsite dose of these changes is small.

There is no effect on environmental qualification of equipment in the main steam tunnel.

An AOT of 12 hours for the Main Steam Line Tunnel Differential Temperature-High upon loss of RBVS is a reasonable amount of time to restore the RBVS before requiring a plant shutdown.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change 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 change surveillance requirements. The NRC staff has determined that the amendments involve 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 the amendments involve no significant hazards consideration, and there has been no public comment on such finding (61 FR 7281). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

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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