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SUBJECT: Discusses effects of change in diesel generator start time from 10-s to 25-s on LOCA analysis in FSAR Chapter 6,3. Large recirculation discharge break peak clad temp not affected by delayed start time.

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September 29, 1982

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
DIESEL GENERATOR START TIME
ER 100450 FILE 247-01
PLA-1321 Docket No. 50-387

Dear Mr. Schwencer:

Introduction

Pennsylvania Power & Light Co. was requested to determine the effects on the LOCA analysis in the FSAR Chapter 6.3 of a change in the diesel generator start time from 10 seconds to 25 seconds. This work resulted from an attempt to change Technical Specification 4.8.1.1.2 which currently requires five diesel generator starts to at least 600 rpm in less than or equal to 10 seconds with an initial accumulator pressure less than or equal to 240 psig and the air compressors secured. The proposed change requires one start in less than or equal to 10 seconds and four starts in less than or equal to 25 seconds with the same initial accumulator pressure and compressor line-up. The Technical Specification change was requested since there is no clear basis for the time requirement of more than one diesel generator start. The diesel generator accumulators were not designed to the requirements of Technical Specification 4.8.1.1.2, and therefore, were not able to meet this specification during surveillance testing. This memo addresses the effects of a 25 second diesel generator start on the limiting and non-limiting LOCA analyses in the FSAR.

Large Break LOCA

The limiting large break LOCA is a recirculation discharge line break with the failure of the LPCI injection valve. This accident will provide no LPCI flow to the vessel since the LPCI injection valve that allows flow to the intact recirculation loop is assumed to fail to open and the LPCI flow to the broken recirculation loop is assumed to flow out the break. Therefore, core spray flow is the only low pressure injection system used in the analysis.

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The sequence of events for the limiting large break LOCA is shown in FSAR Table 6.3-1. At zero seconds the break occurs, offsite power is lost, and the high drywell pressure signal is reached. This initiates a diesel generator start and the core spray start logic. There is a 12 second delay prior to the 4 KV bus being energized on diesel power to allow the diesel to reach rated speed. At 22.5 seconds the core spray pumps will begin to start. At 27 seconds the pumps reach full speed. However, not until 63 seconds is the reactor pressure low enough to open the core spray injection valve to allow flow to the reactor vessel.

The 10 second diesel start requirement in the Technical Specifications is based on the 12 second delay prior to the 4 KV bus energization. Therefore, if the diesel generator start requirement is changed to 25 seconds, the sequence of events for the limiting transient is adjusted as follows. At time zero the break occurs, off-site power is lost, and the high drywell pressure signal is reached. At 27 seconds the 4 KV bus is energized on diesel power. At 37.5 seconds the core spray pumps begin to start. At 42 seconds the pumps reach full speed. At 63 seconds the core spray injection valves open and allow flow to the reactor vessel.

By comparing the two scenarios, it is apparent that the reactor is not affected by the increased diesel generator delay since the core spray pumps are at full speed in both cases when the injection valves open. Therefore, increasing the diesel generator start to 25 seconds does not impact the margin to thermal limits (2200°F peak clad temperature limit) as calculated for the large recirculation discharge break in Chapter 6.3 of the FSAR.

General Electric (GE) was also requested to analyze the effects of the delayed diesel start. GE neglected the time sequencing of the core spray pump start and the injection valve opening. They simply extrapolated the clad temperature versus time plot to show a reflood time that is 15 seconds later. The use of this conservative method results in a peak clad temperature for the limiting discharge side break of 1959°F. This is still well below the maximum allowable peak clad temperature of 2200°F.

Chapter 6.3 of the FSAR also provides curves for a large recirculation suction break. The calculations show that the recirculation suction break is less severe than the discharge break. In the intact loop the LPCI injection valve is assumed to fail. In the broken loop the LPCI flow enters the recirculation discharge piping and a portion of it flows through the pump and out the break. The recirculation pump provides a resistance to the flow out the break which allows for some flow to the reactor vessel when the vessel to containment differential pressure is small. However, as described above, the 25 second diesel generator start will affect both the LPCI pump start time and the core spray pump start time. This delay will delay the accident mitigation provided by the core spray flow and minimized LPCI flow. From the figures provided in

the FSAR, it is obvious that the decrease in reactor pressure is more rapid for the suction line break than for the discharge line break. This causes the injection valves to begin to open before the pumps reach rated speed. Hence, a delay in starting the pumps will delay the core reflood time and fuel heat-up calculation. The analysis in Chapter 6.3 of the FSAR results in a peak clad temperature of 1688°F for the recirculation suction break. However, General Electric has determined that the peak clad-temperature for a recirculation suction break with a 25 second diesel generator start is 1893°F which is still well below the maximum allowable peak clad temperature of 2200°F. PP&L considers this to be a conservative estimate of the peak clad temperature.

Intermediate and Small Breaks

Intermediate and small break LOCAs will have slower depressurization rates than the large break LOCA. A slower depressurization results in core spray and LPCI injection later in the accident and the effects of delaying the injection is not as severe as in the large break LOCA. Since the intermediate and small breaks analyzed in Chapter 6.3 are less limiting than the large break and since the effects on the intermediate and small breaks are less severe than the effects on the large break LOCA, the margin to thermal limits (2200°F peak clad temperature limit) are not reduced by increasing the diesel generator start to 25 seconds for the intermediate and small break cases.

Conclusion

PP&L has determined that the large recirculation discharge break peak clad temperature is not affected by a 15 second delay to the diesel generator start time. For a large recirculation suction break the peak clad temperature is affected but remains well below the 2200°F limit.

Very truly yours,

R J Schwencer for

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

CTC/mks

cc: R. L. Perch - NRC