Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

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Mr. A. Schwencer, Chief
Licensing Branch #2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station, Units 1 & 2
Responses to NRC Questions on
Multiple Control Systems Failures
NRC Docket Nos. 50-373 and 50-374

Reference (a): NRC letter of July 6, 1982, Subject, "Request for Additional Information", from A. Schwencer to L.O. DelGeorge.

Dear Mr. Schwencer

The purpose of this letter is to respond to the questions in Reference (a).

NRC questions 031.290-031.296 deal with failure propogation from High Energy Line Breaks (HELB) on postulated non-safety power buses, non-safety control system, or non-safety sensors including instrument line failures. Each question is answered within the licensing basis of the plant. Non-safety systems are those identified in FSAR Chapter 7. The FSAR Chapter 15 results are confirmed as bounding. Events that require operator action are addressed to demonstrate that all postulated non-safety system failures from HELB events also result in events bounded by the FSAR Chapter 15 analyses.

It was assumed that all safety systems are operable in the HELB environment because they are either already qualified or currently are being qualified for that environment. The safe operation of LaSalle County Station has been addressed on the LaSalle docket via Tabs K and L of the "Ninety Day Report" for Environmental Qualification. Please note that in the Ninety Day Report, no credit was taken for any non-safety systems. The methodology for responding to each of the NRC questions is discussed below to explain the differences between these questions and the responses to NRC questions Q 31.288 and 031.289 (FSAR Amendment 60) previously submitted.

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Questions 031.288 and 031.289 addressed each specific FSAR Chapter 15 event and assumed that all non-safety systems used in the event failed in the worst direction. Question 031.290 examines the failure of non-safety control systems due to HELBs. For Question 031.290, each of the 4 HELBs was examined assuming that for each event all exposed non-safety control systems fail in the worst direction. The exposure environments are as follows: (1) LOCA - all of drywell and primary containment for the short

term and the suppression pool suction areas for long term; (2) Main Steam Line Break (MSLB) - steam tunnel only, (3) Feedwater Line (FWLB) - Turbine Building only; and (4) Instrument Line Break - open area adjacent to the line break inside the Reactor Building or the entire ECCS cubicle if an inside line. Even though each system was identified separately, all non-safety control systems exposed to the specific HELB are assumed to fail and the combined effects were considered.

The response to question 031.291 examined all higher level power sources than MCC's. Question 031.289 only covered power through the Motor Control Center (MCC) level. The results from the examination of higher power level failures were compared to the FSAR Chapter 15 Loss of AC Power Analysis.

Question 031.292 examined simultaneous malfunctions of non-safety control system resulting from sensor (including sensor impulse lines) or power source (including any higher level power sources) malfunctions. Question 031.289 considered the effects of multiple control system failures due to commonality of power sources or sensors on each specific FSAR chapter 15 event. The response to Question 031.292 addressed the simultaneous malfunctions of non-safety control systems and compared the results to the worst case FSAR Chapter 15 event for power losses.

Question 031.293 concerned the fact that the Turbine Trip Without Bypass event was not analyzed. Questions 031.288 and 031.289 addressed this event as having the same results as the Generator Load Rejection Without Bypass event. (See pages Q31.288-22 and Q31-288.23 in FSAR Amendment 60). The Turbine Trip and Generator Load Rejection events are the same for the questions dealing with non-safety control system impacts.

Question 031.295 asked whether all non-safety control systems and their support systems were analyzed. Questions 031.288 discussed which non-safety control systems were analyzed. The response to question 031.295 goes into more detail as to why the systems evaluated in 031.288 are sufficient.

Question 031.296 required confirmation that the Chapter 15 events either took credit for non-safety control systems functioning as designed or that such systems not function at all, whichever would produce the worst case. Questions 031.288 and 031.289 implicitly used the worst case for each non-safety control system. The response to Question 031.296 provides more detail as to why the approach used in the FSAR chapter is adequate.

In conclusion, the responses to Questions 031.290-031.296 demonstrate that no new bounding events are created by the multiple failure hypothesis and that the existing licensing basis for LaSalle County Station as identified in FSAR Chapter 15 is adequate.

This information is being provided to you as a preliminary response. Upon completion of your review and resolution of any further questions, Commonwealth Edison Company will include this in a revision to the FSAR.

If there are any further questions in this matter, please contact this office.

Enclosed for your use are one signed original and thirty-nine copies of this letter and the enclosure.

Very truly yours,

CW Schroeder 10/6/82

C. W. Schroeder
Nuclear Licensing Administrator

Enclosure

cc: NRC Resident Inspector - LSCS

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LASALLE UNITS 1 & 2

CONTROL SYSTEM FAILURES

Q 031.290 Regarding control system failures due to high energy line breaks (HELB), it appears that the methodology used was to fail each control system individually and then determine whether each individual failure adversely affected the accident analysis results for each Chapter 15 event. The staff believes that an analysis of this type can only determine whether HELBs in conjunction with a single control system failure are bounded by the Chapter 15 accident analysis results. We are concerned that HELBs can affect more than one control system. For each HELB, all control systems which could potentially be affected by that break should be assumed to fail in the worst direction and the combined effects of these failures be evaluated. If the consequences of these failures are bounded by the accident analysis, a positive statement to the effect should be provided. (Note: It may be possible to show that although a given type of break could affect multiple control systems, that for any specific break location in that line, only one control system would be affected.)

Response

All HELB's identified in FSAR chapter 15 were analyzed to determine the worst case event assuming the failure of all affected non-safety systems in the worst direction. All safety systems are assumed to operate as delineated in the "Ninety Day Report". The attached table lists a matrix of all non-safety control systems used in the HELB event.

A) LOCA Inside Containment

The initial break detection logic is accomplished using safety systems only. These automatically initiate all accident mitigation including ECCS, containment isolation, turbine trip, recirc pump trip, and scram. This accident mitigation effectively isolates the LOCA environment to the containment, and on a long term basis, areas where suppression pool suction is taken. The licensing basis assumes a loss of all normal (non-emergency) power. Therefore, all non-safety control systems without backup power will lose power. Even assuming spurious signals from non-safety pressure and for level instrumentation, this would not affect the LOCA mitigation since all actions are automatic and initiated by safety grade instrumentation. Failure of feedwater control systems to trip will be beneficial in that more coolant would be provided for core coverage and flashing would be minimized. As the primary containment is automatically isolated (including MSIV's), any spurious operation of the main turbine or condenser systems will not affect the course of this event. Systems outside containment such as the process computer which are not affected by the LOCA will continue to operate. Spurious operation of the area or process radiation monitoring system would not affect the course of this event as the only harsh LOCA environment outside containment would occur long into the event only inside the ECCS cubicles. Consequently, the accident analysis case is bounding.

B) Main Steam Line Break Outside Containment (MSLB)

The initial break detection logic is accomplished using safety systems only. These automatically initiate all accident mitigation including ECCS, containment isolation, turbine trip, recirc. pump trip, and scram. This accident mitigation effectively isolates the MSLB environment to the steam tunnel. This event, like LOCA, assumes a loss of normal power which results in a loss of power to all non-safety control systems without backup power. Failure of the feedwater control system to trip will be beneficial in that more coolant will be provided for core coverage. The increase in pool temperature due to continued feedwater flow would still be bounded by the LOCA case. Since the primary system is automatically isolated (including MSIV's), any spurious operation of the main turbine or condenser systems will not affect the course of this event. The condenser off-gas system and turbine building vent systems are not affected by the MSLB environment and consequently provides acceptable release paths consistent with current FSAR results. Therefore, the accident analysis case is bounding.

C) Feedwater Line Break Outside Containment (FWLB)

The initial break detection logic is accomplished using safety systems only. These automatically initiate all accident mitigation including ECCS, containment isolation, turbine trip, recirc. pump trip, and scram. The feedwater check valves and containment isolation function (including MSIV's) isolate the FWLB environment to the turbine building. For conservatism, the entire turbine building is assumed to be subject to the harsh environment caused by the FWLB. The main turbine and recirculation system are tripped by safety grade instrumentation and are thus unaffected by the FWLB environment. A failure of the feedwater system to trip would result in more water available for core coverage through the unaffected lines and a continued harsh steam, humidity environment around the broken line. However, this has no effect on the safety related accident mitigation functions. Since there is no fuel damage and the containment is isolated, any failure of the condenser off-gas system or turbine building vent system would not result in exceeding dose limits. The area radiation monitoring system and process radiation monitoring systems outside the turbine building would be unaffected and the turbine building itself would be isolated. Therefore, the accident analysis case is bounding.

D) Instrument Line Break

An instrument line break is assumed to occur outside primary containment. All accident mitigation is operator initiated. In order to maximize the extent of the harsh environment, the break is assumed to occur in the open area of the reactor building, as opposed to occurring in one of the ECCS or RWCU equipment rooms. This assumption results in eventual exposure to some degree of all equipment inside the reactor building and not in the main steam tunnel, the RWCU equipment room, or any of the ECCS equipment rooms. Break detection is based on comparison of several readings monitoring the

same process variables, by a general increase in the area radiation monitor or area temperature monitor readings in the reactor building, or by the leak detection system. Process variables can be sensed using safety grade instrumentation such as reactor water level or by comparison of all non-affected process variable sensors. Thus a failure of all affected non-safety break detection logic would not affect the course of the event. All accident mitigation is operator initiated in that no safety systems are tripped. Consequently, the operator will manually trip the turbine and the recirc pumps, initiate shutdown, initiate RHR pool cooling, and the SGTS if required. Since there is no fuel damage and core coverage is maintained with at most operator initiation of RCIC or HPCS, this event does not threaten any safety limits. Due to the redundancy and physical separation in the design of the instrument racks located in the reactor building, any instrument line break will affect only those instrument racks immediately adjacent to it. All other instrument racks will be unaffected. Comparisons of readings will alert the operator both the location of the break and to the erroneous readings. Thus this event is non-limiting.

If the instrument line break is inside one of the ECCS cubicles, the HELB environment is limited to that room. All equipment is assumed failed (both safety and non-safety) as well as that divisional diesel (see Ninety Day Report). The redundant ECCS and all other safety and non-safety equipment outside the affected cubicle are unaffected. Thus this event is non-limiting.

Q 031.291 Those power sources whose failure or malfunction could lead to failure or malfunction of more than one control system were reviewed in part 2 to Question 031.289. Did this review consider all higher level power sources such that the loss of the next higher level bus initiates an event that is already bounded by the Chapter 15 Loss of AC power analysis (e.g., was the loss of a 480V load center which supplies multiple 480V motor control centers considered)? If not, the effects of failure or malfunction of these higher level power sources on multiple control systems should be analyzed. If the consequences of these failures are bounded by the Chapter 15 transient (i.e., anticipated operational occurrence) analysis, a positive statement to that effect should be provided.

Response

An analysis was performed to determine the effect of malfunctions of more than one non-safety control system due to the loss of AC power and to find whether these events are bounded by the chapter 15 Loss of AC Power event. For this analysis, all 480V AC non-ESS switchgear (load centers), all the non-ESS 480V AC Motor Control Centers (MCC) and 120/208V non-ESS AC buses as well as those 480V AC non-ESS MCC's connected to 480V AC ESS switchgear (load centers) and 120/208V AC non-ESS buses connected to 480V AC ESS MCC were considered. In the case of each 480V or 120/208V bus,

each load connected to these buses was individually examined regarding its function and interface and the effect of power loss on multiple control systems. The effect on the control systems due to the loss of these AC power systems collectively was also examined. It was determined by this analysis that after considering all higher level power sources, the loss of the next higher level bus initiated events that were bounded by the chapter 15 Loss of AC Power analysis.

Q. 031.292 It appears that the response to Q 031.289 (the response to this question was actually provided as Part B to Q 031.288) considers the effects of multiple control system failures due to commonality of power source or sensors on the analysis results for those events listed in Chapter 15 of the FSAR. This may go beyond the intent of the question. The intent of Q 031.289 is to determine whether all potential multiple control system failures resulting from power source or sensor (including sensor impulse lines) malfunctions or failures could result in consequences more severe than those considered in the Chapter 15 transient (i.e., anticipated operational occurrence) analysis (i.e., could these failures initiate an unanalyzed event). Determine whether simultaneous malfunctions of control systems resulting from sensor (including sensor impulse lines) or power source (including any higher level power sources identified in the response to Question Q 31.291) malfunctions are bounded by the analyses in Chapter 15. If so, a positive statement to that effect should be provided.

Response

Simultaneous malfunctions of non-safety control systems resulting from sensor, impulse line, or power supply malfunctions were analyzed.

1) Common power sources
All of the feedwater control system and approximately 80% of the recirculation flow control system have a 120V AC common power source, MCC 131A-2 compartment F1.
Both systems, on power supply loss, fail in place and the feed pump turbines and recirc flow control valves maintain their position at the time of power loss.
Other common power sources do not cause any simultaneous failures of control systems.
2) Common impulse lines
Two of the three reactor pressure vessel level transmitters for feedwater cotrol (C34-N004B, N004C) have a common impulse sensing line. A failure of the line will cause the transmitters to read low level. If the control system is operating on the "4B" transmitter which now outputs a minimum level, the control systems will increase flow to the maximum. Since 2 of the 3 level channels are no longer operating properly, there will be no high level trip of the feedwater pumps or the main turbine. This does not result in any new event and is bounded by the existing chapter 15 events.
There are no common impulse line malfunctions that could cause events not already bounded by chapter 15 events.

Q 031.293 Why was the Turbine Trip Without Bypass event (FSAR Section 15.2.3A) not analyzed? This is often the limiting Chapter 15 event for a BWR. Provide a detailed response to Q 031.288 and Q 031.289 for this event.

Response

The Turbine Trip Without Bypass event (FSAR section 15.2.3A) is similar to the Generator Load Rejection Without Bypass event (FSAR Section 15.2.2A). The impact due to a HELB are the same for each event since they are in the same area and both are affected. Non-safety control system failures for either event result in the same consequences. Therefore, Question 031.288 referred the Turbine Trip Event description to the Generator Load Rejection descriptions (see FSAR Amendment 60, pages Q31.288.22 and Q31.288.23).

Q 031.294 A recirculation flow control failure with increasing flow in conjunction with a feedwater flow control failure with increasing flow (caused by a line break adjacent to a motor control center) has been defined as the limiting Part A event in your response to Q 031.280. It is stated that the MCPR remains within limits (1.03). The staff position is that the MCPR criterion is satisfied only if the MCPR remains greater than or equal to 1.06.

Therefore, provide the following additional information.

a. Identify the line break(s) in question.
b. For each break identified above, determine whether the consequences of the event are bounded by the Chapter 15 analyses.
c. Specify the bounding event and demonstrate that the criteria used (e.g., dose rates less than a small fraction of 10 CFR 100) are applicable for each event.

Response

The recirculation flow control failure with increasing flow in conjunction with a feedwater flow control failure with increasing flow was erroneously shown to have an MCPR of 1.03. This was a typographical error. The MCPR should be 1.08 which is the licensing basis for LaSalle County Station.

Q 031.295 Were all non-safety systems (control systems) and their supporting systems analyzed (e.g., was the loss of control or instrument air and the failure of control system circuit cards, both of which would possibly affect multiple control systems, considered)? Another system which perhaps should be included in the anlaysis is the condenser vacuum system.

Response

All non-safety control sytems that form the licensing basis of the plant are identified in FSAR Chapter 7.7. In response to Question 031.288 each non-safety control system that was given as part of the FSAR chapter 15 event mitigation was failed in its worst direction. By assuming the worst case failure of the non-safety control system, the support system did not require examination. Commonality between non-safety sensors or non-safety power supplies was examined for each chapter event (Question 031.289). Based upon the assumed combined failures of all non-safety control systems used in each Chapter 15 event, plus the common mode failures due to common sensors or common power supplies, the conclusion is that the results of failure in common support systems (non-safety) are bounded by the combined failures as assumed in Chapter 15 of the FSAR. Because all non-safety control systems used for each Chapter 15 event were failed plus common mode failures due to sensors or power supplies, this would be sufficient to provide justification that common mode support systems failures would be bounded. The condenser vacuum system is implicitly covered in that a failure would result in an MSIV closure. This case is a milder subset of the MSIV closure case.

Q 031.296 Verify that the Chapter 15 analyses of Anticipated Operational Occurrences either assumed that control systems functioned as designed or did not function at all (i.e., are placed in manual), whichever results in the worst case event (i.e., was any credit taken for control systems in mitigating the effects of these transients).

Response

The Chapter 15 analysis of Anticipated Operational Occurrences assume either non-safety control systems function as designed or do not function at all. For non-safety control system failures, the limiting chapter 15 case is the Loss of AC Power case (non-accident) or the LOCA which assumes a coincident loss of normal power. In general the chapter 15 transients assume normal functioning of plant instrumentation and controls. There are specific events that examine worst case non-safety control system failures:

Feedwater Controller Failure - maximum demand
Loss of Feedwater Flow
Pressure Regulator Failure - open
Pressure Regulator Failure - closed
Recirc. Flow Control Failure - decreasing flow
Recirc. Flow Control Failure - increasing flow
Generator Load Rejection Without Bypass
Turbine Trip Without Bypass
Loss of Condenser Vacuum
Main Condenser Gas Treatment System Failure
Malfunction of Turbine Gland Sealing System

All of the above cases assume a single non-safety control system failure. Responses to Questions 031.288, 031.289, 031.290, and 031.295 address the effects of multiple non-safety control systems failures. Assuming all non-safety control systems fail results in a mild Loss of AC Power scenario which is analyzed and meets all safety limits.

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MATRIX OF NON-SAFETY CONTROL SYSTEMS

AFFECTED BY HELB EVENTS

	LOCA	MSBL	FWLB	Inst. Line Break
Reactor Vessel Instrumentation and Controls				X
Reactor Manual Control Systems				X
Recirc Flow Control System				X
Feedwater Control System			X	X
Pressure Regulator & Turbine Generator Controls			X	X
Neutron Monitoring System (Non-Safety Portion)				
Process Computer System				
Reactor Water Cleanup System				
Area Radiation Monitoring System			X	X
Gaseous Radwaste Control System				
Liquid Radwaste Control System				
Spent Fuel Pool Cooling & Cleanup System				
Refueling Interlocks System				
Process Radiation Monitoring System			X	X
Leak Detection System				X

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