Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

November 12, 1993

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Document Control Desk

Subject: Dresden Station Units 2 and 3
LaSalle County Station Units 1 and 2
Quad Cities Station Units 1 and 2
Compliance with Regulatory Guide 1.97, (Neutron Flux Monitoring)
NRC Dockets 50-237 and 50-249
NRC Dockets 50-373 and 50-374
NRC Dockets 50-254 and 50-265

Reference: 1) Letter from C.P. Patel to D.L. Farrar dated June 3, 1993

2) Letter from D.J. Chrzanowski to Document Control Desk dated August 17, 1993

The purpose of this letter is to provide the supplemental response for Dresden, Quad Cities, and LaSalle committed to in Reference 2. This response is consistent with the NRC adoption of the BWR Owner's Group report; NEDO-31558, "Position on NRC Regulatory Guide 1.97, Revision 3, Requirements for Post Accident Neutron Monitoring System" and completes the required response.

To the best of my knowledge and belief, the statements contained in this document are true and correct. In some respects these statements are not based on my personal knowledge, but on information furnished by other CECo employees, contractor employees, and/or consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

If there are any questions or comments, please contact me at (708) 663-7292.

"OFFICIAL SEAL"
James L. Garling
Notary Public, State of Illinois
My Commission Expires 4/18/97

James L. Garling

Sincerely,

Martin J. Vonk
Generic Issues Administrator
Nuclear Regulatory Services

A003

Attachments:
1) Attachment A; Dresden Station Submittal
2) Attachment B; LaSalle Station Submittal
3) Attachment C; Quad Cities Station Submittal

cc: J. Martin, Regional Administrator-RIII
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Attachment A

Dresden Station
Compliance with Regulatory Guide 1.97
NEDO Compliance Review

REGULATORY GUIDE 1.97
NEDO COMPLIANCE REVIEW - BWR POST ACCIDENT
NEUTRON MONITORING SYSTEM

Introduction

The following reply is presented in response to the NRC's request to review the neutron flux monitoring instrumentation against the criteria of NEDO-31558 to determine whether it meets this criteria and to provide a commitment and time schedule for those items which do not.

In responding to this comparison, between the actual plant configuration and the NEDO report, the bounding Anticipated Transient Without Scram (ATWS) event was the stuck open relief valve with partial scram. This lesser event was selected based on the importance of the Neutron Monitoring System in providing the operator with verification that power is below approximately 3% to avoid the non-routine action of boron injection.

The discussions presented are applicable to the Dresden Nuclear Power Station Units 2 and 3.

1) Range - 1 to 100 Percent Of Rated Power

The Nuclear Monitoring System (NMS) uses three types of neutron monitors. The flux level at which the reactor is critical is monitored by the Source Range Monitors (SRM).

The Intermediate Range Monitors (IRM) cover the flux level from approximately 0.001% to about 40% power. These first two types of monitors (SRM and IRM) are referred to as the start-up range subsystem.

The Local Power Range Monitors (LPRM) and the Average Power Range Monitors (APRM) are used from 3% power to full power. These last two types of monitors (LPRM and APRM) are referred to as the power range subsystem. While the power range is primarily used from the 3% to full power range, it does provide useful information in the range of 1% to full power.

The NMS system design is in compliance with the alternate criteria as specified in the NEDO report.

2) Accuracy - +/- 2 Percent of Rated Power

The application of the accuracy, associated with rated power as indicated by the power range LPRM channels, is not credited as primary information required by the operator for initiation of manually controlled actions for a safety

system to accomplish it's safety function. Therefore it is not classified as Reg. Guide 1.97 type A variable. It is useful however, to the operator in monitoring reactivity at low power levels for the purpose of making appropriate decisions concerning the applicability of boron injection.

Commonwealth Edison has initiated a program to ensure that the basis for various instrument channel accuracies are current with respect to the plant's physical configuration and operating practices. As part of this program, the error analysis for this channel will be evaluated. It is anticipated this will be completed within the next twelve months. If the performed analysis indicates that the +/-2 % accuracy requirement is not bounding, the results of the analysis will be incorporated in the appropriate station procedures and operating practices.

3) Response Characteristic - 5 Seconds For A 10 % Power Change

As identified in the NEDO, the APRMs, designed with a response time of 1 second for a 100% change in flux, are more than adequate to meet the response characteristic requirement.

In addition to the monitor identified above, the complete loop including detector and recorder are well within the 5 second requirement.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

4) Environmental Qualification - Operate In An ATWS Environment

Each channel within the power range configuration consists of a LPRM detector connected via cables and connectors to the input of an APRM. The output of the APRM is connected via cables and connectors to the associated computer input, annunciator, indicating light, process recorder, and Reactor Protection System trip logic.

The APRM and the associated indicating devices as described above, with the associated interconnecting cables and connectors are located within a mild environment and not subject to the environmental effects of the specified ATWS event.

The SRM, IRM, and the LPRM detectors are designed and qualifable to operate within the harsh environment of the Reactor core. The environmental parameters within the Reactor core bound the base environmental parameters of the specified ATWS event as identified in the referenced NEDO report.

The associated cables for the LPRM detectors within the Drywell are qualifiable for a Loss of Coolant Accident (LOCA). The environmental parameters of this accident bound the base environmental parameters of the specified ATWS event as identified in the referenced NEDO report.

The present APRM components, LPRM detectors and associated cables within the Drywell subject to the environmental parameters of the specified ATWS event, are qualifiable for the base ATWS event based on the comparison to the more stringent bounding environmental profiles identified above. A response on the LPRM cable connectors within the Drywell will be provided pending the BWR Owners Group (BWROG) review of equipment qualification for an ATWS environment.

The cable and connectors for the SRM and the IRM for Dresden Unit 2 have been replaced with qualifiable components. An identical modification is scheduled for Dresden Unit 3.

5) Function Time - 1 hour

The alternate requirement identified in the NEDO report states "one hour is judged to be sufficient time for successful completion of operator actions". The present Emergency Operating Procedures (EOPs) do not specify a time for the operator to initiate boron injection, only that injection must occur before the suppression pool temperature reaches 110° F.

Therefore a time of one hour is applied to the duration for which the equipment must remain operational, for the specified ATWS event, in order to provide monitoring that the operator may use in preventing unnecessary boron injection.

As previously noted in item 4, the components that would be subject to environmental conditions (eg. LPRM cables, etc.)have been designed to function in environments with harsher parameters that the specified ATWS event. The remaining components are located within mild environments and are not subject to post-accident environmental effects.

The ability of the power range equipment to function in scenarios more stringent, in terms of time as well as environmental profiles, than the specified ATWS event justify compliance with the alternate criteria as specified in the NEDO report.

6) Seismic Qualification - Not Required

Based on the ATWS Rule 10CFR50.62, seismic qualification of the NMS equipment is not required. As discussed in the NEDO

the portions of the NMS which interface with the RPS trip functions have been seismically qualified to assure that the seismic event does not prevent the automatic trip function of the Reactor Protection System. The remaining equipment does not require seismic qualification.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

7) Redundancy and Separation - Redundancy to Assure Reliability

The APRM configuration consists of six redundant channels (A-F) that receive inputs from a minimum of 20 LPRMs each. The LPRMs are in a dispersed pattern of fixed in-core neutron detectors. There are 41 LPRM assemblies located symmetrically within the core. Each LPRM assembly consists of four miniature fission chambers which are arranged at fixed axial locations approximately 36 inches apart.

The six channels are divided into two redundant sets of APRMs for input into the Rod Block and SCRAM circuity. The two sets of APRMs are redundantly powered from different RPS buses. Both of the RPS buses are highly reliable power sources that are diesel backed.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

8) Power Sources - Uninterruptable and Reliable Power

The NMS derives its power from the Reactor Protection System (RPS) buses A and B. It consists of two independent trip systems powered by independent electrical MCCs that are backed by separate emergency diesel generators via the 4kV essential buses. Power to each of the RPS buses is supplied from dedicated M-G sets that derive power from the MCCs mentioned above. The M-G sets are equipped with high-inertia flywheels so that the generator output is maintained within 5% of the rated output for at least one second to keep the RPS bus energized during a momentary power loss.

The alternate power supply to the RPS buses comes from another reserve MCC which is tied to both buses through a key interlock system which prevents the reserve power from supplying more than one RPS bus at a time. In addition, two Class 1E electrical protection assemblies are provided in series between each power source and its associated RPS bus breaker. These are designed to trip on under/overvoltage and underfrequency.

Finally while the power supply to the RPS buses is not uninterruptible, it is divisionalized and fed from

independent and diverse sources. It is very unlikely that both buses will be lost at the same time. The diversity of the power scheme ensures that at least one divisional set of the NMS is available to provide reactor power indication at all times.

Because the subject of uninterruptible power supplies for the NMS is currently under review by the BWR Owners Group (BWROG), response to this subject will be provided pending the results of their review.

9) Channel Availability - Available Prior To An Accident

As identified in the NEDO report, GE has determined that no event was reported which resulted in a loss of neutron monitoring capability for any of the GE plants. Also the report further substantiates the reliability of the equipment through the percent unavailable statistics.

As the APRMs must be available / operable during power operation, per Technical Specifications they will be immediately available prior to an accident.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

10) Quality Assurance - Limited QA Requirements Based On Generic Letter 85-06

According to the Master Equipment List (MEL), the NMS is comprised of safety-related, Regulatory Guide 1.97 related, and nonsafety equipment. Those components classified as safety-related are subject to more stringent QA requirements which envelope the requirements set forth in Generic Letter 85-06 and therefore require no further action.

While all other components are not completely identified in the MEL, Commonwealth Edison has initiated a program to ensure that each item of the NMS is identified within the MEL with the augmented quality requirements associated with Regulatory Guide 1.97 as applicable to requirements of Generic Letter 85-06. It is anticipated this will be completed within the next 12 months.

11) Display and Recording - Continuous Recording

The APRMs are in compliance with the alternate criteria as specified in the NEDO report in that each APRM is continuously indicated and recorded, on paper in the main control room (front of panel indication).

12) Equipment Identification - Identify In Accordance With Control Room Design Review

The APRM instrumentation was evaluated during the Detailed Control Room Design Review (DCRDR). The philosophies applied to resolve the Human Engineering Discrepancies (HEDs) identified from the DCRDR were consistent with Regulatory Guide 1.97 and NUREG 0737 Supplement 1.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

13) Interfaces - No Interference With RPS Trip Functions

The APRMs provide SCRAM trip signals within the RPS under the following conditions:

a) High-High Neutron Flux
b) APRM Channel Inoperative
c) APRM Channel Reading Downscale (with mode switch in RUN and the associated IRM in the High-High or Inoperative condition).

Both RPS logic channels must receive a trip signal for a SCRAM to occur. The APRM trip interlocks with the RPS are through relay contacts within the APRM.

The APRM is classified as safety related and therefore qualified to interface directly with the RPS system.

There is no other interface between the APRM and the RPS trip functions.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

14) Service, Test and Calibration - Establish In-Plant Procedures

The maintenance, functional testing, and calibration of the LPRMs and the APRMs are currently governed by existing plant procedures and Technical Specifications.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

15) Human Factors - Incorporate Human Factors Engineering Principles

The APRM instrumentation was evaluated during the DCRDR for HEDs. No safety significant HEDs were identified that would

impact the operators use of this equipment. The philosophies applied to resolve the HEDs identified from the DCRDR were consistent with Regulatory Guide 1.97 and NUREG 0737 Supplement 1.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

16) Direct Measurement - Direct Measurement of Neutron Flux

The LPRM detectors utilize a fission-type ionization chamber design that correlates the neutron flux to changes in the resistance of the ionization chamber. As neutron flux increases, ionization of the gas within the ion chamber increases and lowers the resistance between the ion (d.c.) chamber electrodes causing an increase in electrical current. This method is strictly designed for monitoring neutron flux.

The LPRM detectors are in compliance with the alternate criteria as specified in the NEDO report.

Summary

In summary the Average Power Range Monitors (APRMs) meet the alternate criteria contained in NEDO-31558-A, Section 5.2, with the following exceptions;

The accuracy analysis will be completed within the next 12 months. If found not bounding, procedures and operating practices will be upgraded as necessary following completion of the analysis.

A response on the LPRM cable connectors within the Drywell will be provided pending the BWROG review of equipment qualification for an ATWS environment.

A response to the uninterruptable power sources will be provided pending the results of the BWROG evaluation.

The complete update of the Master Equipment List (MEL) with quality requirements for the Neutron Monitoring System (NMS) will be completed within the next 12 months.

References

1) NEDO-31558
Position on NRC Regulatory Guide 1.97, Revision 3 Requirements for Post-Accident Neutron Monitoring System.

2) Regulatory Guide 1.97, Revision 3
Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident.

3) NRC Letter Dated June 3, 1993
Regulatory Guide 1.97 - Boiling Water Reactor Neutron Flux Monitoring (TAC NO. M77660).

4) Commonwealth Edison Letter August 11, 1993
Response to Regulatory Guide 1.97 Compliance (Neutron Flux Monitoring)

Attachment B

LaSalle Station
Compliance with Regulatory Guide 1.97
NEDO Compliance Review

REGULATORY GUIDE 1.97
NEDO COMPLIANCE REVIEW - BWR POST ACCIDENT
NEUTRON MONITORING SYSTEM

LaSalle Conformance to NEDO-31558 Design Criteria for Post-Accident Neutron Monitoring

Section 5.0 of the GE Report NEDO-31558, Position on NRC Regulatory Guide 1.97, Revision 3, Requirements for Post-Accident Neutron System defines and justifies alternate post-accident requirements for the Neutron Monitoring System (NMS) which are acceptable alternates to those specified in RG 1.97. These criteria have been developed based on post-accident operator actions as specified by the BWR Generic Emergency Procedure Guidelines (EPGs) for selected events. They were selected from a broad spectrum of events to include all FSAR Transient and accident events as-well-as ATWS and other events beyond the plant design basis to be consistent with the intent of RG 1.97 and therefore, they are bounding for the post-accident NMS evaluation.

A LaSalle - specific analysis has been performed for each of the selected events in which the operator's use of the NMS based on LaSalle Emergency Operating Procedures (EOPs) has been considered. The LaSalle selected events are comparable to the events postulated in the GE Report.

This analysis has concluded that similarly as in the GE Report the Lesser ATWS event, which is the stuck open relief valve with partial scram failure for the LaSalle Station, defines design requirements for the NMS. Therefore, the alternate design criteria for post-accident neutron monitoring specified in the GE Report are applicable for the LaSalle NMS. A review of the LaSalle NMS instrumentation against these criteria have been performed to determine whether the NMS meets these criteria. Existing specification or capability of the LaSalle NMS has been evaluated against the appropriate alternate criterion considering operator's use of the NMS under the applicable lesser ATWS event only (which is a stuck open relief valve event at LaSalle Station), not for accidents. The results of our review are documented in the following sections.

1. Range

Alternate Requirement: 1 to 100%

LaSalle NMS Capability:

The APRM alone covers the range from 1 to 125% of rated power which envelopes the alternate range requirement. The operator discriminant used in making decisions in accordance

with the applicable EOPs for the subject ATWS event is at the 2 to 12% of rated power level values. These discriminant values are well above the 1% lower range limit of the Average Power Range Monitors (APRMs). Therefore, the existing LaSalle NMS meets the alternate range requirement.

2. Accuracy

Alternate Requirement: 2% of rated power

LaSalle NMS Capability:

The application of the accuracy associated with rated power as indicated by the power range LPRM channel is not credited as primary information required by the operator to take specific manually controlled actions that are required for a safety system to accomplish it's safety function for design basis events and therefore is not classified as a Reg. Guide 1.97 type A variable. It is useful, however, to the operator in monitoring reactivity at low power levels for the purpose of making appropriate decisions in determining the applicability of boron injection. Commonwealth Edison has initiated a program to insure the basis for various instrument channel accuracies are current with respect to the plant's physical configuration and operating practices. As part of this program, the error analysis for this channel will be evaluated. It is anticipated this will be completed within the next twelve months. If the performed analysis indicates that the +/-2% accuracy requirement is not bounding, the results of the analysis will be incorporated in the appropriate station procedures and operating practices.

3. Response Characteristic

Alternate Requirement: 5 sec./10% change

LaSalle NMS Capability:

The response time of the APRM channel performing trip function to the RPS is no more than 60 milliseconds. This response time includes response time of channel components up to APRM. The indication function is accomplished by feeding APRM output signal to the recorders. The recorder step response time (90% step) is one second or less. The overall response time for the APRM channel with the recorder included is less than 1 second and 60 milliseconds. Therefore, the existing NMS meets and exceeds the alternate requirement.

4. Environmental Qualification

Alternate Requirement: Operate in ATWS Environment

LaSalle NMS Qualification:

The environmental qualification is required for the applicable lesser ATWS event, not for accidents. LaSalle NMS equipment must survive lesser ATWS event conditions in order to provide power level monitoring to the operator to mitigate unnecessary boron injection. During the lesser ATWS event, which is the stuck open relief valve for the LaSalle Station, there is continuous steam discharge from the vessel through the safety relief valve blowdown lines to the suppression pool which adds heat to the suppression pool. With the exception for the steam flow through the open relief valve, the nuclear steam supply system is in a normal operating state. The suppression pool is the only system exposed to off-normal conditions. The power level monitoring function performed by the NMS within the alternate range is accomplished by utilizing the components such as detectors, cables and connectors which also perform safety-related functions by providing trip signals to the reactor protection system. These components are located in harsh zones and designed to function during the conditions which establish NMS environmental design requirements for trip function. These conditions will envelop the environmental conditions developed due to lesser ATWS event which is the stuck open relief valve event. GE has qualified the APRM to operate under these conditions for duration of at least one hour. The remaining portion of the NMS such as Local Power Range Monitors (LPRM's), APRM's and recorders are located in the controlled environment which is not affected by the stuck open relief valve event. Therefore the existing LaSalle NMS is qualified for use in the subject lesser ATWS environment.

5. Function Time

Alternate Requirement: 1 hour

LaSalle NMS Capacity:

The LaSalle NMS function time is dependent on the duration of the stuck open relief valve with partial scram failure event only, during which the NMS equipment must survive the environment and function in order to provide power level monitoring to the operator to mitigate unnecessary boron injection. During this event the steam flows out of the stuck open relief valve and adds heat to the suppression pool. Based on LaSalle Emergency Operating Procedures, the operator uses the NMS power level indication in conjunction with the suppression pool temperature to make decisions related to boron injection. As described in Section 4

above, Environmental Qualification of the detectors, cables and connectors are qualified to and designed by GE to operate at least one hour under environmental conditions that envelop the conditions for the stuck open relief valve event. The remaining components of the NMS are required to function in the controlled environment which does not degrade the NMS equipment in the post-event conditions.

Therefore, it is judged that the NMS design assures the NMS functioning for the time much longer than one hour at the stuck open relief valve event environment.

If in the case of unusual circumstances, the failure of the NMS indication has occurred after one hour of functioning in the event, the LaSalle Emergency Operating Procedure takes into account this incident and requires the operator to take actions as though power were above 5%/unknown. These actions include boron injection and therefore assure reactor shutdown under all conditions and plant safety. However, an analysis could be performed to determine a maximum time in which the suppression pool temperature reaches Boron Injection Initiation Temperature at the worst case scenario. The functioning of the NMS indication during that time will help the operator to mitigate unnecessary boron injection.

Based on above it is concluded that the LaSalle NMS is conservatively designed and in conjunction with the LaSalle Emergency Operating Procedures (EOP) meets the alternate requirement.

6. <u>Seismic Qualification</u>

Alternate Requirements: Seismic Qualification Not Required

LaSalle NMS Qualification:

The components of the LaSalle NMS System, that are used to provide safety-related trip signals to the reactor protection system have been seismically qualified to Category I requirements. The remaining portion of the NMS, which does not perform safety-related trip functions, is generally not seismically qualified with the exception of recorders and transfer switches that are qualified to Category I requirements. Since the design requirements are defined by the lesser ATWS event the qualification of the non-safety-related portion of the NMS shall be consistent with the ATWS Rule (10CFR50.62). However, this rule does not require seismic qualification. Therefore, the LaSalle NMS exceeds the alternate requirements.

7. Redundancy and Separation

Alternate Requirement: Redundancy to Assure Reliability

LaSalle NMS Capability:

The LaSalle NMS contains six separate channels (A-F) of APRMs that are grouped in two RPS divisions (A and B). These channels are used to perform safety-related trip function and provide input signals into RPS systems. Therefore, this portion of the circuit meets the design requirements for redundancy and separation as required for safety-related circuits. The indication function is accomplished by using output analog signals from APRM's to feed the separate and redundant recorders (4). Thus, NMS power indication functions such as signal transmission, signal processing and indication meet the alternate requirement.

8. Power Sources

Alternate Requirements: Uninterruptible and Reliable Power Sources

LaSalle NMS Capability:

The LaSalle NMS is fed from interruptible but highly reliable (Diesel - Generator backed) power sources. The LPRM/APRM is powered from redundant 480/120 vac motor-generator (M-G) sets configured in two RPS divisional buses (A and B) and fed from redundant and separate divisional (ESF divisions 1 and 2) 480 vac buses in separate motor control centers in the Auxiliary Building. Either RPS Divisional Bus A or B can be energized by a reserve feed from a non-divisional source via a main control room operator action. Two Electrical Protection Assemblies (EPAs) are installed in series between each of the two RPS M-G sets and RPS buses and between the reserve feed and the RPS buses. EPAs provide redundant protection to the RPS buses by acting to disconnect the RPS from the power source circuits. Each M-G set is equipped with high inertia flywheel which is sufficient to maintain voltage and frequency within 5% of rated values for at least one second following a total loss of power to drive the M-G set.

The M-G set power sources are reliable and uninterrupted as required during a NMS design defining event which is a stuck open relief valve with partial scram failure to assure a continuous neutron flux monitoring.

It has been determined that during this event, the NMS power monitoring will not be lost due to load shedding logics or

similar schemes or a single failure that would cause loss of redundant RPS buses powering the NMS instrumentation. In case of unlikely incident of loss of one RPS division the power level indication will be provided on the redundant division of the NMS.

The power supply to the recorders is not redundant. In all cases NMS recorders are powered from non-Class 1E 120 Vac instrument bus.

Although power sources for the NMS deviates from the alternate requirement for uninterruptibility, they are reliable and capable to provide continuous power to the NMS during the design defining event. Therefore, they meet the alternate requirements with the exception for the recorders. The power supply for the recorders will be upgraded to provide redundancy and improve reliability. CECo will modify the power supply for the recorders to ESF power sources during outages L1R07 (currently scheduled for fall 1995) and L2R07 (currently scheduled for fall 1996).

However, for Loss of Offsite Power event, we deviate from the alternate requirements because both RPS power sources will be lost temporarily during this event. For this event, restoration of power to the APRM is dependent on DG startup time plus manual restart of the RPS M-G sets and reset of the EPAs. Rod Position Indication System (RPIS) would be available for this period of time since it is powered from UPS. This issue is being evaluated by BWROG to justify adequacy of existing M-G set NMS power supplies in which CECo is participating.

9. Channel Availability

Requirement: Available Prior to Accident

LaSalle NMS Capability:

The LaSalle NMS is available while the plant is at power. Additionally, the availability of the NMS at LaSalle was not affected by any of the NMS factors reported in the NPRDS data base during the period from 1985 to 1991. Also the GE "COMPASS" data base over the period of 1975 through 1985 indicates that the NMS availability is extremely high. Therefore, the existing NMS design meets this requirement.

10. Quality Assurance

Alternate Requirement: Limited QA Requirements Based on Generic Letter 85-06

LaSalle NMS Capability:

The portion of the NMS circuit that performs trip functions

to the reactor protection system is Class 1E and was designed, procured and installed as safety-related. The remaining portion of the circuit from APRM's to the recorders although performing non-safety related function has been procured and installed as safety-related. CECo has implemented a QA Program in accordance with 10CFR50, Appendix B which bounds the limited requirements of Generic Letter 85-06. Therefore, the LaSalle NMS exceeds the alternate requirement.

11. Display and Recording

Requirement: Continuous Recording

LaSalle NMS Capability:

The existing NMS design provides capability of continuous recording within required alternate range of every APRM channel associated with RPS Division A or Division B. Therefore, the LaSalle NMS meets the alternate requirement.

12. Equipment Identification

Requirement: Identify in Accordance with CRDR

LaSalle NMS Capability:

The Control Room Design Review (CRDR) at LaSalle Station did not identify any Human Engineering Deficiencies (HEDs) associated with the NMS recorders. Each recorder is clearly identified. Therefore, the LaSalle NMS meets this requirement.

13. Interface

Alternate Requirement: No Interference with RPS Trip Functions

LaSalle NMS Capability:

The LaSalle NMS contains components that are used in performing both tripping and power level indication functions. The portion of the circuit participating in performing safety related RPS trip functions is Class 1E and originally designed by GE. The original design of the circuit complies with the applicable separation and isolation criteria which was approved. The LaSalle Plant has been licensed based on this design. The portion of the tripping circuit that is utilized to perform indication includes detectors, LPRM's and APRM's. Analog output signals from APRM's through transfer switches are feeding recorders to provide power level indication. The recorders

have been procured as Class 1E and Seismic Category I instruments. The transfer switches are also classified as Class 1E and Seismic Category I instruments. Since the signal transmission circuit from APRM's to the recorders is treated as safety-related, although performing non-safety related functions, no circuit isolation is required. The design of NMS satisfies requirements for isolation and separation of non-1E circuits from Class 1E circuits to prevent interference with RPS trip functions and therefore the NMS meets the alternate requirement.

14. Service, Test and Calibration

Requirement: Establish In-Plant Procedures

LaSalle NMS Capability:

The LaSalle Station has established the procedures necessary for calibration and functional testing of NMS. Therefore, LaSalle meets this requirement.

15. Human Factor

Requirement: Incorporate HFE Principles

LaSalle NMS Capability:

LaSalle NMS design complies with the Human Factors Engineering (HFE) principles and no Human Engineering Deficiencies (HEDs) associated with the SRM/IRM/APRM recorders were identified in the Control Room Design Review (CRDR). Therefore, the LaSalle NMS meets this requirement.

16. Direct Measurement

Requirement: Direct Measurement of Neutron Flux

LaSalle NMS Capability:

The LaSalle NMS design uses fission type detectors which provide direct measurement of neutron flux. Therefore the LaSalle NMS meets this requirement.

Summary

The review of the LaSalle NMS instrumentation for conformance to GE Report, NEDO-31558, requirements for post-accident neutron monitoring showed that the NMS meets the alternate criteria as specified in this report, Section 5.0, with the following exceptions:

- The APRM channel accuracy will be evaluated within the next twelve months. Results of the analysis will be incorporated in the appropriate station procedures and operating

practices, if found that the alternate requirement is not bounding.

- As justified above, power sources for the NMS meet the alternate requirements with the exception for the recorders, although they do not meet uninterruptibility criterion. The justification for the uninterruptibility will be provided pending the results of the BWROG evaluation. The power supply for the recorders will be upgraded to ESF power sources during outages L1R07 (currently scheduled for fall 1995) and L2R07 (currently scheduled for fall 1996) to provide redundancy and improve reliability.

References

1) GE Report, NEDO-31558, Class 1, March 1988
Position on NRC Regulatory Guide 1.97, Revision 3
Requirements for Post-Accident Neutron Monitoring System

2) NRC Letter dated June 3, 1993
Regulatory Guide 1.97 - Boiling Water Reactor Neutron Flux Monitoring (TAC No. M77660).

Attachment C

Quad Cities Station
Compliance with Regulatory Guide 1.97
NEDO Compliance Review

REGULATORY GUIDE 1.97
NEDO COMPLIANCE REVIEW - BWR POST ACCIDENT
NEUTRON MONITORING SYSTEM

Introduction

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In responding to this comparison, between the actual plant configuration and the NEDO report, the bounding Anticipated Transient Without Scram (ATWS) event was the stuck open relief valve with partial scram. This lesser event was selected based on the importance of the Neutron Monitoring System in providing the operator with verification that power is below approximately 3% to avoid the non-routine action of boron injection.

The discussions presented are applicable to the Quad Cities Nuclear Power Station Units 1 and 2.

1) Range - 1 to 100 Percent Of Rated Power

The Nuclear Monitoring System (NMS) uses three types of neutron monitors. The flux level at which the reactor is critical is monitored by the Source Range Monitors (SRM).

The Intermediate Range Monitors (IRM) cover the flux level from approximately 0.001% to about 40% power. These first two types of monitors (SRM and IRM) are referred to as the start-up range subsystem.

The Local Power Range Monitors (LPRM) and the Average Power Range Monitors (APRM) are used from 3% power to full power. These last two types of monitors (LPRM and APRM) are referred to as the power range subsystem. While the power range is primarily used from the 3% to full power range, it does provide useful information in the range of 1% to full power.

The NMS system design is in compliance with the alternate criteria as specified in the NEDO report.

2) Accuracy - +/- 2 Percent of Rated Power

The application of the accuracy, associated with rated power as indicated by the power range LPRM channels, is not credited as primary information required by the operator for

initiation of manually controlled actions for a safety system to accomplish it's safety function. Therefore it is not classified as Reg. Guide 1.97 type A variable. It is useful however, to the operator in monitoring reactivity at low power levels for the purpose of making appropriate decisions concerning the applicability of boron injection.

Commonwealth Edison has initiated a program to ensure that the basis for various instrument channel accuracies are current with respect to the plant's physical configuration and operating practices. As part of this program, the error analysis for this channel will be evaluated. It is anticipated this will be completed within the next twelve months. If the performed analysis indicates that the +/-2 % accuracy requirement is not bounding, appropriate actions will be implemented.

3) Response Characteristic - 5 Seconds For A 10 % Power Change

As identified in the NEDO, the APRMs, designed with a response time of 1 second for a 100% change in flux, are more than adequate to meet the response characteristic requirement.

In addition to the monitor identified above, the complete loop including detector and recorder are well within the 5 second requirement.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

4) Environmental Qualification - Operate In An ATWS Environment

Each channel within the power range configuration consists of a LPRM detector connected via cables and connectors to the input of an APRM. The output of the APRM is connected via cables and connectors to the associated computer input, annunciator, indicating light, process recorder, and Reactor Protection System trip logic.

The APRM and the associated indicating devices as described above, with the associated interconnecting cables and connectors are located within a mild environment and not subject to the environmental effects of the specified ATWS event.

The SRM, IRM, LPRM detectors are designed and qualifiable to operate within the harsh environment of the Reactor core. The environmental parameters within the Reactor core bound the base environmental parameters of the specified ATWS event as identified in the referenced NEDO report.

The associated cables within the Drywell for the SRM, IRM, and LPRMs are qualifiable for a Loss of Coolant Accident (LOCA). The environmental parameters of this accident bound the base environmental parameters of the specified ATWS event as identified in the referenced NEDO report.

The present power range components, LPRM detectors and associated cables within the Drywell subject to the environmental parameters of the ATWS event, are qualifiable for the base ATWS event based on the comparison to the more stringent bounding environmental profiles identified above. A response on the SRM, IRM, and LPRM cable connectors within the Drywell will be provided pending the BWR Owners Group (BWROG) review of equipment qualification for an ATWS environment.

5) Function Time - 1 hour

The alternate requirement identified in the NEDO report states "one hour is judged to be sufficient time for successful completion of operator actions". The present Emergency Operating Procedures (EOPs) do not specify a time for the operator to initiate boron injection, only that injection must occur before the suppression pool temperature reaches 110° F.

Therefore a time of one hour is applied to the duration for which the equipment must remain operational, for the specified ATWS event, in order to provide monitoring that the operator may use in preventing unnecessary boron injection.

As previously noted in item 4, the components that would be subject to environmental conditions (e.g., LPRM cables etc.) have been designed to function in environments with harsher parameters that the specified ATWS event. The remaining components are located within mild environments and are not subject to post-accident environmental effects.

The ability of the power range equipment to function in scenarios more stringent, in terms of time as well as environmental profiles, than the specified ATWS event justify compliance with the alternate criteria as specified in the NEDO report.

6) Seismic Qualification - Not Required

Based on the ATWS Rule 10CFR50.62, seismic qualification of the NMS equipment is not required. As discussed in the NEDO the portions of the NMS which interface with the RPS trip functions have been seismically qualified to assure that the seismic event does not prevent the automatic trip function

of the RPS. The remaining equipment does not require seismic qualification.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

7) Redundancy and Separation - Redundancy to Assure Reliability

The APRM configuration consists of six redundant channels (1-6) that receive inputs from a minimum of 20 LPRMs each. The LPRMs are in a dispersed pattern of fixed in-core neutron detectors. There are 41 LPRM assemblies located symmetrically within the core. Each LPRM assembly consists of four miniature fission chambers which are arranged at fixed axial locations approximately 36 inches apart.

The six channels are divided into two redundant sets of APRMs for input into the Rod Block and SCRAM circuity. The two sets of APRMs are redundantly powered from different RPS buses. Both of the RPS buses are highly reliable power sources that are diesel backed.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

8) Power Sources - Uninterruptable and Reliable Power

The NMS derives its power from the Reactor Protection System (RPS) buses A and B. It consists of two independent trip systems powered by independent electrical MCCs that are backed by separate emergency diesel generators via the 4kV essential buses. Power to each of the RPS buses is supplied from dedicated M-G sets that derive power from the MCCs mentioned above. The M-G sets are equipped with high-inertia flywheels so that the generator output is maintained within 5% of the rated output for at least one second to keep the RPS bus energized during a momentary power loss.

The alternate power supply to the RPS buses comes from another reserve MCC which is tied to both buses through a key interlock system which prevents the reserve power from supplying more than one RPS bus at a time. In addition, two Class 1E electrical protection assemblies are provided in series between each power source and its associated RPS bus breaker. These are designed to trip on under/overvoltage and underfrequency.

Finally, while the power supply to the RPS buses is not uninterruptible, it is divisionalized and fed from independent and diverse sources. It is very unlikely that both buses will be lost at the same time. The diversity of the power scheme ensures that at least one divisional set of

the NMS is available to provide reactor power indication at all times.

Because the subject of uninterruptible power supplies for the NMS is currently under review by the BWR Owners Group (BWROG), response to this subject will be provided pending the results of their review.

9) Channel Availability - Available Prior To An Accident

As identified in the NEDO report, GE has determined that no event was reported which resulted in a loss of neutron monitoring capability for any of the GE plants. Also the report further substantiates the reliability of the equipment through the percent unavailable statistics.

As the APRMs must be available / operable per Technical Specifications, they will be immediately available prior to an accident.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

10) Quality Assurance - Limited QA Requirements Based On Generic Letter 85-06

According to the Master Equipment List (MEL), the Neutron Monitoring System is comprised of safety-related, Regulatory Guide 1.97 related, and nonsafety equipment. Those components classified as safety-related are subject to more stringent QA requirements which envelope the requirements set forth in Generic Letter 85-06 and therefore require no further action.

While all other components are not completely identified in the MEL, Commonwealth Edison has initiated a program to ensure that each item of the NMS is identified within the MEL with the augmented quality requirements associated with Regulatory Guide 1.97 as applicable to requirements of Generic Letter 85-06. It is anticipated this will be completed within the next 12 months.

11) Display and Recording - Continuous Recording

The APRMS are in compliance with the alternate criteria as specified in the NEDO report in that each APRM is continuously indicated and recorded on paper in the main control room (front of panel indication).

12) Equipment Identification - Identify In Accordance With Control Room Design Review

The APRM instrumentation was evaluated during the Detailed Control Room Design Review (DCRDR). The philosophies applied to resolve the Human Engineering Discrepancies (HEDs) identified from the DCRDR were consistent with Regulatory Guide 1.97 and NUREG 0737 Supplement 1.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

13) Interfaces - No Interference With RPS Trip Functions

The APRMs provide SCRAM trip signals within the RPS under the following conditions:

a) High-High Neutron Flux
b) APRM Channel Inoperative
c) APRM Channel Reading Downscale (with mode switch in RUN and the associated IRM in the High-High or Inoperative condition).

Both RPS logic channels must receive a trip signal for a SCRAM to occur. The APRM trip interlocks with the RPS are through relay contacts within the APRM meter.

The APRM meter is classified as safety related and therefore qualified to interface directly with the RPS system.

There is no other interface between the APRM and the RPS trip functions.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

14) Service, Test and Calibration - Establish In-Plant Procedures

The maintenance, functional testing, and calibration of the LPRMs and the APRMs are currently governed by existing plant procedures and Technical Specifications.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

15) Human Factors - Incorporate Human Factors Engineering Principles

The APRM instrumentation was evaluated during the DCRDR for HEDs. No safety significant HEDs were identified that would

impact the operators use of this equipment. The philosophies applied to resolve the HEDs identified from the DCRDR were consistent with Regulatory Guide 1.97 and NUREG 0737 Supplement 1.

The APRMs are in compliance with the alternate criteria as specified in the NEDO report.

16) Direct Measurement - Direct Measurement of Neutron Flux

The LPRM utilize a fission-type ionization chamber design that correlates the neutron flux to changes in the resistance of the ionization chamber. As neutron flux increases, ionization of the gas within the ion chamber increases and lowers the resistance between the ion (dc) chamber electrodes causing an increase in electrical current. This method is strictly designed for monitoring neutron flux.

The LPRM detectors are in compliance with the alternate criteria as specified in the NEDO report.

Summary

In summary the Average Power Range Monitors (APRMs) meet the alternate criteria contained in NEDO-31558-A, Section 5.2, with the following exceptions;

The accuracy analysis will be completed within the next 12 months. If found not bounding, appropriate actions will be implemented.

A response on the SRM, IRM, and LPRM cable connectors within the Drywell will be provided pending the BWROG review of equipment qualification for an ATWS environment.

A response to the uninterruptable power sources will be provided pending the results of the BWROG evaluation.

The complete update of the Master Equipment List (MEL) with quality requirements for the Neutron Monitoring System (NMS) will be completed within the next 12 months.

References

1) NEDO-31558
Position on NRC Regulatory Guide 1.97, Revision 3
Requirements for Post-Accident Neutron Monitoring System.

2) Regulatory Guide 1.97, Revision 3
Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident.

3) NRC Letter Dated June 3, 1993
Regulatory Guide 1.97 - Boiling Water Reactor Neutron Flux Monitoring (TAC NO. M77660).

4) Commonwealth Edison Letter Dated August 11, 1993
Response to Regulatory Guide 1.97 Compliance (Neutron Flux Monitoring)