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ComEd

ESK-97-066

March 20, 1997

United States Nuclear Regulatory Commission
Washington, DC 20555

Attention: Document Control Desk

Subject: Quad Cities Station Units 1 & 2
Response to NRC Resident Inspection Report
50-254;265/96020 (DRP)
NRC Docket Nos. 50-254/265

References: (a) NRC Resident Inspection Report 50-254; 265/96020 (DRP) and Notice of Violation from J. L. Caldwell to E. Kraft, dated February 20, 1997.

Recent events have raised concern over the methodology used by the company in evaluating and trending Emergency Diesel Generator (EDG) performance.

All ComEd nuclear generating stations use a corporate directive and local station procedures to provide the means of assessing, maintaining, and trending EDG and Station Blackout (SBO) DG system reliability. These documents are consistent with the guidelines given in Regulatory Guide 1.9, Regulatory Guide 1.155, NUMARC 87-00, and INPO 96-003. A computer based tracking program provides additional assistance in assessment as well as a means of trending system reliability performance.

The attached documents provide the history of the establishment of a reliability program for ComEd DGs and clarification of the use of this program.

If you have any questions concerning this letter, please contact Chuck Peterson, Regulatory Affairs Manager, at (309) 654-2241 extension 3609.

Respectfully,

R. W. Pence for ESK

E. S. Kraft, Jr.
Site Vice President
Quad Cities Station

IE01

Attachment: (1) ComEd Diesel Generator Reliability Program
(2) ComEd Response to 10 CFR 50.63\

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ATTACHMENT 1
ComEd Diesel Generator Reliability Program
ESK-97-066

I. **Diesel Generator Reliability Program**

Recent events (start failure of the 1/2 Emergency Diesel Generator (EDG) on January 17, 1997) at Quad Cities Station have raised concern over the methodology used by the company in evaluating and trending EDG performance.

A common process is used by all six ComEd nuclear generating stations. NOD TS.20 is the corporate directive that describes the reliability program. This directive was written consistent with the guidelines given in Regulatory Guide (RG) 1.9, RG 1.155, and NUMARC 87-00. This directive is used as the basis for local station procedures and provides a means of assessing, maintaining, and trending DG system reliability. Flowcharts in station procedures simplify the task of demand assessment. A computer based tracking program provides additional guidance in assessment as well as a means of trending system reliability performance. The information gathered under this program is submitted monthly to INPO.

Dresden and Quad Cities Stations' commitment is to conform to the five elements of RG 1.155, section 1.2, Reliability Program. Byron, Braidwood, and LaSalle Stations were originally committed to follow RG 1.108. As part of the reviews for implementation of the SBO Rule, their commitments were changed to RG 1.9 with exceptions as documented in Technical Specifications and UFSAR as applicable. Zion Station committed to RG 1.108 due to a confirmatory order. As part of their Technical Specifications upgrade project, their commitment will change from RG 1.108 to RG 1.9. Implementation of a reliability program was required for SBO Rule compliance for all stations in order to maintain the individual station target reliabilities. Target reliabilities are 95% for all stations except LaSalle whose target is 97.5%.

With the implementation of the Maintenance Rule within ComEd, an additional mechanism exists to evaluate the overall DG system performance. This process provides an additional assessment of the failures and ensures a high reliability of the system. If the performance criteria are exceeded, methods are in place that will prompt the creation of a plan to return the system to an appropriate performance level.

II. **Determination of Valid Successes and Failures**

The recent start failure (January 17, 1997) of the 1/2 EDG was evaluated by System Engineering to be an invalid start failure. The reasoning behind this is as follows. Additional supporting details are documented in the subsequent section.

1) The EDG was not in a standby mode (could not be relied on in an emergency because it had not been declared operable) prior to the start attempt.

2) There is reasonable doubt that the cause of the failure would have definitely resulted in a failure during another start attempt.

3) The EDG was successfully started and loaded approximately 15 minutes after the first start demand, without any corrective maintenance performed or significant troubleshooting (based on the exceptions list in RG 1.9).

All demands, valid and invalid, successes and failures, are entered into the reliability tracking database. The valid successes and failures are used to calculate the reliability percentage. The invalid demands are entered into the tracking database in order to maintain a record of all demands made on the DGs. A review, using the procedure flowchart (QCAP 0400-14, Attachment C) and the guidance provided in RG 1.9, of all valid and invalid failures since January 1, 1992 was performed to determine if any were classified incorrectly. None of the invalid failures were reclassified as valid. One invalid failure was attributed to a component malfunction (exciter circuit breaker open pole which was maintenance induced). The circuit breaker is required to operate during the emergency mode. The evaluation was temporarily changed to a valid failure to determine the affect on the DG reliability. The percent reliability was recalculated and remained well above the required 95%.

The methodology used is based on the direction provided in NOD TS.20. This is consistent with the reporting of reliability to INPO and the guidance found in RG 1.155 and RG 1.9. The station procedure in use was written from the procedure used at Byron and Braidwood Stations to ensure that consistency would be maintained between the stations.

III. **Detailed Determination for January 17, 1997 Start Failure**

In RG 1.9, Section 2.1, Definitions, the definition of a start failure states:

> "...Any condition identified in the course of maintenance inspections (with the emergency diesel generator in the standby mode) that would definitely have resulted in a start failure if a demand had occurred should be counted as a valid start demand and failure. (underline added)"

In the NRC inspection report, this definition was quoted as being used inconsistently by Quad Cities Station in the application of RG 1.9 for evaluating failures. In the case of the most recent failure, the EDG was not in a standby mode (could not be relied on in an emergency because it had not been declared operable) prior to the start attempt. The attempted start was intended to be the operability test for the failed governor shutdown solenoid that caused a failure of the engine to shutdown on January 14, 1997. Although the start demand did fail, because of the nature of the failure there is reasonable doubt that this would have resulted in a failure during another start attempt. Several starts had been successfully performed during the previous months with no failures or problems noted. The defective sub-component of the air start motor was determined to be a non-wear induced manufacturing defect. Therefore, the air start motor had the potential of a start failure at any time during previous operation, but had no other identified failed starts attributed to it.

In Section 2, Diesel Generator Testing, the Exceptions portion states:

> "Unsuccessful attempts to start or load-run should not be counted as valid demands or failures when they can be definitely attributed to any of the following:
>
> - ...Component malfunctions or operating errors that did not prevent the emergency diesel generator from being restarted and brought to load within a few minutes (i.e., without corrective maintenance or significant problem diagnosis).
> - A failure to start because a portion of the starting system was disabled for test purposes if followed by a successful start with the starting system in its normal alignment.
>
> Each diesel generator *valid* failure that results in the emergency diesel generator being declared inoperable should be counted as one demand and one failure. Exploratory tests during corrective maintenance or preventive maintenance should not be counted as demands or failures. However, the successful test that is performed to declare the emergency diesel generator operable should be counted as a demand. (underline added)"

Quad Cities System Engineering was not clear in discussions with the NRC Resident in referencing the exception regarding the starting system. This exception did not apply in this instance because there was adequate air pressure to start the EDG in the test alignment (one bank of two air receivers isolated). However, as previously stated, the first exception listed above is applicable to this failure. The EDG was successfully started and loaded approximately 15 minutes after the first start demand, without any corrective maintenance performed or significant troubleshooting. Because the first start demand was not successful and the EDG remained inoperable, it should not be counted as valid. The start demand that was used to declare the EDG operable after replacement of the air start motors was counted as a valid demand.

Using QCAP 0400-14, Attachment C, DG Demand Evaluation Logic Flowchart, the failure was evaluated as follows:

1) The first decision block asks "Was demand troubleshooting or maintenance test?" This answer is NO.

2) The next decision block on the flowchart asks "Did DG reach rated speed and voltage within required time?" This answer is NO.

3) The flowchart then directs the user to go to page 4 of the attachment and perform a type 1 evaluation.

4) Page 4 lists seven questions to be answered yes or no. These questions are based on the exceptions listed in RG 1.9 Section 2.1. For the specific failure associated with the 1/2 EDG, only question 4 can be answered YES. This question states, "Component malfunctions or operating errors that did NOT prevent the EDG's from being restarted and brought to load within a few minutes (i.e., without corrective maintenance or significant problem diagnosis)."

5) Page 5 of the attachment documents the evaluation types and cases. For the 1/2 EDG it is a type 1 case c, which is a YES to any question other than numbers 6 and 7. This is listed as an invalid failure.

Additionally, a review of the failure for Maintenance Rule was performed. The failure was identified as a Maintenance Rule Function Failure (MRFF), but not a Maintenance Preventable Functional Failure (MPFF). The basis for this is as follows:

> "...The EDG was in a maintenance condition however, had it been in service, it still may have failed. Even though the nature of the failure mechanism (manufacturer's defect combined with no existing dimensional tolerances or procedure for detection) was not readily detectable, it is believed that a more thorough inspection (i.e. hand rotation to check for binding) might have revealed the problem prior to the failure. Tolerances for this defect have never been addressed by the manufacturer. Evaluation for applicability to 10 CFR Part 21 is in progress. Based on 1) No manufacturer guidance, and 2) Intermittent failure mode, this failure is NOT a MPFF."

IV. Reliability Improvement Initiatives

During the review of the failures since January 1, 1992, the following trends were identified. Two valid failures (September and October 1995) on the Unit 2 EDG were attributed to intermittent binding of the air start motors and intermittent operation of the governor shutdown solenoid. The 1/2 EDG has had two failures (one valid -- March 18, 1993, one invalid -- January 17, 1997) associated with air start motor operation and one invalid failure (January 14, 1997) to shutdown attributed to a binding governor shutdown solenoid.

Actions taken to improve the reliability of the air start motors include verifying proper storage conditions and operation prior to installation. Additionally, the method used to rebuild air start motors by ComEd personnel is under review as part of the root cause investigation for PIF 97-0134. Upon the completion of this review, a process to send air start motors to the EDG vendor for overhaul to ensure all critical sub-components are within proper tolerances may be established.

To improve the start reliability of the EDGs, a design to change the governor shutdown solenoid from an "energize to run" to an "energize to shutdown" model is being implemented (tracked by NTS 254-200-97-00402). This will not eliminate the potential failure modes of the solenoid itself. However, failure of the solenoid to operate properly will only affect the ability to shutdown the engine instead of starting. A failure to shutdown the engine does not have the same magnitude safety concern as a failure to start.

V. Summary

Recent events at Quad Cities Station have raised concern over the methodology used by the company in evaluating and trending DG performance.

All ComEd nuclear generating stations use a corporate directive and local station procedures to provide the means of assessing, maintaining, and trending EDG and Station Blackout (SBO) DG system reliability. These documents are consistent with the guidelines given in Regulatory Guide 1.9, Regulatory Guide 1.155, NUMARC 87-00, and INPO 96-003. A computer based tracking program provides additional assistance in assessment as well as a means of trending system reliability performance. Attachment 2 provides the details associated with the establishment of a reliability program for ComEd DGs.

I. **ComEd Response to 10 CFR 50.63**

Recent events (start failure of the 1/2 Emergency Diesel Generator (EDG) on January 17, 1997) at Quad Cities Station have raised concern over the methodology used by the company in evaluating and trending EDG performance.

Generic Letter (GL) 84-15 was issued to convey the NRC's reliability expectations for Emergency Diesel Generators (EDG) for plants that were licensed prior to 1978. Plants licensed in 1978 and later were required to follow Regulatory Guide (RG) 1.108. Reference (a) stated that the EDG system reliability was acceptable at present levels and that current testing and maintenance practices would continue. The recommendation to reduce the number of cold fast starts of the EDG system was put into place by changing the Technical Specifications to remove the operability testing of the EDG for inoperable equipment. Procedures retained verification of EDG status for availability. No commitments were made to further change maintenance and surveillance practices, implement a reliability program, or to implement RG 1.108.

10 CFR 50.63 was approved in 1988 with reference (b) as the station's reply. This response outlined the proposed Station Blackout (SBO) duration, description of procedures to be implemented, and a list of proposed modifications and installation schedule. It was stated in this response that the target EDG reliability would be established at 0.95 to correspond with the requirements of RG 1.155, Section 1.1, and NUMARC 87-00, Section 3.2.4. No statement in the response addressed implementation of a program to ensure that the target reliability was maintained.

NUMARC 87-00 was issued to provide guidance and methodologies in implementing NUMARC's station blackout initiatives. This guidance was accepted by the NRC as reflected within NUMARC 87-00, Appendix K. Shortly after its issue, reference (y) was distributed to provide additional information and clarification to NUMARC 87-00. This clarifying information was accepted by the NRC in a letter from A. C. Thadani (NRC) to A. M. Marion (NUMARC) January 1990. Reference (s) was issued subsequent to the release of the original revision of NUMARC 87-00. This supplement provided clarification of definitions in Appendix D. There was no request for individual plant responses to NUMARC 87-00 or to any supplementary information transmittals thereafter.

Reference (c) was written to supply the supplemental information that was requested by NUMARC. This letter stated that the EDG reliability target would be maintained, but no specific reliability program was identified.

A meeting between ComEd and the NRC was held on March 28, 1990. An alternative coping methodology was presented to the staff and preliminarily accepted. A revised response was requested by the NRC staff and submitted in reference (d). The revised response stated that the target EDG reliability would be maintained at 0.95. Additionally, a diesel generator reliability program incorporating the five elements discussed in RG 1.155 would be established to ensure this target is maintained.

Reference (e) details the NRC's acceptance of ComEd's response and proposed method of dealing with a Station Blackout. Several recommendations requiring additional information were specified in the safety evaluation. Among them was the concern that documentation of a formal reliability program meeting the guidance of RG 1.155, Position 1.2, Items 2 through 5, should be implemented and maintained with the SBO submittals.

Reference (g) details a revised implementation schedule for compliance with the Station Blackout Rule. It further stated that the DG reliability program was currently in development and when issued, it would include the Alternate AC (AAC) DGs.

Reference (h) is a supplemental safety evaluation which evaluates ComEd's responses to the NRC's recommendations made in reference (e). The staff accepted ComEd's response which stated that the DG reliability program will conform to RG 1.155, Position 1.2, items 2 through 5 and will be implemented by December 20, 1991.

Reference (i) was compiled to address ventilation and condensate makeup concerns listed in reference (h). It also proposed to the NRC, a revised schedule for the implementation of the DG reliability program (December 11, 1992) and SBO procedure changes not associated with an equipment modification (August 31, 1992).

Reference (j) contained additional information pertaining to the previously requested schedule revision in reference (i). Extensions were being requested due to the draft rule revision to 10 CFR 50.63 and the second draft revision to RG 1.9. Inconsistencies in these drafts with previous revisions required additional time to evaluate their impact on the development of the DG reliability program. The need for these additional evaluations required the implementation date be extended to September 1, 1993.

Reference (k) contains the one time schedular exemption requesting an additional six months to comply with 10 CFR 50.63. Additionally, this letter transmitted to the NRC the notification that a DG reliability program had been established and implemented at Dresden and Quad Cities Stations conforming to the five elements of RG 1.155, section 1.2. This program is documented in NOD TS.20 (reference (w)) and applies to the SBO DGs and the EDGs.

Byron, Braidwood, and LaSalle Stations were originally committed to follow RG 1.108. As part of the reviews for implementation of the SBO Rule, their commitments were changed to RG 1.9 with exceptions as documented in Technical Specifications and UFSAR as applicable. Zion Station committed to RG 1.108 due to a confirmatory order. As part of their Technical Specifications upgrade project, their commitment will change from RG 1.108 to RG 1.9. Implementation of a reliability program was required for compliance with the SBO Rule for all stations.

NOD TS.20 was written consistent with the guidelines given in RG 1.9, RG 1.155, and NUMARC 87-00. This directive was used as the basis for local station procedures (reference (x) for Quad Cities) and provides a means of assessing, maintaining, and trending DG system reliability. Flowcharts in station procedures simplify the task of

demand assessment. A computer based tracking program provides additional guidance in assessment as well as a means of trending system reliability performance. The information gathered under this program is submitted monthly to INPO (under the guidelines in reference (u)). This process is used by all six ComEd nuclear generating stations.

II. **References**

(a) Response to Generic Letter 84-15, G. Alexander (ComEd) to H. R. Denton (NRC) dated October 12, 1984.

(b) Response to Station Blackout Rule, M. H. Richter (ComEd) letter to T. E. Murley (NRC) dated April 17, 1989.

(c) Supplemental response to Station Blackout Rule, M. H. Richter (ComEd) letter to T. E. Murley (NRC) dated March 30, 1990.

(d) Revised response to Station Blackout Rule, M. H. Richter (ComEd) letter to T. E. Murley (NRC) dated May 18, 1990.

(e) Safety Evaluations of the Response to the Station Blackout Rule related to Dresden, Units 2 & 3, and Quad Cities, Units 1 & 2, B. L. Siegel (NRC) to T. J. Kovach (ComEd) dated December 11, 1990.

(f) Response to Station Blackout Safety Evaluations, M. H. Richter (ComEd) to T. E. Murley (NRC), dated January 21, 1991.

(g) Response to Station Blackout Safety Evaluations, M. H. Richter (ComEd) to T. E. Murley (NRC), dated February 15, 1991.

(h) Supplemental Safety Evaluations of the Response to the Station Blackout Rule related to Dresden, Units 2 & 3, and Quad Cities, Units 1 & 2, L. N. Olshan (NRC) to T. J. Kovach (ComEd) dated July 18, 1991.

(i) Response to Supplemental Station Blackout Safety Evaluations, M. H. Richter (ComEd) to T. E. Murley (NRC), dated September 9, 1991.

(j) Station Blackout, P. L. Piet (ComEd) to T. E. Murley (NRC), dated November 24, 1992.

(k) Proposed Schedular Exemption for Commitments Related to 10 CFR 50.63, Station Blackout (SBO) Rule, J. L. Schrage (ComEd) to NRC, dated September 1, 1995.

References (cont'd)

(l) Notification of a Change to Schedule for Commitments Related to 10 CFR 50.63, Station Blackout (SBO) Rule, B. Rybak (ComEd) to NRC, dated November 30, 1995.

(m) Change to Implementation Commitment - Station Blackout Rule, R. M. Pulsifer (NRC) to D. L. Farrar (ComEd), dated December 18, 1995.

(n) Generic Letter 84-15, Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability, dated July 2, 1984.

(o) Regulatory Guide 1.108, Periodic Testing of Diesel Generator Units Used As Onsite Electric Power Systems at Nuclear Power Plants, Revision 1, August 1977.

(p) Regulatory Guide 1.155, Station Blackout, Revision 0, August 1988.

(q) Regulatory Guide 1.9, Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants, Revision 3, July 1993.

(r) NUMARC 87-00, Guidelines and Technical Basis for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1, August 1991.

(s) Diesel Generator Reliability, W. H. Rasin (NUMARC) to NUMARC Administrative Points Of Contact, dated August 20, 1990.

(t) 10 CFR 50.63, Loss Of All Alternating Current Power, 1988.

(u) World Association of Nuclear Operators (WANO) Performance Indicator Program Utility Data Coordinator Reference Notebook, INPO 96-003, September 1996.

(v) Nuclear Operations Policy, NOP-TS.1, Emergency Diesel Generator Reliability Program, Revision 0, January 2, 1993.

(w) Nuclear Operations Directive, NOD-TS.20, Emergency Diesel Generator Reliability Program, Revision 0, January 2, 1993.

(x) QCAP 0400-14, Emergency and Station Blackout Diesel Generator Reliability/Maintenance Effectiveness Monitoring Program, Revision 4, June 27, 1996.

(y) Station Blackout Implementation: Request for Supplemental SBO Submittal to NRC, NUMARC, January 4, 1990.