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June 12, 1992

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Beaver Valley Power Station, Unit No. 1 and No. 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Combined Inspection Report 50-334/91-80 and 50-412/91-80
Electrical Distribution System Functional Inspection

In response to the NRC correspondence dated April 1, 1992 which transmitted the above referenced inspection report, attached is a schedule for the resolution of the Unresolved Items resulting from the inspection.

An extension of the due date for this response to June 12, 1992 was agreed to by Region I.

If there are questions concerning this response, please contact Mr. K. E. Halliday at (412) 393-5600.

Sincerely,

J. D. Sieber

Attachment

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Mr. M. W. Hodges, Director, Division of Reactor Safety
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Central File (2), ND3NSM:5595

References:

ND1MNE:6175

DUQUESNE LIGHT COMPANY
Nuclear Group
Beaver Valley Power Station Units 1 & 2

Combined NRC Inspection 50-334/91-80 and 50-412/91-80
Electrical Distribution System Functional Inspection
Unresolved Items

OVERVIEW

Duquesne Light Company has reviewed the results of the Electrical Distribution System Functional Inspection of Beaver Valley Units 1 & 2, Combined Inspection Report 50-334/91-80 and 50-412/91-80. This response addresses the 14 unresolved items identified in the inspection report. The level IV violation and the deviation which were part of this report have been addressed separately in a previous submittal to the NRC (dated May 8, 1992).

As stated in the Inspection Report, it is agreed that several issues contained within the 14 unresolved items represent potential design weaknesses and areas of concern, but not plant operability issues. Most of these weaknesses are the result of the calculation methodology applied for Beaver Valley Unit 1 (BV-1) in the early 1970s. If issues of safety significance develop during the effort to address these unresolved items, appropriate review/corrective measures will be taken to resolve the issues.

Our scheduled response times reflect the extent of analytical efforts required to completely resolve the issue. This recognizes that a substantial amount of this work can only be performed sequentially (i.e., with the performance of one task dependent upon the completion of another).

In the Executive Summary of Inspection Report 91-80, two areas of concern in the technical support area were identified. To address the concern of the small number of supervisors relative to the size of the electrical engineering staff, an interim organization has been implemented that increased the number of supervisors from 2 to 4. To address the issue of limited system knowledge of the engineering personnel, the overall training requirements for all Nuclear Engineering Department personnel is currently under review by department management.

The resolutions of each of the unresolved items is prescribed as follows.

1. Setting of Degraded Grid Relays — 50-334/91-80-04 and 50-412/91-80-04

Description:

A review was performed of degraded grid relay settings and reset capability, coordination with the EDG start and fast bus transfer schemes, and applicable schematics. This review determined that the degraded grid relays on the 4160 V and 480 V safety related buses were set at 90% +/-1.6% of their respective nominal bus voltage. Therefore, the minimum theoretical voltages allowed on the switchgear and on the load center buses, before the appropriate automatic action takes place, are 3677 V and 424 V, respectively.

To ensure that the specified settings adequately protect the safety related motors from undervoltage conditions, the continuous ratings of the motors were also surveyed. A sampling of several 4160 V and 480 V motors revealed a continuous rating of 90% of the nominal (nameplate) voltage, i.e., 3744 V and 414 V (460 V x 0.9), respectively. A comparison of the above values shows that, under degraded voltage conditions, the 4160 V motor would be operating at a voltage below their minimum continuous rating and that a 10 V margin exists for the 480 V motors. In addition, when the cable voltage drop from the bus to the motors is taken into consideration, the voltage at the motors' terminals could be considerably less than the motors' continuous rating.

The 90% relay setting was verified through a review of several Relay Setting Sheets and is in accordance with the guidelines contained in BV-1 and BV-2's "Protective Relay Philosophy and Practices for 4160 V and 480 V Systems", Engineering Standard No. ES-E-004, Revision 0, dated September 11, 1989, and ES-E-003, Revision 0, dated February 14, 1989, respectively. The +/-1.6% tolerance was calculated in a Westinghouse analysis of the relay loop.

The team discussed the concern with the licensee who pointed out that the settings were in agreement with Item 6 of Table 3.3-4 of BV-1 and BV-2's Technical Specification. The licensee also indicated that the transformer tap settings kept the bus voltage near the nominal values. However, they were unable to provide an analysis to show that the motors could be operated below their continuous rating should a degraded voltage condition exist.

The setting of the degraded grid relays and/or the capability of the safety related motors to operate below their continuous setting is unresolved pending appropriate analysis or justification by the licensee (50-334/91-80-04, 50-412/91-80-04).

Proposed Resolution: 50-334/91-80-04 and 50-412/91-80-04

The current degraded grid relay setpoints were established recognizing that equipment will operate below 90% of nameplate voltage for periods of time with minimal impact on the equipment and that corrective actions would be taken to improve degraded grid conditions. The electrical grid in the BVPS area is very strong and does not operate at degraded voltage conditions or normally experience voltage excursions of a magnitude to cause low voltage concerns.

The degraded grid relay setpoints will be addressed by the upgrade of applicable electrical calculations. Pending completion of this effort, the use of interim setpoints will be investigated and implemented, if appropriate. Final setpoint determination will be made after completion of the necessary calculational efforts.

Scheduled Date:

50-334/91-80-04 Interim setpoints implemented - 9th refueling outage
Final setpoints implemented - 11th refueling outage

50-412/91-80-04 - Interim setpoints implemented - 4th refueling outage
Final setpoints implemented - 5th refueling outage

2. <u>4 KV Breaker Interrupting</u> 50-334/91-80-05

Description:

The team was unable to make an assessment of the adequacy of the circuit breakers to interrupt the Unit 1 system fault currents. However , the team determined that the 4 KV breakers had an interrupting capacity of only 30,000 A. When this is compared to the 46,200 A interrupting rating of the Unit 2 circuit breakers and when the small interrupting margin of the Unit 2 circuit breakers is considered the adequacy of the Unit 1 breakers is of concern. Therefore this issue is unresolved pending appropriate calculations by the licensee.

Proposed Resolution: 50-334/91-80-05

The Unit 1 4kv circuit breakers were supplied from the ITE Corporation . These breakers are all Type 5HK250 except for the feeder breakers to the non-1E 4kv buses which are Type 5HK350. Per manufacturer's information, the Type 5HK350 breakers are rated 46,200 amps symmetrical at 1.05 per unit voltage The Type 5HK250 breakers have symmetrical ratings of 30,000 amps at 4760 volts, 35,000 amps at 4160 volts and 37,500 amps at 3850 volts.

The preliminary results of a design analysis indicates that the worst case calculated short circuit generated on any of the Unit 1 4kv buses - class 1E or non-class 1E - is 27,600 amps symmetrical. Based upon this preliminary analysis the interrupting capacity of the 4kv circuit breakers appears to be adequate. A thorough review of the calculation inputs, methodology and assumptions will be performed, and the results recalculated prior to issuance.

Scheduled Date:
50-334/91-80-05 - Final calculations will be issued by April 1, 1994

3. <u>125 Vdc Short Circuit Calculation</u> 50-334/91-80-06 and 50-412/91-80-06

Description:

The team examined BV-2 Calculation No. 10080-E-062, Revision 4, which analyzed the short circuit currents available in battery systems 2-1 to 2-6. The results of this calculation were then used to assess the interrupting capability of the circuit breakers and the ability of the cables to withstand the maximum, predicted short circuit currents. The team focused on the Class 1E battery system 2-2, but all Class 1E and non Class 1E systems were considered.

Pertaining to the calculation, the team noted that it had not included the contribution from battery chargers and the dc motors. The team considered the 125 A contribution from the battery chargers, by itself, to be of minor significance to the results. However, the combined effect of this and the energy feedback from the applied motors, e.g., a 60 hp motor on battery system 2-5, could have a significant impact on the calculation results and should have been considered.

No short circuit calculations were available for the Unit 1 battery systems. Therefore, no conclusions could be reached.

Based upon the above, the analysis for available short circuit current in the battery system is unresolved pending the licensee's revision of the Unit 2 calculations and preparation of the Unit 1 calculations (50-334/91-80-06) (50-412/91-80-06).

Proposed Resolution: 50-334/91-80-06 and 50-412/91-80-06

Prior to 1991, short circuit currents were evaluated for Unit 1 safety related battery systems, and appropriate modifications were made to existing circuits. Open items which remain will be resolved prior to issuing the calculation.

A short circuit calculation for the Unit 1 non-1E battery system will be performed.

Significant Unit 1 battery charger and motor contributions will be factored into these calculations.

Unit 2 calculation 10080-E-062 was reviewed to address the concern of DC motors not being considered . It was found that the contribution of a 30 hp (Oil Backup Pump) motor had in fact been considered for battery system 2-5, as found on page 11 of the calculation 10080-E-062 Rev 4, and a 60 hp pump motor was considered for battery system 2-6 as found on page 17 of this calculation. Our review indicates that significant loads have been considered and that no additional action is required on this issue.

Scheduled Date:

50-334/91-80-06	December 31, 1992:	Completion of calculations for 125 VDC safety related systems
	December 31, 1993:	Completion of calculations for 125 VDC non-safety related systems
50-412/91-80-06	No additional action is required.	

4. Steady State Loading of EDG 50-334/91-80-07

Description:

Calculation 8700-DEC-E-048, Revision 0, dated January 13, 1989, using the spread sheet method, evaluated the steady state loads for the BV-1 Emergency Diesel Generator (EDG) No. 1. The study identified the loads imposed on the EDG at each step of the automatic sequence and for the period after the automatic loading under three scenarios: Design Basis Accident, Loss of Normal Power, and Safety Injection.

The team's review of this calculation revealed that the acceptance criteria specified that the maximum coincident (short time) load should not exceed 90% (2745 kW) of the 30 minute diesel generator's rating (3,050 kW). Based upon the load summary tables, the maximum coincident load for the worst case scenario (Safety Injection) was 2741.3 kW or slightly below the value stated in the acceptance criteria. In addition, the team determined that the maximum calculated continuous load was 2579.3 kW, also slightly below the continuous rating (2,600 kW) of the EDG.

Although both values were well within the 2000 hour rating of the machine, 2850 kW, the team noted that minimal margin existed between the calculated loads and the imposed limits. However, the licensee responded that, since the maximum coincident and continuous loading occurred after the automatic sequencing, potential overloads could be handled administratively. The licensee also indicated that the calculation was undergoing revisions. In support of this, they provided an internal memorandum, dated February 25, 1991, which identified incorrect entries found during a review of mechanical inputs in EDG Load Study Calculation 8700-DEC-E-048. The summary sheets of this memorandum were an updated version of Attachment F to Calculation 8700-DEC-E-048.

The team's review of the revised loads list identified several areas of concern:

1. The worst case loading occurs under the Loss of Normal Power scenario and, for this case, the maximum steady state load is 2754 kW, which slightly exceeds the acceptance criteria of 2745 kW of Calculation 8700-DEC-E-048. The licensee reiterated that the loads are limited by administrative controls and provided operating procedures to show how certain loads are cycled. However, this was not clear from the body of the calculation.

2. For the motor loads on pages 2A, 3A, and 4A, the memorandum identifies the nominal horsepower, "HP"; the flow curve brake horsepower, "Curve BHP" and a calculated brake horsepower, "Calculation BHP". Since, in some cases, the EDG loading uses the "Calculation BHP" which is less conservative than the "Curve BHP", the team asked the licensee to provide an analysis or calculation identifying the bases for the calculated brake horsepower and the criteria for selecting these values instead of the ones derived from the flow curves. The team was unable to determine the availability of such data.

3. The motors for Auxiliary Feed Water Pumps FW-P-3A and 3B appear to be underrated for the intended functions. This issue is discussed in details under Section 10 of this report.

4. Several discrepancies exist between the loads as identified in the FSAR and in the memorandum. The FSAR did not appear to reflect the changes identified in Attachment F of the calculation, dated January 1989.

In order to verify that the 2745 kW load at the running power factor would be carried by the EDG, the team compared it to the Reactive Capability Curve included in the EDG Data, 8700-1.30-32, Page 15, but determined that this curve was generic. The licensee was not able to supply the documented basis and applicability of this curve for Unit 1 EDGs during the inspection period.

The team observed that calculation 8700-DEC-E-048 only addressed EDG No. 1 The reason for this was that EDG No. 1 was more heavily loaded. In view of the February 25, 1991 memorandum, the team calculated the EDG No. 2 loads and found them to be less than those on No. 1. The team also observed that swing pump load had not been considered to be carried either by EDG No. 1 or by EDG No.2.

The above issues were identified and discussed with the licensee who agreed that the revised calculation would include necessary clarifications. In view of the above, the steady state loading of the diesel generator is unresolved pending revision of the calculation by the licensee and review of the results by the NRC. (50-334/91-80-07)

Proposed Resolution: 50-334/91-80-07

1. The Unit 1 EDG loading has been investigated and it was found that, by more detailed evaluation of the generator loads, the 2745 kW limit would not be exceeded. The team also expressed concern that the calculation did not specifically mention administrative requirements for shutting down the auxiliary feedwater pump prior to manually loading the residual heat removal pump on the EDG. A review of the operating procedures to address loading on the EDG has been performed and appropriate statements addressing all similar administrative controls will be incorporated into the 'Operating Scenario' section of the revised calculation.

2. The mechanical load inputs for the diesel generator load study were developed by calculating the pump or fan motor input BHP requirements based on the calculated system flows and head and efficiency data from the manufacturer's certified test curves. The calculated loads should agree with the 'Curve BHP' in all cases where data is derived from the same source. Minor differences may occur due to difficulty in accurately reading the manufacturer's curves which typically plot BHP on a very small scale. For the diesel generator load study, the calculated value was always used in lieu of the curve value. A review of the calculated and curve values will be performed to assure that the values are consistent.

3. The results of a preliminary analysis indicates that the existing motor is adequate to provide the BHP requirements of the auxiliary feedwater pump. The calculation will be verified prior to completion.

4. Upon completion of the above items, an FSAR change will be incorporated into the next UFSAR update.

Specific reactive capability curve data for the Unit 1 EDGs is not available at present. A transient analysis is being performed that will demonstrate the reactive capabilities of the Unit 1 EDG. See unresolved item 5 for further discussion and schedule.

Swing pump loads were not specifically discussed in calculation 8700-DEC-E-048 Rev. 0. However, the swing pump loads on either train are enveloped by the Train 'A' pump analysis. Therefore, the calculation results are not effected. A statement will be added to the revised calculation to document this consideration of the swing pump loads.

Scheduled Date:

50-334/91-80-07	Actions for resolutions 1 thru 4 listed above will be complete by September 1, 1992. Refer to unresolved item 5 for the scheduled completion date on the EDG transient analysis. The UFSAR update will be incorporated into the 1993 annual update.

5. Dynamic Loading of the EDG   50-334/91-80-08 and
50-412/91-80-08

Description:

An analysis to demonstrate the transient loading capability of the BV-1 emergency diesel generators was included in Calculation 10080-E-048. The team's review of the applicable portions of this calculation revealed that the analysis was based upon a generic Dead Load Pickup Capability Curve and upon a manufacturer's letter, dated December 4, 1972 to Stone & Webster Engineering Corp. The Dead Load Curve was used to analyze Step 1 of the EDG's automatic loading, whereas the manufacturer's letter was used to analyze the other steps. This letter included a summary of sample EDG loading cases to which the licensee was to compare the postulated accident loading steps. As long as these were enveloped by a sample loading case, it was concluded that the voltage drop and its recovery time to 90% were acceptable.

The team's evaluation of the analysis indicated that there was no assurance that the curve was applicable to the Unit 1 EDGs and no back up calculations to support the design basis of the sample cases. In addition, no diesel generator test as described in Sections 8.6.2 and 8.6.3 of the FSAR was available for review at the time of the inspection. Unit 2 Calculation 10080-E-048, similarly, did not include a transient analysis. Based on the above, the team concluded the transient loading capability of the Unit 1 and Unit 2 emergency diesel generators is unresolved pending the licensee's retrieval of applicable tests or their preparation of an appropriate analysis. (50-334/91-80-08) (50-412/91-80-08).

Additionally, the team reviewed surveillance testing of BV-1 EDGs for the ability to supply the required real and reactive power during auto sequencing. One of the tests simulated a LOCA with loss of offsite power. The second verified the response of the machine but the loads added fail to envelope DBE loads. It was also noted that critical performance parameters were not adequately recorded (i.e., voltage, frequency and rack position).

Proposed Resolution:

50-334/91-80-08 -- A transient analysis to evaluate EDG loading capability is being performed utilizing a computerized program combining both analytical and test information. Testing is being planned for the 9th refueling outage to gather performance data not currently available. The modeling validation will be completed within three (3) months after the 9th refueling outage.

Additional validation effort, if determined to be required, could extend completion of the task to the 10th refueling outage. Appropriate corrective action, if necessary, will be taken pending the results of this analysis.

Performance testing procedures will be evaluated and revised, if necessary, assuring that all of the pertinent performance parameters are recorded.

50-412/91-80-08 -- The same program will be utilized to evaluate loading capability of the Unit 2 EDGs with modeling validation to be completed within 3 months after the 4th refueling outage. Appropriate corrective action, if necessary, will be taken pending the results of this analysis. While a transient analysis for Unit 2 is not available at present, it should be noted that the Unit 2 EDG manufacturer's loading test was conducted utilizing larger motors than the actual connected loads.

Scheduled Date:

50-334/91-80-08 Unit 1 EDG analysis to be completed by 3 months after the end of the 9th refueling outage.

50-412/91-80-08 Unit 2 EDG analysis to be completed by 3 months after the end of the 4th refueling outage.

Performance testing procedures (OSTs) will be revised by November 2, 1992.

6. EDG Mode Change 50-334/91-80-09 and 50-412/91-80-09

Description

To address the sequencing of safety related loads on the emergency diesel generators following a loss of offsite power, the team reviewed Drawing 8700-RE-21 CL-4, Revision 4, dated March 21, 1989, for Unit 1, and Drawing 12241-E-12A, Sheet 1, Revision 12, dated June 9, 19[illegible] for Unit 2. The review included the control schemes for stripping the 4160 V bus and sequencing the safety related loads on the bus, the type and setting of the sequence timers, and the setpoint drift.

For Unit 1, sequencing was accomplished using an electro-mechanical timer with a cam actuated contact. With this type of timer, the cams are assembled on the same shaft and are rotated by the same motor. Therefore, the time between load addition remains essentially constant and the possibility of two motors being started at the same time because of drift is non existent. For Unit 2, the automatic sequence was accomplished using individual solid state timing relays with negligible drift.

The review of the Beaver Valley 1 electrical schematic revealed that, when the EDG is in parallel with the offsite transmission system, a degraded grid condition or a loss of offsite power would cause the tripping of the normal breaker and the immediate addition of emergency bus loads, before the governor could change from the droop to the isochronous operation, and the voltage regulator could change from the parallel to the isolated mode. This is caused by the fact that a set of contacts associated with the tripped breaker, along with the already closed EDG breaker, signal the load sequencer to load the emergency bus. The estimated time for this occurrence could be 0.5 seconds or less. This condition exists every time the EDGs are tested, including those times when they are tested to support Limiting Conditions for Operation.

The licensee was unable to provide an analysis for this event by the end of the inspection. The licensee indicated that they would review their design bases documents to see if the issue had been addressed. This item is unresolved pending appropriate review and evaluation by the licensee (50-334/91-80-09) (50-412/91-80-09).

Proposed Resolution:

50-334/91-80-09
The BVPS Unit No.1 EDG has a Woodward type UG-8 governor. This governor is a mechanical governor and does not have separate parallel and isochronous modes of operation. If a scenario occurs as described above, the voltage regulator will change from parallel to isochronous mode of operation, but the governor does not have to change its mode of operation. An evaluation of this event will be performed.

50-412/91-80-09
The BVPS Unit No. 2 EDG has a Woodward EGB-50 governor with EGA Box. The EGA Box electrically switches the governor from parallel to isochronous mode of operation when required. The voltage regulator also changes from parallel to isochronous mode of operation. An evaluation of this event will be performed.

Scheduled Date:

50-334/91-80-09 An evaluation will be completed by October 31, 1993.

50-412/91-80-09 An evaluation will be completed by March 31, 1994.

7. Penetration Heat Loads 50-334/91-80-10

Description:

No calculation was available for review to establish the suitability of the Unit 1 electrical containment penetrations to carry continuous load currents without exceeding the allowable temperature rating. Although the licensee furnished Specification No. BVS-384, Revision 3, which referenced the IEEE 317 Standard, in the absence of a relevant calculation, the team had no basis for concluding that the Unit 1 penetrations were adequately sized and protected for the continuous loads. Therefore, the capability of the Unit 1 penetrations is unresolved pending appropriate calculations by the licensee (50-334/91-80-10).

A review of the effects of heating due to short circuits as well as the protective device scheme for the ability to protect conductors against prolonged overcurrents found that:

1. Short circuit values stated in BVS-384 are similar to those for Unit 2 penetration assemblies which were found to be acceptable.

2. Protective devices for the 300 hp Residual Heat Removal Pump (RH-P-1B) indicated satisfactory protection based on review of motor curves.

Based on the unavailability of calculations the team concluded that, although the design appeared satisfactory, they had no basis for making an appropriate determination. The team was also unable to conclusively determine whether the appropriate protection had been provided.

Proposed Resolution 50-334/91-80-10

BV-1 penetrations were procured in accordance with specification BVS-384 from an approved vendor with a 10CFR-50, Appendix B program. The penetration continuous loads specified were utilized by the penetration vendor as design inputs. The continuous loading limits for the BV-1 penetrations are specified on the shop drawings provided by the vendor.

The BV-1 penetration vendor is no longer in business, so additional data from the manufacturer is unavailable. Resolution of this item will require development of additional information not currently available. Since an immediate concern is not apparent, resolution will be a long term action.

Scheduled Date:
50-334/91-80-10 An action plan will be developed by October 31, 1992 to address this issue.

8. Cable Sizing 50-412/91-80-11

Description:

To address the sizing of the feeder cables used with both safety and non-safety related loads of Unit 2, the team reviewed Calculation No. 10080-E-072, Revision 2. This review revealed that the calculation allowed the use of 550° C upper limit for insulation temperature, instead of the usual 250° C required by the IPCEA Standards, when the cable is subjected to short circuit currents. The team expressed concern regarding the finding since the allowed temperature was close to the 577°C auto-ignition temperature of the cable jacket material supplied by the Kerite Company. The team also found that an associated Calculation No. 10080-E-020, Revision 3, produced even higher temperatures than the allowed limit. However, in this case, the use of larger sizes cables, effectively reduced the maximum predicted temperature to below the imposed limit.

The team was particularly concerned for the absence of a station procedure to inspect cables after a short circuit, a practice specified as important by the architect-engineer in 1985. Additionally, there was no information available regarding melting and flow of the insulation and cascading effects on adjacent equipment.

In consideration of the observations pertaining to the short circuit current available and of the fact that no procedure existed requiring a full inspection of the cable after an overload trip of the feeder breaker, the completeness of the calculation for the BV-2 4.16 kV cables is unresolved pending appropriate analysis and corrective action by the licensee (50-412/91-80-11).

Proposed Resolution: 50-412/91-80-11

The 550° C upper temperature limit for short circuit considerations is mentioned in calculation 10080-E-020, Rev.3, not in calculation 10080-E-072, Rev. 2. The basis for this acceptance criteria is contained in letter 2DLS-23991, dated 1/7/85. The 550° C maximum temperature ensures that a three phase bolted or a phase to phase fault current cannot cause a cable to ignite since it is below the 577° C auto-ignition temperature for Kerite Co. cable jacket material.

We have reviewed the existing documentation and Duquesne Light Company believes that the 550°C criteria stated in calculation 10080-E-020 Rev. 3 is acceptable.

Calculation 10080-E-020, Rev. 3 was reviewed to determine if certain cables exceeded the 550° C temperature limit. Although the condition was indicated in a portion of the calculation, the conclusion section indicated the issue had been resolved for each case. Additional reviews will be conducted to confirm the adequate resolution of this issue.

Criteria for cable testing or inspection following short circuit conditions is being developed. Once established the Operating Procedures will be revised accordingly.

Scheduled Date:
50-412/91-80-11 The above actions will be completed by December 31, 1992

9. <u>Unit 1 Design Documents</u> 50-334/91-80-12

Description:

The team noted that much of the design documentation for Unit 1 was not readily available for review during the inspection. The licensee indicated that the documentation is retained in deep storage and would require additional time for retrieval. Some specific unresolved issues, e.g., short circuit available at the 125 Vdc bus and electrical penetration heat loads, were identified in the section above. However, the team also identified other areas where an adequate evaluation of the Unit 1 electrical system could not be fully evaluated because of the lack of documents. These areas include (1) sizing of MCC cables for power and control circuits; (2) acceptability of the fast bus transfer scheme; (3) short circuit current available at the 120 Vac buses and (4) coordination of dc protective devices. These issues are unresolved and will be reviewed when appropriate documentation can be made available by the licensee (50-334/91-80-12)

Proposed Resolution: 50-334/91-80-12

(1) Sizing of MCC Cables for Power and Control Circuits

Preliminary BV-1 calculations 8700-DEC-E-082, Revision 0, "Cable Sizing Analysis For Loads Fed By Safety Related Motor Control Centers" and 8700-DEC-E-113, Revision 0, "1E MCC Control Circuit Voltage Drop" were performed, but have not yet been issued. A more detailed review and validation of these calculations is required prior to their approval and use. Part of the validation requires input from other calculations not yet complete.

The 8700-DEC-E-082 calculation will be superseded by other calculations to be developed, while the 8700-DEC-E-113 calculation will be issued.

Scheduled Date:

Safety Related MCC Power Cable Sizing calculation will be completed by March 31, 1993.

Safety Related MCC Control Circuit Voltage Drop calculation will be completed by June 30, 1994.

(2) Acceptability of Fast Bus Transfer Scheme

During the audit the NRC reviewed in detail the Fast Bus Transfer Study for BV-2 and found it adequate. The review of the Unit 1 fast bus transfer concluded that the summary of results for the study were lost and only a printout of the analysis data was retrievable.

Due to the time that has transpired between the original BV-1 transfer study and the present, the study will be updated.

It is expected that the revised BV-1 transfer study will yield acceptable results consistent with the existing BV-2 transfer study due to the following parallels:

- Both units experience similar inputs due to the influence of connected loads and generators on the system grid.
- Both units utilize the same transfer scheme and the same model 4KV circuit breakers to accomplish the transfer.
- BV-1 has a smaller cumulative load to transfer than BV-2.

Scheduled Date: An updated BV-1 fast bus transfer study will be completed by September 30, 1994.

(3) 120VAC Short Circuit Analysis

A preliminary BV-1 calculation addresses the magnitude of the fault currents available at the 120V AC system. The calculation has not been approved because the results obtained depend on design inputs from two other calculations not yet approved.

Scheduled Date: The analysis will be completed by June 30, 1994

(4) Coordination of D.C. Protective Devices

Unit 1 preliminary calculation 8700-DEC-E-062, "Safety-Related 125 VDC Short Circuit Analysis", has been reviewed and it has been concluded that existing system independence and redundancy envelopes any breaker coordination concerns. This condition will be further reviewed and corrective measures implemented if necessary.

Scheduled Date:
Safety Related system studies will be completed by December 31, 1992.

10. Capability of Auxiliary Feed Pumps 50-334/91-80-13

Description:

A review was performed of the manufacturers' pump and fan characteristic curves to determine the power demand on the emergency diesel generators for the three accident scenarios listed in the FSAR: (1) Design basis accident (DBA); (2) Loss of normal power with unit trip; and (3) Safety injection signal with coincident loss of power and unit trip.

Major pump loads on the 4160 V emergency system, according to Table 8.5-1 of the FSAR, included: the charging high head safety injection pumps (CH) with a nameplate rating of 600 HP; the 250 HP low head safety injection pumps (SI), the 300 HP outside recirculation spray pumps (RS), the 500 HP river water pumps (RW), the steam generator auxiliary feed pump (FW) with a 400 HP rating, the 300 HP residual heat removal pumps (RH), and the primary plant component cooling water pumps (CC) rated at 400 HP. On the 480 V system, the team identified the major pumps to be the quench pumps, the inside recirculation spray pumps, the containment air circulation fans, and the leak collection exhaust fans, each pump rated at between 150 and 3'0 HP.

In conjunction with the pumps head/flow curves, the team reviewed a recent reassessment of the Unit 1 diesel generator electrical loads (study 8700-DEC-E-048) and the mechanical engineering review of the same, documented in an internal memorandum, dated February 25, 1991. The team noted that the steam generator auxiliary feed pump load had been changed to 495 BHP, a 23.7% increase above the motor nameplate, 400 HP with 15% service factor, and a 28.9% increase over the 384 BHP specified in the FSAR. The pump motor appeared to be operating above its continuous rating, even when the service factor was considered. Significantly, in Unit 2, flow restricting devices had been installed in the feedwater lines to protect the auxiliary feed pumps from runout conditions.

Pertaining to the FSAR, the licensee stated that it was outdated and that it did not reflect runout conditions and maximum power demand for a postulated pipe break in the pump discharge line.

The auxiliary feedwater system comprises two motor operated pumps, each powered by a redundant emergency bus, and one turbine driven pump. The turbine driven pump is not considered available in an accident involving steam generator or supporting systems. Following a feedwater pipe break coincident with a loss of normal power, if one diesel failed to start, the remaining redundant motor driven pump would automatically start and operate at runout conditions. In the initial phase of the accident, the pump is not essential, therefore, this pump could be shutoff without consequences. However, later, when the heat sink capacity of the affected steam generator begins to deplete, the pump is needed to maintain a minimum flow through the steam generators and must be available after the break is isolated.

During the estimated 10 minutes, minimum, required by the operator to diagnose the accident and temporarily stop the pump, the pump would be subjected to runout conditions with consequent cavitation and potentially serious damage. Similarly, the motor could suffer damage because of its operating beyond its rating.

Discussions with the licensee pertaining to the pumps' operation in the above mode indicated that a series of high capacity tests simulating the runout conditions had been conducted to evaluate the pumps behavior. The licensee stated that no visual or audible abnormalities were observed at the time except for a noise reduction when the pump reached its runout condition. Flows, pressures, and motor amperes had also been measured.

The team evaluated the net positive suction head available at the tested runout flow and found it to be below the required value indicating that during the runout tests, the pump had operated in cavitation. However, there was no evidence that the pump had been subjected to a comprehensive damage assessment program and, therefore, no positive indication of the present conditions of the pumps. The team also noted that the licensee had failed to check the motor efficiency against the given curves. On the other hand, the team verified that the hydraulic to shaft horsepower ratios for both motor driven pumps matched the curve efficiency value for the tested flow.

The licensee recognized the possibility of having run the pump in cavitation for the duration of the tests and that they could not prove absence of damage to either the pump or the motor. However, they indicated that recent monthly performance tests, conducted at the pumps' rated flow (350 GPM), showed no performance degradation.

Following the inspection, the licensee further evaluated the conditions of the pumps and concluded that apparently no damage had occurred during the runout tests that had been previously conducted. However, the capability of the pump to operate at runout conditions, in the event of a feedwater line break, is unresolved pending appropriate analysis and corrective actions by the licensee. This analysis should consider the effects on the motors' operability and environmental qualification if the motors are operated above their nameplate rating under worst environmental and voltage conditions. In addition, the analysis should address the setting of the breakers' protective devices to ensure that the breakers do not trip on overload (50-334/91-80-13).

Other than the considerable AFW pump load increase on the diesel generator, the load study, Calculation No. 8700-DEC-048, identified other minor load increases over the FSAR values for an estimated total of 296 HP. The effects of these added loads on the operability of the diesel generators are discussed elsewhere in the report.

Proposed Resolution: 50-334/91-80-13

The auxiliary feedwater pump concerns have been evaluated, and it has been concluded that the auxiliary feedwater pumps at Beaver Valley Unit 1 can experience a runout condition under postulated accident and test conditions. Based on a review of past and current test data, the pumps show no signs of degradation and current performance is acceptable. Test procedures will be revised to assure that runout conditions are not experienced during future testing. The manufacturer has confirmed that the pumps are capable of providing acceptable operation following a ten minute period at runout conditions.

The motor loads have been evaluated for the postulated maximum loading condition. Based on worst case conditions of temperature rise and ambient temperature, the winding temperatures remain well below the allowable value. Relay trip settings will be further evaluated to determine the appropriate setting considering pump protection and maximum postulated loads.

Scheduled Date:

50-334/91-80-13 The electrical evaluation will be completed by September 1, 1992. The test procedures will be revised by August 31, 1992.

11. Switchgear Seismic Qualification 50-334/91-80-14 and 50-412/91-80-14

Description:

During a walkdown, the team noticed an unusual amount of 480 V breakers in the racked out position and expressed concern regarding the impact of such configurations on the seismic qualification of the switchgear. The licensee stated that the "racked out" configuration had been evaluated by way of "in-situ" testing of safety related MCCs and that this had showed virtually no change in vibratory response, despite the numerous racked out pans. Therefore, they believed that the 480 V switchgear would respond in a similar manner. The licensee also indicated that the issue was under review and it would be resolved by analysis or test or a combination of both.

This item is unresolved pending completion of the licensee's evaluation (50-334/91-80-14) (50-412/91-80-14).

Proposed Resolution: 50-334/91-80-14 and 50-412/91-80-14

A Duquesne Light Company internal "Safety System Functional Evaluation" performed prior to the EDSFI inspection questioned the effect of breakers left in the "racked out" position on the seismic qualifications of the 480 V Motor Control Centers in Unit 1. As a result, "in-situ" testing was performed which demonstrated no appreciable effect on the seismic qualification.

The MCCs used in Unit 2 are of a different manufacturer, which can be "racked out " without opening the compartment door, and will be evaluated for that condition.

A similar review will be performed for the 480 V switchgear for both Unit 1 and Unit 2 to determine if there is any appreciable effect on seismic qualification due to the racked out configuration.

Scheduled Date:

50-334/91-80-14 - The Unit 1 evaluation will be complete 6 months after the 9th refueling.

50-412/91-80-14 - The Unit 2 evaluation will be complete 6 months after the 4th refueling.

12. Rating of Diesel Generator PTs   50-334/91-80-15

Description:

A review of BV-1 drawings 8700-RE-21BT revealed that the Potential Transformers (PTs) for the voltage regulator and the static exciter were rated at 2,400/120 V and 2,400/240 V, respectively. These rating are adequate when the EDG is operated in the test mode with its "Y" point grounded. However, when the EDG is operated with the "Y" point ungrounded, as in Design Basis Accident mode, a ground on one phase would drive the other two phases to 4,160 V with respect to ground.

The concern was that ground detection relays, in this application, are normally set at approximately 21 amps to eliminate nuisance trips. Therefore, a small ground on any phase would go undetected. This ground, however, would be adequate to elevate the potential of the ungrounded phases to 4,160 V above ground. The potential transformers associated with these phases would then be exposed to a potential of 4,160 V between live parts and the core steel and case bushings, with potential damage to the PTs. Damage to the PT's insulation would ultimately adversely impact the operation of the voltage regulator and the static exciter.

By the end of the inspection, the licensee was not able to provide design bases documents to show that the insulation rating of these PTs was adequate for operation with a postulated grounded phase. This issue is unresolved pending appropriate review and analysis by the licensee (50-334/91-80-15).

Proposed Resolution: 50-334/91-80-15

In order to demonstrate that the insulation rating of the PTs in question are adequate to operate with a postulated grounded phase, it is essential that the name plate data be retrieved. Since a bus outage is required, the nameplate information will be obtained and evaluated during the next refueling outage.

Scheduled Date:
50-334/91-80-15 - This will be resolved prior to restart from the 9th Refueling Outage.

13. Generator Bearing Cooling 50-412/91-80-16

Description:

During an inspection of the BV-2 EDGs, plastic pipe was used for the cooling water supply to the rear bearing of the EDGs. This pipe appeared to have been replaced and, in one case, the use of a toothed tool was evident. The team was concerned that a failure of these lines could ultimately render the EDGs inoperable as a result of a rear bearing failure, loss of jacket cooling water, or shorting of the generator from the broken pipe water spray.

The licensee had no analysis clearly demonstrating the capabilities of the pipe. However, they indicated that, to their knowledge the units had been supplied with the plastic pipe. Apparently, the reason for the pipe was that an electrical insulating material was required to totally isolate the rear bearing from the rest of the EDG.

Regarding the observation that the pipe appeared to have been replaced with one of a different color, the licensee noted that they had replaced six of the eight installed pieces of pipe over a period of several years, including some that had been damaged and replaced during start-up. The last replacement occurred in October 1990. According to Maintenance Work Request No. 909461, the pipe had been broken in such a manner as to allow the jacket cooling water to go into the bearing oil. During this replacement, the Maintenance Department requested Engineering to review and approve the use of a material with physical characteristics different from the originally specified ones. The new material was approved. However, the team found no evidence that an evaluation had been done of the new material's performance in the environment of the EDG room and compared to the original material's specification requirements.

In view of the above, the acceptability of the new plastic pipe is unresolved pending appropriate analysis by the licensee (50-412-91-80-16).

Proposed Resolution: 50-334/91-80-16

An analysis was performed to justify the installed PVC piping. The analysis conservatively assumes the following: 1) lowest strength PVC piping installed, 2) the worst case environmental temperatures, 3) seismic and operating condition loading and 4) conservative design values on the piping. The results indicate that the PVC piping is suitable for this application.

Additionally, the PVC pipe is compatible with and recommended for use with the NALCO 39M coolant additive, per NALCO's product bulletin.

Therefore, the installed PVC pipe is acceptable for use in the EDG bearing cooling water connections for the life of the plant.

Scheduled Date: No additional action is required.

14. Relay Testing 50-334/91-80-17

Description:

The calibration was witnessed of a Class 1E undervoltage relay used to start the Unit 1 'A' diesel generator. During this test, the Asea Brown Boveri relay exhibited a setpoint drift which appeared to be temperature related since the test cart was located in an area where a cold draft was blowing on the cart and on the relay.

The testing personnel stated that a letter would be sent to Nuclear Plant Engineering requesting an evaluation and a determination of the impact of this condition on plant operation. By the end of the inspection, the licensee had not completed its evaluation.

The team also reviewed letter RBRB142, dated September 6, The team also reviewed letter RBRB142, dated September 6, 1991, which discussed a setpoint problem with relays 27-VB100 and 27-VC100. These relays are used to detect undervoltage on the supply to the reactor coolant pumps. The writer of the letter had suggested that, the day before their testing, the relays should be set outside their Technical Specification limits so that, by the time they were tested, they would have drifted into the correct band.

The team requested a copy of Engineering Memorandum No. EM 101626 which responded to the letter, but the licensee was not able to retrieve the response by the end of the inspection. Therefore, the response of the undervoltage relays to temperature changes is unresolved pending appropriate evaluation by the licensee and review by the NRC (50-334/91-80-17).

Proposed Resolution: 50-334/91-80-17

The relay in question is an ASEA Brown Boveri (formerly ITE) Type 47H, class 1E undervoltage relay. The setpoint for this relay is 99 volts with an acceptable range of 99 to 102 volts per the applicable Relay Calibration Procedure (RCP). The applicable procedures for this relay do not currently address the environment in which the relays are tested, and will be revised to reflect this. The relay testing personnel are currently ensuring that prior to testing, the relays are in a stable environment. Subsequent relay testing has demonstrated that the relay setpoint remains in its range when calibrated in a more stable test environment.

Relays -VB100 and 27-VC100 are G.E. Type CFV. During the pe... rmance of monthly Maintenance Surveillance Procedures (MSPs), the relay "as found" setpoints were found outside the setpoint range specified. These past setpoint shifts have since been attributed to cooling of the coils due to a time delay between the de-energization of the coil and checking the "as found" setpoint. The manufacturer's instruction manual GEI-15536G states that the relay setpoint will increase after heating from energization. This effect corresponds to that seen from reviewing past relay "as left" and "as found" setpoint data. Based upon this review, the applicable surveillance procedures will be superseded with a new procedure which will require checking the relay setpoint immediately after de-energization. The relay technicians are aware of this situation and are implementing the proposed changes.

n reference to letter RBRB142, the letter suggested owering the relay setpoint prior to performing the monthly calibration to attempt to compensate for this suspected heating effect. Note that this was never done or seriously considered. Also, note that it was never suggested to lower the setpoint below Technical Specification limits, only to a limit slightly below that contained in the applicable surveillance procedure which is considerably higher than the Technical Specification limit.

Scheduled Date:

50-334/91-80-17 - The applicable relay procedures will be revised and personnel re-trained by September 30, 1992.