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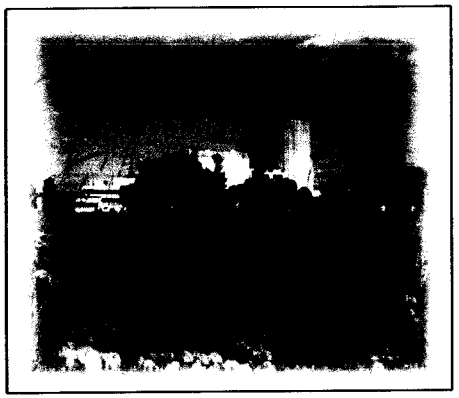

Prairie Island Nuclear Generating Plant

Diesel Generator Test Loads

July 23, 2009

Agenda

- 9:00 Introductions
- 9:05 Purpose of Meeting
- 9:10 Requested changes
- 9:25 Regulatory basis
- 10:10 RAI response summary
- 10:30 Technical discussion
- 10:55 Discussion
- 11:15 Conclusion

Introductions

- Xcel Energy Attendees
  - Jon Anderson — Regulatory Affairs Manager
  - Scott McCall — Engineering Plant and Systems Manager
  - Don Hartinger — Engineering Supervisor
  - Dave Carlisle — Engineering
  - Dwain Lambert — Engineering
  - Dale Vincent — Licensing

Purpose of Meeting

- Discuss the basis for the license amendment request submitted November 4, 2008, to revise emergency diesel generator test loads and responses to the NRC requests for additional information

Purpose of Meeting

- Discussion Points
  - Regulatory Guide 1.9
  - Re-rate (de-rate)

Requested Changes

Unit 1 EDG background

- D1 and D2
- Fairbanks-Morse diesel generator sets
- Ratings
  - 3000 kW (1000 hour)
  - 2750 kW (continuous)
- Jacket cooling from cooling water (service water) system
- Independent fuel oil storage system
- Original installation

Requested Changes

Unit 2 EDG background

- D5 and D6
- SACM (Wärtsilä) diesel generator sets
- Rating - 5400 kW (continuous)
- Radiator cooled
- Independent fuel oil storage system
- Installed 1992 for SBO Rule
- Similar EDGs used world-wide
- One other SACM EDG in USA – same model

Requested Changes

- SR 3.8.1.3
  - EDG monthly 2 hour test
  - Current TS: test Unit 2 EDGs $\geq$ 5100 kW
  - Proposed TS: test Unit 2 EDGs $\geq$ 4000 kW
  - Commitment: test Unit 2 EDGs $\geq$ 5100 kW

Requested Changes

- SR 3.8.1.9
  - EDG 24 month – 24 hour test
  - Current for Unit 2 EDGs
    - 2 hours $\geq$ 5562 kW and $\leq$ 5940 kW
    - Remaining hours $\geq$ 4860 kW
  - Proposed for Unit 2 EDGs
    - 2 hours $\geq$ 5400 kW and $\leq$ 5940 kW
    - Remaining hours $\geq$ 4000 kW

Requested Changes

- SR 3.8.1.9
  - Current for Unit 1 EDGs
    - Remaining hours $\geq$ 2475 kW
  - Proposed for Unit 1 EDGs
    - Remaining hours $\geq$ 2500 kW

Regulatory Basis

- Regulatory Picture
  - Design and test EDGs for the design and licensing basis loads
    - Regulation
    - Regulatory Guides
    - TS

Regulatory Basis

- AEC GDC Criterion 39 - Emergency Power For Engineered Safety Features
  - *Alternate power systems shall be provided and designed with adequate independency, redundancy, capacity, and testability to permit the functioning required of the engineered safety features. As a minimum, the onsite power system and the offsite power system shall each, independently, provide this capacity assuming a failure of a single active component in each power system.* (emphasis added)

Regulatory Basis

- 10CFR 50.36(c)(3) *Surveillance requirements*.
  - Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. (emphasis added)

Regulatory Basis

- TS 1.1 OPERABILITY
  - A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant . . .

Regulatory Basis

- Design and licensing basis loads
  - LOOP = 2821 kW
  - LOOP + LOCA = 3731 kW
  - SBO = 3840 kW

Regulatory Basis

- Regulatory Guidance
  - Safety Guide 1.9
  - RG 1.9 (Revisions 1 and 2)
    - Assure EDG size (rating) is large enough to handle design basis and licensing basis loads
    - Perform acceptance testing to assure EDG can perform at the design and licensing basis loads

Regulatory Basis

- Regulatory Guide 1.9
  - NSPM (and predecessor licensees) committed to RG 1.9 Revision 2 for Unit 2 EDG sizing and acceptance testing

Regulatory Basis

- Regulatory Guide 1.9
  - Unit 2 EDG Design Report - November 1990
    - An important function of this report is to detail our commitments to various codes, standards, and Regulatory Guides. Our commitments, and exceptions, to the various "Standards" are explicitly described in the various sections of the report. Note, however, that these commitments are for design, procurement, fabrication and construction only: operational and surveillance commitments will be made through the License Amendment Request.

Regulatory Basis

- Regulatory Guide 1.9
  - Unit 2 EDG Design Report - November 1990
    - Committed to
      - RG 1.9,Revision 2,
      - RG 1.108, Revision 1
      - Applied for design and procurement purposes
        - » Includes acceptance testing

Regulatory Basis

- Regulatory Guide 1.9
  - LAR submitted March 1992
    - Proposed test loads
    - No regulatory basis cited in LAR for test loads
    - Bases cited RG 1.9 for design features
  - NRC LA 103/96 December 1992
    - Approved test loads
    - No regulatory guide cited in SE for test loads

Regulatory Basis

- Regulatory Guide 1.9
  - Revision 2 does not provide guidance applicable to periodic testing of EDGs
    - "Selection, Design and Qualification of Diesel Generator Units Used As Standby (On-site) Electric Power Systems at Nuclear Power Plants"
  - Revision 3 added "and Testing"

Regulatory Basis

- Unit 2 EDG sizing
  - 5400 kW - 100% of continuous rating
  - 5400 kW above design basis loads
    - LOOP = 2821 kW
    - LOOP + LOCA = 3731 kW
  - 5400 kW is 40% over SBO load
    - SBO = 3840 kW

Regulatory Basis

- 4000 kW is the appropriate TS required test load

Regulatory Basis

- TS test at 4000 kW demonstrates:
  - Capacity to permit the functioning required of the engineered safety features (AEC GDC 39)
  - Necessary quality of components is maintained (10CFR 50.36(c)(3))
  - Limiting condition for operation will be met (10CFR 50.36(c)(3))
- 4000 kW could be considered the required EDG "rating" for Regulatory Guide 1.9 purposes

Regulatory Basis

- Precedent
  - Calvert Cliffs has two SACM DG sets
    - One set is an EDG
  - TS require monthly test at 4000 kW
  - Perform monthly test at 90 to 100% continuous rating (5400 kW)
  - Resolve issues identified above 4000 kW by CAP

Regulatory Basis

- Additional commitment
  - The Prairie Island Nuclear Generating Plant Unit 2 Emergency Diesel Generators (EDGs) will be tested at or above 90% of their rated load on a schedule consistent with SR 3.8.1.3. Abnormalities in EDG performance between the SR 3.8.1.3 test load and the rated load will be evaluated under NSPM's corrective action program, which incorporates trending capabilities, and corrected under the maintenance program.

Regulatory Basis

- NSPM proposes that TS testing at 4000 kW with CAP testing at loads comparable to vendor rating
  - Commitment to RG 1.9, Revision 2 met
    - Unit 2 EDGs sized (rated) to supply design basis loads
    - Extra capacity also provided

RAI Response Summary

- RAI 1
  - Describe the differences between the apparent compliance with RG 1.9 cited in the above examples of LARs and the statements made in the proposed LAR dated November 04, 2008. Specifically, describe how the proposed changes for reducing the 2 hour and the 22 hour testing ranges for EDGs D5 and D6 maintain compliance with the requirements of RG 1.9

RAI Response Summary

- RG 1.9 Statements
  - NSPM (and predecessor licensees) committed to RG 1.9 Revision 2 for Unit 2 EDG sizing and acceptance testing
  - RG 1.9 Revision does not have requirements for periodic testing

RAI Response Summary

- RG 1.9 Statements
  - LAR October 29, 2007
    - Although this LAR is consistent with the intent of RG 1.9 Revision 4 guidance for power factor test loading, this LAR does not commit to compliance with the provisions of RG 1.9, Revision 4
  - LAR August 16, 2007
    - Although this LAR is consistent with the RG 1.9, Revision 4, guidance for Unit 1 EDG monthly test loading, this LAR does not commit to compliance with the provisions of RG 1.9, Revision 4

RAI Response Summary

- RG 1.9 Statements
  - LAR November 21, 2005
    - Regulatory Guide 1.9, "Selection, Design and Qualification of Diesel Generator Units used as Standby (Onsite) Electric Power Systems at Nuclear Power Plants"
      This Regulatory Guide describes an acceptable basis for the selection of diesel generator sets of sufficient capacity and margin . . . These changes do not impact the capacity or margin of the emergency diesel generators; thus this license amendment request does not change the plant compliance with this Regulatory Guide.

RAI Response Summary

- RAI 2
  - On page 15 of 30 of the LAR, the licensee provides a discussion on why this proposed amendment "... does not involve a re-rate or de-rate ..." of the D5 and D6 EDGs at PINGP Unit 2. Provide an evaluation of the consequences of permanently de-rating EDGs D5 and D6 to comply with the testing requirement of RG 1.9, as well as enveloping the worst case accident load profile

RAI Response Summary

- EDG re-rate or de-rate
  - Xcel does not propose to de-rate these EDGs
  - No physical modifications are proposed that affect rating
  - Xcel proposes to continue monthly test at loads comparable to EDG rating
  - The current rating provides capacity margin

RAI Response Summary

- RAI 3
  - The discussion in the LAR indicates that the reliability of EDGs D5 and D6 has been impacted by the TS required load testing. Provide details for EDG target reliability assumed for compliance with 10 CFR 50.63 (Station Blackout Rule) and the reliability indicator for the last 20, 50, and 100 demands

RAI Response Summary

	Valid Demand/ Failures		
	Last 20	**Last 50**	**Last 100**
Allowable Failures (Trigger Values)	3	4	5
Actual Failures	1	2	3
Trigger Values Exceeded - Yes/No?	No	No	No

RAI Response Summary

- Start and Load Run Demand Data
  - Trigger failures have not been exceeded
  - None of the failures were due to "high load" operation
  - These failures were due to:
    - A problem with the Diesel Engine Room Cooling Fan
    - Problems (2) with the Diesel Engine LVDT

RAI Response Summary

- High load operations
  - High crankcase pressure
  - Three shutdowns since 2001
  - Yearly inspections

Technical Discussion

Background

- Safeguards AC Distribution
  - Two independent 4 KV buses per unit
  - Each safeguards 4 KV Bus has two paths from the offsite transmission system
  - Each safeguards bus has one Emergency Diesel Generator (EDG)
  - Each safeguards bus has a dedicated sequencer which senses UV/DV and transfers the bus to the alternate source or to the EDG

Technical Discussion

Background

- Station Blackout Design
  - Each safeguards bus has a bus-tie available to the same Train bus on the opposite unit
  - Each EDG is capable of sequentially starting and supplying the safe shutdown (Mode 3) loads for its unit along with the essential loads of the same-Train opposite unit in the event of an SBO

Technical Discussion

Background

- Design Loads
  - LOOP loads (Train A)(USAR Table 8.4-4)
    - 2821 kW
  - LOCA + LOOP loads (Train A)(USAR Table 8.4-2)
    - 3731 kW
  - SBO loads (Train B)(USAR Section 8.4.4)
    - 3840 kW

Technical Discussion

Background

- Accident LOCA/DBA with LOOP vs. Time

Load Periods	Total Load
0-5 Minutes	3731 KW
5-30 Minutes	3728 KW
30 Minutes – 1 Hour	3720 KW
1 Hour – 14 Days	2509 KW

Technical Discussion

Background

- LOCA/DBA with Loop
  - For the first hour (3731 KW),
    - 69% of rated load (5400 KW)
    - 93% of proposed Tech Spec Load (4000 KW)
  - For remaining 14 days (2509 KW),
    - 46% of rated load (5400 KW)
    - 63% of proposed Tech Spec Load (4000 KW)

Technical Discussion

Background

- Accident scenarios

Condition	Load	Mission Time
DBA/LOOP	3731 KW	14 Days
SBO	3840 KW	4 hours
LOOP	2821 KW	14 Days

Technical Discussion

Decrease Monthly Test Load

- Benefits
  - Increase EDG availability
  - More accurate troubleshooting
  - More efficient maintenance execution

Technical Discussion

Decrease Monthly Test Load

- Test at 5100 to 5300 kW
  - Demonstrate that no problems are missed that could possibly be missed if the site was only testing at lower power
  - Problems identified between 4000 kW and 5300 kW handled by CAP and Work Management processes at the next available opportunity

Technical Discussion

Decrease Monthly Test Load

T. S. Limit: 5100-5300 kW

- Unnecessary to test at 5100 kW to prove operability at 3840 kW
- Results in Emergent Response
  - Increase Likelihood of human factors errors
  - Difficulty in completing repairs in 14 days
  - Increases Out of Service Time
- Resulted in three Unit 2 shutdowns
  - Challenges the organization
  - Cycles the plant
- Complies with RG Rev 2

T. S. Limit: 4000 kW

- Testing sufficient to assure engine can operate above 3840 kW
- Allows for Planned Response
  - Parts availability
  - Staffing scheduling
  - Pre-staging
  - Rescheduling of other work
  - Can complete repairs in 14 days
- Allows for better troubleshooting and investigations
- Planned activities are executed
  - Safer
  - Better quality
  - More efficient
- Limited base line data at 4000 kW

Discussion

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