

November 17, 2006

MEMORANDUM TO: A. Randolph Blough, Director
Division of Reactor Safety
Region I

FROM: John Lubinski, Deputy Director **/RA/**
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: FINAL RESPONSE TO TASK INTERFACE AGREEMENT 2006-01
RELATED TO THE ADEQUACY OF EMERGENCY DIESEL
GENERATOR AND SHUTDOWN TRANSFORMER LOAD TESTING AT
PILGRIM NUCLEAR POWER STATION (TAC NO. MD0178)

By your memorandum dated January 4, 2006, Region I submitted a request for a Task Interface Agreement (TIA) related to the adequacy of Emergency Diesel Generator (EDG) and Shutdown Transformer Load Testing at Pilgrim Nuclear Power Station (Pilgrim). The purpose of the TIA request is to determine whether the EDG load sequence testing conducted during the last refueling outage met Technical Specification (TS) and regulatory requirements.

The inspector questioned the adequacy of Entergy's testing as it relates to the Pilgrim TS Surveillance Requirements (SRs). Pending further review, the inspectors documented this as an unresolved item in NRC Inspection Report No. 05000293/2005003.

Specifically, Region I requested a determination, from the NRC Office of Nuclear Reactor Regulation (NRR), of the following issues:

1. Is testing of the EDG with some loads in conjunction with overlap testing acceptable to meet the requirements of this SR? Specifically, can sequencer testing for timing; individual start and run of equipment, while being supplied by offsite power; full load testing of the diesel; and the Special Test for Automatic ECCS Load Sequencing of Diesels and Shutdown Transformer with Simulated Loss of Offsite Power and Special Shutdown Transformer Load Test show that "the conditions under which the diesel generator is required ... accept the emergency loads within the specified time sequence."
2. Is Entergy's position, i.e., that "small loads" added to the diesel will not impact diesel performance as long as the total load placed on the diesel is below its rated load, acceptable? If so, what constitutes a small load?
3. If it is determined that from a technical aspect the testing performed by the licensee does ensure that the diesel and sequencer will fulfill their design functions, does the licensee need to amend their TS to ensure compliance with the words in the SR?

Based on additional information submitted by the licensee, NRR, Division of Engineering, Electrical Engineering Branch and Division of Inspection and Regional Support, Technical Specifications Branch has completed its evaluation of the above technical issues. A summary of the staff's determination is as follows:

The purpose of SR 4.9.A.1.b is to verify:

- 1) EDG performance (voltage and speed) under transient conditions, and
- 2) operability of the EDG load sequence logic

Operability of the diesel engine and ac generator under simulated emergency conditions is demonstrated through surveillance testing. Pilgrim SR 4.9.A.1.b is used to verify that the diesel engine can provide the load capacity and torque needed to maintain generator speed (frequency) and that the voltage regulator and excitation system can provide the high reactive power necessary to maintain terminal voltage within acceptable limits. If these capabilities are not periodically demonstrated, the technical bases for declaring the EDG to be operable lack credibility.

The staff concludes that testing of the EDG without sequencing all the emergency connected loads as defined by the licensee final safety analysis report (FSAR) Table 8.5.1, is not in compliance with the stated TS SR 4.9.A.1.b. The staff expects the licensee to follow its FSAR Section 8.5.5 which states that "Readiness can be demonstrated by periodic testing which insofar as practical, simulates actual emergency conditions." Overlap testing of the emergency connected loads should be limited to "small loads" such as motor operated valves (MOV's) and other similar load capacity components which would cause damage or undesirable consequences if actuated during testing.

The current Pilgrim TSs adequately provide the sequence load testing expected by the NRC staff. Pilgrim SR 4.9.A.1.b is similar to the standard technical specification (STS) SR 3.8.1.11 and SR 3.8.1.19 for BWR/4 (NUREG - 1433, R3.1).

The draft TIA response was issued for Region I comments on September 29, 2006. Based on a teleconference with the Region on October 16, 2006, Region I had no comments. NRR's final TIA response is attached. There were additional comments from the NRC Staff that were incorporated in this final response, these changes did not substantially alter the NRC staff conclusions from the draft response.

Docket No. 50-293

Enclosure:
As stated

Based on additional information submitted by the licensee, NRR, Division of Engineering, Electrical Engineering Branch and Division of Inspection and Regional Support, Technical Specifications Branch has completed its evaluation of the above technical issues. A summary of the staff's determination is as follows:

The purpose of SR 4.9.A.1.b. is to verify:

- 1) EDG performance (voltage and speed) under transient conditions, and
- 2) operability of the DG load sequence logic

Operability of the diesel engine and ac generator under simulated emergency conditions is demonstrated through surveillance testing. Pilgrim SR 4.9.A.1.b is used to verify that the diesel engine can provide the load capacity and torque needed to maintain generator speed (frequency) and that the voltage regulator and excitation system can provide the high reactive power necessary to maintain terminal voltage within acceptable limits. If these capabilities are not periodically demonstrated, the technical bases for declaring the EDG to be operable lack credibility.

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The current Pilgrim TSs adequately provide the sequence load testing expected by the NRC staff. Pilgrim SR 4.9.A.1.b is similar to the standard technical specification (STS) SR 3.8.1.11 and SR 3.8.1.19 for BWR/4 (NUREG - 1433, R3.1).

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION
FOR TASK INTERFACE AGREEMENT 2006-01
RELATED TO THE ADEQUACY OF EMERGENCY DIESEL GENERATOR AND SHUTDOWN
TRANSFORMER LOAD TESTING AT PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

1.0 BACKGROUND

On March 10, 2005, Entergy Nuclear Operations, Inc. (Entergy or the licensee) approved a change to Procedure No. 8.M.3-1, "Special Test for Automatic ECCS [Emergency Core Cooling System] Load Sequencing of Diesels and Shutdown Transformer with Simulated Loss of Offsite Power and Special Shutdown Transformer Load Test," using Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59 process. This licensee procedure is used to fulfill the requirements of Technical Specification (TS) Surveillance Requirement (SR) 4.9.A.1.b. One aspect of the change involved removing the automatic sequencing of the reactor building closed cooling water (RBCCW) and salt service water (SSW) pumps (both of which are emergency connected loads) during the simulated loss-of-coolant accident (LOCA)/loss-of-offsite power (LOOP) testing.

Pilgrim SR 4.9.A.1.b, states "Once per operating cycle the condition under which the diesel generator is required will be simulated and test conducted to demonstrate that it will start and accept the emergency loads within the specified time sequence...." and SR 4.9.A.1.c, states "Once per operating cycle with diesel loaded per 4.9.A.1.b verify that on diesel generator trip, secondary (offsite) AC power is automatically connected within 11.8 to 13.2 seconds to the emergency service buses and emergency loads are energized through the load sequencer in the same manner as described in 4.9.A.1.b.1..."

The inspector questioned the adequacy of Entergy's testing as it relates to the requirements of the TS SRs. Entergy justified the change to the testing based, in part, on the TS 4.9.A.1 bases wording which discusses start and run time requirements for the core spray and residual heat removal pumps sequence timing to verify safety analysis assumptions described in the Pilgrim Updated Final Safety Analysis Report (UFSAR). The licensee stated that to meet the SRs they combined the results of the test in question with their existing load sequencer testing, amperage loading calculations and full-load diesel testing. The inspectors found that this testing does not actually verify the complete loading sequence following an emergency diesel generator (EDG) start from ambient conditions as prescribed by TS 4.9.A.1.b nor shutdown transformer loading following an EDG trip as prescribed by TS 4.9.A.1.c. As a result, the inspectors questioned whether Entergy could make this change without prior Nuclear Regulatory Commission (NRC) approval.

Enclosure

2.0 EVALUATION

By this Task Interface Agreement, the NRC Region I office requested answers to the following questions:

1. Is testing of the EDG with some loads in conjunction with overlap testing acceptable to meet the requirements of this SR? Specifically, can sequencer testing for timing; individual start and run of equipment, while being supplied by offsite power; full load testing of the diesel; and the Special Test for Automatic ECCS Load Sequencing of Diesels and Shutdown Transformer with Simulated Loss of Offsite Power and Special Shutdown Transformer Load Test show that "the conditions under which the diesel generator is required ... accept the emergency loads within the specified time sequence."

The purpose of TS SRs 4.9.A.1.b and 4.9.A.1.c is to demonstrate the operation of the EDG during LOCA/LOOP. Although Pilgrim has custom TSs, these TS SRs 4.9.A.1.b and 4.9.A.1.c are equivalent to the Standard Technical Specification (STS) (NUREG-1433, R3.1) SR 3.8.1.11, and SR 3.8.1.19. The bases for the STS states: "The requirement to verify the connection and power supply of permanent and auto-connected loads is intended to satisfactorily show the relationship of these loads to the EDG loading logic (emphasis added). In certain circumstances, many of these loads cannot actually be connected or loaded without potential for undesired operation. For instance, emergency core cooling systems (ECCS) injection valves are not desired to be stroked open, high pressure injection systems are not capable of being operated at full flow, or shutdown cooling systems performing a decay heat removal functions are not desired to be realigned to the ECCS mode of operation. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the EDG system to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified." The STSs provide these provisions for conducting such overlapping tests for "small loads" which are typically loads associated with motor operated valves (MOVs) and other similar load capacity components because operating these components could cause undesirable effects such as ECCS injection.

The Pilgrim bases is similar except in the description of what may not be practical for sequencing emergency connected loads. The Pilgrim bases states in part, "The test of the diesel generator during the refueling outage will be more comprehensive in that it will functionally test the system; i.e., it will check diesel generator starting, closure of the diesel generator breaker, and sequencing of load on the diesel generator."

On April 24, 2006, the NRC staff asked the licensee to provide the basis for determining the inability to sequence one RBCCW and one SSW pump on the EDG during surveillance testing of TS SRs 4.9.A.1.b and 4.9.A.1.c. By letter dated June 5, 2006, the licensee stated that "B" trains of RBCCW and SSW were not available during the SRs of the "B" EDG conducted on April 28, 2005. The RBCCW and SSW were not available since the RBCCW heat exchanger was out of service for channel repairs and eddy current testing. The SSW and RBCCW systems were returned to service on April 29, 2005, at 12:00 pm and on April 30, 2005, at 4:00 am, respectively.

On April 24, 2006, the NRC staff asked the licensee to explain why starting the last sequenced loads, RBCCW and SSW pumps, will not adversely affect the performance of the EDG. On June 5, 2006, the licensee provided the EDG performance impact of starting the last sequenced load(s) RBCCW and SSW. The licensee stated that in the SR, the core spray pump and two residual heat removal pumps are running at minimum flow. Actual loading on the EDG at the point when all three of these pumps are running (which includes all other loads normally powered in this configuration) is 1053 kW [1.7321×180 (measured current) $\times 4222$ (measured voltage) $\times 0.8$ (assumed power factor)]. The EDG power margin available is 1547 kW [2600 (EDG continuous rating) - 1053] for starting of SSW and RBCCW pumps. The inrush and steady state power requirements for the SSW pump are 560 kW [100 (HP) $\times 0.746$ (kW/HP) $\times 6$ (inrush factor) / 0.8 (efficiency)] and 93.25 kW [100 (HP) $\times 0.746$ (kW/HP) / 0.8 (efficiency)], respectively.

The starting and steady state power requirements for the RBCCW pump are 336 kW [60 (HP) $\times 0.746$ (kW/HP) $\times 6$ (inrush factor) / 0.8 (efficiency)], and 55.95 kW [60 (HP) $\times 0.746$ (kW/HP) / 0.8 (efficiency)], respectively. With 1547 kW available, there is sufficient capacity on the EDG to start the SSW pump, which develops 560 kW inrush, then 93.25 kW during steady state. After the SSW pump is started, the available margin is 1453.75 kW (1547-93.25) to start the RBCCW pump load of 336 kW during inrush, then 55.95 kW during steady state. The licensee further demonstrated that the EDG has sufficient kVA margin to start and run both RBCCW and SSW pumps. The NRC staff finds that overlap testing auto-connected loads including the RBCCW and SSW pumps could technically justify the diesel load sequence design function however, overlap testing could not demonstrate the EDG performance under transient conditions, and does not satisfy the Pilgrim SR requirement to demonstrate the emergency load sequence.

2. Is Entergy's position, i.e., that "small loads" added to the diesel will not impact diesel performance as long as the total load placed on the diesel below its rated load, acceptable? If so, what constitutes a small load?

Overlapping tests for "small loads" which are loads primarily associated with some specific MOVs and other similar load capacity components are allowed by the STS, because operating these components could cause undesirable effects such as ECCS injection. The staff expects the licensee to follow its TSs which states that "The condition under which the diesel generator is required will be simulated and test conducted to demonstrate that it will start and accept the emergency load within the specified time sequence." This would include all emergency connected loads that would not result in an undesirable consequence or equipment damage. Undesirable consequence would not include schedule inconvenience or plant maintenance priorities that would prevent testing emergency connected loads.

Entergy's position that "small loads" will not impact EDG performance, is not acceptable to the NRC staff. The above position does not address the starting requirements of the "small loads" and available margin on the EDG. The addition of "small loads" will have no impact on the performance of EDG if the available margin (kW and kVA) on the EDG before the addition of the "small loads" is greater than the starting requirements (kW and kVA) of the "small loads." However, in order to simulate actual conditions the test should include all loads practical including "small loads" that would not produce undesirable operational effects.

3. If it is determined that from a technical aspect the testing performed by the licensee does ensure that diesel and sequencer will fulfill their design functions, does the licensee need to amend their TS to ensure compliance with the words in the SR?

In response to question 1, the NRC staff has determined that from a technical aspect the testing performed by the licensee provides some assurance that the EDG and sequencer could fulfill their design functions. However, the licensee should follow its TSs and the Final Safety Analysis Report (FSAR) Section 8.5.5 which states that "Readiness can be demonstrated by periodic testing which insofar as practical, simulates actual emergency conditions." The licensee is not in compliance with its custom TS modifying the test to exempt RBCCW and SSW loads. We understand that the "A" trains of RBCCW and SSW systems were available and were included in the surveillance test of the "A" EDG.

The current Pilgrim TSs adequately provide the sequence load testing expected by the NRC staff. Pilgrim SR 4.9.A.1.b is similar to STS for BWR/4 SR 3.8.1.11 and SR 3.8.1.19.

3.0 Conclusion

The NRC staff concludes that testing of the EDG without sequencing all the emergency connected loads as defined by the licensee in its UFSAR Table 8.5.1, is not in compliance with the stated TS SR 4.9.A.1.b. The licensee is expected to comply with its licensing basis in UFSAR Section 8.5.5 which states that "Readiness can be demonstrated by periodic testing which insofar as practical, simulates actual emergency conditions." Overlap testing of the emergency connected loads should be limited to MOVs and other similar load capacity components which would cause damage or undesirable consequences if actuated during testing.

The addition of "small loads" which are identified in the STS as MOVs and other similar load capacity components do not have a great impact on the performance of an EDG as long as the available margin (kW and kVA) on the EDG before the addition of the "small loads" is greater than the starting requirements (kW and kVA) of the "small loads."

The current Pilgrim TSs adequately provide the sequence load testing expected by the NRC staff. Pilgrim SR 4.9.A.1.b is similar to the STS SR 3.8.1.11 & 19.

Principal Contributors: A. Pal
R. Clark

Date: November 17, 2006