



FirstEnergy Nuclear Operating Company

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10 CFR 50.90

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Response to NRC Staff Request for Additional Information Regarding License
Amendment Request on Division 3 Emergency Diesel Generator Start Time
Surveillance Requirement (TAC No. ME1691)

A license amendment request to revise the Perry Nuclear Power Plant (PNPP) Technical Specifications regarding a Division 3 emergency diesel generator start time requirement was submitted on June 30, 2009 (Accession No. ML091900387). The Nuclear Regulatory Commission (NRC) staff provided a request for additional information (RAI) regarding this amendment request by letter dated March 23, 2010 (Accession No. ML100740652). Responses to the RAI items are attached.

The attachment explains that emergency core cooling system (ECCS) injection valve response time requirements are met when injection valves are partially open; thus, the High Pressure Core Spray (HPCS) system response time is met even when diesel generator minimum allowable voltage and frequency are considered. Clarifications of the Updated Safety Analysis Report (USAR) are being tracked per the corrective action process to provide a more consistent reflection of this design/licensing basis information within the USAR.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - Fleet Licensing, at (330) 761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 24, 2010.

Sincerely,

Mark B. Bezilla

Attachment: Response to RAI on Division 3 Emergency Diesel Generator Start Time

cc: NRC Region III Administrator

NRC Resident Inspector Office

NRC Project Manager

State of Ohio

A001
MRL

Response to RAI on Division 3 Emergency Diesel Generator Start Time
Page 1 of 3

The Nuclear Regulatory Commission (NRC) staff provided a request for additional information (RAI) regarding the FirstEnergy Nuclear Operating Company (FENOC) license amendment request (LAR) for the Perry Nuclear Power Plant, regarding a Division 3 emergency diesel generator (EDG) start time requirement. The NRC staff requests are presented below in bold type, followed by the FENOC response.

In the LAR, the licensee states that the accident analysis (SAFER/GESTR) assumes that design flow from the high-pressure core spray (HPCS) system is available 29 seconds after initiation of a Loss-of-Coolant Accident signal. The EDG start time and HPCS isolation valve stroke time are portions of the overall 29-second time. The analysis does not credit flow during partial opening of associated HPCS valve. According to the Updated [Safety] Analysis Report Table 6.2-22, the containment isolation motor operated valve E22F004 has a 'CLOSE' stroke time of 16 seconds. Assuming that the valve 'OPEN' stroke time is also 16 seconds (nominal voltage and frequency), that leaves 13 seconds for the HPCS EDG to attain the required voltage and frequency. In the LAR, the licensee is requesting that the HPCS EDG voltage and frequency (after 13 seconds) to be "at or above" 3900 Volts (V) and 58.8 Hertz (Hz). At this voltage and frequency, the stroke time may be longer than 16 seconds, resulting in less time available for the EDG to start.

- 1. Provide a summary of the analysis for the valve stroke time to open when the HPCS EDG voltage and frequency attain the minimum acceptable values.**

Response

Frequency: A change in electrical frequency will result in a speed change in motors such as those that drive motor-operated valves open and closed. A two percent reduction in frequency due to an EDG operating at the Technical Specifications (TS) minimum allowable frequency of 58.8 Hz (1.2 Hz below nominal 60 Hz frequency) would result in approximately a two percent increase in calculated valve stroke time. Application to the HPCS injection valve with its calculated nominal stroke time of 16 seconds results in an overall calculated valve stroke time of 16.33 seconds. As noted in the response to RAI item 3, this generically calculated value is not an actual stroke time of the subject valve.

Voltage: Although some industry documents indicate that changes in electrical voltage provided to a motor can result in changes in motor speeds, motors at the Perry Nuclear Power Plant (PNPP) are rated to perform at voltage reductions larger than the 6.25 percent voltage reduction provided by a diesel-generator operating at 3900V (260V below nominal 4160V), and such a voltage reduction

would not be expected to have any appreciable impact on the speed of a motor¹. The possible relationship of a voltage reduction to valve speed is the subject of an ongoing corrective action program evaluation; however, to be responsive to this NRC request for information, a relationship is assumed to exist in order to illustrate that the result would not be a concern. In 1995, Dr. Pragasen Pillay [Reference 1] identified that certain types of motors operating at ninety percent (90%) of normal voltage could see a 1-1/2 percent decrease in full load speed. Proportionally, a 6.25 percent reduction in voltage would result in less than a one percent (<1%) decrease in full load speed.

Total impact of both frequency and voltage: Rounding up the voltage speed decrease to one percent, and applying that speed decrease to the longer 16.33 second stroke time determined above due to the frequency reduction, would result in a total 16.5 second calculated stroke time (rounded up again, to the nearest tenth). This 0.5 second total increase in calculated stroke time due to reduced frequency and voltage is more than compensated for by the margin available due to the factors discussed in the responses to RAI items 2 and 3.

2. Provide a summary of the analysis for time required for full design flow into the reactor vessel, after initiation of an accident signal, with the HPCS valve partially open and the HPCS EDG at minimum allowable voltage and frequency.

Response

As explained in existing Note 19 to PNPP Updated Safety Analysis Report (USAR) Table 6.2-32, "Containment Isolation Valve Summary," the emergency core cooling system (ECCS) response time requirement is met when injection valves are partially open. For the HPCS injection valve (a gate valve), the flow rates credited in the ECCS analysis are achieved when the valve is partially open, at 80 percent of its overall stroke. With a calculated valve-wide-open stroke time of 16.5 seconds due to the HPCS EDG operating at minimum allowable voltage and frequency (see the results of RAI item 1), rated flow is passing through the valve within 13.2 seconds (16.5 seconds x 0.8) from the beginning of the valve stroke. The total time when the credited flow rate is reached, with a 13-second EDG start time plus a 13.2 second valve stroke to the 80 percent open position, is 26.2 seconds from the initiation of an accident signal. This 26.2 second time is less than the 29 second time delay from the initiating signal that is used as an input into the ECCS analyses.

¹ Note that the valve motors/actuators at PNPP, including those for the subject HPCS injection valve, are designed to provide appropriate torque and thrust from the actuator to open (and close) the valve at voltages significantly lower than the 3900V value specified as the minimum acceptable value for the diesel-generators. The valves are set up per the motor-operated valve (MOV) diagnostics program to withstand degraded voltage at the medium-voltage (4160V) busses down to 3730V; approximately ten percent (10%) below the normal 4160V that the electrical grid and emergency diesel-generators (EDGs) typically provide to these busses. Therefore a voltage of 3900V from an EDG provides more torque and thrust capabilities than required for the valves to perform their function.

3. Provide supporting documentation that shows how the HPCS valve stroke time has been validated.

Response

Valve testing has consistently shown that the HPCS injection valve strokes open more quickly than the calculated time listed in the USAR table, whether the test is performed under static (no flow) or dynamic (flow) conditions. The surveillance test procedures for this valve identify that its reference value in the open direction is 13.4 seconds, with an acceptable range from 11.4 seconds to 15.4 seconds. This valve has been stroke-time tested in the open direction 12 times since 2001²; three times by the motor-operated valve (MOV) diagnostics program, and nine times by the in-service test (IST) program. The slowest MOV program open stroke time since 2001 was measured at 13.06 seconds, taken from hand switch actuation until the valve actuator control switch stops the valve (rounded to the nearest hundredth). The slowest IST program open stroke time since 2001 was measured at 13.5 seconds, taken from control signal initiation to receipt of open position indication (rounded to the nearest tenth).

Dynamic flow conditions do not result in relevant changes in this valve's stroke time. Actual stroke times during dynamic tests performed on June 18, 1994, ranged from 12.840 to 12.895 seconds, as compared to a static test on May 25, 1994, of 12.821 seconds; a difference of less than a tenth of a second. PNPP engineers are not aware of any adverse impacts on valve opening stroke times under flowing conditions, either at PNPP or elsewhere in the industry.

4. Provide details on any plant procedures that allow operation of the HPCS EDG as a compensatory power source for other safety-related equipment during unavailability of Division 1 or Division 2 EDGs.

Response

Division 3 is electrically independent from Divisions 1 and 2. Due to design requirements to maintain divisional separation, there are no provisions for pre-aligning the Division 3 EDG to either Division 1 or 2 such that the Division 3 EDG could be credited prior to occurrence of an accident as an immediate-response power source for Division 1 or 2 safety-related equipment.

Procedures for response to accidents include limited provisions for manually re-aligning Division 3 to one of the other divisions subsequent to the start of an event, should the normally aligned EDG not respond. However, the brief valve stroke time increases due to EDG operation at TS minimum allowable values of voltage and frequency would be irrelevant when compared to the time required to manually align the EDG to one of the other electrical divisions.

REFERENCE

1. P. Pillay, "Practical Considerations in Applying Energy Efficient Motors in the Petro-Chemical Industry," IEEE, PCIC-95-21, September, 1995.

² This valve was refurbished and the stroke time reset by the MOV diagnostics program in 1999.