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10 CFR 54

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

SUBJECT:
Davis-Besse Nuclear Power Station, Unit No. 1
Docket No. 50-346, License Number NPF-3
Reply to Supplemental Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application, (TAC No. ME4613) Environmental Report Severe Accident Mitigation Alternatives Analysis

By letter dated August 27, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102450565), FirstEnergy Nuclear Operating Company (FENOC) submitted an application pursuant to Title 10 of the *Code of Federal Regulations*, Part 54 for renewal of Operating License NPF-3 for the Davis-Besse Nuclear Power Station, Unit No. 1 (DBNPS). During a telephone conference call on July 29, 2011, with Ms. Paula Cooper, Nuclear Regulatory Commission (NRC) Environmental Project Manager, the NRC discussed supplemental requests for additional information (RAIs) to clarify FENOC responses to the severe accident mitigation alternatives (SAMA) analysis RAIs submitted by FENOC letter dated June 24, 2011 (ADAMS Accession No. ML11180A233). FENOC agreed to submit responses to the NRC supplemental SAMA analysis RAIs discussed during the call.

The Attachment provides the FENOC response to the NRC supplemental RAIs. The NRC request is shown in bold text followed by the FENOC response.

A145
NRR

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Clifford I. Custer, Fleet License Renewal Project Manager, at 724-682-7139.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 1, 2011.

Sincerely,

Barry S. Allen

Barry S. Allen

Attachment:

Reply to Supplemental Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1 (DBNPS), License Renewal Application, Environmental Report, Attachment E, Severe Accident Mitigation Alternatives (SAMA) Analysis

cc: NRC DLR Project Manager
NRC DLR Environmental Project Manager
NRC Region III Administrator

cc: w/o Attachment or Enclosure
NRC DLR Director
NRR DORL Project Manager
NRC Resident Inspector
Utility Radiological Safety Board

Supplemental Question RAI 1.[d]

Clarify whether the scope of the 2008 "gap self assessment" included Level 2 as well as Level 1 internal events, and whether a review of internal flooding and the high winds hazard was performed.

SUPPLEMENTAL RESPONSE RAI 1.d

The 2008 gap self assessment

- included Level 2 as well as Level 1 internal events;
- did not include internal flooding; and,
- did not include high winds.

Supplemental Question RAI 4.b

Was the escalation factor for the updated analysis the same one as used originally, and if not what was it? Was transient population considered in the updated analysis?

SUPPLEMENTAL RESPONSE RAI 4.b

The population escalation factor used for the updated analysis (accounting for the Canadian population) is the same as was used for the original analysis.

Transient population (between 0-30 miles) was considered in the original analysis. The same transient population was considered in the updated analysis.

Supplemental Question RAI 5.b

Clarify which and how applicable SAMAs meet the intent of improving seismic capacity for the BWST. Address in your response the cited SAMAs (i.e., AC/DC-01, CC-10, and CW-09) and SAMA CC-19.

SUPPLEMENTAL RESPONSE RAI 5.b

SAMA candidate CC-10 considers providing an in-containment reactor water storage tank; this SAMA candidate would meet the intent of improving seismic capacity for the borated water storage tank (BWST) by providing a suction source to the injection pumps independent of the BWST.

SAMA candidates AC/DC-01 (provide additional DC battery capacity) and CW-09 (additional training on loss of component cooling water) are not related to the BWST. SAMA candidate CC-19 addresses switchover from the BWST to the containment sump, which does not meet the intent of improving seismic capacity.

Supplemental Question RAI 5.d

1. **Clarify whether the automatic actions that were identified and evaluated in the response to RAI 5.d.ii are the only candidates or meant to be representative of other possibilities. Clarify that further unevaluated potentially cost beneficial automating options do not remain.**

2. **Describe the PRA modeling assumptions used to calculate the SAMA benefits for AC/DC-[28R] and OT-08R similar to that shown in Table E.7-1 of the ER.**

SUPPLEMENTAL RESPONSE RAI 5.d

1. The following SAMA candidates evaluate automating operator actions. Only those SAMA candidates that were evaluated in detail are listed here; SAMA candidates that were screened (or subsumed, or already implemented) are not listed even if they considered automating operator actions.

    - AC/DC-14 (Table E.7-1) – makes the station blackout diesel generator and corresponding human failure event perfectly reliable.

    - AC/DC-25 (Table E.7-1) – provides dedicated DC power for auxiliary feedwater pump control and eliminates the need for local manual control.

- AC/DC-26 (Table E.7-1) – provides an alternator/generator driven by the auxiliary feedwater pumps to provide DC power for the auxiliary feedwater pumps and eliminates the need for local manual control.
- AC/DC-27 (Table E.7-1) – makes the human failure event to refuel the station blackout diesel generator fuel tank perfectly reliable.
- AC/DC-28R (RAI 5.d) – automatically starts and loads the station blackout diesel generator on Bus D2 upon loss of power to the bus.
- CC-19 (Table E.7-1) – makes the human failure events for switchover of high pressure injection and low pressure injection suction from the BWST to the containment sump for loss of coolant accidents perfectly reliable.
- CC-22R (RAI 7.d) – automates refill of the BWST.
- CW-26R (RAI 7.a) – automates reactor coolant pump trip on high motor bearing cooling temperature.
- FW-17R (RAI 7.e) – automates start of the motor-driven feedwater pump in the event the automated emergency feedwater system is unavailable.
- OT-08R (RAI 5.d) - automatically starts and loads the station blackout diesel generator on Bus D2 upon loss of power to the bus in combination with automatically starting the motor-driven feedwater pump.

As described in the FENOC response (ML11180A233) to RAI 5.c, internal events and large early release frequency (LERF) basic events (including human failure events) with a risk reduction worth (RRW) equal to or greater than the cost of a procedure change were identified and evaluated. Hardware modifications were also considered based on RRW values. This method was judged to identify all potentially cost-beneficial automating options.

2. The probabilistic risk assessment (PRA) modeling assumptions used to calculate the SAMA benefits for SAMA candidates AC/DC-28R and OT-08R are as follows:

   - SAMA candidate AC/DC-28R evaluates automatically starting and loading the Davis-Besse station blackout diesel generator on Bus D2 upon loss of power to the bus.

     A bounding assessment of the potential benefit of automatically starting the station blackout diesel generator and loading it on bus D2 upon loss of power to the bus was performed by removing the human action to start the station blackout diesel generator from the cutsets.

     Core damage frequency (CDF) = 8.17E-06/yr.

- SAMA candidate OT-08R evaluates automatically starting and loading the station blackout diesel generator on Bus D2 upon loss of power to the bus in combination with automatically starting the motor-driven feedwater pump.

  A bounding assessment of the potential benefit of automatically starting the station blackout diesel generator and loading it on bus D2 upon loss of power to the bus with automatically starting the motor-driven feedwater pump was performed by removing the human actions to start the station blackout diesel generator and motor-driven feedwater pump from the cutsets.

  CDF = 5.43E-06/yr.

Supplemental Question RAI 6.j

Provide the increased evacuation speed used in the Case E1 sensitivity analysis.

SUPPLEMENTAL RESPONSE RAI 6.j

The increased evacuation speed used in sensitivity case E1 (use a more realistic (higher) speed of evaluation (ESPEED)) is 1.0 meters/second.

Supplemental Question RAI 7.a - 7.f

Describe the PRA modeling assumptions used to calculate the SAMA benefit similar to that shown in Table E.7-1 of the ER.

SUPPLEMENTAL RESPONSE RAI 7.a - 7.f

7.a

A SAMA candidate (CW-26R) to provide an automatic reactor coolant pump trip on loss of cooling to the reactor coolant pump seal thermal barrier cooler and loss of seal injection flow was evaluated for Davis-Besse.

A bounding assessment of the potential benefit of automating a reactor coolant pump trip on high motor bearing cooling temperature or on a loss of cooling to the reactor coolant pump seal thermal barrier cooler and a loss of seal injection flow was performed

by making the operator action to trip the reactor coolant pumps on loss of seal cooling and injection perfectly reliable.

CDF = 7.50E-06/yr.

7.b

As described in the FENOC response (ML11180A233) to RAI 7.b, the Davis-Besse design and PRA already includes use of the Decay Heat Removal System as a suction source for high pressure injection. For cases in which reactor coolant system pressure is too high for adequate flow, the high pressure injection pumps can be aligned to take suction from the discharge of the decay heat removal pumps; this is possible with the BWST as the suction source or with the containment sump as the suction source.

7.c

As described in the FENOC response (ML11180A233) to RAI 7.c, this SAMA candidate considers automating high pressure injection on low pressurizer level following a loss of secondary side heat removal where Reactor Coolant System pressure remains high while level drops. This SAMA was a viable consideration for Three Mile Island (TMI) based on plant design and system configuration. At TMI, the High Pressure Injection System is also the makeup system – there is a single Makeup and Purification System that provides normal makeup as well as standby Engineered Safety Actuation Signal (ESAS)-selected pumps which automatically inject high-pressure water into the Reactor Coolant System from the BWST in mitigation of loss of coolant accident scenarios. In addition, as discussed in Volume 3 of the Babcock and Wilcox Emergency Operating Procedure Technical Basis Document (EOP TBD), (Chapter III.C, "Lack of Adequate Primary to Secondary Heat Transfer"), for all plants except Davis-Besse, high pressure injection cooling must not be intentionally delayed if feedwater is not available. High pressure injection cooling must be established in a timely manner to assure adequate core cooling; it must be started early enough to slow Reactor Coolant System inventory depletion so that high pressure injection cooling will match decay heat before the core is uncovered.

At Davis-Besse, however, the plant design and systems are different from those at TMI. Davis-Besse has a separate safety High Pressure Injection System in addition to the normally-operating makeup system. The Davis-Besse High Pressure Injection System is not capable of injecting water into the RCS until pressure reaches ~1600 psig. In addition, because Davis-Besse has two makeup pumps, makeup/high pressure injection cooling can be delayed until the core outlet temperature reaches 600°F provided the Reactor Coolant System pressure-temperature limit is not exceeded. Although the Davis-Besse PRA considers makeup/ high pressure injection cooling in response to a loss of feedwater, including the associated operator actions, automating this function was not considered because of the complexity associated with the number of options and systems involved (e.g., pumps, valves, and alignment options, injection line options, and bleed options). Consequently, this SAMA candidate was not considered for Davis-Besse.

7.d

A SAMA candidate (CC-22R) to provide an automatic refill of the BWST was evaluated for Davis-Besse.

A bounding assessment of the potential benefit of automating refill of the BWST was performed by making the operator action to refill the BWST perfectly reliable.

CDF = 9.76E-06/yr.

7.e

A SAMA candidate (FW-17R) to automatically start the auxiliary feedwater pump when the emergency feedwater system is unavailable was evaluated for Davis-Besse. Based on the Davis-Besse design, this SAMA was interpreted as automatically starting the motor-driven feedwater pump in the event both turbine-driven auxiliary feedwater pumps were not available.

A bounding assessment of the potential benefit of automating start of the motor-driven feedwater pump was performed by removing cutsets containing operator actions to start the motor-driven feedwater pump, thereby making the operator actions to start the motor-driven feedwater pump perfectly reliable.

CDF = 7.03E-06/yr.

7.f

A SAMA candidate (CB-22R) to use a "gagging" device that could be used to close a stuck-open steam generator safety valve for a steam generator tube rupture was evaluated for Davis-Besse.

A bounding assessment of the potential benefit of utilizing a "gagging device" on a stuck open main steam safety valve was performed by removing main steam safety valve failures to close from the cutsets.

CDF = 9.24E-06/yr.