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W3F1-2005-0058

October 20, 2005

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

Subject: NRC Bulletin 2003-01 Additional Information
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

By letter dated June 10, 2004, Entergy provided responses to requests for additional information (RAIs) to NRC Bulletin 2003-01, Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors for Waterford 3. On April 20, 2005, the NRC requested the following additional information. How will Entergy minimize risk associated with the emergency core cooling (ECCS) suction strainer clogging issue from now until the final implementation of Generic Safety Issue-191 corrective actions for Waterford 3? Specifically, describe the technical analysis resulting from the review of the WCAP-16204 eleven candidate operator actions (COAs) for each of the three plants. If actions will not be taken, give detailed reasons for that conclusion for each candidate operator action affected. If actions are considered to be applicable, when will they be implemented? This additional information is contained in the attachment.

There are no new commitments contained in this submittal. Should you have any questions concerning this submittal, please contact Greg Scott at (504) 739-6703.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 20, 2005.

Sincerely,

AJH/GCS/cbh

Attachment

A103

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Attachment to

W3F1-2005-0058

NRC Bulletin 2003-01 RAI

Waterford 3 Response

This response is applicable to Waterford 3 and is based on an implementation strategy for Revision 5.3 to CEN-152, Emergency Procedure Guidelines (EPG). NRC Bulletin 2003-01 identifies possible interim compensatory measures and, while other measures may also be acceptable, requires justification if any of the identified measures are not implemented. The measures suggested in the bulletin that pertain to Emergency Operating Procedures (EOP) and EPG coverage are:

- Operator training on indications of and responses to sump clogging.
- Procedural modifications, if appropriate, that would delay the switchover to sump recirculation.
- Ensuring the availability of alternate water sources to refill the Refueling Water Tank (RWT) or provide inventory for ECCS injection and containment spray (CS).

General guidance requirements imposed by Revision 5.3 of the EPGs related to possible interim compensatory measures include:

- Requirement to make preparation for early refill of the RWT (pre-recirculation actuation signal (RAS)).
- Requirement to plan for alternate Reactor Coolant System (RCS) injection.
- Requirement to monitor for Containment Sump blockage.
- Requirement to early terminate one train of CS and one train of high-pressure safety injection (HPSI).

Indications of degraded sump performance are currently considered to be indicative of scenarios beyond the design bases. This has the following two basic implications: 1) actions to mitigate degraded sump performance can be counter to actions prescribed for design bases scenarios if necessary and 2) actions specifically for sump degradation should not be performed until degradation symptoms are observed. Some actions may exist or be added that are within the design bases and provide a pre-emptive aspect that reduces the likelihood of sump degradation; however, no pre-emptive actions should be taken that are counter to the design bases without first verifying or modifying the design bases as necessary.

There are two general symptoms of sump blockage sufficient to degrade recirculation performance: sump level and pump cavitation. Sump level indication is provided both inside the sump screen and outside (containment floor level). Decreasing level inside the sump screen could be an indication of excessive blockage, especially if coupled with stable or increasing levels external to the screen. Signs of possible pump cavitation include parameters indicating erratic behavior such as fluctuating flow, discharge pressure or motor amps, or excessive pump vibrations. The point is, once actual pump degradation occurs, actions to mitigate the sump blockage and preserve pump operability must be taken promptly.

WCAP-16204 11 COAs

COA A1a – Secure one spray pump.
COA A1b – Secure both spray pumps.

Response: Waterford 3's position is to ensure these actions are taken when necessary rather than preemptively, as described in the EOPs.

The CEN-152 bases for this step states that the intent of this step is to secure unneeded CS pumps as early as possible after it has been confirmed that they have performed their safety function. The overall objective is to:

- Reduce the demand on the Refueling Water Storage Pool (RWSP),
- Delay the time to the start of containment recirculation during small breaks,
- Reduce the flow rate to the sump when containment recirculation begins,
- Reduce the pressure differential across the sump screens if there is a build up of debris.

This is a plant specific instruction. Each plant must consider the advantages and disadvantages as they apply to their plant specific design and incorporate this action if it is determined to be risk beneficial with respect to containment sump blockage.

In the early minutes following a Loss of Coolant Accident (LOCA), the operators are extremely busy responding to the event in accordance with their EOPs. The EOPs are used to verify the satisfactory control or restoration of critical safety functions and provide actions to restore and maintain those safety functions when degraded conditions exist. To avoid the risk of taking an incorrect action for an actual event, the EOPs do not prescribe contingency actions until symptoms that warrant those contingency actions are identified. The EOPs are written in such a way that the operator need not diagnose an event in order to establish and maintain a safe plant configuration. To be effective in delaying the switchover to containment sump recirculation, operator actions to stop one train of ECCS must be taken in the first few minutes of the accident. The human failure probability of achieving this action is high given the short action time available. Additionally, this action would introduce a significant opportunity for operator errors based on other actions that are required during this time frame. Any risk benefit achieved by the action would have to offset the additional risk introduced by the additional action during this critical time period. At best, the securing of one train of ECCS during a Large Break Loss of Coolant Accident (LBLOCA) prior to recirculation is considered to be risk neutral. More likely it would lead to an increase in the risk of operator error in performing other critical tasks.

Furthermore, upon receipt of a RAS, Low Pressure Safety Injection (LPSI) pumps automatically stop. Since normal CS flow is via the Shutdown Cooling Heat Exchanger (SDCHX) (and LPSI pumps are secured post-RAS), the Spray pumps provide a substantial means of decay heat removal during an accident post-RAS. The other means of decay heat removal is the containment fan coolers. The EOPs currently contain steps for Spray termination once it has been determined that the Spray system has adequately performed

its safety function. Assuming single failure on the running train, early termination of Spray may result in the safety function of CS not being completed. Procedure OP-902-002 (LOCA) allows CS to be terminated if the containment pressure is less than 16.4 psia and stable or lowering, RAS has not actuated, and CS is not needed for iodine removal.

COA A2 – Manually establish one train of containment sump recirculation prior to automatic actuation.

Response: Entergy has decided not to implement this COA. Although it would be possible to switch one train of HPSI and Spray to the sump early, the current design basis post-LOCA NPSH analysis has determined that the available margin is small. This margin is insufficient to provide for a timely and meaningful response. Furthermore, the hydraulic behavior of a single train aligned to the sump immediately upon switchover will not provide an indication of the sump performance with both trains several minutes later. In addition, there is an extensive operator burden involved during a design basis event. Manually aligning one ECCS train to sump recirculation requires several manual control component manipulations. This could be required early in a LOCA event while the operator is verifying proper ECCS component operations and responding to the event. This would introduce a greater opportunity for operator error and burden that could negatively affect accident mitigation. Manually aligning one ECCS train to sump recirculation places a burden on operators to make quick assessments of the break size and containment heat load needs before the RWSP draindown is completed. It also places a burden on the operators to conduct a successful manual transfer and shutdown of ECCS lineups. Consequently, the potential exists for decreased submerged sump screen area and a lack of NPSH margin due to a low volume of water in the containment.

Upon receipt of a RAS pre-trip annunciator (RWSP level less than 15%), the Annunciator Response Procedure (ARP) directs monitoring for proper ECCS pump operation (OP-500-009, ATT 4.67/4.77). The annunciator provides a cue to operations personnel who would then focus on pump performance prior to and post RAS. This focus would allow for early detection of possible sump blockage. This results in sump blockage monitoring before the RAS setpoint of 10% RWSP level. Additionally, an EOP step independent of the RAS pre-trip annunciator further directs monitoring of containment sump blockage. The procedure provides instructions for monitoring ECCS pump performance for containment sump blockage. HPSI pump discharge pressure, flow, motor amperage and pump noise are all monitored for indications of sump blockage. If sump blockage is detected through the monitoring of HPSI pump parameters, contingency actions are taken per the EOPs to secure one HPSI train. LPSI pump parameters are not monitored as they automatically secure upon a RAS.

COA A3 – Terminate one train of HPSI/high-head injection after recirculation alignment.

Response: Waterford 3's position is to ensure these actions are taken when necessary to protect equipment (i.e., actual sump blockage indication) rather than preemptively based upon the possibility that sump blockage may occur.

Concerning early termination of one train of HPSI/high-head injection after recirculation alignment, CEN-152 bases for this step states: The intent of this step is to permit securing one HPSI pump following RAS if two HPSI trains are not needed for core heat removal.

This action reduces the total ECCS flow through the containment sump screens in order to reduce debris buildup on the screens. It also establishes a protected train for use at a later time if needed. This instruction is applicable post-RAS only. It does not replace or alter the standard HPSI stop/throttle criteria which are available before and after RAS. This is a plant specific instruction. Each plant must consider the advantages and disadvantages as they apply to their plant specific design and incorporate this action in their EOPs if it is determined to be risk beneficial with respect to containment sump blockage.

As stated in the WCAP-16204, deliberate manual securing of one HPSI train is not considered a "failure." Thus, analysis is required to show acceptable consequences with a failure of the remaining running train after manually stopping one HPSI train. This would result in an interruption of core flow until the operator could start the standby HPSI pump. This could result in a significant increase in the fuel peak cladding temperature and consequently a significant increase in radiological dose to the public. Entergy believes that this negative impact outweighs the potential benefit of minimizing sump blockage. Therefore, stopping one HPSI pump is not risk beneficial due to the risk of core damage should a single failure of the one operating HPSI pump occur.

EOPs directs personnel to monitor for sump blockage, loss of suction and cavitation on HPSI pumps. Upon detection of indications of sump blockage, the EOPs direct early HPSI termination by verifying one train of HPSI is secured.

COA A4 – Early termination of one LPSI/RHR pump prior to recirculation alignment.

Response: Waterford's position is to ensure these actions are taken when necessary to protect equipment (i.e., actual sump blockage indication) rather than preemptively based upon the possibility that sump blockage may occur.

As stated in the WCAP-16204, deliberate manual securing of one LPSI/SDC train is not considered a "failure." Thus, analysis is required to show acceptable consequences with a failure of the remaining running train after manually stopping one LPSI/SDC train. This would result in an interruption of LPSI/SDC flow until the operator could start the standby LPSI/SDC pump. This could result in a significant increase in the fuel peak cladding temperature and consequently a significant increase in radiological dose to the public. Entergy believes that this negative impact outweighs the potential benefit of minimizing sump blockage. Therefore, stopping one LPSI pump is not risk beneficial due to the risk of core damage should a single failure of the one operating LPSI/SDC pump occur.

Furthermore, early termination of LPSI/SDC prior to recirculation alignment requires several manual control component manipulations. This would introduce a greater opportunity for operator error and burden that could negatively affect accident mitigation.

COA A5 – Refill of RWST.

Response: This is currently covered under the SAMGs.

COA A6 – Inject more than one RWSP volume from a refilled RWSP or by bypassing the RWSP.

Response: Injection of more than one volume of the RWSP would result in more water introduced into containment than assumed in Waterford 3's design basis. This injected volume of water would increase the flooding level which will adversely impact vital equipment in the containment building. However, injecting more than one RWSP volume from a refilled RWSP is currently addressed in the Waterford 3 SAMGs.

Current plant design does not allow for bypassing the RWSP.

COA A7 – Provide more aggressive cooldown and depressurization following a SBLOCA.

Response: Current EOPs expedite RCS cooldown by providing a floating step to initiate cooldown, which may be performed upon initial entry into the EOP. The maximum allowed cooldown rate is limited by technical specifications and is monitored using EOP OP-902-002.

The primary strategy of the SBLOCA EOP (OP-902-002) is to minimize primary break flow while performing a controlled cooldown (i.e., performed as rapidly as possible within Technical Specifications requirements). RCP NPSH requirements, if RCPs are running, are monitored by OP-902-009, Attachment 2. This results in maintaining RCS pressure low enough to minimize primary break flow, while allowing two RCPs to run, thereby aiding in core heat removal. On natural circulation, cooldown rates are half of forced circulation rates. This requires RCS pressure to be lowered during the cooldown, thereby minimizing primary break flow.

COA A8 – Provide guidance on symptoms and identification of containment sump blockage.

Response: Upon receipt of a RAS pre-trip annunciator (RWSP level 15%), the Annunciator Response Procedure, OP-500-009, Attachment 4.67/4.77, directs monitoring for sump blockage. This initiates sump blockage monitoring well before the RAS setpoint of 10% RWSP level. Additionally, an EOP (OP-902-002,) independent of the RAS pre-trip annunciator further directs monitoring of containment sump blockage.

The procedure provides instructions for monitoring for containment sump blockage. HPSI pump suction pressure, discharge pressure, flow, motor amperage, pump noise are all monitored for indications of sump blockage. LPSI pump parameters are not monitored as LPSI pumps automatically secure upon a RAS. If sump blockage is detected, contingency actions are taken per the EOPs to perform early HPSI termination (See COA A9 response).

If there are indications of a reduction in NPSH or pump performance, the operator reviews the parameter trends and attempts to diagnose what is happening (for example: an individual pump in distress, a valve or system component failure, or sump screen blockage). Accurate diagnosis of these occurrences under accident conditions is difficult and would require the operator to rely heavily on knowledge, experience, and training. None of the available indications would provide a 100% conclusive diagnosis.

COA A9 – Develop contingency actions in response to containment sump blockage, loss of suction, and cavitation.

Response: EOPs direct use of its procedure steps to monitor for sump blockage and for loss of suction or cavitation on HPSI pumps. Upon detection of indications of sump blockage, the EOPs direct early HPSI termination by verifying one train of HPSI is secured. CEN -152, Revision 5.3 provided the basis for actions delineated in the EOP.

COA A10 – Early termination of one train of HPSI/high-head injection prior to recirculation alignment.

Response: Waterford's position is to ensure these actions are taken when necessary to protect equipment (i.e., actual sump blockage indication) rather than preemptively based upon the possibility that sump blockage may occur.

As stated in the WCAP-16204, deliberate manual securing of one HPSI train is not considered a "failure." Thus, analysis is required to show acceptable consequences with a failure of the remaining running train after manually stopping one HPSI train. This would result in an interruption of core flow until the operator could start the standby HPSI pump. This could result in a significant increase in the fuel peak cladding temperature and consequently a significant increase in radiological dose to the public. Entergy believes that this negative impact outweighs the potential benefit of minimizing sump blockage. Therefore, stopping one HPSI pump is not risk beneficial due to the risk of core damage upon a single failure loss of the one operating HPSI pump.

Furthermore, early termination of HPSI prior to recirculation alignment requires a manual control component manipulation. This would introduce a greater opportunity for operator error and burden that could negatively affect accident mitigation.