Entergy

Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 501 858 5000

0CAN1000504

October 19, 2005

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

Subject: NRC Bulletin 2003-01 Additional Information
Arkansas Nuclear One – Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6

Dear Sir or Madam:

By letter dated August 31, 2005 (0CAN080502) 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 Arkansas Nuclear One (ANO). Subsequently, the NRC requested additional information that is provided in the attachment to this submittal.

There are no new commitments contained in this submittal. Should you have any questions concerning this submittal, please contact Ms. Natalie Mosher at (479) 858-4635.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 19, 2005.

Sincerely,

Dale E. James
Acting Director, Nuclear Safety Assurance

DEJ/hbm

Attachment

A103

cc: Dr. Bruce S. Mallett
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

U. S. Nuclear Regulatory Commission
Attn: Mr. Mohan Thadani
Mail Stop 0-7 D1
Washington, DC 20555-0001

U. S. Nuclear Regulatory Commission
Attn: Mr. Drew Holland
Mail Stop 0-7 D1
Washington, DC 20555-0001

Attachment to

0CAN100504

RAIs

ANO-1 RAIs

COA A1a and A1b (secure one or both spray pumps before recirculation actuation signal (RAS)) RAI: Does Entergy secure one or both spray pumps before RAS as a matter of procedure, or does the licensee secure spray pumps based on plant conditions, not necessarily before RAS? Entergy needs to discuss how the operators would decide whether and when to secure spray pumps in a loss-of-coolant accident (LOCA) situation.

ANO-1 does not secure either reactor building spray pump prior to sump recirculation. ANO-1 does not have an automatic transfer to the reactor building sump. This operation is performed manually from the control room when the borated water storage tank (BWST) level reaches 6 feet. The 6-foot level ensures an adequate volume of water is transferred to the sump before securing suction from the BWST. The emergency operating procedure (EOP) directs the throttling of reactor building spray flow to between 1050 and 1200 gpm per train prior to going on sump recirculation. Once sump transfer is performed the operators are directed by procedure to monitor for signs of sump blockage including fluctuating suction pressure, discharge pressure, flow, and motor amps. When sump blockage is detected the EOP requires one train of spray to be secured if there is indication of containment breach or both trains of spray secured if there is no indication of breach.

COA A6 (inject more than one RWST volume from a refilled RWST or by bypassing the RWST) RAI: Entergy needs to explain when and under what conditions it would inject a second BWST volume (refilled as discussed in COA A5), and from what sources and via what pathways/pumps operators could bypass the BWST and inject directly into the reactor coolant system (RCS). Please list of the water sources and pathways/pumps operators could use.

The ANO-1 Severe Accident Management guideline (SAMG) and EOP provide instructions for refilling the BWST as discussed in COA A5. Neither document provides specific guidance for when to inject additional recovered BWST volume into the RCS. The control room operators expect this guidance to come from the Technical Support Center (TSC) staff based upon plant conditions and needs at the time. The added inventory to the BWST can be injected using the low-pressure injection (LPI) pumps with suction transfer back to the BWST. OP-1104.004, *Decay Heat Removal Operating Procedure*, contains guidance for aligning an LPI pump back to the BWST.

By correspondence dated August 31, 2005 (0CAN080502), Entergy stated that ANO-1 SAMG Chapter III.D step 3.8.2 contains the following: Additional borated water sources available or can be made available for injection which include but are not limited too:

- BWST (T-3) any remaining inventory following suction transfer to the reactor building (RB) sump.
- Transfer any clean waste receiver tank (T-12s) inventory to the BWST or spent fuel pool (SFP).
- Batch boric acid and water additions to the BWST.
- Offsite sources of borated water delivered to the site and transferred to the BWST.

Unborated water may be added to the SFP from any excess condensate storage tank (CST) inventory or by the service water system to then provide additional diluted but still borated make-up to the BWST. As a last resort, pure unborated water can be provided to the BWST for injection by the LPI pumps.

The operators are very familiar with the pathways/pumps that would be used for these sources which would be determined at the time of the event.

A proceduralized method of adding inventory directly into the RCS, bypassing the BWST, is via normal makeup from the makeup tank (MUT). The MUT supplies a suction source to the makeup pumps (P-36A/B/C). The makeup pumps then inject into the RCS via one of nine pathways. There are four high pressure injection (HPI) lines, four seal injection lines, and one normal makeup control valve (this injects using an HPI line). Each HPI line can supply approximately 140 gpm. Each seal injection line typically supplies approximately 10 gpm to each reactor coolant pump (RCP). Normal makeup flow can supply approximately 160 gpm. Makeup to the MUT is demineralized water from the condensate transfer system with a flow rate to the MUT of approximately 120 gpm and boric acid pumps from the boric acid addition tank. The boric acid pumps can supply approximately 40gpm. SAMG Chapter III.A identifies the SFP as a source of water for injection into the RCS. The flow path can be to the BWST using a spent fuel cooling pump, or if the BWST is not available, using a spent fuel pump to the suction of an available LPI pump or the HPI system. Available SFP volume is limited due to siphon breakers on the suction line. Additional makeup to the SFP via condensate transfer or SW or fire water can then be supplied to the RCS via the previously described spent fuel connections.

COA A7 (provide more aggressive cooldown and depressurization following a small break LOCA) RAI: Although the important concept of "rapid cooldown" (at a rate near the TS limit) is discussed, it is only mentioned conditionally in terms of loss of sub-cooling margin, low HPI pump flow, indicated head voids and RCP trip timing. Other scenarios are discussed such as "OP ... (Forced Flow Cooldown) is written for a plant cooldown under LOCA conditions where SCM (sub-cooling margin) is adequate so normal rate limits would apply." This COA calls for operators to distinguish between "controlled" cooldowns and "rapid" cooldowns with the purpose of avoiding emergency sump recirculation altogether (going straight to shutdown cooling) for small to medium LOCAs. Entergy needs to answer whether the operators are trained in this important distinction and have procedures which allow/direct them to conduct rapid cooldowns post-LOCA when appropriate.

For ANO-1 the term "rapid cooldown" has a specific procedure-based meaning. A "rapid cooldown" is one that is performed at a rate faster than technical specification limits based upon the inability to maintain inventory and subcooling margin during a LOCA. This is a very special and specific case, and other cooldowns are performed within technical specification limits. ANO-1 operators are trained to perform all cooldowns as quickly as possible but within technical specifications limits. This includes normal as well as LOCA and post-transient cooldowns.

COA A8 (develop guidance on symptoms and identification of containment sump blockage) RAI: The licensee needs to provide detail on what is looked at by operators to make them aware of a developing sump clogging event (erratic current, erratic discharge flow, etc.) and how that information is used to diagnose the problem.

The EOP contains specific symptoms of sump blockage. The symptoms are lowering sump level and fluctuations in emergency core cooling system (ECCS) pump performance including erratic indication of suction and discharge pressure, flow, and amperage. Specific panel instruments are listed in the EOP along with identified Plant Monitoring System and Safety Parameter Display System computer points.

By correspondence dated June 10, 2004 (0CAN060402), Entergy stated that the operator training conducted at ANO consisted of a computer based training course which included a comprehensive discussion of the issue, a discussion of compensatory measures, symptoms of sump screen blockage, potential water sources, and pictures of specific instrument indications (e.g., for ANO-1: reactor building pressure, reactor building sump level, reactor building spray flow, and low-pressure injection (LPI) flow, and for ANO-2: high-pressure safety injection (HPSI) pressure, HPSI flow, containment spray pressure, containment spray flow, containment sump level, and containment flood level).

COA A9 (develop contingency actions in response to containment sump blockage, loss of suction and cavitation) RAI: Entergy needs to discuss the contingency actions which operators would take if the sump were to clog.

Upon indication of sump blockage, the EOP directs that in addition to securing one or both spray pumps (as discussed in response to A1a and A1b) that the suction flow path is re-verified and LPI flow is reduced to minimum allowed by design. Operator actions beyond those described in the EOP would be directed by the TSC utilizing SAMG guidance. If the sump were to clog, the SAMG would direct the TSC staff to consider such actions as injecting additional coolant into the RCS.

ANO-2 RAIs

COA A1a/COA A1b (secure one or both containment spray pumps before RAS) RAI: It is not clear that whether service water being dropped from the fan coolers and rerouted to the shutdown cooling heat exchanger after RAS will prevent the operators from performing their required pre-spray termination criterion determination "containment spray NOT required for decay heat removal following RAS actuation." Entergy provides extensive information on entry into shutdown cooling in their answer, but it is not understood why. Also, does Entergy secure one or both spray pumps before RAS as a matter of procedure, or does the licensee secure spray pumps based on plant conditions, not necessarily before RAS? Entergy needs to discuss how the operators would decide whether and when to secure spray pumps in a LOCA situation.

Service water remains aligned to the containment fan coolers during a RAS; therefore, spray termination criteria is not affected. Containment spray pumps are only secured based on plant conditions (i.e., normal spray termination criteria or indication of sump blockage).

COA A7 Provide more aggressive cooldown and depressurization following a small-break LOCA) RAI: Entergy talks in terms of a "controlled" rather than a "rapid" cooldown, just the opposite of the apparent intent of the COA. COA A7 is an operator training/terminological issue. Will operators, for small and medium break LOCAs, cooldown and depressurize rapidly (at or near the TS cooldown rate limit) or not?

The terms "controlled" and "rapid" are not defined for the ANO-2 EOPs; however, operators are trained to perform cooldowns associated with a small or medium break LOCAs as quickly as technical specifications allow.

COA A9 Develop contingency actions in response to containment sump blockage, loss of suction, and cavitation) RAI: Entergy only discusses complete termination of one train of core spray and HPSI. Entergy needs to discuss what operators would do in response to sump clogging. Is this information in CEN-152, Revision 5.3?

Operators would monitor for sump clogging, and if clogging is detected, they would secure one train of HPSI and containment spray by placing pumps in pull-to-lock. Operators would then continue to monitor for loss of HPSI and spray pump suction. If loss of pump suction is observed, then the operators would place the second containment spray pump in pull-to-lock and throttle HPSI injection to achieve maximum flow while minimizing cavitation. If adequate flow is unable to be achieved, then all HPSI pumps are placed in pull-to-lock. The TSC is notified anytime HPSI or spray pumps are placed in pull-to-lock in these steps. CEN-152, Revision 5.3 was used as input to the latest EOP revision. Operator actions beyond those described in the EOP would be directed by the TSC utilizing SAMG guidance. If the sump were to clog, the SAMG directs the TSC staff to consider such actions as injecting additional coolant into the RCS.