



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 28, 2014

Vice President, Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNITS 1 AND 2 – UPDATE REGARDING AUDIT
ACTIVITIES ASSOCIATED WITH ORDER EA-12-049 (MITIGATION
STRATEGIES) (TAC NOS. MF0942 AND MF0943)

Dear Sir or Madam:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A735), the U.S. Nuclear Regulatory Commission (NRC) ordered Entergy Operations, Inc. (Entergy, the licensee) to take certain actions at Arkansas Nuclear One, Units 1 (ANO-1) and 2 (ANO-2), associated with the Fukushima Near-Term Task Force Recommendations. Order EA-12-049 directed that actions be taken by licensees to develop and implement strategies to maintain or restore core cooling, reactor coolant system (RCS) inventory, containment cooling, and spent fuel pool cooling capabilities during beyond-design-basis external events (BDBEE).

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A151), Entergy submitted an Overall Integrated Plan (OIP) for ANO-1 and ANO-2, in response to Order EA-12-049. By letters dated August 28, 2013 and February 27, 2014 (ADAMS Accession Nos. ML13241A414 and ML14059A229), Entergy submitted six-month updates to the OIP. By letter dated April 8, 2014 (ADAMS Accession No. ML14098A114), Entergy requested relief for implementing the requirements of Order EA-12-049 at ANO-1, based on modification schedules at ANO-2, to support the planned mitigation strategies for both units. The NRC staff approved the requested relief by letter dated May 20, 2014 (ADAMS Accession No. ML14114A697). The relief extends the ANO-1 full implementation date for a period of approximately eight months beyond the original required compliance date.

By letter dated February 25, 2014 (ADAMS Accession No. ML14098A114), the NRC staff issued an interim staff evaluation (ISE) for the OIP submitted by Entergy for ANO-1 and ANO-2. The proposed Diverse and Flexible Mitigation Capability (FLEX) strategy for ANO-1 and ANO-2 includes the deployment of a portable diesel generator (FLEX DG) that will be connected to the existing plant electrical distribution system for each unit. This will allow the energizing of selected loads in the distribution system to implement the FLEX strategy, such as critical instrumentation and battery chargers. The FLEX DG will also power the ANO-2 charging pumps to provide RCS makeup for both units. The proposed use of the plant installed ANO-2 charging pumps for RCS makeup during the transition phase of the BDBEE, as opposed to portable equipment, is considered an alternative to the NRC-endorsed guidance in the Nuclear Energy Institute (NEI) document, NEI 12-06, Rev. 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" dated August 21, 2012 (ADAMS Accession No. ML12242A378).

The ISE identified Open Item 3.2.1.D regarding the RCS makeup strategy described in the licensee's first six-month update, and during the audit process, as follows:

The NRC staff has reviewed the ANO approach that uses the Unit 2 charging pump to supply makeup to the Unit 1 RCS for inventory control but has not concluded that this approach is acceptable. The staff has identified a number of concerns that need to be addressed regarding the proposed RCS inventory control strategy. Therefore, this open item tracks completion of the development of an acceptable integrated RCS makeup strategy that meets the requirements of Order EA-12-049.

The following concerns were noted in the ISE: (1) reliability of the strategy, considering operational human factors implications when using installed plant equipment and operators from one unit to respond to events at the other, or both, unit(s), (2) the feasibility and flexibility of the makeup strategy, should one unit enter an extended loss of all alternating current (ac) power (ELAP) conditions at a time offset from the other unit, (3) licensing implications of the proposed strategy for a potential circumstance where ANO-1 is in an ELAP condition and ANO-2 is not, and (4) with respect to using installed charging pumps as a proposed alternative to NEI 12-06, whether the approach provides an equivalent level of flexibility for responding to an undefined event as would be provided through conformance with NEI 12-06.

The NRC staff has considered additional information in the course of the ANO mitigating strategies audit process with regard to the concerns listed above associated with Open Item 3.2.1.D as described below:

(1) Reliability of the strategy, considering operational human factors implications when using installed plant equipment and operators from one unit to respond to events at the other, or both, unit(s).

The licensee is installing direct connections for the FLEX DG to two separate, diverse safety related electrical switchgear, as well as a new piping cross-tie and piping tie-ins, to facilitate RCS makeup to ANO-1 from the ANO-2 charging pumps. The proposed alternate strategy relies only on the deployment of the FLEX DG and the alignment of cross-connects and cross-ties to provide RCS makeup to either or both units, as required, during a BDBEE. The pre-installed electrical connections and piping cross-ties simplify the operator actions required to initiate RCS makeup as compared to the actions associated with the installation of a large portable pump and more extensive temporary cables and piping/hoses. Therefore, the proposed alternate strategy reduces the number and complexity of operator actions to establish RCS makeup during a BDBEE.

The ANO-1 and ANO-2 control rooms are located adjacent to each other. During the audit process, after the issuance of the ISE, the NRC staff travelled to the ANO site and was able to observe the control room layout and communications to verify that the licensee's assertions regarding inter-unit communications appear to be feasible. According to the licensee, operators interface regularly with the opposite unit's control room for activities such as operating shared systems and outage activities. In addition, the operator keys for both units are common, allowing the use of keys for one unit to support the other unit for activities such as operating

locked-closed valves to implement the FLEX charging pump strategy. During the audit process the licensee stated that the necessary operator training on the inter-unit strategy would be incorporated into initial and continuing training to assure that the strategy is reliable for as long as the requirements of the order are applicable. In addition, the licensee indicated that the strategy will be guided by written instructions, thus helping to assure a low probability of human performance errors. Therefore, the NRC staff has reasonable assurance that inter-unit coordination, as described in the licensee's mitigation strategies plan, could be reliably accomplished.

(2) The feasibility and flexibility of the makeup strategy, should one unit enter ELAP conditions at a time offset from the other unit:

The differences in reactor design between ANO-1 and ANO-2 result in the need for RCS makeup early in the BDBEE for ANO-1, but much later for ANO-2. ANO-2 has three charging pumps available for normal makeup to RCS inventory. None of the three charging pumps are credited to respond during design-basis accident conditions and one pump can be unavailable without impacting the normal function of the system per the ANO-2 Technical Requirements Manual (TRM). Early in the BDBEE one ANO-2 charging pump will be dedicated to supply RCS makeup as required to ANO-1 while the remaining 2 charging pumps are available for normal RCS makeup for ANO-2. If both units are simultaneously impacted by the BDBEE, a single charging pump can meet the RCS makeup requirements for both ANO-1 and ANO-2.

Should ANO-2 enter ELAP while ANO-1 is only in a loss of all offsite power, ANO-1 would have the normally designated RCS makeup capacity available for that unit. ANO-2 has sufficient volume in the safety injection tanks to accomplish RCS cooldown without a pump injection source. During the audit process, the licensee provided an operational evaluation that showed that should either unit enter ELAP conditions at a time offset from the other unit, less limiting timing considerations would result, and thus the inter-unit strategy does not introduce a safety concern in those scenarios. The NRC staff reviewed the operational evaluation and concluded that it supports a reasonable assurance determination for the success of the overall strategy.

(3) Licensing implications of the proposed strategy for a potential circumstance where ANO-1 is in an ELAP condition and ANO-2 is not:

During the audit process, the licensee provided further information regarding the ANO-2 charging pumps. These pumps are not Technical Specification (TS) required or controlled equipment and are not credited for design-basis accident mitigation. While they are not TS-required and their flow is not credited, the diesel loading calculations conservatively assume the pumps are running for a design-basis accident. Thus, their potential use across units does not introduce a licensing conflict in a scenario where one unit is in an ELAP and the other is not. The charging pumps are controlled in the licensee maintained ANO-2 TRM. The ANO-2 TRM requires that at least 2 charging pumps be Functional in Modes 1, 2, 3 and 4, with an allowed unavailability time of 72 hours when only 1 charging pump is Functional. The boric acid makeup tanks, the borated water source for the charging pumps, are also controlled in the TRM and not the TSs, with similar 72 hour unavailability requirements

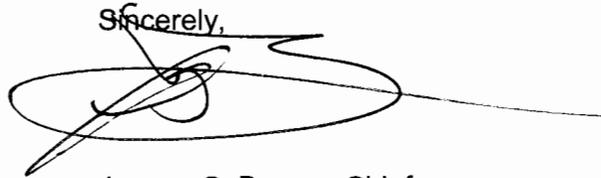
associated with a minimum volume. Therefore, designation of a charging pump to provide RCS make-up to ANO-1, with the unit in ELAP while ANO-2 is not, is consistent with the ANO-2 licensing basis.

(4) With respect to using installed charging pumps as a proposed alternative to NEI 12-06, whether the approach provides an equivalent level of flexibility for responding to an undefined event as would be provided through conformance with NEI 12-06:

Section 3.2.2, Guideline (13) of NEI 12-06 states that, “[r]egardless of installed coping capability, all plants will include the ability to use portable pumps to provide RPV[reactor pressure vessel]/RCS/SG[steam generator] makeup as a means to provide a diverse capability beyond installed equipment.” The licensee proposes an alternative to this guidance. The licensee maintains that use of a designated ANO-2 charging pump provides sufficient flexibility in that none of the 3 charging pumps are credited for accident mitigation and modifications will be installed to accommodate a direct power connection to a FLEX DG as well as modifications to cross-connect flow between ANO-1 and ANO-2. In this way, the proposed alternative achieves the flexibility intended in the guidance and complies with the requirements of Order EA-12-049. During a site visit to ANO as part of the audit process, the NRC staff was able to observe, in detail, the licensee’s proposed layout for the electrical modifications that will support the charging pump strategy. This included a review of the proposed connection locations, building penetration locations, and proposed and existing equipment locations. This review provided the NRC staff with reasonable assurance that the overall strategy has an equivalent level of flexibility for responding to an undefined event as would be provided through conformance with NEI 12-06.

Based on the information resulting from the supplemental and ongoing audit of ANO's implementation of Order EA-12-049, as discussed above and in the ISE, the NRC staff concludes that the licensee has provided sufficient information to determine that there is reasonable assurance that the plan, when properly implemented, will meet the requirements of Order EA-12-049 at ANO-1 and ANO-2. This conclusion is contingent upon the successful completion of the items described in Entergy's letter dated April 8, 2014, regarding the implementation schedule for order compliance at ANO-1. Further review of ISE Open Item 3.2.1.D will continue during the remainder of the audit phase to ensure that the implementation steps continue to be developed consistent with the NRC's current understanding of the mitigating strategies plan for ANO-1 and ANO-2. If you have any questions, please contact John Hughey, Mitigating Strategies Project Manager, at 301-415-3204, or at john.hughey@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jeremy S. Bowen', is written over a large, horizontal, oval-shaped scribble. A thin horizontal line extends to the right from the end of the signature.

Jeremy S. Bowen, Chief
Mitigating Strategies Projects Branch
Mitigating Strategies Directorate
Office of Nuclear Reactor Regulation

Docket Nos. 50-313 and 50-368

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Sincerely,

/RA/

Jeremy S. Bowen, Chief
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Mitigating Strategies Directorate
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JHughey, NRR/MSD

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OFFICE	NRR/MSD/PM	NRR/DORL/PM	NRR/MSD/LA
NAME	JHughey	PBamford (w/comments)	SLent
DATE	05/27/14	05/21/14	05/27/14
OFFICE	NRR/MSD/MESB/BC	NRR/MSD/SA	NRR/MSD/MSPB/BC
NAME	SBailey (w/comments)	EBowman	JBowen
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