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2CAN091401

September 24, 2014

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

SUBJECT: Response to Request for Additional Information
Containment Building Emergency Escape Air Lock Testing and Exemption from Certain Requirements of 10 CFR 50, Appendix J
Arkansas Nuclear One, Unit 2
Docket No. 50-368
License No. NPF-6

Dear Sir or Madam:

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.90, Entergy Operations, Inc. (Entergy) submitted a request for an amendment to the Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specifications (TS) to revise the local leak test requirements for the Containment Building Emergency Escape Air Lock doors (Reference 1). The Reference 1 amendment request also included a request for exemption from certain requirements of 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors." The Reference 1 request was supplemented by Entergy on March 17, 2014 (Reference 2), to include reference to exemption criterion 10 CFR 50.12(a)(2)(ii) (compliance not required to achieve underlying purpose of the rule), consistent with an amendment approved previously by the NRC for the Palisades Nuclear Power station.

By letter dated August 11, 2014 (Reference 3), the NRC issued a Request for Additional Information (RAI) associated with the subject Entergy amendment and exemption request. Entergy responses to the RAI questions are included in Attachment 1 of this letter.

Additional information, as detailed in this letter, with respect to the original Entergy requests (References 1 and 2) has been reviewed and Entergy has determined that the information does not invalidate the no significant hazards consideration (NSHC) discussed in the Reference 1 and 2 letters.

In accordance with 10 CFR 50.91(b)(1), a copy of this letter and the reasoned analysis about NSHC is being provided to the designated Arkansas state official.

There are no additional commitments included in this letter.

If you have any questions or require additional information, please contact Stephenie Pyle at 479-858-4704.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on September 24, 2014.

Sincerely,

ORIGINAL SIGNED BY JEREMY G. BROWNING

JGB/dbb

Attachment: Response to Request for Additional Information – Escape Hatch Seal Contact Check

REFERENCES:

1. Entergy letter dated January 21, 2014, License Amendment Request – *Containment Building Emergency Escape Air Lock Testing and Exemption from Certain Requirements of 10 CFR 50, Appendix J* (2CAN011402, ML14021A085)

2. Entergy letter dated March 17, 2014, License Amendment Request Supplemental – *Containment Building Emergency Escape Air Lock Testing and Exemption from Certain Requirements of 10 CFR 50, Appendix J* (2CAN031402, ML14077A139)

3. NRC letter dated August 11, 2014, *Request for Additional Information Regarding License Amendment and Exemption Requests for Changes to Emergency Escape Air Lock Testing,* (2CNA081402, ML14218A602)

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Attachment to

2CAN091401

Response to Request for Additional Information

Escape Hatch Seal Contact Check

Response to Request for Additional Information

Escape Hatch Seal Contact Check

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By letter dated August 11, 2014 (Reference 3), the NRC issued a Request for Additional Information (RAI) associated with the subject Entergy amendment and exemption request. The NRC questions and Entergy responses are included below.

RAI-1: Overall Air Lock Test

In the submittal dated March 17, 2014, the licensee stated that the overall air lock leak rate tests had been shown to be effective (e.g., third paragraph on page 7 of the attachment). Regarding these successful tests, please provide the following information:

(a) The typical test configuration in terms of whether the strong back is used with the air lock barrel or not.

(b) The directions of the forces applied to the seals by the air lock barrel pressure and/or the strong back. In addition, specify if the direction is the same as the one that would occur during a postulated loss of coolant accident.

(c) The pressures applied during the air lock pressure test.

Response

(a) Because both doors open inward toward the Containment Building, applying pressure to the air lock barrel (area between the two doors) places force on the inner door (the door in contact with the Containment Building atmosphere) in the opposite direction of accident forces, contrary to air lock design. Therefore, a strong back must be utilized on the Containment Building side of the inner door to prevent the door from being blown open during pressurization of the barrel. No strong back is required on the outer door during the barrel test since pressures are applied in the accident (design) direction. No strong back is applied to either door during performance of the door seal checks and Integrated Leak Rate Testing (ILRT) of the Containment Building, which provides evidence that the air lock remains sufficiently sealed.

(b) Pressure applied to the outer door during the barrel test is in the same direction as that postulated during an accident. The barrel pressure, per design, also acts to further seat the door against both the seals and the frame, simulating maximum accident conditions. During the barrel test, pressure is also applied to the inner door. However, the pressure is in the opening direction of the door (opposite direction of accident pressure). The inner door is not designed to withstand pressure forces in the direction in which the door opens. This is clearly stated in the vendor technical manual and, therefore, the strong back test clamp is required to be installed on the inner door prior to testing. Applying pressure without a strong back installed on the inner door would damage the door and its latching mechanism, resulting in substantial leakage. Therefore, by design, a strong back must be installed on the inner door, which acts to hold the inner door closed, prior to performance of the barrel test.

No strong backs are utilized on either door during performance of the ILRT. The ILRT pressurizes the Containment Building, applying pressure to the inner door in the accident direction. The barrel and outer door would experience pressure forces only if the inner door seals exhibited some amount of leakage. If both doors were considered leak tight, the inner door remains effectively pressure tested via the ILRT and the outer door via the barrel test.

Normal plant design requires two barriers to limit leakage from the Containment Building. Because the air lock includes four barriers (two seals on each door, all in series), the combination of the barrel test, seal contact checks, and the ILRT are sufficient to ensure leakage will be minimized.

(c) In accordance with ANO-2 TS 6.5.16, the air lock leak rate test must be performed at greater than or equal to P_a (design Containment Building accident pressure). The TS defines P_a as being 58 psig. The leak test procedure specifies a test pressure of 59 psig with a minimum pressure of 58.6 psig and maximum pressure of 61.5 psig).

RAI-2: Between-the-Seals-Test

Regarding the between-the-seals tests:

(a) Please provide details about the test protocol that describe how the test pressure was supplied/applied.

(b) Please justify why the test pressure was applied in the opposite direction of accident pressure (see fourth paragraph on page 5 of the attachment to the letter dated March 17, 2014).

(c) Please explain whether the applied pressure in the between-the-seals-test would "lift" the door open or off its sealing surface leading to leakage.

(d) Please summarize the efforts (investigations, modifications, maintenance) in terms of seal design, seal material, seal shape, seal operation conditions, door modifications, test methods etc. that have been considered or conducted to resolve the failure of between-the-seals pressure test cases. Also, please include a description of other gasket materials/profiles that may have been considered that could be qualified for the application that might form a better sealing joint (and more set resistant) without the need for strongbacks.

Response

(a) ANO uses a mass flowmeter to measure the door seal leakage. The leak rate test procedure states that the outlet (pressurization) valve is to be opened slowly to pressurize the test connection (door seals). Leak rate test protocol requires that the outlet pressure to be stable prior to recording leak rate data. Informational observations during initial pressurization of the door seals have identified leakage occurring at pressures much lower than the 10 psig test pressure. These observations supported vendor input that the existing door design is not suitable for a consistently successful door seal pressure test. Formal testing at alternative lower pressure is not performed.

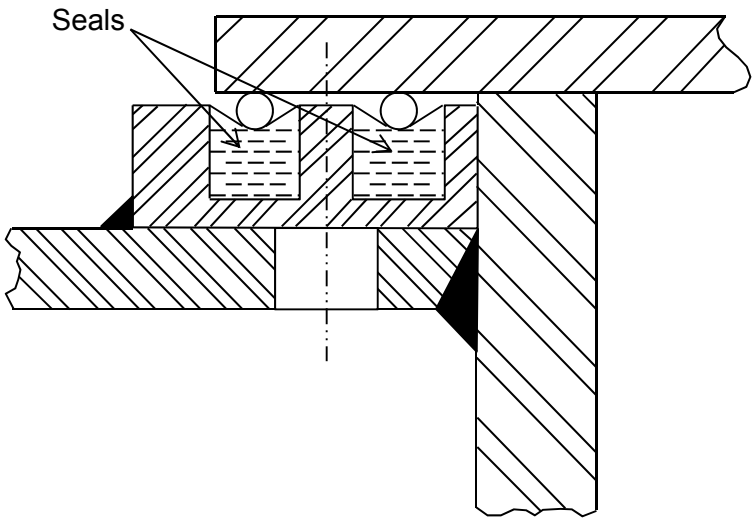
(b) The between-the-seals pressure test is limited by the door design and configuration of the seals. Since the seals are implanted into the stationary bulkhead frame, applying test pressure between the seals will act to push the door away from the stationary bulkhead and lift the door off of its contact position with the seals. Thus the design configuration does not present other options for performing between-the-seals testing such that forces would not be applied in the opposite direction of accident pressures.

(c) The response to RAI-2(b) above describes the airlock design and the testing limitations that result in the between-the-seals test acting to push the door open, i.e., lift the door from its sealed position. The airlock doors are designed with a two point locking configuration to hold the doors in position. The two locking pins (located at 0° and 180°) are not designed to ensure doors are sealed with a force equivalent to accident pressure. These locking pins are designed to ensure the doors are in position and contacting the seals with limited sealing forces. Additional sealing forces are applied to the inner door as Containment Building pressure increases following accident initiation. If the inner door is postulated to leak during an accident, the airlock barrel would pressurize and provide additional sealing forces to the outer door.

The locking pin has been readjusted (with vendor oversight) on more than one occasion in the recent past in an attempt to apply the closing torque necessary to support a successful between-the-seals test. Inconsistent test results from the between-the-seal test indicate the test leads to leakage by applying forces in the direction to “lift” the door from its seating contact with the seals. Adjusting the locking pins to increase the door closing torque intended to improve test results, in turn, increases the force required to open the door for emergency egress significantly. Making the door more difficult to open is contrary to maintaining the airlock safety function for permitting personnel escape from the Containment Building during an emergency situation. The increased torque can lead to locking pin damage and can result in a jammed door.

(d) As stated in the previous submittals, the seal material currently in use is an ethylene-propylene-diamine-monomer (EPDM), which is the vendor recommended and qualified material. The seals are a square cross-section shape design formed in a continuous circle to fit the bulk head frame seal channel. By design of the channel, the seal shape is limited. In addition, each door is designed with a “nose/sealing bar” that provides a continuous protrusion into the flat-faced seal for improved sealing contact (see diagram below). These features prevent seal design changes without extensive changes to the design and hardware of the hatch. The vendor has documented that the sealing limitations of the airlock design is related to the 2-pin latching configuration. Specifically,

the vendor has stated in design proposals that the “current design is a direct drive with very little mechanical advantage to seal the doors to allow any reasonable test pressure to be applied between the seals without the use of strong backs.”



As a result of the original design limitations, the modifications recommended were extensive. For example, a complete change-out of the inner and outer bulkhead and door assemblies would be required to support incorporating an “O” ring seal design with a 3-pin latching configuration. Based on vendor information, the “O” ring seal design is superior to the flat seal profile design. Consideration was also given to a gear reduction design for the opening and closing mechanism. While this option would improve the ability to increase sealing forces, there is insufficient evidence as to whether such a modification would ensure future success with respect to between-the-seal pressure testing.

The following maintenance/modification related activities have been performed over the past recent years:

1. Increased door to seal contact by adjusting door settings
2. Designed a torque amplifying device to assist in opening / closing the door due to increasing the contact pressures
3. Replaced door seals every refueling outage
4. Upgraded door locking bolt compression springs to allow for additional closing forces with improved ability to open the doors
5. Replaced locking bolt brackets and pins
6. Obtained vendor support and expertise to maintain and adjust the door for optimum performance

More extensive modifications considered include the following (or a combination thereof): 1) bulkhead replacement, 2) gearbox replacement, and 3) door replacement with four-dog design.

Test methods have included the use and non-use of a strong back to hold the door in place, substantial maintenance/modification as described above, increasing closing torque, and informational observation of pressure and air flow response during the initial pressurization phase of the test. No single effort was identified that would ensure consistent successful leak rate testing.

RAI-3: Seal Contact Check

In Section 2.2 of the attachment to the letter dated March 17, 2014, the licensee stated that the seal contact check method had been incorporated into and practiced through maintenance procedures. Please provide the information or historical records (if available) that can show the effectiveness of seal contact check on the overall air lock full pressure leak test (i.e. provide information that shows how performance of seal contact check led to a successful full pressure leak test).

Response

The seal contact check is performed per Work Plan 2411.029, "Emergency Air Lock Inspection, Lubrication, and Chalk Test." The procedure requires hatch leak testing as dictated by the TSs following completion of the seal contact check. The following table provides leak test results following seal contact checks over the past few refueling outages. The results indicate that performance of the seal contact check is instrumental in the successful completion of subsequent leak testing. Numerical values are leak rate results in standard cubic centimeters per minute (sccm).

Outage	Barrel Test	Barrel Leakrate Admin Limit	Outer Door Seals	Inner Door Seals	Door Leakrate Admin Limit
2R19 Spring 2008	220	3000	10	15	200
2R20 Fall 2009	1030	3000	2	5	200
2R21 Spring 2011	1550	3000	0	1	1628
2R22 Fall 2012	1026	3000	0	5	1628
2R23 Spring 2014	486	3000	21	35	1628

RAI-4: Strongback

According to the licensee (attachment to the letter dated March 17, 2014, Section 3.0), NRC violations have been cited relating to the use of a strongback during air lock door testing as potential test pre-conditioning. Also, according to the licensee (Attachment to letter dated March 17, 2014, Section 2.1), pressure testing without the strongback is beyond the approved vendor technical manual instructions. Please clarify whether the strongback will be used in future door leak testing.

Response

The strong back will only be used on the inner door during the barrel test, as required by design. Performance of the barrel test without use of the strong back on the inner door could result in catastrophic failure of the door since test pressure is being supplied in the opposite direction intended for the door function. A strong back is not, and has not, been required for the outer door to support the barrel test. For between-the-seals testing, excessive closing force will continue to be applied, at the risk of damaging door mechanisms and inhibiting personnel emergency egress, to support successful test results (i.e., a strong back is no longer used for between-the-seals testing).

RAI-5: Escape Hatch

Please provide a description of historical escape hatch usage. Specifically, please clarify whether the escape hatches been operated such that they are only opened to allow emergency egress or to allow maintenance or testing of the hatch itself. Please provide an estimate of how often the escape hatches been used (opened) when containment integrity was required during the past 10 years (accurate enough count to determine never/rarely/often).

Response

The Escape Hatch is not used for normal or routine access during an outage. Opening only occurs to support testing and maintenance activities during refueling outages when Containment Building integrity is not required (Containment Building closure capability, however, is maintained). Because the seals are replaced each refueling outage, door openings will occur to support seal replacement and adjustment until proper seating is achieved and a successful contact check is completed. Obtaining a successful as-left between-the-seals pressure test of each door has resulted in additional door openings. Absent the between-the-seals test, the hatch would be closed following the seal contact check and the barrel test performed. Upon successful completion of the barrel test, the doors would normally be maintained closed until the next refueling outage.

A review of the Station Log over the past 10 years indicated no opening of either Escape Hatch door when Containment Integrity was required since performance of the Escape Hatch leak rate in fall 2009. Prior to this, hatch leak rates may have been performed mid-cycle during periods when Containment Integrity was required. This practice was ceased in 2009 due to unnecessary challenge to Containment Integrity.

RAI-6: Escape Hatch Door Seal Pressure Test

Section 4.0 of the attachment to the letter dated March 17, 2014, states, in part:

> On rare occasions, minor modifications accompanied with significant maintenance efforts have resulted in successful performance of the as-left between-the-seals test; however, the following as-found tests grossly failed, even at low test pressures of approximately 12 psig [pounds per square inch gauge].

Given that the TS currently specifies testing the seals at a minimum pressure of 10 psig, please identify whether lower pressures were tried that would allow for repeatable determination of satisfactory seal "bead" and gasket contact; something that would be more definitive/quantitative than a more qualitative chalk/ink contact line visual inspection.

Response

As stated in response to RAI 2(a) above, informational observations during initial pressurization of the door seals have identified leakage occurring at pressures much lower than the 10 psig test pressure. These observations supported vendor input that the existing door design is not suitable for a consistently successful door seal pressure test. Formal testing at alternative lower pressure is not performed.

7.0 REFERENCES

1. Entergy letter dated January 21, 2014, License Amendment Request – *Containment Building Emergency Escape Air Lock Testing and Exemption from Certain Requirements of 10 CFR 50, Appendix J* (2CAN011402, ML14021A085)

2. Entergy letter dated March 17, 2014, License Amendment Request Supplemental – *Containment Building Emergency Escape Air Lock Testing and Exemption from Certain Requirements of 10 CFR 50, Appendix J* (2CAN031402, ML14077A139)

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