Question

RAI B.1.17-1 (External Surfaces Monitoring)

Background

During its onsite audit, the staff walked down portions of the diesel generator building and noted that the air intake plenums, under normal operating conditions, draw outside air directly into the diesel generator rooms, without any conditioning of the ambient air. This is also represented on LRA Drawing PID-22-07A, "HVAC Diesel Generators."

LRA Table 3.0-1, "Service Environments for Mechanical Aging Management Reviews," states that the River Bend environment of "air-indoor" corresponds to "air-indoor uncontrolled" in the GALL Report. GALL Report Section IX.D, "Environments," defines "air-indoor uncontrolled" as an environment with temperatures higher than dew point (i.e., condensation can occur, but only rarely) and "air –outdoor" as an environment consisting of moist, possibly salt laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation.

NRC Standard Review Plan for License Renewal Applications (SRP-LR), Sections 3.2.2.2.3.2, 3.2.2.2.6, 3.3.2.2.3, 3.3.2.2.5, 3.4.2.2.2, and 3.4.2.2.3 discuss the possibility of aging effects extending to stainless steel components exposed to air "which has recently been introduced into buildings (i.e., components near intake vents)." The corresponding LRA sections state that there are no indoor stainless steel components located near unducted air intakes in engineered safety features, auxiliary, or steam and power conversion systems.

Issue

For in scope components in the diesel generator building (e.g., items in LRA Tables 3.3.2 10, "Standby Diesel Generator," 3.3.2 11, "HPCS Diesel Generator," 3.3.2 18 12, "Standby Diesel Generator System Nonsafety Related Components Affecting Safety Related Systems," 3.3.2 18 13, "HPCS Diesel Generator System Nonsafety Related Components Affecting Safety Related Systems," 3.3.2 17, "Fuel Oil System"), it is unclear to the staff why the air environment in this building is considered "air indoor" given that, under normal operating conditions, outdoor air is drawn directly into the diesel generator rooms. Other than being protected from exposure to weather, components in these systems appear to be exposed to an environment where condensation from humid air can occur relatively frequently, contaminants from cooling tower treatment chemicals may be present, and chlorides from atmospheric air may be present. The staff notes that some materials exposed to air-indoor will have no aging effects requiring management whereas these materials will have aging effects requiring management (e.g., loss of material for stainless steel, aluminum; cracking for stainless steel) for exposure to air which has recently been introduced into buildings.

In addition, based on the staff's walkdown of the diesel generator building during its onsite audit, it is unclear to the staff how the applicant determined that the indoor stainless steel components are not located near unducted air intakes as stated in LRA Sections 3.2.2.2.3.2, 3.2.2.2.6, 3.3.2.2.3, 3.3.2.2.5, 3.4.2.2.2, and 3.4.2.2.3. It is also unclear to the staff if there are ducted air intakes which could result in stainless steel components located inside buildings being exposed to outdoor air.

Request

1. Provide information that establishes the "air-indoor" environment cited for components inside the diesel generator building for the LRA tables discussed above. Include information that addresses normal operating conditions, where outdoor air is drawn directly into the diesel generator rooms and its impact on whether condensation occurs on components more than rarely, as described in the corresponding definition of the GALL Report.

2. In light of the staff's observation during its walkdown of the diesel generator building, provide information that establishes there are no indoor stainless steel components located near ducted or unducted air intakes in engineered safety features, auxiliary, or steam and power conversion systems. Include information that addresses the associated sections of SRP-LR regarding components exposed to air that has been recently introduced into buildings.

Response

Note: A previous response to RAI B.1.17-1 was submitted by letter RBG-47834, dated March 8, 2018. Due to subsequent discussion between NRC and Entergy personnel, the response is revised, superseding in its entirety the previous response submitted by letter RBG-47834.

1. The external surfaces of stainless steel components within the diesel generator building are exposed to air recently introduced into the building. Outdoor air travels upward through horizontally mounted screens before entering ventilation air intake plenums through vertically mounted dampers. The dampers include 0.5-inch wire mesh screens. Air then enters the diesel rooms through horizontal openings in the bottom of the intake plenum. Exposure to precipitation is the primary difference between air-indoor and air-outdoor environments. The intake air path precludes precipitation from affecting components in the building.

   Condensation is an external environment conservatively cited in the LRA for service water components (carbon steel) within the diesel generator building because those components can operate at temperature below the dew point. However, condensation has rarely been observed on components in the building. Based on this operating experience, the introduction of outdoor air into the building has minimal, if any, effect on the degree of condensation.

   Because condensation is rarely expected, precluding significant loss of material of stainless steel and aluminum components and cracking of stainless steel components, and the path that air must travel to enter the diesel generator building precludes precipitation from affecting components in the building, an indoor air environment is appropriate.

2. LRA Sections 3.2.2.2.3, 3.2.2.2.6, 3.3.2.2.3, 3.3.2.2.5, 3.4.2.2.2, and 3.4.2.2.3 are revised to conservatively delete the statement that no stainless steel components are located near unducted air intakes.

   Numerous stainless steel components included in the LRA are exposed to outdoor air, including accumulators, filter housings, flow elements, piping, tubing, and valves, among others. These components are included in auxiliary systems and steam and power conversion systems with cracking as an applicable aging effect; however, after being in service for over 30 years, cracking has not been observed. Operating experience review did not reveal failures or concerns related to stress corrosion cracking (SCC) of stainless steel components due to contaminants in outdoor air within auxiliary systems or steam and power conversion systems. (Engineered safety features systems have no components exposed to outdoor air.)

   As described in NUREG-1800, Rev. 2, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)*, applicable air environments that could initiate SCC or loss of material due to pitting and crevice corrosion in stainless steel components include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. Although most of the criteria cited in the SRP-LR do not apply to River Bend Station, sufficient data is not available to determine based solely on the environment that SCC will not occur during the period of extended operation.

The possibility exists for SCC and loss of material due to pitting and crevice corrosion of stainless steel components exposed to air recently introduced into a building, as opposed to air within air-conditioned buildings, where these aging effects are not experienced. However, it is reasonable to conclude that stainless steel components located indoors are less susceptible to aging effects than those exposed to an outdoor environment. Consequently, a surface examination will be performed in accordance with the One-Time Inspection Program on stainless steel components externally exposed to outdoor air to verify SCC is not occurring on stainless steel components exposed to indoor air, even if the air has been recently introduced into a building. In addition, a visual examination will be performed in accordance with the One-Time Inspection Program on stainless steel components externally exposed to outdoor air to verify loss of material is not occurring on stainless steel components exposed to indoor air, even if the air has been recently introduced into a building.

A one-time visual inspection of components exposed to outdoor air will also include aluminum components. This will confirm that loss of material is not occurring on aluminum components exposed to indoor air, even if the air is recently introduced into a building.

Stainless steel and aluminum components exposed to indoor air are not identified in the LRA as having aging effects requiring management, which is consistent with NUREG-1801, Revision 2. For stainless steel and aluminum components such as those in the diesel generator building, indoor air is the appropriate external environment as described above. Assigning an outdoor air environment to components located indoors is not deemed appropriate because they do not experience the harsher environment of outdoor components, and attributing the aging effects of cracking and loss of material to stainless steel components or loss of material to aluminum components exposed to indoor air would be inconsistent with NUREG-1801. Rather than identifying aging effects inconsistent with NUREG-1801 in the Section 3 LRA tables, the potential for SCC and loss of material for stainless steel components and for loss of material for aluminum components exposed to outdoor air recently introduced into a building will be assessed through a one-time inspection of outdoor components in accordance with the One-Time Inspection Program.

Changes to the LRA follow with additions underlined and deletions lined through.

3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. This paragraph in NUREG-1800 pertains to loss of material due to pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. Although this paragraph is referenced only by a PWR table line (V.D1.E-01) in NUREG-1801, it could also apply to BWR plants. However, the ESF systems at RBS do not include partially encased stainless steel tanks exposed to this environment. Therefore, this paragraph is not applicable.

2. Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Chloride contamination of components exposed to outdoor air may occur. However, at RBS there are no ESF system

components exposed to outdoor air in the scope of license renewal. ~~At RBS, there are no stainless steel ESF system components located indoors near unducted air intakes.~~ The One-Time Inspection Program uses visual examinations of aluminum and stainless steel components externally exposed to outdoor air to verify loss of material of aluminum and stainless steel components exposed to air recently introduced into a building is not occurring.

3.2.2.2.6 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. However, at RBS there are no ESF system components exposed to outdoor air in the scope of license renewal. ~~At RBS, there are no stainless steel ESF system components located indoors near unducted air intakes.~~ The One-Time Inspection Program uses NDE surface examinations of stainless steel components externally exposed to outdoor air to verify cracking of stainless steel components exposed to air recently introduced into a building is not occurring.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. ~~There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.~~The One-Time Inspection Program uses NDE surface examinations of stainless steel components externally exposed to outdoor air to verify cracking of stainless steel components exposed to air recently introduced into a building is not occurring.

3.3.2.2.5 Loss of Material due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801, loss of material for stainless steel components exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. ~~There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.~~ The One-Time Inspection Program uses visual examinations of aluminum and stainless steel components externally exposed to outdoor air to verify loss of material of aluminum and stainless steel components exposed to air recently introduced into a building is not occurring.

3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. ~~There are no stainless steel steam and power conversion system components in the scope of license renewal that are located indoors near unducted air intakes.~~ The One-Time Inspection program uses NDE surface examinations of components externally exposed to outdoor air to confirm that cracking of stainless steel components exposed to air recently introduced into a building is not occurring.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801, loss of material for stainless steel components exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. ~~There are no stainless steel steam and power conversion system components in the scope of license renewal that are located indoors near unducted air intakes.~~ The One-Time Inspection Program uses visual examinations of stainless steel components externally exposed to outdoor air to verify loss of material of stainless steel components exposed to air recently introduced into a building is not occurring. There are no aluminum components exposed to indoor air in steam and power conversion systems.

A.1.32 One-Time Inspection

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of internal and external surfaces of RCIC piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of stainless steel component external surfaces exposed to outdoor air	A one-time surface examination will confirm that cracking of components externally exposed to air recently introduced into a building is not occurring.
A representative sample of stainless steel component external	A one-time visual examination will confirm that loss of material of components externally exposed to air

surfaces exposed to outdoor air	recently introduced into a building is not occurring.
A representative sample of aluminum component external surfaces exposed to outdoor air	A one-time visual examination will confirm that loss of material of components externally exposed to air recently introduced into a building is not occurring.

B.1.32 ONE-TIME INSPECTION

Program Description

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of internal and external surfaces of RCIC piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of stainless steel component external surfaces exposed to outdoor air	A one-time surface examination will confirm that cracking of components externally exposed to air recently introduced into a building is not occurring.
A representative sample of stainless steel component external surfaces exposed to outdoor air	A one-time visual examination will confirm that loss of material of components externally exposed to air recently introduced into a building is not occurring.
A representative sample of aluminum component external surfaces exposed to outdoor air	A one-time visual examination will confirm that loss of material of components externally exposed to air recently introduced into a building is not occurring.