

**ST. LUCIE NUCLEAR PLANT, UNITS 1 AND 2
SUBSEQUENT LICENSE RENEWAL APPLICATION (SLRA)
REQUESTS FOR ADDITIONAL INFORMATION
(External Surfaces & Selective Leaching)**

SAFETY REVIEW

RAI B.2.3.23-1

Regulatory Basis

Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

Background

SLRA Table 3.3.2-4, “Diesel Generators and Support Systems – Summary of Aging Management Evaluation,” states the external surfaces of copper alloy with greater than 15 percent zinc heat exchanger radiator tubes exposed to air-indoor uncontrolled will be managed for reduction of heat transfer and cracking using the external surfaces monitoring of mechanical components program.

The staff recently became aware of operating experience at St. Lucie for an emergency diesel generator (EDG) radiator leak that occurred in June 2022. The cause of the leak was dezincification on the external surfaces of yellow brass EDG radiator tubes, which are exposed to an air – indoor uncontrolled environment. According to the NRC Resident Inspector, site personnel considered the leak to be a functional failure.

A subsequent review of historical operating experience by the NRC staff identified EDG radiator tube leaks in May and June of 2001 (Ref Licensee Event Report 335/2001-006 (ML012050195)). Although the radiator tube designs have been modified to eliminate the original soldered mechanical tube joints that had failed, the event report noted that corrosion of the radiator cooling fins was due to “humid salt-laden” air. The staff notes that the environment descriptions in SLRA Table 3.0-1 only includes salt-laden air for “Air – outdoor” and not for “Air indoor uncontrolled.”

Issue

The air environment in the EDG rooms appears to be a more aggressive environment based on the presence of salt-laden air. Based on the air environment classification as “air-indoor uncontrolled,” the staff seeks clarification for whether different aging management activities are warranted for this potentially more aggressive air environment and, if so, whether other locations in the plant are similarly exposed to a comparable environment.

Request

Provide information regarding the need to adjust any aging management activities as a result of the potentially more aggressive air environment within the EDG rooms and whether other rooms would be similarly exposed to a comparable environment.

RAI B.2.3.23-2

Regulatory Basis

Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

Background

SLRA Section B.2.3.23 includes enhancements to the external surfaces monitoring of mechanical components program to conduct periodic visual inspections or surface examinations on components made from various materials, including copper alloy with greater than 15 percent zinc. SLRA Table 3.3.2-4, "Diesel Generators and Support Systems – Summary of Aging Management Evaluation," credits the above program for managing cracking due to the external air environment of the emergency diesel generator (EDG) radiator tubes.

As part of the operating experience information associated with the recent EDG radiator leak at St. Lucie, NRC regional inspectors provided an Imperia Engineering Partners report, "Failure Analysis of 1B2 EDG Radiator," Revision 0, July 2022. Section 4.4 of the report notes that neither visual nor mechanical detection methods are useful in detecting the selective leaching observed in the radiator tubes due to inaccessibility. The report also notes that there was no report of seepage or slow leakage prior to the rapid leak of the radiator tube and that the tube ultimately failed by cracking due to overload.

Issue

Although the Imperia report's statement about inaccessibility only addressed the detection of selective leaching, the NRC staff believes it is comparably applicable to the detection of cracking of the EDG radiator tubes that are addressed in SLRA Table 3.3.2-4. Based on the apparent inaccessibility to the tube surface, it is also not clear how 20 percent of the radiator tube surface area can be either visually inspected or surface examined for cracking, as provided in an enhancement to the associated aging management program.

Request

Provide information regarding the ability to detect cracking of the EDG radiator tubes given the inaccessibility of the tube surfaces, using currently proposed enhancements to the external surfaces monitoring of mechanical components for surface examinations or ASME Code Section XI VT-1 inspections. In addition, for the EDG radiator tubes, provide the bases for conducting aging management activities to detect cracking on a 10-year frequency, given that the recent tube leaks occurred with less than 10 years of operation.

RAI B.2.3.21-3

Regulatory Basis

Section 54.21(a)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the U.S. Nuclear Regulatory Commission (NRC) staff must make to issue a renewed license (10 CFR 54.29(a)) is that actions have been identified and have been or will be taken with respect to managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under 10 CFR 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis. In order to complete its review and enable making a finding under 10 CFR 54.29(a), the staff requires additional information in regard to the matters described below.

Background

SLRA Table 3.3.2-4, "Diesel Generators and Support Systems – Summary of Aging Management Evaluation," states the external surfaces of copper alloy with greater than 15 percent zinc heat exchanger radiator tubes exposed to air-indoor uncontrolled will be managed for reduction of heat transfer and cracking using the external surfaces monitoring of mechanical components program. The staff notes that the external surfaces of the subject components are not being managed for loss of material due to selective leaching.

SLRA Section B.2.3.21, "Selective Leaching," states the following (in part):

"[t]he PSL Selective Leaching AMP [aging management program] includes inspections of components made of gray cast iron, ductile iron, and copper alloys (except for inhibited brass) that contain greater than 15% Zn or greater than 8% Aluminum exposed to a raw water, closed-cycle cooling water, treated water, waste water, soil, or groundwater environment."

The staff recently became aware of operating experience at St. Lucie for an emergency diesel generator (EDG) radiator leak that occurred in June 2022. The cause of the leak was dezincification on the external surfaces of yellow brass EDG radiator tubes, which are exposed to an air-indoor uncontrolled environment.

Issue

Based on its review of the SLRA, the staff noted loss of material due to selective leaching is being managed for components exposed to water or soil environments. However, based on the operating experience noted above, the staff seeks clarification with respect to why loss of material due to selective leaching is not being managed for copper alloy with greater than 15 percent zinc components exposed to air-indoor uncontrolled or more aggressive air

environments (i.e., air-outdoor and condensation). The staff's issue is not applicable to less aggressive air environments (i.e., air-indoor controlled and air-dry).

Request

1. Provide any additional clarifying information with respect to the operating experience noted above and revise the SLRA (as appropriate).
2. State the basis for why loss of material due to selective leaching is not an aging effect requiring management for copper alloy with greater than 15 percent zinc components exposed to air-indoor uncontrolled, air-outdoor, or condensation environments. Alternatively, revise the SLRA (as appropriate) to reflect that the subject components will be managed for loss of material due to selective leaching.