Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 54

December 8, 2010
3F1210-03

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

Subject: Crystal River Unit 3 – Response to Request for Additional Information for the Review of the Crystal River Unit 3, Nuclear Generating Plant, License Renewal Application (TAC NO. ME0274) and Amendment #15

References: (1) CR-3 to NRC letter, 3F1208-01, dated December 16, 2008, "Crystal River Unit 3 – Application for Renewal of Operating License"

(2) NRC to CR-3 letter, dated November 8, 2010, "Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC NO. ME0274)"

Dear Sir:

On December 16, 2008, Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc. (PEF), requested renewal of the operating license for Crystal River Unit 3 (CR-3) to extend the term of its operating license an additional 20 years beyond the current expiration date (Reference 1). Subsequently, the Nuclear Regulatory Commission (NRC), by letter dated November 8, 2010, provided a request for additional information (RAI) concerning the CR-3 License Renewal Application (Reference 2). Enclosure 1 to this letter provides the response to Reference 2. Enclosure 2 to this letter contains Amendment #15 to the CR-3 License Renewal Application.

No new regulatory commitments are contained in this submittal.

If you have any questions regarding this submittal, please contact Mr. Mike Heath, Supervisor, License Renewal, at (910) 457-3487, e-mail at mike.heath@pgnmail.com.

Sincerely,

Jon A. Franke
Vice President
Crystal River Unit 3

JAF/dwh

Enclosures: 1. Response to Request for Additional Information
2. Amendment 15 Changes to the License Renewal Application

xc: NRC CR-3 Project Manager
NRC License Renewal Project Manager
NRC Regional Administrator, Region II
Senior Resident Inspector

A04D
NRR

STATE OF FLORIDA

COUNTY OF CITRUS

Jon A. Franke states that he is the Vice President, Crystal River Nuclear Plant for Florida Power Corporation, doing business as Progress Energy Florida, Inc.; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

Jon A. Franke
Vice President
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 8th day of December, 2010, by Jon A. Franke.

Carolyn E Portmann

Signature of Notary Public
State of Florida

CAROLYN E. PORTMANN
Commission # DD 937553
Expires March 1, 2014
Bonded Thru Troy Fain Insurance 800-385-7019

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ENCLOSURE 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

REQUEST FOR ADDITIONAL INFORMATION

RAI B.2.22-3

Background:

Given that there have been a number of recent industry events involving leakage from buried or underground piping, the staff required further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping and Tanks Inspection Program. By letter dated July 8, 2010, the staff issued RAI B.2.22-2 requesting that the applicant provide information regarding how Crystal River Unit 3 Nuclear Generating Plant (CR-3) will incorporate the recent industry operating experience into its aging management reviews and programs. The applicant responded on August 9, 2010. In reviewing the response, the staff determined that additional information is required.

Issue:

1. The staff requires further details on leaks that have occurred in the fire protection buried piping and corrosion at the ground to air interface to fully understand plant-specific operating experience at the station. The staff noted that in the first paragraph of the response to Request 1 of RAI B.2.22-2, the applicant separately discussed two instances of buried piping that was damaged during excavations. It is not clear to the staff whether these are two separate or a single instance of damage.

2. Beyond stating that a minimum of one inspection of buried fire protection piping will occur every ten years, the license renewal application (LRA) and supplemental material did not contain enough specifics on the planned inspections for the staff to determine if the inspections would be adequate to manage the aging effect for all material, safety/code class, and potential to contain hazardous material (i.e., material which, if released, could be detrimental to the environment such as diesel fuel and radioisotopes that exceed U.S. Environmental Protection Agency (EPA) drinking water standards) categories of in-scope buried pipes and tanks.

3. The staff does not have enough information to conclude if the condensate storage tank, emergency feedwater tanks, or the buried emergency feedwater or condensate piping contain tritium above the EPA drinking water limit. Given the degraded condition of the cathodic protection system for the emergency feedwater and condensate system, the staff believes that augmented inspections might be appropriate if the piping contains hazardous material.

4. The RAI response did not state the as-found condition of backfill observed during recent buried piping inspections.

5. The LRA and response to the RAI does not provide the staff enough information to determine:

   a. If buried in-scope fuel oil piping is cathodically protected.

b. What amount of degradation could have occurred during the period beginning 2004 when cathodic protection for condensate system and emergency feedwater system was not maintained.

c. If the short length of piping from the Condensate Storage Tank to the Turbine Building is cathodically protected and if it has a safety-related function.

6. In relation to the nuclear services and decay heat sea water system which is either under water or buried 30 feet below grade:

   a. The staff believes that in instances where it is not possible to expose the program designated length of piping during each inspection, an alternative examination should be proposed. The staff is not aware of a method other than ultrasonic examination that would be effective at providing a reasonable assurance that the buried piping would meet its current licensing basis function(s).

   b. Based on the RAI response it does not appear that the steel piping portions of the nuclear services and decay heat sea water system is cathodically protected.

7. The RAI response to RAI B.2.22-2 states in the discussion on the emergency feedwater/condensate system that this system includes some stainless steel associated with the interfacing piping in these systems; however, the staff noted that there does not appear to be any stainless steel aging management review (AMR) line items in the condensate system and emergency feedwater system tables.

8. It is not clear to the staff (a) how often the buried fuel oil storage tanks are subjected to internal ultrasonic inspections, (b) how an internal visual inspection can be used to evaluate the external conditions of the tank material, (c) how an internal visual inspection can be used to evaluate the condition of the external coatings on the tank, and (d) how ultrasonic tests of the tank heads and lower shells provides sufficient information to evaluate the condition of all external surfaces of the tank.

9. The LRA does not contain details on the availability of the cathodic protection system, and what periodic testing is conducted on the cathodic protection system. The staff believes that cathodic protection is an important preventive measure for steel piping.

Request:

1. State the cause(s) of the buried fire protection piping leaks described in response to RAI B.2.22-2. State the material of the piping, coating condition and cause of the leak at the ground to air interface. State whether the two instances of buried piping that was damaged during excavations are two separate or a single instance of damage and the basis for why the evaluation concluded that this damage occurred during excavation.

2. For buried in-scope piping, respond to the following:

   a. State the minimum number of excavated direct visual inspections of buried in-scope piping which will be conducted during the 30-40, 40-50, and 50-60 year operating periods. When describing the minimum number of inspections, differentiate between material, code/safety-related piping, and potential to contain hazardous material category piping inspection quantities of buried in-scope piping.

b. For the minimum number of planned inspections, state the length of piping that will be excavated and that will have a direct visual inspection conducted.

3. State whether the condensate storage tank, emergency feedwater tanks, or the buried emergency feedwater or condensate piping contain tritium above the EPA drinking water limit. If buried portions of the systems contain hazardous material, state what percent of total linear feet of buried in-scope piping will be inspected by excavation and direct inspection during each 10-year period starting 10 years prior to the period of extended operation. If there are no planned inspections for this piping, justify why it is acceptable to not inspect in-scope buried pipe containing hazardous materials.

4. State the as-found condition of backfill observed during recent buried pipe inspections. If the inspections detected the presence of rocks and sharp objects in the backfill around buried pipes justify why the minimum inspections are adequate to detect potential pipe degradation as a result of coating damage or holidays, or damage to the exterior surface of non-coated piping.

5. For buried in-scope piping, respond to the following:

   a. State whether the fuel oil piping is protected by cathodic protection. If this piping is not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

   b. Given (a) that the cathodic protection system for the condensate and emergency feedwater system buried piping was not being regularly monitored and maintained since 2004, (b) troubleshooting is ongoing and the cathodic protection system is not yet fully restored, and (c) even though some inspections have been conducted, coating degradation or holidays can be randomly distributed, justify how the minimum design wall thickness will be maintained throughout the period of extended operation including the projected amount of degradation that could have occurred during this period.

   c. State whether the short length of piping from the condensate storage tank to the Turbine Building is cathodically protected and if it has a safety-related function. If this piping is not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

6. In relation to the nuclear services and decay heat sea water system buried piping which is either under water or buried 30 feet below grade, respond to the following:

   a. If alternative volumetric examination methods, beyond ultrasonic examinations, will be used for conducting an interior wall thickness measurement, justify why they will be effective at providing a reasonable assurance that the buried in-scope piping systems will meet their current licensing basis function and state what percentage of interior axial length of the pipe will be inspected during each inspection.

b. If the buried steel portions of this system are not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

7. Identify the AMR line item that includes the stainless steel, associated with the interfacing piping in the emergency feedwater/condensate system.

8. For the buried in-scope fuel oil storage tanks:

   a. State how often each of the buried fuel oil storage tanks are subjected to internal ultrasonic inspections.

   b. Justify how an internal visual inspection can be used to evaluate the external conditions of the tank material.

   c. Justify how an internal visual inspection can be used to evaluate the condition of the external coatings on the tank.

   d. Justify how ultrasonic tests of the tank heads and lower shells provide sufficient information to evaluate the condition of all external surfaces of the tank.

9. In relation to the cathodic protection system:

   a. State the availability of the cathodic protection system, and if portions of the system are not available 90 percent of the time or will be allowed to be out of service for greater than 90 days in any given year, justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.

   b. State whether annual ground potential surveys of the cathodic protection system are conducted and what acceptance criteria is used, or if annual ground potential surveys are not conducted, justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.

Response:

The nine sections of this Request for Additional Information (RAI) are answered in turn below. The text of each request item is repeated prior to the associated response.

<u>Request:</u>

1. State the cause(s) of the buried fire protection piping leaks described in response to RAI B.2.22-2. State the material of the piping, coating condition and cause of the leak at the ground to air interface. State whether the two instances of buried piping that was damaged during excavations are two separate or a single instance of damage and the basis for why the evaluation concluded that this damage occurred during excavation.

<u>Response:</u>

The failure of the buried fire protection piping referenced in the CR-3 LRA Appendix B description of the Buried Piping and Tanks Inspection Program was associated with a section of uncoated PVC piping that failed due to heavy equipment loading. As noted in the LRA discussion, this failure was determined not to be caused by age related degradation.

The instance of corrosion at the ground to air interface discussed in the response to RAI B.2.22-2 was associated with a carbon steel line attached to the Condensate Storage Tank and was detected by an external (visual) examination of the area in question. The corrosion was at the point where the buried (coated) portion of the piping emerged from the ground and transitioned to painted piping. The corrosion was caused by localized wetted conditions and inadequate coating at the point the piping entered the ground. Corrective action consisted of cleaning the corrosion down to bare metal, verifying adequate wall thickness, and applying rust preventive coating. There was no leakage associated with this event.

The discussion of piping damaged during excavation pertains to a single incident, in which an out of scope demineralized water line was damaged during the excavation of an adjacent Emergency Feedwater line. The conclusion that the damage was caused by the excavation was based on first hand observation. Apart from the physical damage directly resulting from the excavation, the coatings and base metal on the damaged line were inspected and found to be in excellent condition. The associated focused inspection of the Emergency Feedwater line also identified no degradation of the piping or protective coating.

<u>Request:</u>

2. For buried in-scope piping, respond to the following:

   a. State the minimum number of excavated direct visual inspections of buried in-scope piping which will be conducted during the 30 – 40, 40 – 50, and 50 – 60 year operating periods. When describing the minimum number of inspections, differentiate between material, code/safety-related piping, and potential to contain hazardous material category piping inspection quantities of buried in-scope piping.

   b. For the minimum number of planned inspections, state the length of piping that will be excavated and that will have a direct visual inspection conducted.

<u>Response:</u>

a. CR-3 will perform inspections consistent with the recommendations of NUREG-1801, draft Revision 2. An exception is noted with regard to inspections of the Nuclear Services and Decay Heat Seawater intake conduits, as discussed in the response to *item 6 of this RAI, below. The planned inspection schedule for buried in-scope piping during the last 10 years of the current license period and through the period of extended operation, is provided in the table appended to this response. Note that CR-3 may substitute internal non-destructive examinations or pressure testing for direct visual inspections as described in Program Description XI.M34, Item 4.b.x, of NUREG-1801, draft Revision 2.*

The substitution of alternative methods for detection of aging effects is an exception to the Buried Piping and Tanks program description in NUREG-1801, Volume 2, Section XI.M34, Revision 1. LRA Subsections A.1.1.20 and B.2.20 will be revised to reflect these changes. Refer to Enclosure 2 of this letter for a discussion of the specific changes made to the LRA.

b. See response to Item 2.a, above.

CR-3 Buried Piping Inspection Schedule

System	Mat'l	Code ?	Safety Related ?	Haz Mat ?	Cath. Prot. ?	GALL Prev. Action Cat.	Length of Buried Piping (Approx.)	30 - 40 Yr Inspections	40 - 50 Yr Inspections	50 - 60 Yr Inspections
Condensate	Carbon Steel	N	N **	Y***	Y	D	450	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length
	Carbon Steel	N	N	Y***	N	E	20	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length
Emergency Feedwater	Carbon Steel	Y	Y	Y***	Y	D	1000	At least 1 focused inspection, with at least 20 feet aggregate length	At least 1 focused inspection, with at least 20 feet aggregate length	At least 1 focused inspection, with at least 20 feet aggregate length
Fire Protection	Cast Iron	N	N	N	N	F	3300	Opportunistic Inspections, system monitoring per 4.b.ix	Opportunistic Inspections, system monitoring per 4.b.ix	Opportunistic Inspections, system monitoring per 4.b.ix
Fuel Oil	Carbon Steel	Y	Y	Y	Y	D	220	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length	At least 1 focused inspection, with at least 10 feet aggregate length
Nuclear Services and Decay Heat Seawater	Cast Iron	Y	Y	N	N	F	600	At least 1 focused inspection, with at least 25% aggregate length	At least 1 focused inspection, with at least 25% aggregate length	At least 1 focused inspection, with at least 25% aggregate length

Notes:

* *CR-3 may substitute internal non-destructive examinations or pressure testing for direct visual inspections as described in Program Description XI.M41, Item 4.b.x, of NUREG-1801, draft Revision 2.*

** *Although this piping is not safety related, it will be treated as safety related for the purposes of defining the inspection schedule.*

*** *Initially treated as hazardous material. Inspection schedule may be revised per NUREG-1801, draft Revision 2, upon verifying tritium levels below EPA drinking water limits.*

Request:

3. State whether the condensate storage tank, emergency feedwater tanks, or the buried emergency feedwater or condensate piping contain tritium above the EPA drinking water limit. If buried portions of the systems contain hazardous material, state what percent of total linear feet of buried in-scope piping will be inspected by excavation and direct inspection during each ten year period starting ten years prior to the period of extended operation. If there are no planned inspections for this piping, justify why it is acceptable to not inspect in-scope buried pipe containing hazardous materials.

Response:

It can be assumed that the Condensate Storage Tank and Emergency Feedwater Tank follows the tritium levels in the Condensate System, since both these tanks are directly connected to the Condensate System and there is a certain amount of condensate reject that occurs or can occur to either of these tanks and connected piping. Prior to the Steam Generator Replacement (SGR) outage that is currently on-going, CR-3 has been operating with elevated tritium in the Condensate System since early plant operation due to primary to secondary leakage in the "B" Once Through Steam Generator. This tritium value fluctuates with the tritium production in the reactor coolant system throughout the fuel cycle. The last Condensate System tritium value on file was collected on September 24, 2009, just prior to entering the SGR outage, and measured 3.29E-5 uCi/ml (versus the EPA drinking water value of 2E-5 uCi/ml or 20,000 pCi/l). With the installation of new OTSGs, it is expected that there will be minimal or no primary to secondary leakage, such that tritium levels in the Condensate will be maintained below than the EPA limit for drinking water. However, inspection schedules for the Condensate Storage Tank, Emergency Feedwater Tank and connected piping are initially specified based on tritium levels being above EPA drinking water limits. These schedules may be revised per NUREG-1801, draft Revision 2, upon verifying tritium levels are below the EPA drinking water limits. (See the response to item 2, above.)

Request:

4. State the as-found condition of backfill observed during recent buried pipe inspections. If the inspections detected the presence of rocks and sharp objects in the backfill around buried pipes justify why the minimum inspections are adequate to detect potential pipe degradation as a result of coating damage or holidays, or damage to the exterior surface of non-coated piping.

Response:

As stated in the response to RAI B.2.22-2, backfill at CR-3 consisted of limerock or dolomite, crushed to specification for the intended purpose. The use of this material promotes an alkaline environment that is non-aggressive with respect to corrosion for buried piping components. While there is no procedural requirement to inspect and document specific characteristics of backfill during excavations, a review of documentation for excavations has not identified abnormal observations relating to backfill, or to deleterious materials being contained in backfill. Based on discussions with personnel associated with recent excavations, it has been observed that the backfill material was dry, and consolidated to produce a tight, homogenous consistency. Documentation for buried piping inspections *reflects that coatings and piping material were found to be in good condition, with no indications of damage due to improper backfill material or other backfill deficiencies.*

Request:

5. For buried in-scope piping, respond to the following:

   a. State whether the fuel oil piping is protected by cathodic protection. If this piping is not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

   b. Given (a) that the cathodic protection system for the condensate and emergency feedwater system buried piping was not being regularly monitored and maintained since 2004, (b) troubleshooting is ongoing and the cathodic protection system is not yet fully restored, and (c) even though some inspections have been conducted, coating degradation or holidays can be randomly distributed, justify how the minimum design wall thickness will be maintained throughout the period of extended operation including the projected amount of degradation that could have occurred during this period.

   c. State whether the short length of piping from the Condensate Storage Tank to the Turbine Building is cathodically protected and if it has a safety-related function. If this piping is not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

Response:

a. *The buried Diesel Generator fuel oil piping extending from the Fuel Oil Storage Tanks to the piping system inside the Auxiliary Building is electrically connected to the tanks and isolated at the Auxiliary Building penetration from the balance of piping. As such, this piping is also served by the impressed current cathodic protection system provided for the tanks. It is noted that dedicated monitoring locations for monitoring cathodic protection effectiveness are not provided for this piping.*

   This piping will be inspected consistent with the recommendations of NUREG-1801, draft Revision 2, to assure it will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation (See response to item 2, above for additional details on inspection schedule). A review of the operating history of monitoring locations on the Fuel Oil Storage Tanks over the past five years reflects this impressed current system has a high degree of reliability. Since dedicated locations are not provided to facilitate monitoring the effectiveness of cathodic protection along the length of the piping, NUREG-1801, draft Revision 2, Table 4a, Preventive Action condition "D" will initially be applied to the piping. Pending establishing monitoring *capability and verifying satisfactory operating experience in maintaining the requisite degree of reliability, the inspection schedule for this piping may be revised consistent with Preventive Action condition "C".*

b. *The cathodic protection system for the subject Condensate and Emergency Feedwater System piping has largely been restored at this time. The circumstances that led to the lack of monitoring of this equipment have been addressed in the CR-3 Corrective Action Program, and effective actions prescribed to preclude recurrence have been identified. While maintenance activities are ongoing to optimize system effectiveness in some locations, it is reasonable to assume that the system will be functional and reliable through the period of extended operation.*

   Emergency Feedwater System and Condensate System piping with cathodic protection will be inspected consistent with the recommendations of NUREG-1801, draft Revision 2, to assure it will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation (See response to item 2, above for additional details on inspection schedule). Considering the period when cathodic protection on this piping was not being monitored, initial inspections for this piping are specified consistent with NUREG-1801, draft Revision 2, Table 4a, for steel with Preventive Action condition "D". Pending satisfactory operating experience in maintaining the requisite degree of reliability, the inspection schedule for this piping may be revised consistent with Preventive Action condition "C".

c. *The short length of Condensate System piping between the Condensate Storage Tank and the Turbine Building, and managed by the Buried Piping and Tanks Inspection Program, is not safety related, but is assumed to contain hazardous material (See response to item 3 above). This piping (approximately 20 ft.) is not provided with cathodic protection and will be inspected consistent with the recommendations of NUREG-1801, draft Revision 2, Table 4a, for steel with Preventive Action condition "E". (See response to item 2, above for additional details on inspection schedule.)*

Request:

6. In relation to the nuclear services and decay heat sea water system buried piping which is either under water or buried 30 feet below grade, respond to the following:

   a. If alternative volumetric examination methods, beyond ultrasonic examinations, will be used for conducting an interior wall thickness measurement, justify why they will be effective at providing a reasonable assurance that the buried in-scope piping systems will meet their current licensing basis function and state what percentage of interior axial length of the pipe will be inspected during each inspection.

   b. If the buried steel portions of this system are not cathodically protected, (a) provide an analysis that demonstrates that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation, assuming that no coatings are applied to the piping, or (b) justify why the number of the planned inspections of this piping is sufficient to reasonably assure that this piping will continue to meet or exceed the minimum design wall thickness throughout the period of extended operation.

Response:

a. *As discussed in the response to RAI B.2.22-2, excavation of the Nuclear Services and Decay Heat Seawater System intake conduits for direct inspection is not feasible based on their depth of installation and proximity to the intake canal. Moreover, it is not desirable to remove significant portions of the cement lining to do direct ultrasonic examinations, given the increased potential to precipitate corrosion in the areas of cement lining repairs. CR-3 will use alternative methods, such as Broadband Electromagnetic (BEM) scanning, to examine the piping from the inside to determine the condition of its external surfaces. These examinations will be performed using qualified methods subject to performance demonstration to verify the efficacy of the examination techniques and inspection results. This examination will be performed on at least 50% of the length of one of the two intake conduits, such that at least 25% of the piping length of both conduits will be inspected.*

   Qualification of the test methods will be established based on proven technology and test parameters, consideration of operating experience at other facilities, and will be validated with a performance demonstration specific to CR-3. The performance demonstration will incorporate piping material, design and service conditions, and will verify the ability of the test methods, equipment, and personnel to detect loss of material with sufficient resolution to ensure no loss of intended function. Initial testing will be performed prior to the period of extended operation, and will be repeated at intervals based on test results to ensure no loss of intended function prior to the next test performance. Test qualifications, including performance demonstration results, will be documented with the results of the initial testing.

   The use of inspection alternative methods, such as BEM scanning, is an exception to NUREG-1801 (both Revision 1 and draft Revision 2). This exception is acceptable given the qualifications associated with the test method, including performance demonstration, as discussed above.

b. *Test results from inspections (discussed above) will be subject to engineering evaluation to assure no loss of intended function through the next test interval. Test intervals will be specified as necessary to support this result, with a maximum test interval of no more than once every 10 years.*

   The specification of test intervals based on the evaluation of test results, not to exceed 10 years, is an exception to the provisions of NUREG-1801, draft Revision 2, Item 4.b.x. The initial inspection of the Nuclear Services and Decay Heat Seawater System intake conduits will take place prior to the period of extended operation. Noting the length of time that these conduits will have been buried at the time of initial inspection, acceptance criteria will be specified based on test results to assure the piping's intended function is maintained through the next test interval. Failure to satisfy these acceptance criteria would be addressed through the CR-3 Corrective Action Program, including revising the test interval, as appropriate.

Request:

7. Identify the AMR line item that includes the stainless steel, associated with the interfacing piping in the emergency feedwater/condensate system.

Response:

The subject stainless steel "interfacing piping" in the context of the response to RAI B.2.22-2 is the 1-inch line connecting Emergency Feedwater Tank EFT-2 to the Secondary Sampling System (See drawing 302-082-LR, Sheet 2 (F7 – F9)). The portion of the piping in the scope of license renewal is that piping inside the EFT-2 building, based on the potential for spatial interaction with safety related components in that space. This stainless steel piping is in scope up to the exit point at the building penetration; the interfacing buried piping outside the penetration performs no intended function and is not in the scope of license renewal.

Request:

8. For the buried in-scope fuel oil storage tanks:

   a. State how often each of the buried fuel oil storage tanks are subjected to internal ultrasonic inspections

   b. Justify how an internal visual inspection can be used to evaluate the external conditions of the tank material

   c. Justify how an internal visual inspection can be used to evaluate the condition of the external coatings on the tank

   d. Justify how ultrasonic tests of the tank heads and lower shells provide sufficient information to evaluate the condition of all external surfaces of the tank.

Response:

a. The Diesel Generator Fuel Oil Storage Tanks are emptied, cleaned and inspected, including ultrasonic examinations, at a nominal frequency of once every 10 years.

b. The LRA Appendix B description of the Fuel Oil Chemistry Program, exception (3) regarding Detection of Aging Effects, is not intended to state or infer that the condition of exterior surfaces or coatings will be characterized by visual internal inspections. Noting that the Fuel Oil Chemistry Program is credited with age management of the internal surfaces of the subject tanks, this statement is only intended to convey that, if deficiencies are noted during visual examinations of the inside of the tank, local ultrasonic examinations can be used to verify sufficient wall thickness remains in those areas.

c. See response to item b, above.

d. As shown in LRA AMR Table 3.3.2-28, the License Renewal Buried Piping and Tanks Inspection Program is utilized to manage external surfaces of the Emergency Diesel Fuel Oil Storage Tanks. This program utilizes preventive measures (coatings, cathodic protection), and periodic inspections to manage external surfaces of buried components. These coated, steel tanks have a reliable impressed current cathodic protection system, hence NUREG-1801 draft Revision 2, Table 4c, Preventive Action condition "C" is considered applicable. While no external inspections are specified by Table 4c in this *condition, ultrasonic examination of the lower shell and heads provide confirmatory information that the cathodic protection system is effectively protecting the tanks against loss of material.*

Request:

9. In relation to the cathodic protection system:

    a. State the availability of the cathodic protection system, and if portions of the system are not available 90% of the time or will be allowed to be out of service for greater than 90 days in any given year, justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.

    b. State whether annual ground potential surveys of the cathodic protection system are conducted and what acceptance criteria is used, or if annual ground potential surveys are not conducted, justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.

Response:

a. CR-3 intends to maintain plant cathodic protection equipment to a high degree of reliability throughout the period of extended operation. Inspection schedules of buried piping and tanks are conservatively specified considering that cathodic protection systems might have a reliability of less than 90% unless operating experience substantiates that a higher degree of reliability exists. (See responses to items 2 and 5 above.)

b. Periodic maintenance of plant cathodic protection equipment is performed at a frequency of at least once per year. Acceptance criteria are specific to component design. For impressed current and passive cathodic protection equipment, test parameters include measurement of reference potential to soil.

RAI B.2.25-5

Background:

The applicant is currently performing major repairs to the containment. Since October 8, 2009, a large number of prestressing tendons have been de-tensioned/removed. In addition, concrete has been removed in different areas. Vertical through-wall cracks have been identified in the containment concrete.

Issue:

There is a potential of corrosion in the containment liner plate exposed to humidity and moisture via the through-wall cracks present in the concrete containment. This condition may have introduced corrosion in the liner plate which can affect the containment liner's ability to act as a leak tight barrier during the period of extended operation.

Request:

Provide information related to monitoring the condition of the containment liner plate to capture any potential effects of long term exposure to humidity and moisture that may have occurred during the current long term shutdown.

Response:

The portion of liner plate which was exposed during the Steam Generator Replacement (SGR) outage was examined for damage and corrosion prior to being embedded in concrete with a detailed visual examination in accordance with ASME Section XI, Subsection IWE. No excessive corrosion was identified during these examinations. The exposed liner plate was subject to the most direct exposure to the humidity and moisture during the outage. The exposed rebar that was left in place was also in direct exposure to the humidity and moisture during the outage. The exposed portion of the liner plate and the reinforcing steel was subjected to outdoor humidity and moisture for approximately one year. A detailed visual examination in accordance with ASME Section XI, Subsection IWL was performed on the exposed rebar, and no excessive corrosion was identified.

The outside face of the liner plate, which remained embedded in concrete, is located 42 inches from the exposed surface. The vertical cracks in question are all less than 0.007 inch in width and generally occur at the location of vertical tendons. These cracks are less than allowed by the American Concrete Institute (ACI) for "exterior exposure" (0.010 in. as specified in ACI 318-63 – Section 1508(b)) and for "acceptance without further evaluation" (0.015 in. as specified in ACI 349.3R96). Additionally, ACI 224R-01 provides guidance to the design engineer for minimizing the formation of cracks that could be detrimental to embedded steel. The condition more applicable to the CR-3 Containment wall is the "Humidity, moist air, soil" case with a maximum allowable width of 0.012 inch. The vertical cracks in question are less than recommended by ACI 224R-01. Additionally, the vertical orientation of the concrete surface prevents water migration to the liner plate. The outside face of the liner is embedded in concrete which provides an alkaline environment that is not conducive to corrosion.

Based on the above, there are not expected to be any additional aging effects due to the exposure of the containment liner plate to humidity and moisture during the SGR outage. CR-3 will continue to perform surface examinations of the accessible containment concrete in accordance with the ASME Section XI, Subsection IWL, Aging Management Program. In addition, the liner plate accessible interior surfaces will continue to be examined in accordance with the ASME Section XI, Subsection IWE Aging Management Program and tested in accordance with the 10CFR50, Appendix J, Aging Management Program.

RAI B.2.25-6

Background:

In response to RAI B2.25-3, provided in letter dated December 30, 2009, the applicant stated that during the 2009 refueling outage, an American Society of Mechanical Engineers (ASME) Section XI, Subsection IWE (IWE) program examination was performed on the accessible reactor building liner plate. In addition to the bulges of the liner plate previously identified in

2007, additional bulges were identified during the fall 2009 IWE examination. The applicant further stated that a Nuclear Condition Report has been initiated and will be evaluated by the applicant prior to acceptance of the liner plate for continued service. The applicant also stated that the acceptance of the liner plate for continued service shall be in accordance with IWE-3122 by examination, corrective measures or repair/replacement activity, or by engineering evaluation. The details and basis of this engineering evaluation and/or corrective actions will be available for U.S. Nuclear Regulatory Commission review prior to return to operation of CR-3 from the fall 2009 refueling outage.

Issue:

Presence of bulges can potentially introduce corrosion on the concrete side of the liner plate which may affect its ability to perform its design function during the period of extended operation.

Request:

Provide information regarding the corrective actions planned/performed for the bulges in the liner plate to demonstrate that the liner plate will be able to perform its intended function during the period of extended operation.

Response:

A response was provided to the request in this RAI by CR-3 letter 3F1110-03, dated November 23, 2010 (Accession Number ML103280373).

RAI B.2.26-5

Background:

The applicant is currently in the process of repairing a significant portion of the containment which includes new concrete, removal and re-installation of prestressing tendons, followed by a structural integrity test.

Issue:

LRA Section B.2.26 states that ASME Section XI, Subsection IWL Program is implemented in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55(a) and ASME Section XI, Subsection IWL, 2001 Edition, through the 2003 Addenda. ASME Section XI, IWL 2410 states, "Concrete shall be examined in accordance with IWL-2510 at 1, 3, and 5 years following the completion of the Containment Structural Integrity Test CC-6000 and every 5 years thereafter." LRA Section B.2.26 does not address the containment concrete surface examination frequency after the new structural integrity test.

Request:

Discuss the plans and frequency for performing the containment concrete surface examination after the new structural integrity test to establish a new baseline and trend in concrete degradation for the period of extended operation.

Response:

CR-3 plans to perform a containment concrete surface examination in accordance with the repair/replacement guidance of ASME Section XI, Subsection IWL (2001 Edition through the 2003 Addenda). A Detailed visual examination (IWL-2310(b)(4)) of the surface of all containment concrete placed during repair/replacement activities will be performed prior to the start of the containment pressure test, at test pressure, and following completion of depressurization in accordance with IWL-2230 and IWL-5250. In addition, CR-3 plans to perform an examination (IWL-2510) of the surface of all containment concrete placed during repair/replacement activities at 1 year (±3 months) in accordance with IWL-2410(d). After the 1 year concrete surface examination, CR-3 plans to continue subsequent examinations on the original in-service inspection schedule in accordance with subsection IWL-2410(c). The anticipated date for the 1 year concrete surface examination in accordance with IWL-2410 is late 2011 and is dependent upon the completion date of the containment pressure test required by IWL-5000.

In addition, CR-3 plans to perform a General visual examination of the remainder of the containment concrete, outside of the repair/replacement affected concrete after the containment pressure test(s). This General visual examination is not required until 2011/2012 by the ASME Section XI, Subsection IWL Code original in-service inspection schedule in accordance with subsection IWL-2410(c), but is being performed to validate the existing containment concrete trends going forward and to capture any changes since the last required examination in 2007.

Subsequent examinations (per the original in-service inspection schedule in accordance with IWL-2410 of every 5 years ± 1 year) will be in 2012 (R17), then 2016 (R19), prior to entry into the period of extended operation.

During the period of extended operation, the inspection schedule will remain at every 5 years (± 1 year).

In addition to the ASME Section XI Repair/Replacement activities, CR-3 plans to perform a Containment Structural Integrity Test using the ASME Section III, Article CC-6000 guidance. This test is an Owner Elected - Augmented Test which is not required by ASME Section XI Repair/Replacement requirements, but is being performed to provide additional assurance that the restored containment will function under design loads.

RAI B.2.26-7

Background:

The applicant has removed 64 (44 percent) of vertical tendons and 155 (54 percent) of the hoop tendons from the containment. These tendons will be reinstalled/replaced. In addition, the remaining vertical tendons will be re-tensioned.

Issue:

LRA Section B.2.26 states that the ASME Section XI, Subsection IWL Program is implemented in accordance with 10 CFR 50.55(a) and ASME Section XI, Subsection IWL, 2001 Edition, through the 2003 Addenda. ASME Section XI, IWL-2420 states, "Unbonded post-tensioning systems shall be examined in accordance with IWL-2510 at 1, 3, and 5 years following the completion of the containment Structural Integrity Test and 5 years thereafter." LRA Section B.2.26 does not address the containment post tensioning system examination frequency following the removal, reinstallation, and replacement of 44 percent of vertical tendons and 54 percent of the hoop tendons.

Request:

Discuss the plans and frequency for performing the containment unbonded post-tensioning system examination following the completion of the new structural integrity test to establish a new baseline and trend for the loss of prestress in the hoop and vertical tendons during the period of extended operation.

Response:

CR-3 plans to perform the containment unbonded post-tensioning system examinations in accordance with the repair/replacement guidance of ASME Section XI, Subsection IWL (2001 Edition through the 2003 Addenda). An Augmented examination of the post-tensioning system affected by the repair/replacement activities (IWL-2520) will be performed in accordance with Table IWL-2521-2. Table IWL-2521-2 requires an initial examination of the post-tensioning system following completion of the repair/replacement activities at 1 year ± 3 months. After the 1 year examination, CR-3 plans to continue subsequent examinations on the original in-service inspection schedule in accordance with Subsection IWL-2420. The anticipated date for the 1 year examination of the post-tensioning system in accordance with IWL-2520 is late 2011 and is dependent upon the completion date of the containment pressure test required by IWL-5000.

Subsequent examinations (per the original in-service inspection schedule in accordance with IWL-2420(c) of every 5 years ± 1 year) will be in 2012 (R17), then 2016 (R19), prior to entry into the period of extended operation.

During the period of extended operation, the inspection schedule will remain at every 5 years (± 1 year).

In addition to the ASME Section XI Repair/Replacement activities, CR-3 has decided to perform a Containment Structural Integrity Test using the ASME Section III, Article CC-6000 guidance. This test is an Owner Elected - Augmented Test which is not required by ASME Section XI Repair/Replacement requirements and is being performed to provide additional assurance that the restored containment will function under design loads.

RAI B.2.26-8

Background:

During the repair of the containment, vertical cracks of up to 5 mils in width have been recorded in the containment concrete exterior surface. These cracks appear to be through the 42 inch thick containment wall at numerous locations.

Issue:

LRA Section B.2.26 states that the ASME Section XI, Subsection IWL Program is an existing program consistent with NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S2. Element 6 of NUREG-1801, Section XI.S2, states that, "IWL-3000 provides acceptance criteria for concrete containments." IWL-3310 requires that an engineering evaluation report shall be prepared if there is evidence of damage or degradation sufficient to warrant further evaluation.

Request:

Discuss the effect of vertical through wall cracks on the containment structure during the period of extended operation. This discussion should include inspection and repairs (if necessary) of the containment required to demonstrate that the effects of these cracks on the containment will be adequately managed for the period of extended operation.

Response:

A partial response to RAI B.2.26-8 is included in RAI response B.2.25-4 (CR-3 letter, 3F1110-03, dated November 23, 2010 – Accession Number ML103280373). As stated in the B.2.25-4 response, vertical cracks were observed in the containment concrete exterior surface. The vertical cracks were all less than 0.007 inch in width, which is less than the acceptance criteria for concrete surface visual examinations delineated in ASME Section XI, Subsection IWL-2310(a) and IWL-2510; and the guidance of ACI 201.1 and ACI 349.3R. However, these vertical cracks were identified and addressed by the CR-3 Corrective Action Program even though they are less than the size to be recorded. An evaluation was performed to assess the impact to design basis loading conditions. The evaluation determined that after completion of the concrete repair in Containment Bay 3-4, sufficient prestress will be imposed during tendon re-tensioning to sufficiently close the cracks and ensure closure for all design loads through the period of extended operation.

Recognizing that these cracks are not distinguishable by size from shrinkage cracking on the surface, the new cracks have been mapped and a design record created. A sample, consisting of four locations, of the cracks will be measured at the following three points in time:

- *Before and after tendons are retensioned,*
- *After the system pressure tests that follow current repairs, and*
- *During the one year repair/replacement required surveillance.*

Further engineering evaluation will be performed to assess changes, if they are observed.

For the period of extended operation, CR-3 will continue to perform the concrete surface examinations of the accessible containment concrete in accordance with the ASME Section XI, Subsection IWL Aging Management Program.

RAI B.2.28-4

Background:

The applicant is currently performing major repairs to the containment which will be followed by a structural integrity test and an integrated leak rate test (ILRT).

Issue:

LRA Section B.2.28 states that "the CR-3 10 CFR 50, Appendix J Program utilizes the performance-based approach of 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, and includes appropriate guidance from Regulatory Guide 1.163, September 1995, "Performance-Based Containment Leak-Test Program," as modified by NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J.""

Section 9.2.3 of NEI 94-01, Revision 2, states that Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per 15 years based on acceptable performance history. Acceptable performance history is defined as successful completion of two consecutive periodic Type A tests where the calculated performance leakage rate was less than the maximum allowable leakage rate at the calculated peak accident pressure.

Considering the extent of containment repairs, the applicant may need to establish a new acceptable performance history to demonstrate that the containment will remain essentially leak tight during the period of extended operation.

Request:

Discuss how an acceptable performance history for the Type A test would be established after the new structural integrity test to ensure that the effects of the aging of the containment will be adequately managed during the period of extended operation.

Response:

CR-3 is committed to NEI 94-01-1995, Revision 0. This document states in Section 9.2.2, "Initial Test Intervals," that:

> *"A preoperational Type A test shall be conducted prior to initial reactor operation. If initial reactor operation is delayed longer than 36 months after completion of the preoperational Type A test, a second preoperational Type A test shall be performed prior to initial reactor operations.*
>
> *The first periodic Type A test shall be performed within 48 months after the successful completion of the last preoperational Type A test. Periodic Type A tests*

> *shall be performed at a frequency of at least once per 48 months, until acceptable performance is established in accordance with Section 9.2.3. The interval for testing should begin at initial reactor operation. Each test interval begins upon completion of a Type A test and ends at the start of the next test."*

Specifically, the terms "initial" and "preoperational" are used and indicate that the requirements of this Section are applicable to new, never before tested, Containment Buildings.

NEI 94-01-1995, Section 9.2.3, "Extended Test Intervals", allows the frequency of Type A testing to be extended to once per 10 years:

> *"Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per 10 years based on acceptable performance history. Acceptable performance history is defined as completion of two consecutive periodic Type A tests where the calculated performance leakage rate was less than 1.0 L_a. A preoperational Type A test may be used as one of the two Type A tests that must be successfully completed to extend the test interval, provided that an engineering analysis is performed to document why a preoperational Type A test can be treated as a periodic test. Elapsed time between the first and last tests in a series of consecutive satisfactory tests used to determine performance shall be at least 24 months."*

CR-3 has previously established acceptance performance history of Type A testing and extended this test interval to once every 10 years.

CR-3 classifies the work on its Containment Building as a "repair" based on the design basis and function being fully restored. NEI 94-01-1995, Section 9.2.4, "Containment Repairs and Modifications," address the requirements when such repairs are made:

> *"Repairs and modifications that affect the containment leakage integrity require leakage rate testing (Type A testing or local leakage rate testing) prior to returning the containment to operation."*

NEI 94-01-1995, Section 9.2.4, makes no mention of a requirement to re-establish extended Type A testing intervals due to Containment Building "repairs." Instead, this section calls out a requirement to perform Type A testing or local leakage rate testing when containment leakage integrity may be affected by such repairs. Therefore, CR-3 plans to perform a Type A test in accordance with the CR-3 Improved Technical Specifications, following the Containment Building repairs, prior to returning the Containment Building to service to assess the success of the repairs. The frequency for the subsequent periodic Type A test will be 10 years. CR-3 has no plans to re-establish additional periodic Type A testing.

RAI 4.5.1-1

Background:

The applicant is currently performing major repairs to the containment. This includes removal and reinstallation of 44 percent of vertical tendons and 54 percent of the hoop tendons. In addition the remaining vertical tendons will be re-tensioned to a higher level of prestressing.

Issue:

LRA Section 4.5.1 states that for the purposes of extending the plant operating license, regression analysis was used to extrapolate the tendon prestress forces to the end of the period of extended operation. This regression analysis will have to be revised since the majority of vertical and hoop tendons will be re-tensioned following concrete repairs.

Request:

Provide plans and schedules for performing a regression analysis to account for re-tensioned tendons, changes in tendon relaxation, and changes in the concrete creep of the old versus the new concrete to ensure that the effects of aging of the prestressing tendons will be adequately managed during the period of extended operation.

Response:

As stated in CR-3 letter, 3F1110-03, dated November 24, 2010 (Accession Number ML103280373), in a response concerning LRA Section 4.5.1, a tendon re-tensioning plan is being developed, and an update to LRA Subsection 4.5.1 will be provided after the tendon re-tensioning plan is approved. The following plans are provided to ensure that the effects of aging of the prestressing tendons will be adequately managed during the period of extended operation:

LRA Subsection 4.5.1 will be revised to change the evaluation of the time-limited aging analysis to demonstrate that loss of prestress on the intended function(s) will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii), rather than projecting the analyses to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as previously submitted. As a result of this change in methodology, the discussion in LRA Subsection 4.5.1 is being revised to provide information on how the program will be managed. In addition, an Aging Management Program is added to Appendix B as Subsection B.3.3 and to Appendix A as Subsection A.1.1.41 for the Concrete Containment Tendon Prestress aging management program in accordance with NUREG-1801, Program X.S1. Also, Appendix A, Subsection A.1.2.4, Concrete Containment Tendon Prestress is revised to reflect use of an aging management program in accordance with 10 CFR 54.21(c)(1)(iii). Refer to the specific changes in Enclosure 2.

A regression analysis and log-linear trend plot for the dome tendons and the hoop tendons which have not been de-tensioned, has been developed based on individual tendon test results during the first eight surveillances and projected to end of the period of extended operation. The projected value of these dome tendons and hoop tendons is greater than the minimum required value at the end of the period of extended operation.

Since the vertical tendons and some of the hoop tendons will be re-tensioned to original lock-off forces, regression analysis and log-linear trend plots cannot be developed because there will be no historical tendon lift-off force available to plot. However, end-of-life group mean forces were calculated by subtracting elastic shortening and time dependent losses from the lock-off forces. Time dependent losses are being used for concrete creep, concrete shrinkage and pre-stressing steel relaxation. The values calculated demonstrate that prestress in the vertical tendons and re-tensioned hoop tendons should be greater than the minimum required value at the end of the extended period of operation, and that the tendons should maintain their design basis function. A regression analysis and log-linear trend plots for the vertical and re-tensioned hoop tendons will be re-established after there is sufficient historical data to perform a regression analysis to meet ASME Section XI, Subsection IWL requirements. The regression analysis and log-linear trend plot for the re-tensioned vertical and hoop tendons will be re-established under the Concrete Containment Tendon Prestressing Program to meet the requirements of ASME Section XI, Subsection IWL.

New repair concrete comprises less than 5% of the total wall volume and consequently, tendon force losses due to concrete creep and shrinkage was determined by the creep and shrinkage characteristic functions of the original concrete. However, concrete creep characteristics were updated based on actual CR-3 original concrete mix creep test results and a more realistic temperature correction. Tendon wire relaxation characteristics were not revised.

Schedule:

- *LRA Appendix B, Subsection B.3.3, Concrete Containment Tendon Prestress Program is provided with this response.*
- *LRA Appendix A.1.1.41, Concrete Containment Tendon Prestress Program is provided with this response.*
- *LRA Appendix A.1.2.4, Evaluation of TLAA for Concrete Containment Tendon Prestress is provided with this response.*
- *Regression analyses and log-linear trend plot for the dome tendons and the hoop tendons which have not been de-tensioned will be performed as part of the Concrete Containment Prestress Program following the next scheduled tendon surveillance.*
- *Regression analyses and log-linear trend plots for the re-tensioned vertical and hoop tendons will be performed as part of the Concrete Containment Prestress Program prior to the period of extended operation.*

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ENCLOSURE 2

AMENDMENT 15 CHANGES TO THE LICENSE RENEWAL APPLICATION

Amendment 15 Changes to the License Renewal Application

Source of Change	License Renewal Application Amendment 15 Changes
RAI B.2.22-3	*Replace Subsection A.1.1.20, on page A-13, with the following:* *The Buried Piping and Tanks Inspection Program is a new program that manages the aging effect of loss of material for the external surfaces of buried steel piping components and tanks in CR-3 systems within the scope of License Renewal. The Program includes preventive measures to mitigate corrosion by protecting the external surface of buried components through use of coating or wrapping. The Program also includes visual examination of buried piping components made accessible by excavation. Program administrative controls to be developed include ensuring an appropriate as-found pipe coating and material condition inspection is performed whenever buried piping within the scope of this Program is exposed; verifying that Detection of Aging Effects is performed consistent with the requirements of NUREG-1801, draft Revision 2, except that alternative methods will be utilized for inspection of the Nuclear Services and Decay Heat Seawater System intake conduits; specifying that an inspection datasheet will be used; requiring inspection results to be documented; including precautions concerning excavation and use of backfill for License Renewal piping and tanks, including a requirement that buried pipe and tank coating inspection shall be performed, when excavated, by qualified personnel to assess its condition; and including a requirement that a coating engineer or other qualified individual should assist in evaluation of any pipe and tank coating damage or degradation found during the inspection.* *Revise LRA Subsection B.2.20 on page B-67 as follows:* ***Program Description*** *The Buried Piping and Tanks Inspection Program manages the aging effect of loss of material for the external surfaces of buried steel components in CR-3 systems within the scope of License Renewal. Components within the scope of the Program consist of steel piping components and two buried tanks. Not included are the underground concrete pipes connecting the Auxiliary Building to the Nuclear Services and Decay Heat Sea Water System Discharge Structure which are managed by the Structures Monitoring Program. The aging effects/mechanisms of concern are loss of material due to general, galvanic, pitting, and crevice corrosion and MIC. To manage the aging effects, this new program includes: (a) preventive measures to mitigate degradation (e.g., coatings and wrappings required by design), and (b) visual inspections of external surfaces of buried piping and tanks for evidence of coating damage and degradation.* *Detailed procedural requirements for the Program will be developed and incorporated into implementing procedures. These procedures will provide the administrative controls for the Program and will: (1) ensure an appropriate as-found pipe coating and material condition inspection is performed whenever buried piping within the scope of this Program is exposed, with a minimum frequency of at least one buried piping inspection each 10 years, (2) verify that opportunistic and/or focused inspections are performed consistent with the requirements of Section 4 - Detection of Aging Effects, in NUREG-1801, draft Revision 2. An exception to Section 4 is taken with regard to the Nuclear Services and Decay Heat Seawater System intake conduits, which will be inspected prior to the period of extended operation using qualified methods subject to performance demonstration, with subsequent test intervals based on test* *(continued)*

Source of Change	License Renewal Application Amendment 15 Changes
RAI B.2.22-3 (continued)	*results, not to exceed 10 years. (3) specify that an inspection datasheet is used, (4) require inspection results to be documented, (5) include precautions concerning excavation and use of backfill for License Renewal piping, (6) include a requirement that buried piping coating inspection shall be performed, when excavated, by qualified personnel to assess its condition, and (7) include a requirement that a coating engineer or other qualified individual (such as the Coatings Program Manager) should assist in evaluation of any buried piping coating damage and/or degradation found during the inspection. Any evidence of damage to the coating or wrapping, such as perforations, holidays or other damage will cause the protected components to be inspected for evidence of loss of material. The Program assures that the effects of aging on buried piping components are being effectively managed for the period of extended operation.* ***NUREG-1801 Consistency*** *The Buried Piping and Tanks Inspection Program is a new program that is consistent with NUREG-1801, Section XI.M34, with exceptions.* ***Exceptions to NUREG-1801*** <u>*Program Elements Affected*</u> • ***Parameters Monitored/Inspected*** *Coatings and wrappings are inspected by visual techniques, with the exception of the Nuclear Services and Decay Heat Seawater System inlet conduits, where excavation and inspection is not feasible. In this case, the effectiveness of coatings and wrappings in protecting the piping will be assessed by monitoring the material condition of the piping itself, utilizing qualified methods subject to performance demonstration to verify the efficacy of the examination techniques and inspection results.* • ***Detection of Aging Effects*** *The substitution of alternative methods for direct visual examinations in detection of aging effects is an exception to the Buried Piping and Tanks Inspection Program description in NUREG-1801, Volume 2, Section XI.M34, Revision 1. This is acceptable in that substitute methods and allowances were developed based on updated operating experience and regulatory guidance incorporated into NUREG-1801, draft Revision 2. Where alternative inspection methods will be employed that are not specifically included in the recommendations of NUREG-1801, draft Revision 2, inspection qualification requirements and specification of inspection intervals ensure that intended function(s) are maintained.* ***Enhancements*** *None.* ***Operating Experience*** *The Buried Piping and Tanks Inspection Program is a new program applicable to buried piping. There is no existing operating experience (OE) to validate the effectiveness of this Program. NUREG-1801 is based on industry OE through January 2005. Recent industry* *(continued)*

Source of Change	License Renewal Application Amendment 15 Changes
RAI B.2.22-3 (continued)	*OE has been reviewed for applicability. More recent OE is captured through the normal OE review process where it is screened for applicability. This process will continue through the period of extended operation. The CR-3 Buried Piping and Tanks Inspection Program has been updated to incorporate the operating experience and regulatory guidance found in NUREG-1801, draft Revision 2.* ***Conclusion*** *Implementation of the Buried Piping and Tanks Inspection Program provides reasonable assurance that the aging effect of loss of material due to corrosion mechanisms will be managed such that systems and components within the scope of License Renewal will continue to perform their intended functions consistent with the CLB for the period of extended operation.*
RAI 4.5.1-1	*Revise LRA page A-3 to include new Subsection A.1.1.41 entitled "Concrete Containment Tendon Prestress Program," and insert the following Subsection A.1.1.41 on page A-21.* *A.1.1.41, Concrete Containment Tendon Prestress Program* *This Concrete Containment Tendon Prestress Program provides reasonable assurance of the adequacy of prestressing forces in the CR-3 prestressed concrete containment tendons during the current and extended period of operation under 10 CFR 54.21(c)(1)(iii). The program is an existing program that is part of the ASME Section XI, Subsection IWL Program (2001 Edition, through the 2003 Addenda) as supplemented by the requirements of 10 CFR 50.55a(b)(2)(viii). The Program assesses the adequacy of containment tendon prestressing forces during each scheduled surveillance. Program acceptance criteria comply with ASME Section XI, Subsection IWL Article IWL-3000 Acceptance Standards. Trend lines are developed, one for each tendon group, using the measured tendon forces. These trend lines are projected through the period of extended operation. The program provides corrective actions if the acceptance criteria are not met.* *Revise LRA Subsection A.1.2.4 on page A-38 by replacing the third and fourth paragraphs with the following:* *As a result of the hydro-demolition of the Reactor Building wall in preparation for the Steam Generator Replacement (SGR) in 2009, a delamination was exposed between adjacent hoop tendons within the boundaries of the temporary access opening. This has affected the Concrete Containment Prestress Program as vertical tendons and many of the hoop tendons are planned to be re-tensioned to original lock-off values. For the vertical tendons and re-tensioned hoop tendons, a regression analysis cannot be performed because the historical tendon force lift-off values are no longer applicable after re-tensioning. For the vertical tendons and re-tensioned hoop tendons end of life group mean forces were calculated by subtracting elastic shortening and time dependent losses from the 70% guaranteed ultimate tensile strength force at which the tendons are planned to be seated after re-tensioning. Time-dependent losses were used in the calculation for concrete creep, concrete shrinkage and pre-stressing steel relaxation. Updated values for creep were used based on original concrete testing results and a more realistic temperature correction. For subsequent surveillances of the vertical tendons and re-tensioned hoop tendons, individual predicted tendon prestress values will be calculated in a similar manner. The regression analysis and log-linear trend plot for the re-tensioned vertical and hoop* *(continued)*

<table>
<tr><th>Source of Change</th><th>License Renewal Application Amendment 15 Changes</th></tr>
<tr><td>RAI 4.5.1-1 (continued)</td><td>
tendons will be re-established under the Concrete Containment Tendon Prestress Program to meet the requirements of ASME Section XI, Subsection IWL prior to the period of extended operation.
Based on the results of this evaluation, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation using the CR-3 Concrete Containment Tendon Prestress Program in accordance with 10 CFR 54.21(c)(1)(iii).
Revise LRA page B-3 by adding new Subsection B.3.3, "Concrete Containment Tendon Prestress Program," and add the following new row to Table B-1 on page B-11.
<table>
<tr><td>X.S1</td><td>Concrete Containment Tendon Prestress</td><td>Concrete Containment Tendon Prestress Program</td><td>Existing program consistent with NUREG-1801 with exceptions</td></tr>
</table>
Insert the following after LRA Subsection B.3.2:
B.3.3 CONCRETE CONTAINMENT PRESTRESS PROGAM
Program Description
The Concrete Containment Tendon Prestress Program provides reasonable assurance of the adequacy of prestressing forces in the CR-3 prestressed concrete containment tendons during the current and the period of extended operation under 10 CFR 54.21(c)(1)(iii). The program is an existing program that is part of ASME Section XI, Subsection IWL (2001 Edition, through the 2003 Addenda) as supplemented by the requirements of 10 CFR 50.55a(b)(2)(viii). The program assesses the adequacy of containment tendon prestressing forces throughout the period of extended operation.
The acceptance criteria consists of lower limits on the forces in individual tendons and the minimum required prestressing force or value. The lower limit on the force in an individual tendon is, as specified in IWL 3221.1(b), 95% of the force predicted for the tendon at the time of the test. The predicted value or base value for individual tendons is developed accounting for prestress losses that are identified in NRC Regulatory Guide 1.35.1. The requirements of IWL-3221.1(b) are followed if the measured force falls below 95% of the force predicted force.
As specified in IWL-3221.1(a), the average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon must be equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon. Also, trend lines of the measured tendon force are developed. Engineering reviews the results and trends from consecutive surveillances and if it is determined that the trend of prestress loss for individual tendons, or for any of the three groups of tendons, is larger than expected the cause and extent of such occurrence is determined. If this trend indicates that the resulting prestress forces will be less than the minimum required prestress forces prior to the next scheduled surveillance, then additional testing and evaluation shall be performed prior to the completion of the current surveillance to determine the cause and extent of such occurrence. The trend lines are projected through the period of extended operation.
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<tr><th>Source of Change</th><th>License Renewal Application Amendment 15 Changes</th></tr>
<tr><td>RAI 4.5.1-1 (continued)</td><td>
NUREG-1801 Consistency
The Concrete Containment Tendon Prestress Program is an existing program consistent with NUREG-1801, Section X.S1, with exceptions.
Exceptions to NUREG-1801
<u>Program Elements Affected</u>

Monitoring and Trending
NUREG-1801, X.S1, states that predicted lower limit (PLL), minimum required value (MRV), and trending lines are developed for the period of extended operation and that NRC Regulatory Guide (RG) 1.35.1 provides guidance for calculating the PLL and MRV. CR-3 calculates expected (predicted) forces for individual tendons. These calculations account for the losses, elastic shortening, stress relaxation, concrete creep and shrinkage that are identified in RG 1.35.1, but do not develop upper / lower limits on the predicted forces. This exception to the NUREG-1801 program is consistent with the requirements of ASME Section XI, Subsection IWL and is justified based on the NRC Safety Evaluation Report related to the CR-3 Improved Technical Specification amendment issued on March 16, 2000 (ML003693799).
Acceptance Criteria
NUREG-1801 specifies that acceptance criteria normally consist of PLL and MRV calculated based on RG 1.35.1 guidance. As stated for Monitoring and Trending, CR-3 accounts for the effects of the prestress losses identified in RG 1.35.1 to determine the predicted value or base value for individual tendons to account for prestress losses, but does not develop upper and lower limits on predicted forces. Use of a single predicted force, rather than a predicted lower limit as an acceptance value is consistent with ASME Section XI, Subsection IWL Article IWL-3000 Acceptance Standards and the additional requirements of 10 CFR 50.55a. This exception is justified based on the NRC Safety Evaluation identified in the discussion of Monitoring and Trending above.

Enhancements
None.
Operating Experience
The Concrete Containment Tendon Prestress Program is part of the ASME Section XI, Subsection IWL Program and is implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements. Periodic program reviews are performed. The Program is upgraded based on industry and plant-specific operating experience.
Plant-specific OE includes the results of periodic examinations of the Reactor Building (RB) tendon surveillances. The 8th Tendon Surveillance or 30th year was completed in the Fall of 2007 during Refueling Outage 15. Nuclear Condition Reports (NCRs) were initiated when measured forces were less than 95% of predicted forces. Adjacent tendons were tested in
(continued)
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Source of Change	License Renewal Application Amendment 15 Changes
RAI 4.5.1-1 (continued)	*accordance with IWL-3221.1. All tendons with less than 95% of predicted force were restored to the predicted force. An NCR was initiated to determine why Tendon Surveillance results identified from previous surveillances had several instances of tendon lift-off forces below the Predicted Base Value and below the 95% of predicted value. The result of the NCR was that, while tendon testing results demonstrated lower than expected lift-off values leading to adjacent tendons being tested, the end result was the acceptance criteria for any overall group were met; and there was no adverse condition. However, a follow-up investigation for the lift-off forces in the hoop prestressing tendons for the 6th, 7th and 8th surveillances was performed. More realistic concrete creep functions based on actual CR-3 concrete mix were used. A new calculation showed all but six measured hoop tendon forces would have exceeded (i.e., met) forecast values. The six measured forces that were below predicted still exceeded the lower acceptance limit (95% of predicted). Therefore, all tendon forces measured during the 6th, 7th and 8th surveillances were acceptable when re-evaluated with more realistic concrete creep values. In addition, the mean of the lift-off forces measured during each of the surveillances exceeded the mean of the predicted hoop tendon forces. The prestress trend analysis determined the tendon forces would remain above the minimum force requirements well beyond the next surveillance period as well as through the period of extended operation.* *During the hydro-demolition of the RB wall in preparation for Steam Generator Replacement (SGR) in 2009, a delamination was exposed between adjacent hoop (i.e., horizontal) tendons within the boundaries of the temporary access opening. An NCR was initiated to identify the condition, perform a root cause investigation, and provide the corrective actions to repair the condition. To initiate repairs, a large number of tendons were de-tensioned (64 of 144 vertical tendons and 155 of 282 hoop tendons) and the delaminated concrete was removed. The concrete repair was completed and tendons were re-installed, as required. Detailed re-analyses of the RB are being performed to aid in the development of the re-tensioning plan. All the vertical tendons and the de-tensioned hoop tendons are planned to be re-tensioned to the original lock-off force. All the dome tendons and the undisturbed hoop tendons (127) are planned to be left in their original condition without re-tensioning. New minimum required mean prestressing forces have been determined for the hoop and vertical tendons. A calculation was prepared with a regression analysis to extrapolate the tendon prestress forces to the end of the extended period of operation for the dome tendons and undisturbed hoop tendons. The Log-Linear Mean Force Trend plots demonstrate that prestress in dome tendons and undisturbed hoop tendons is expected to be above the applicable minimum required prestressing force at the end of the extended period of operation. For the vertical tendons and re-tensioned hoop tendons, a regression analysis cannot be performed because the historical tendon force lift-off values are no longer applicable after re-tensioning. For the vertical tendons and re-tensioned hoop tendons end of life group mean forces were calculated by subtracting elastic shortening and time dependent losses from the 70% guaranteed ultimate tensile strength force at which the tendons are planned to be seated after the re-tensioning plan is finalized. Time dependent losses were used in the calculation for pre-stressing steel relaxation, concrete creep and shrinkage. Updated values were used for creep based on original concrete used at CR-3. The tendon values calculated demonstrate that prestress in the vertical tendons and re-tensioned hoop tendons are expected to be greater than the minimum required value at the end of the period of extended operation.* *(continued)*

Source of Change	License Renewal Application Amendment 15 Changes
RAI 4.5.1-1 (continued)	***Conclusion*** *Continued implementation of the Containment Tendon Prestress Program will provide reasonable assurance that the aging effects of loss of RB tendon prestressing forces will be adequately managed so that the intended functions of the tendons will be maintained during the period of extended operation.*