

NON-CONCURRENCE PROCESS COVER PAGE

The U.S. Nuclear Regulatory Commission (NRC) strives to establish and maintain an environment that encourages all employees to promptly raise concerns and differing views without fear of reprisal and to promote methods for raising concerns that will enhance a strong safety culture and support the agency's mission.

Employees are expected to discuss their views and concerns with their immediate supervisors on a regular, ongoing basis. If informal discussions do not resolve concerns, employees have various mechanisms for expressing and having their concerns and differing views heard and considered by management.

Management Directive (MD) 10.158, "NRC Non-Concurrence Process," describes the Non-Concurrence Process (NCP).

The NCP allows employees to document their differing views and concerns early in the decision-making process, have them responded to (if requested), and include them with proposed documents moving through the management approval chain to support the decision-making process.

NRC Form 757, "Non-Concurrence Process," is used to document the process.

Section A of the form includes the personal opinions, views, and concerns of a non-concurring NRC employee.

Section B of the form includes the personal opinions and views of the non-concurring employee's immediate supervisor.

Section C of the form includes the agency's evaluation of the concerns and the agency's final position and outcome.

NOTE: Content in Sections A and B reflects personal opinions and views and does not represent the official agency's position of the issues, nor official rationale for the agency decision. Section C includes the agency's official position on the facts, issues, and rationale for the final decision.

1. Was this process discontinued? If so, please indicate the reason and skip questions 2 and 3:
Process was not discontinued
2. At the completion of the process, the non-concurring employee(s):
Continued to non-concur
3. For record keeping purposes:
This record has been reviewed and approved for public dissemination

NRC FORM 757 (06-2019) NRC MD 10.158		U.S. NUCLEAR REGULATORY COMMISSION		1. NCP Tracking Number NCP-2021-006
NON-CONCURRENCE PROCESS (Continued)				Date 2021-09-27
Section A – To Be Completed by Non-Concurring Employee				
2. Title of Subject Document Safety Evaluation Report Related to the Subsequent License Renewal of North Anna Power Station, Units 1 and 2			3. ADAMS Accession Number ML21264A011	
4. Document Signer Smith - NRR, Brian - DIRECTOR, DIV NEW AND RENEWED LIC.		5. Document Signer's Office NRR		6. Document Signer's Email Brian.Smith@nrc.gov
7. Name of Non-Concurring Employees Allik, Brian - MATERIALS ENGINEER		8. Non-Concurring Employee Offices NRR		9. Employee Emails Brian.Allik@nrc.gov
10. Non-Concurring Employee's Role for the Subject Document Document Contributor				
11. Name of Non-Concurring Employee Supervisors Bloom, Steven - BRANCH CHIEF		12. Non-Concurring Employee Supervisor Offices NRR		13. Supervisor Emails Steven.Bloom@nrc.gov
14. I would like my non-concurrence considered, but a written evaluation in Sections B and C is not necessary.				
15. When the process is complete, I would like management to determine whether public release of the NCP Form (with or without redactions) is appropriate (Select "No" if you would like the NCP Form to be non-public): Yes				
16. Reasons for the Non-Concurrence, Potential Impact on Mission, and the Proposed Alternatives Please see attached.				
17. Submitted By / Submitted On Allik, Brian - MATERIALS ENGINEER				2021-09-27

Section A

16. Reasons for the Non-Concurrence, Potential Impact on Mission, and the Proposed Alternatives

During its review of the North Anna Subsequent License Renewal Application (SLRA), the staff noted that six failures of buried gray cast iron fire protection system piping had occurred between 1984 and 2003 (the degradation mechanism was cracking due to cyclic loading from pre-existing manufacturing flaws in the pipe or flaws that were initiated during the installation process). In response to these failures, Dominion added Enhancement No. 6 to SLRA Section B2.1.27, "Buried and Underground Piping and Tanks," (see letter dated August 26, 2021 (ADAMS Accession No. ML21238A297)) to address how this aging effect will be managed during the subsequent period of extended operation (SPEO). The staff's evaluation of this enhancement is documented in SER (Safety Evaluation Report) Section 3.0.3.2.14, "Buried and Underground Piping and Tanks." I am writing this non-concurrence because Dominion has not demonstrated that cracking due to cyclic loading will be adequately managed during the SPEO based on the following reasons:

Inspection Methodology. The August 26, 2021, submittal states visual (VT) and magnetic particle (MT) examinations will be conducted on buried gray cast iron piping with radiographic (RT) non-destructive examination (NDE) applied to areas that have potential surface cracking identified using the MT method. During my review of documentation provided on Dominion's ePortal, I noted "[c]harpy V-notch tests performed at 70 degrees F revealed that the cast iron pipe material has practically no notch toughness" (MESL-N-00233, "Analysis of North Anna Station Cast Iron Fire Protection Line Failure," dated October 12, 1989). Based on the brittle nature of the material, I have concerns that pre-existing embedded flaws in the pipe (which would not be detected by internal or external surface examinations) could result in future failures.

Inspection Sample Size. The August 26, 2021, submittal states the quantity of inspections for cracking due to cyclic loading was selected for consistency with Preventive Action Category F in GALL-SLR Report Table XI.M41-2, "Inspection of Buried and Underground Piping and Tanks." This designation is not appropriate based on the following reasons:

- Cracking due to cyclic loading is not an aging effect/mechanism addressed in GALL-SLR Report AMP XI.M41, "Buried and Underground Piping and Tanks." Therefore, relating inspections for cracking due to cyclic loading to an inspection category in GALL-SLR Report AMP XI.M41 (without adequate technical justification) is not appropriate.
- LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank Recommendations," (ADAMS Accession No. ML15308A018) significantly reduced the number of inspections for Preventive Action Category F (i.e., 20 inspections in each 10-year interval (on average) to 6 inspections in each 10-year interval). These reduced inspection quantities in LR-ISG-2015-01 were later incorporated into GALL-SLR Report AMP XI.M41 in 2017. The reduction in inspections was based (in part) on the staff's review of industry operating experience not identifying failures of the intended function of buried piping components (i.e., sufficient flow at adequate pressure is delivered). Based on operating experience at North Anna where there were six failures of buried gray cast iron piping in the fire protection system, the use of Preventive Action Category F (as

prescribed in LR-ISG-2015-01 and later incorporated into GALL-SLR Report AMP XI.M41) in this instance is not appropriate.

Consideration of Time Since Last Failure. Failures of buried gray cast iron fire protection system piping have not occurred at North Anna since 2003. The rationale provided by the staff for this in SER Section 3.0.3.2.14 is "corrective actions taken after the 2003 event reduced the frequency and magnitude of the hydraulic transients." However, due to the continued growth of flaws in the pipe (that have not yet grown to a critical flaw size) in conjunction with the potential for ongoing graphitic corrosion (i.e., selective leaching) of the pipe, it would take a less severe hydraulic transient in the future (i.e., the SPEO) to result in failure when compared to the failures that occurred prior to 2003.

Projecting Crack Growth to the End of the SPEO. The August 26, 2021, submittal states if results of the destructive examination inspections determine the cracking is due to cyclic loading, then Engineering will perform a crack growth evaluation and a flaw stability evaluation based on the predicted crack lengths at the end of the SPEO. In my opinion, more quantitative details need to be provided with respect to the crack growth and flaw stability evaluations due to the brittle nature of the material (e.g., acceptance criteria for cracks, critical crack length, material properties for the crack growth evaluation, pressure surge values and number of cycles used in the crack growth evaluations).

Corrective Actions. The August 26, 2021, submittal states if results of the evaluations indicate the depth or extent of cracking of the base metal is projected to cause loss of intended function prior to the end of the SPEO, Engineering will perform an evaluation to determine the extent of condition, extent of cause, and the need for further follow-on actions through the Corrective Action Program. If this threshold is reached (i.e., cracking is projected to cause loss of intended function), then it would be reasonable to assume that there is a substantial amount of piping with similar characteristics. Given that there is a history of failures of this piping, this threshold would indicate that the piping has reached end-of-life and should be replaced.

Credit for Undefined NDE Techniques. In SER Section 3.0.3.2.14, the staff stated "Dominion will maintain cognizance of new and improved NDE techniques for potential incorporation into procedures, which will maintain the capabilities of the inspections consistent with the latest industry knowledge and experience." Based on my experience as a technical reviewer in license renewal, it does not seem appropriate for the staff to credit undefined NDE techniques (which may or may not be used in the future) in the SER. Typically, the staff evaluates whether a specific NDE technique (e.g., ultrasonic testing) is capable of detecting a specific degradation mechanism (e.g., loss of material due to general corrosion).

NRC FORM 757 (06-2019) NRC MD 10.158		U.S. NUCLEAR REGULATORY COMMISSION		1. NCP Tracking Number NCP-2021-006
NON-CONCURRENCE PROCESS (Continued)				Date 2021-10-15
Section B – To Be Completed by Non-Concurring Employee’s Supervisor				
2. Title of Subject Document Safety Evaluation Report Related to the Subsequent License Renewal of North Anna Power Station, Units 1 and 2			3. ADAMS Accession Number ML21264A011	
4. Name of Non-Concurring Employee’s Supervisor Bloom, Steven - BRANCH CHIEF		5. Non-Concurring Employee’s Supervisor Email Steven.Bloom@nrc.gov	6. Office NRR	
7. Comments for the NCP Reviewer to Consider I support my staff’s use of the non-concurrence process and agree with the technical merits of this non-concurrence with respect to North Anna adequately revising the Buried and Underground Piping and Tanks Aging Management Program (AMP) due to failures of buried gray cast iron fire protection system piping caused by cracking due to cyclic loading from pre-existing manufacturing flaws or flaws initiated during the installation process. However, Dominion has included an enhancement to detect cracking by cyclic loading by performing excavations in which the excavated piping will be examined by non-destructive and destructive methods. If cracking is identified, Dominion will perform a crack growth evaluation and a flaw stability evaluation at the end of the subsequent period of extended operation. If necessary, an extent of condition, extent of cause, and the need for further follow-on actions will be entered in the Corrective Action Program. This enhancement forms the basis for the determination with reasonable assurance that this AMP will address cracking due to cyclic loading of the gray cast iron piping of the fire protection system piping.				
8. Reviewed By / Reviewed On Bloom, Steven - BRANCH CHIEF				2021-10-15

NRC FORM 757 (06-2019) NRC MD 10.158	U.S. NUCLEAR REGULATORY COMMISSION	1. NCP Tracking Number NCP-2021-006
	NON-CONCURRENCE PROCESS (Continued)	Date 2021-12-13

Section C – To Be Completed by NCP Coordinator

2. Title of Subject Document Safety Evaluation Report Related to the Subsequent License Renewal of North Anna Power Station, Units 1 and 2	3. ADAMS Accession Number ML21264A011
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4. Name of NCP Coordinator Johnson, Marieliz - PROJECT MANAGER	5. NCP Coordinator's Email Marieliz.VeraAmadiz@nrc.gov	6. Office NRR
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7. Agreed Upon Summary of Issues

The non-concurring employee contends that Dominion has not demonstrated that cracking due to cyclic loading of buried gray cast iron fire protection system piping will be adequately managed during the SPEO. Summary of Issues • Based on the brittle nature of the material, pre-existing embedded flaws (which would not be detected by internal or external surface examinations proposed by the applicant) could result in future failures of the piping. • The quantity of inspections for cracking due to cyclic loading was selected for consistency with Preventive Action Category F in GALL-SLR Report Table XI.M41-2, "Inspection of Buried and Underground Piping and Tanks," but this is inappropriate due to the aging effect/mechanism not being included in the GALL-SLR aging management program, and the past history of failures at North Anna. • The continued growth of flaws in the piping (that have not yet grown to a critical flaw size) in conjunction with the potential for ongoing graphitic corrosion (i.e., selective leaching) of the piping would take a less severe hydraulic transient in the future (i.e., the subsequent period of extended operation) to result in failure when compared to the failures that occurred prior to 2003. • Should the inspections identify cracking for which evaluations indicate the depth or extent of cracking of the base metal is projected to cause loss of intended function prior to the end of the subsequent period of extended operation, the history of failures of this piping would indicate that the piping has reached its end-of-life and should be replaced. • The SER should not credit undefined NDE techniques, which may or may not be used in the future.

8. Evaluation of Non-Concurrence and Rationale for Decision

The non-concurring staff member's use of the non-concurrence process is appreciated as an appropriate mechanism to raise concerns and differing views. I also appreciate the comments provided by the non-concurring employee's supervisor in Section B and find them to be consistent with my evaluation discussed below. The technical issues identified in the non-concurrence are legitimate technical issues related to aging management of buried gray cast iron piping. However, the issues identified in the non-concurrence will be appropriately evaluated and addressed within the context of the principles of license renewal, the NRC's reactor oversight activities, and the standard of "reasonable assurance" in approving renewed licenses. The process outlined in 10 CFR Part 54 for license renewal (which includes subsequent license renewal) is founded on these principles as stated in the Statements of Consideration for the 1995 license renewal rule (60 Federal Register 22464): · The ongoing regulatory process is adequate to ensure the safety of currently operating plants · The plant-specific licensing basis must be maintained in the same manner and to the same extent as during the original licensing term, in part through a program of age-related degradation management for plant structures and components that meet the scoping and screening requirements of the rule One part of the NRC's ongoing regulatory process is the implementation of the oversight program, which includes several aspects that are pertinent to aging management program implementation and potential licensee corrective actions: resident inspector reviews, regional inspector reviews of ISI-related activities, and review of corrective actions. The basis for approval of subsequent license renewal applications is the concept of "reasonable assurance," as stated in 10 CFR 54.29 (with emphasis added): A renewed license may be issued by the Commission up to the full term authorized by § 54.31 if the Commission finds that: (a) Actions have been identified and have been or will be taken with respect to the matters identified in Paragraphs (a)(1) and (a)(2) of this section, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant's CLB in order to comply with this paragraph are in accord with the Act and the Commission's regulations. These matters are: (1) 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 § 54.21(a)(1); and (2) time-limited aging analyses that have been identified to require review under § 54.21(c). In addition to the requirements for subsequent license renewal, the agency's overall regulatory

process involves numerous NRC activities related to operating plants, including the reactor oversight process to verify operation in compliance with the CLB. In particular, the process involves oversight of licensee performance relative to regulatory requirements, such as conformance to the quality assurance requirements of Appendix B to 10 CFR Part 50. As an example, Criterion XVI of Appendix B, "Corrective Actions," describes the need to determine the cause of the condition and to take corrective action to preclude repetition for significant conditions adverse to quality. Although the applicability of Appendix B is limited to license renewal SSCs that are in scope in accordance with 54.4(a)(1), Appendix A1 of the NAPS subsequent license renewal application (SLRA) states: The scope of the existing QA Program is expanded to also include safety-related and nonsafety-related structures and components (SCs) subject to AMPs. Regarding the specific bases cited in the non-concurrence: Inspection Methodology This topic has two interrelated items: (1) potential failure of embedded flaws missed by the NDE methods, and (2) adequacy of the proposed NDE methods. Embedded flaws – The failure of a cracked structure is driven by the fracture toughness of the material, which can be translated into a critical value of the crack opening, i.e., the amount the crack opens under load. For similarly sized flaws (e.g., length and depth), the same load will cause a larger crack opening (i.e., larger stress intensity factor) in a surface breaking flaw as compared to an embedded flaw due to the surrounding material restraint. Therefore, the failure behavior of a surface breaking flaw will bound a similarly sized embedded flaw. Adequacy of NDE – Visual examinations are capable of finding surface-breaking flaws, whereas magnetic particle testing is also a surface examination technique but it is cited as having a penetration depth of 2-3 mm, or a combined ~0.2 inch of the pipe cross section out of a pipe wall thickness of ~0.5 in. Therefore the proposed examination methods are capable of interrogating a substantial portion of the near-surface material that could lead to failure of the piping. With the much reduced stress intensity that would exist for an embedded flaw in the non-interrogated region of the piping, failure of an undetected flaw within that volume would be unlikely. With the adequacy of the proposed surface examination techniques directly tied to the very low likelihood of failure of potentially missed embedded flaws in the non-interrogated piping material, the techniques discussed in the application are judged to be effective in detecting cracking on the piping surface and near surface material that could lead to piping failure. Inspection Sample Size This topic has two interrelated items: (1) relating inspections for cracking due to cyclic loading to an inspection category in GALL SLR Report AMP XI.M41 (without adequate technical justification) is not appropriate, and (2) the use of Preventive Action Category F (as prescribed in LR-ISG-2015-01 and later incorporated into GALL-SLR Report AMP XI.M41) in this instance is not appropriate. Use of GALL-SLR Report AMP XI.M41: Two objectives of AMPs are the ability to detect the aging effect(s) of interest and the implementation of preventive actions to limit the impacts of aging on component and structure intended functions. Although cracking due to cyclic loading is not explicitly identified in the cited GALL-SLR AMP, the AMP is stated to be appropriate to manage cracking in steel buried piping, albeit from a corrosion cracking mechanism. The applicant's proposed use of this AMP to manage cracking due to cyclic loading is acceptable because cracks resulting from cyclic loading (i.e., planar, non-branching cracks) should have a higher likelihood of detection as compared to a stress-corrosion cracking or cracking from a similar mechanism that produces branched cracks. Therefore, in this case the precise mechanism of the cracks is not relevant in determining whether the aging effect of cracking can be managed by the AMP. Regarding preventive measures, the effectiveness of the NAPS changes in pump testing procedures is clear in that no failures of the piping have occurred since 2003, after six prior failures in the previous 19 years. Although these actions are not consistent with the preventive measures addressed in the GALL-SLR AMP to address corrosion-induced mechanisms, the intent of preventive measures is to reduce the number of failures – the NAPS test procedure changes have clearly done that. The Category F inspections in the GALL-SLR Report AMP represent the worst case for corrosion-related aging effects in the AMP, with no effective implementation of preventive measures (i.e., cathodic protection system, coating and/or backfill do not meet acceptance criteria), and are a conservative inspection regimen. For the circumstances at NAPS, the successful implementation of preventive measures and no operating experience of pipe failures since 2003 are indicative that the causes of the cracking have been controlled; therefore the Category F inspections are adequate for this piping. Any adverse findings from the planned inspections would be entered into the corrective action program and would result in implementation of corrective actions, one step of which would likely be an expansion of the inspection sample. Consideration of Time Since Last Failure The continued growth of flaws in the piping, in conjunction with the potential for ongoing selective leaching, and the potential implications for likelihood of additional pipe failures is an interesting consideration, in particular given the apparent history of inadvertent pump actuations since the pump test procedure changes in 2003. The planned inspections by the applicant will assess the extent of selective leaching in this piping, as well as any indications of cracking, to enable a more complete consideration of this item. It is speculative as to the extent of flaw growth – if any – that has occurred due to the implementation of the modified pump

test procedure and the few inadvertent pump actuations. Further, it isn't clear that a less severe transient would result in failure of the piping – the inadvertent pump actuations that have occurred since 2003 with no failures are one indication of this. Projecting Crack Growth to the End of the SPEO Although the staff would prefer to have details on the crack growth and flaw stability evaluations that will be implemented as a part of corrective actions, this information is not necessary to find the program acceptable and is more appropriately reviewed as a part of oversight should these evaluations be necessary. Corrective Actions The Corrective Actions element of the GALL-SLR Report Section XI.M41 states: Results that do not meet the acceptance criteria are addressed in the applicant's corrective action program under those specific portions of the quality assurance (QA) program that are used to meet Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Until the applicant has completed its examinations and evaluated the results, speculation on the potential findings is premature. Similarly, it is too early to pre-judge the implications of potential examination and evaluation results, and potential additional follow-on actions. In this case, the GALL-SLR AMP has identified the applicant's corrective action program as acceptable and there is no basis at this time to question the adequacy of that guidance for this instance. Corrective actions, should they be necessary, would be more appropriately reviewed as a part of oversight. Credit for Undefined NDE Techniques The statement is correct in that the staff should not base its findings on unspecified NDE techniques, whether they will reflect the latest technology or not. The safety evaluation report (SER) wording is clear that acceptability of the program is based on the proposed examination technique(s) by the applicant and not its plan to maintain cognizance of new and improved NDE techniques: While this activity is not a basis for the staff's finding that this enhancement is acceptable, it provides confirmation that the applicant will take a proactive approach to this program by remaining knowledgeable on the latest evolutions of NDE technology and considering implementation of them in its program. Summary I want to re-state my appreciation to the employee for using the non-concurrence process to raise his concerns and differing views. Note that our initial review of the cited concerns led us to make changes to the SER to clarify the bases for finding the applicant's program adequate to provide reasonable assurance. For the reasons stated above, I am confident that the proposed aging management program(s) will effectively manage the aging effects associated with the buried gray cast iron piping during the subsequent period of extended operation. Therefore, there is reasonable assurance that that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB and the renewed license can be issued.

<p>9. Coordinated By / Coordinated On Johnson, Marieliz - PROJECT MANAGER</p>	<p>2021-12-30</p>
<p>10. Approved By / Approved On Taylor, Robert - DEP. OFFICE DIRECTOR FOR NEW REACTORS</p>	<p>2022-01-04</p>