VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

November 30, 2001

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 01-647
LR/MWH R0
Docket Nos.: 50-280/281
50-338/339
License Nos.: DPR-32/37
NPF-4/7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY AND NORTH ANNA POWER STATIONS UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
LICENSE RENEWAL APPLICATIONS

In an October 11, 2001 letter, the NRC requested additional information regarding the license renewal applications (LRAs) for Surry and North Anna Power Stations. The attachment to this letter contains the responses to the Requests for Additional Information (RAIs) associated with Sections 3.1.1, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.6.2, 4.4, B2.2.1, B2.2.7, B2.2.9, B2.2.17, and B2.2.19 of the LRA.

Should you have any questions regarding this submittal, please contact Mr. J. E. Wroniewicz at (804) 273-2186.

Very truly yours,

David A. Christian
Senior Vice President – Nuclear Operations and Chief Nuclear Officer

Attachment

Commitments made in this letter: None

A001

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COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Christian who is Senior Vice President and Chief Nuclear Officer of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 30th day of November, 2001.

My Commission Expires: 3-31-04.

Maggie McClure
Notary Public

(SEAL)

Attachment

License Renewal – Response to RAI
Serial No. 01-647

Response to Request for Additional Information

Dated October 11, 2001

Surry and North Anna Power Stations, Units 1 and 2

License Renewal Applications

Sections 3.1.1, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.6.2, 4.4, B2.2.1, B2.2.7, B2.2.9, B2.2.17, and B2.2.19

Virginia Electric and Power Company
(Dominion)

Section 3.1.1, "Reactor Coolant System Piping and Associated Components"

RAI 3.1.1.2-1:

Topical Report WCAP-14575-A, Section 3.1, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components contains a discussion on industry issues associated with the RC piping components. Renewal applicant action item number 3 from the staff's final safety evaluation report (SER) states that "[t]he renewal applicant should complete the updated review of generic communications and capture any additional items not identified by the original review." The original review includes published documents up to 1994. In response to the renewal applicant action item, the applicant states that it has completed a review of all generic communications related to the RCS components. Discuss the criteria used to determine which issues in the generic communications required an aging management review.

Dominion Response:

Dominion has reviewed generic communications issued from 1994 to May 2000 for aging management issues related to RC system components. The following criteria were established to identify aging issues in generic communications relevant to the RC system:

1. The issue is aging related (i.e., not a design deficiency or operational event), and
2. The issue is applicable to in-scope RC system components, and
3. The issue involves a material/environment combination or aging mechanism/effect that was not already considered in the aging management review for the RC system.

Based on the review of the generic communications issued since 1994, no additional issues requiring evaluation were identified.

RAI 3.1.1.2-2:

Renewal applicant action item number 6 from the staff's final SER for WCAP-14575-A states that, "[t]he license renewal applicant should perform additional inspection of small-bore RC system piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore piping is adequately managed during the period of extended operation." In response to this action item, the applicant states that selected volumetric examinations are being performed on Surry, Unit 1, on a sample population of welds in several 3-inch lines in the safety injection (SI) and chemical and volume control systems (CVCS). The SI and CVCS lines are Class 2; however, they are used as leading indicators for small-bore piping conditions in Class 1 systems. Provide justification for the conclusion that the SI and CVCS small-bore lines bound all small-bore lines within the scope of the license renewal for the RC piping system.

Dominion Response:

Dominion has reviewed in-house operating experience from North Anna and Surry Power Stations and there have been no indications of cracking from age related degradation in small-bore piping.

Based upon further review of inspections being performed as part of the Risk Informed Inservice Inspection Program, Dominion has determined that volumetric examinations of Class 2 small bore piping welds have limited value in managing aging of in-scope Class 1 RC system small bore piping and will not credit these inspections as part of the aging management activity for these lines. Rather, as presented in the Surry and North Anna applications as a licensee follow-up action (Section B2.2.11 and Table B4.0-1), Dominion will participate in the EPRI Materials Reliability Project Industry Task Group on thermal fatigue to address small-bore piping issues. Dominion will follow industry activities related to failure mechanisms for small-bore piping and evaluate industry recommendations for aging management. Changes will be made to the ISI Program - Component and Component Support Inspections activity, as appropriate, based on industry recommendations.

RAI 3.1.1.2.2-1:

Both LRAs, Table 3.1.1-1, identifies the inservice inspection (ISI) program as an aging management activity for cracking in piping and valve bodies. The footnotes in Table 3.1.1-1 indicate that ISI as an aging management activity is applicable to Class 1 components only. If there are any Class 2 piping or valve bodies that are within the scope of the license renewal for RC piping and associated components discuss how cracking as an applicable aging effect will be managed during the period of extended operation.

Dominion Response:

As discussed in paragraph C3.2.1 of the Surry and North Anna applications, cracking resulting from stress corrosion cracking can occur in non-sensitized austenitic stainless steel components at temperatures greater than 140°F. However, Class 2 components of the RC system operate in less than 140°F environments. Therefore, cracking of RC system Class 2 components due to stress corrosion cracking is not an applicable aging effect.

As discussed in paragraph C3.2.2 of the application, flaw initiation and growth is evaluated and managed only for Class 1 pressure boundary components of the RC system. The ASME Class 1 components relied upon to maintain the reactor coolant pressure boundary warrant additional measures to assure nuclear safety beyond those required for ASME Class 2 components. Therefore, cracking due to flaw initiation and growth is an aging effect associated only with ASME Class 1 components.

Section 3.5, "Aging Management of Structures and Component Supports"

RAI 3.5-1:

In both LRAs, Section 3.5.1, the applicant does not include an aging management review of a de-watering system for control of hydrostatic pressure to the containment liner plate. If a de-watering system is relied upon for control of hydrostatic pressure to the containment liner plate, then the de-watering system needs to be included within the scope of license renewal and subject to an aging management review, as applicable. Therefore, the applicant needs to demonstrate that the buildup of hydrostatic pressure cannot affect the intended function of the Containment liner plate, or needs to provide an aging management program for the SCs of the containment de-watering system.

Dominion Response:

The foundation mats of the Surry and North Anna Containments are located below the ground water table. The below-grade foundation and exterior wall design includes a waterproof membrane and high-density, low-permeability concrete that significantly reduce the likelihood of groundwater migration to the Containment liner. Therefore, the occurrence of hydrostatic pressure on the Containment liner due to groundwater is unlikely. In addition to design features, a non-safety related Containment subsurface drainage system was installed to further reduce the potential for hydrostatic pressure on the liner.

The subsurface drainage system was originally determined not to be within the scope of license renewal. However, further review has determined, in consideration of the importance of the Containment liner, that the drainage system will be conservatively included within the scope of license renewal to ensure its operability through the extended period of operation.

An aging management review has been completed for the subsurface drainage system components, the associated component supports, and the associated concrete access shafts. The pump casings, valve bodies and piping associated with the system are subject to loss of material and will be managed by the Work Control Process activity described in Section B2.2.19 of the applications. Component supports are subject to loss of material, and will be managed by the Infrequently Accessed Area Inspection activity described in Section B2.1.2. Although the aging management review has concluded that there are no aging effects requiring management for the concrete access shafts, the potential aging effects of loss of material, cracking, and change in material properties will be managed, as discussed in the response to RAI 3.5-7, with the Infrequently Accessed Areas Inspection activity.

The response to this RAI will require changes to the UFSAR Supplement that will be presented to the NRC staff in a future revision.

RAI 3.5-2:

Both LRAs, Section 3.5.1, contain a statement that the structures and structural members located below the local groundwater elevation are not exposed to aggressive chemicals on the basis of recent chemical analyses of the groundwater described in Appendix C. The results of the recent groundwater analyses, presented in Appendix C were reviewed by the staff. The pH level, chloride content, and sulfate content demonstrate that the groundwater is not aggressive. Consequently, the staff agrees that loss of material, cracking, and change in material properties caused by aggressive chemical attack are not significant for below grade exterior concrete regions for structures and structural components that are within the scope of license renewal and subject to an aging management review. In addition, loss of material due to corrosion of embedded steel and cracking due to corrosion of embedded steel for below grade exterior regions are not significant. However, there is no discussion on future sampling to ensure that groundwater conditions do not change. Identify if the associated aging management activities include period sampling of groundwater to ensure non-aggressive conditions throughout the period of extended operation, or provide a technical basis for not requiring periodic sampling.

Dominion Response:

At the Surry site, groundwater samples, taken from March 1995 to September 2000, indicate ranges of 3.67 to 14.02 ppm for chlorides (average value 7.32 ppm) and 3.04 to 6.58 ppm for sulfates (average value 4.24 ppm). Groundwater pH values reported from tests conducted in June 1985, October 1999, and July 2000 indicate a range of 7.23 to 8.40 (average value 7.84). The results of the groundwater analysis indicate that the chemistry of the groundwater is not aggressive and has a conservative margin compared to the aggressive chemical threshold limits, which are pH < 5.5, Chloride > 500 ppm, Sulfate > 1500 ppm in accordance with the conclusion of NUREG-1557.

At the North Anna site, groundwater samples taken in 1992, 1995, 1998, and 2000 indicate ranges of 1.9 to 28 ppm for chlorides (average value of 9 ppm) and 4.4 to 33.0 ppm for sulfates (average value of 13.52 ppm). Reported groundwater pH values range from 6.76 to 10.80 (average value is 7.68). Similar to the Surry site, the groundwater at the North Anna site is not aggressive and has a conservative margin compared to the aggressive chemical threshold limit.

At both Surry and North Anna, there is currently not enough historical groundwater sampling data available to develop a groundwater chemistry trend. Although Dominion does not expect the groundwater at either of the sites to become aggressive, routine monitoring of the groundwater chemistry at both sites is presently being conducted and will be continued on an annual basis throughout the period of extended operation. Monitoring of groundwater chemistry will be performed as part of the Civil Engineering Structural Inspection aging management activity described in Section B2.2.6 of the application.

The response to this RAI will require changes to the UFSAR Supplement that will be presented to the NRC staff in a future revision.

RAI 3.5-3:

In both LRAs, Section 3.5.1 and Table 3.5.1-1, the information provided indicates that no aging effects of containment concrete require aging management. However, for the containment concrete (dome, walls, and basemat) there has been sufficient operating experience that demonstrate the need for aging management of containment structures (e.g., NRC Secy-96-080, April 16, 1996, "...nearly one-half of the concrete containments have reported degradation related to the concrete or the post-tensioning system.") Consequently, 10 CFR 50.55a requires inservice inspection of containment concrete in accordance with ASME Section XI, Subsection IWL (Examination Category L-A) and also specifies additional provisions beyond those required in Subsection IWL. It was noted that the implementation of the ASME Code, Section XI, Subsection IWL, Examination Category L-A, inservice examination is a current requirement and, therefore, the same program could be credited for the period of extended operation. On the basis of the above discussion, the applicant is asked to either credit its ASME Code, Section XI, Subsection IWL, Examination Category L-A, inservice examination or a similar program as its AMA for containment concrete, or provide a more detailed technical justification for not managing potential aging of containment concrete.

Dominion Response:

As presented in Section 3.5.1 and in Table 3.5.1-1 of the North Anna and Surry license renewal applications, the Dominion aging management review for the Containment concludes that there are no aging effects requiring management for concrete structural members. This conclusion is supported by both the aging effects evaluation and a review of site operating experience. However, based on discussions with the NRC staff and in a letter to Florida Power and Light dated October 30, 2001, the staff disagrees with this position and is requiring aging management of concrete for the effects of loss of material, cracking, and change in material properties.

Therefore, Dominion will credit the examinations required by ASME Section XI, Subsection IWL, Examination Category L-A to manage the potential aging effects of concrete structural members of the Containment. These examinations will be added to the ISI Program - Containment Inspections aging management activity that is currently included in the application.

The response to this RAI will require changes to the UFSAR Supplement that will be presented to the NRC staff in a future revision.

RAI 3.5-4:

In both LRAs, Section B2.2.12, the applicant does not identifies ISI, Subsection IWE, Category E-D (seals, gaskets, and moisture barriers) inspection activities as being within the scope of the ISI aging management activities. Therefore, the staff requests that the applicant identify the aging management activities for seals, gaskets, and moisture barriers, as applicable, or provide a technical justification for not managing any of these components that are within the scope of license renewal and subject to an AMR.

Dominion Response:

Dominion uses the Work Control Process to manage the aging of Containment seals and gaskets since that activity involves more thorough and more frequent inspection of the seals and gaskets than do inservice inspections which are required only once per 10-year interval. Confirmation that the Work Control Process is a wide-ranging activity with numerous tasks for a variety of systems and components is described in the response to RAI B2.2.19-3.

Regarding moisture barriers, there are no such barriers that are within the scope of ISI-IWE, Category E-D inspections incorporated into the design of the Containment structures for Surry or North Anna.

Table 3.5.1-1 (Containment) of the License Renewal Applications for Surry and North Anna confirms the use of the Work Control Process to manage aging effects for seals and gaskets (identified as O-rings in the table).

RAI 3.5-5:

In both LRAs, Appendix B, the information provided states that the ISI Program - Containment Inspection includes Category E-P (all pressure retaining components), which refers to 10 CFR 50, Appendix J, Option B. However, there is no description of the 10 CFR 50, Appendix J leak rate testing activity as an aging management program. In a conference call with the applicant, dated August 8, 2001, the applicant stated that Option B is one means of fulfilling the requirements of 10 CFR Part 50, Appendix J. The applicant verified that they use Option B as approved by the staff for both NAS and SPS. However, in previous discussions with the industry, the staff justified the need for an applicant to credit an integrated leak-rate program that is described in more detail in the LRA. Although the staff has determined that an integrated leak rate test performed in accordance with Appendix J, Option B, and consistent with the requirements in TS is one means of managing the applicable aging of the Containment structure, simple reference to the ISI Program - Containment Inspection includes Category E-P, which in turn references Appendix J, Option B, is in itself not sufficient for the staff to make its determination. The applicant needs to more clearly document that the testing will be performed in accordance with Appendix J, Option B, and consistent with the associated requirements in TS.

Dominion Response:

Containment leakrate testing is performed as required by Surry Technical Specification 4.4 (Containment Tests) and North Anna Technical Specification 3.6.1.2 (Containment Leakage). These technical specifications invoke the testing requirements of 10 CFR 50, Appendix J, Option B. Containment leakrate testing, in accordance with the ISI Program - Containment Inspection activity described in Section B2.2.12 of the application, is credited with managing the aging of Containment pressure-retaining components. Compliance with identified testing requirements and acceptance standards confirms that the management of aging effects for sealing surfaces is effective to ensure the integrity of the Containment pressure boundary.

RAI 3.5-6:

In both LRAs, Section 3.5.1 (under the heading "Environment"), the information provided indicates that the general air temperature in containment is not greater than 150°F, and hot pipe penetrations are exposed to elevated localized temperatures of less than 200°F. Elevated temperatures in the auxiliary building structures, other Class I structures (except the main steam valve house), and fuel buildings are not addressed in the LRAs, Sections 3.5.2 through 3.5.4. In a telecommunication dated August 8, 2001, the applicant stated that with the one exception noted above, the air temperature for both plant containments are maintained below 150°F, and that there are no known areas of localized air temperatures greater than 200°F. The applicant needs to more clearly document this information for the staff to perform its evaluation.

Dominion Response:

With the exception of the upper level of the Surry and North Anna Main Steam Valve Houses, the air temperature for both Surry and North Anna Containments, Auxiliary Buildings, Other Class 1 Structures, and Fuel Buildings is maintained below 150°F, and there are no known areas of localized air temperatures greater than 200°F in any of these structures.

The maximum temperature for the Surry Main Steam Valve Houses is identified as 140°F in Section 3.5.3 of the application. However, upon further review, there is no conclusive temperature data to support this maximum temperature. Therefore, the upper level of the Surry Main Steam Valve Houses will be assumed to be exposed to greater than 150°F air temperature as noted above. Aging effects for concrete in both the Surry and North Anna Main Steam Valve Houses will be managed as described in the response to RAI 3.5-7.

RAI 3.5-7:

In both LRAs, Sections 3.5.2, 3.5.3, and 3.5.4, the information provided does not include a discussion regarding operating experience associated with structural concrete members. Industry experience indicates that age-related concrete degradation has occurred at a number of plants. In a telecommunication dated August 8, 2001, the applicant maintained that they are unaware (with the exception of the SPS intake structure) of any ongoing aging at North Anna and Surry that can adversely effect the intended function of any on-site structures for the period of extended operation. However, on the basis of the staff's concern, they agreed to manage potential aging of the Containment by crediting its existing ISI-IWL, Category L-A as stated in RAI 3.5-4, above. The applicant will use the findings from these inspections as a leading indicator for potential aging of other on-site structures, and will take appropriate steps to address the aging of the containment structure and other on-site structures under its 10 CFR Part 50, Appendix B program. Although this approach appears reasonable, the staff does not agree that an extrapolation of structural aging for the period of extended operation can be made based on the past performance or the on-going aging of the containment structure to other structures requiring aging management. On the basis of this discussion, the staff requests that the applicant either, implement an AMA for the potential aging of the concrete nuclear structures (other than containment) that are within the scope of license renewal, or provide a technical justification for not managing the associated aging, such that there is reasonable assurance that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation.

Dominion Response:

As presented in the Surry and North Anna license renewal applications, there are certain specific concrete structures or concrete structural members for which Dominion has identified aging effects requiring management. For these structures, an aging management activity has been identified in the application to manage the effects of aging. However, for the majority of the concrete in structures within the scope of license renewal, Dominion has concluded that there are no aging effects requiring management. This conclusion is supported by both the aging effects evaluation and a review of site operating experience. However, the NRC staff disagrees with this position and is requiring aging management of concrete.

In response to the NRC staff concern, Dominion initially proposed to use the findings from the ISI-IWL external Containment inspections as a leading indicator for potential aging degradation of the structural concrete in structures other than Containment.

However, based on further discussions with the NRC staff, and in a letter to Florida Power and Light dated October 30, 2001, the staff is requiring aging management of concrete in structures other than Containment directly for the effects of loss of material, cracking, and change in material properties. Therefore, Dominion will credit the Civil Engineering Structural Inspection activity and the Infrequently Accessed Area Inspection activity, described in Sections B2.2.6 and B2.1.2 of the application,

respectively, to manage the potential aging effects of concrete internal to the Containment and concrete in other in-scope structures.

The response to this RAI will require changes to the UFSAR Supplement that will be presented to the NRC staff in a future revision.

Section 3.6, "Aging Management of Electrical and Instrumentation and Controls"

RAI 3.6.2-1:

In both LRAs, Section 3.6.2, the applicant does not identify any applicable aging effects for non-environmentally qualified cables. Industry operating experience indicates that aging of cables requires aging management. Therefore, the applicant is requested to perform an aging management review of non-EQ cables consistent with industry operating experience and submit aging management activities that demonstrate that the applicable aging effects will be managed throughout the period of extended operation.

Dominion Response:

As presented in Section 3.6.2 and Table 3.6.2-1 of the Surry and North Anna license renewal applications, the Dominion aging management review concludes that there are no aging effects requiring management for cables and connectors. This conclusion is supported by both the aging effects evaluation and a review of site operating experience. However, the NRC staff disagrees with this position, and is requiring management of cable aging effects.

Therefore, to address the NRC staff concern, Dominion has developed an aging management activity for non-environmentally qualified cables and connectors within the scope of license renewal. This new aging management activity is described below.

Non-EQ Cable Monitoring Aging Management Activity

Age-related degradation of cable jackets and connector coverings can result from exposure to high values of radiation or temperature, or to wetted conditions. The effects of aging become evident as cracking or changes in material properties in the form of discoloration or bulging that can be detected by visual inspection. Visual inspections also determine the presence of water around cables. The purpose of the Non-EQ Cable Monitoring activities will be to perform representative sample inspections of accessible cable jackets and connector coverings that are utilized in non-EQ applications.

Temperature monitoring in cable trays at Surry and North Anna Power Station has shown that actual temperatures are below the value that can adversely affect cable jackets and connector coverings. In-situ temperature monitoring has been performed at cable tray locations that included power cables for major components that could experience ohmic heating. The measured temperatures have been compared to the 60-year service limits determined using the guidance provided in Sandia National Laboratory report SAND96-0344 (Reference C). The evaluation of measured temperatures has confirmed that margin exists with respect to the 60-year service limits. It is expected that the cable-tray temperatures will not change significantly during

the period of extended operation, thus precluding a concern regarding cable and connector integrity. However, areas that could be susceptible to elevated temperatures will be included in the inspection plan.

Radiation exposure can cause cracking of cable insulation. The gamma/neutron dose that causes age-related degradation is based on a 60-year service radiation dose limit. As with thermal aging, evaluations confirm that degradation due to radiation exposure is not expected since the 60-year exposures remain below the 60-year service limit. Visual inspections will be performed in the Containment buildings, based on radiation survey data, to confirm the absence of age-related degradation due to radiation exposure.

Evaluations for cables at Surry and North Anna that are within the scope of license renewal indicate the expected absence of wetted conditions. This expectation is substantiated by the absence of any direct-buried medium voltage cable that is exposed to significant voltage (i.e., subjected to system voltage more than 25 percent of the time) at Surry and North Anna, and the design of manholes that contain in-scope medium voltage cables. The only non-EQ, medium-voltage cables of concern for potentially wetted conditions are the power cables for the service water pump motors at North Anna. Engineered features have been installed to prevent these non-EQ medium-voltage cables from being exposed to significant moisture. The existence of drain holes in the bottom of manholes and the seals that have been placed at manhole covers provide reasonable assurance that the cable will not become submerged. Periodic inspections will confirm the absence of standing water in the affected manholes.

In order to confirm that ambient conditions have not changed sufficiently to lead to age-related degradation of the in-scope cable jackets and connector coverings, initial visual inspections of representative samples of accessible, non-EQ application insulated power cables, instrumentation cables, and control cables (including low-voltage instrumentation and control cables that are sensitive to a reduction of insulation resistance) will be performed as a Licensee Follow-up Action between Year 30 and the end of the current operating license. Subsequent inspections will be performed at least once per 10 years during the period of extended operation.

An evaluation of the Non-EQ Cable Monitoring activities, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference A), is as follows:

Scope

Although evaluations have shown that aging effects requiring management are not expected for cable jackets and connector coverings that are within the scope of license renewal, Dominion plans additional activities to provide confirmation of these evaluations. A detailed review of Surry and North Anna facilities will be performed to

determine areas of high temperature or radiation for possible age-related degradation of cable jackets and connector coverings. An inspection plan will be developed, based on the results of this review, to visually examine representative samples of accessible, non-EQ cable jackets and connector coverings in the areas identified by the review as having potentially adverse localized conditions.

Preventive Actions

The non-EQ cable monitoring activity is designated condition monitoring. No preventive actions are required.

Parameters Monitored or Inspected

An inspection plan will be developed to visually examine representative samples of accessible, non-EQ cable jackets and connector coverings for surface indications, such as cracking, discoloration, or bulging. Areas will also be visually monitored to determine the presence of water around cables. EPRI document TR-109619 (Reference B) will be used for guidance in performing the inspections.

Detection of Aging Effects

Visual inspections of representative samples of non-EQ power, instrumentation, and control cable jackets and connector coverings detect the presence of cracking, discoloration, or bulging, which could indicate aging effects requiring management. These effects could be due to high values of radiation, high temperature, or wetted conditions. The potentially adverse localized environment, due to moisture, which could lead to water-treeing in medium-voltage cables that are within the scope of license renewal, is also detected by visually monitoring for the presence of water around cables.

Monitoring and Trending

Visual inspections for surface indications on non-EQ cable jackets and connector coverings can identify indications of age-related degradation due to heat, radiation, or wetted conditions. Periodic inspection for water collection in cable manholes will continue to be performed despite the fact that no water is expected due to the design of the manholes.

Initial visual inspections for representative samples of non-EQ, insulated power, instrumentation, and control cables and connectors will be performed as a Licensee Follow-up Action between year 30 and the end of the current operating license. Subsequent inspections will be performed at least once per 10 years during the period of extended operation.

Acceptance Criteria

The acceptance criterion for the condition of non-EQ cable jackets and connector coverings is the absence of anomalous indications that are signs of degradation. Such indications include cracking, discoloration, or bulging. The acceptance criterion with respect to wetted conditions is the absence of exposure to significant moisture. Cable found to be submerged in standing water for more than a few days will be subject to an engineering evaluation and corrective action. Inspection results for the condition of non-EQ cables and connectors will be summarized in a documented engineering evaluation. Any anomalies resulting from the inspections will be dispositioned by Engineering. Occurrence of an anomaly that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. The engineering evaluation of inspection results for the representative samples of accessible cables and connectors will consider whether the observed condition is applicable for other accessible or inaccessible cables and connectors. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to preclude recurrence.

Confirmation Process

The confirmation process for non-EQ cable monitoring involves the Work Control Process to monitor cable conditions on an on-going basis.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The non-EQ cable monitoring activity is new and has no operating experience. However, Dominion operating experience has shown that cable jacket anomalies have occurred, and have been evaluated and corrected to maintain intended functions at Surry and North Anna.

Summary

The non-EQ cable monitoring activity will confirm the acceptable condition of accessible, non-EQ cable jackets and connector coverings. A Licensee Follow-up Action Item ensures that an initial visual inspection will be performed for representative samples of accessible non-EQ cable jackets and connector coverings between year 30 and the end of the current operating license, and that subsequent inspections will be performed at least once per 10 years during the period of extended operation. Although age-related degradation is not expected for power, instrumentation, and control cables and connectors in their normal operating environments, visual inspections will provide reasonable assurance that the intended functions will be maintained, consistent with the current licensing basis, during the period of extended operation.

References

A. NUREG-1800, Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants, Nuclear Regulatory Commission, April 2001.

B. TR-109619, Guideline for the Management of Adverse Localized Equipment Environments, Electric Power Research Institute, Palo Alto, CA, June 1999.

C. SAND96-0344, UC-523, Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations, U.S. Department of Energy and Electric Power Research Institute, September 1996.

The response to this RAI will require changes to the UFSAR Supplement that will be presented to the NRC staff in a future revision.

Section 4.4, "Environmental Qualification"

RAI 4.4-1:

Please provide a description of the North Anna and Surry environmental qualification reanalysis attributes.

Dominion Response:

NORTH ANNA AND SURRY EQ COMPONENT REANALYSIS ATTRIBUTES

Section 4.4, Paragraph 2, of the North Anna and Surry License Renewal Applications identifies Option (iii), as defined in 10 CFR 54.21(c)(1)(iii), as the methodology used to evaluate environmentally qualified (EQ) equipment for the extended period of operation associated with license renewal. The Dominion Environmental Qualification Program (EQ Program) is in compliance with 10 CFR 50.49 and provides reasonable assurance, through analysis, testing, refurbishment, and replacement, that the equipment qualification (including aging) is adequately managed now and will continue to be maintained throughout the period of extended operation. In addition a substantial engineering effort has been conducted to review the aging analyses for each EQ equipment type that has an established qualified life of 40 years or more. The review has been performed using the same methodologies established by the EQ program. The methods and summary results of this review are also provided in Sections 4.4 of the respective License Renewal Applications.

The re-analysis of an aging evaluation is normally performed to extend the qualification by reducing the excess conservatism incorporated in the prior evaluation or by showing that existing qualification parameters envelop the requirements for the period of extended operation. As part of the Dominion EQ Program, re-analysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e). While a life-limiting component condition may be due to thermal, radiation, or mechanical cyclical aging; the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component or an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The re-analysis of an aging evaluation is documented according to the Dominion Quality Assurance Program requirements, which require the verification of assumptions and conclusions. Important attributes of a re-analysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed in the following paragraphs.

Analytical Methods – The Dominion EQ Program uses the same analytical models in the re-analysis of an aging evaluation as those previously applied during the prior or original 10 CFR 50.49 evaluation. The Arrhenius methodology, which is approved by the NRC, is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for radiation aging evaluation demonstrates qualification for

the total integrated dose; that is, the normal radiation dose for the projected installed life plus the accident radiation dose. For license renewal, the method for establishing the 60-year normal radiation dose is to multiply the 40-year dose by 1.5 (60 years/40 years = 1.5). The result is added to the accident radiation dose to obtain the total integrated dose of the component. For cyclical aging, a similar approach may be used. Other models may be justified on a case-by-case basis.

Data Collection and Reduction Methods – Reduction of the excess conservatism in the component service conditions (e.g., temperature, radiation, mechanical cycles) used in the prior aging evaluation is the chief method used for re-analysis based on the Dominion EQ Program procedures. Temperature used in an aging evaluation should be conservative and based on plant design temperatures or on actual plant temperature data. Plant temperature data may be used in an aging evaluation in various ways, such as (a) directly applying the plant temperature data in an aging evaluation or (b) using the plant temperature to demonstrate conservatism when applying plant design temperatures in an evaluation. Any changes to material activation energy values as part of a re-analysis are to be justified on a component/materials-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used in radiation and cyclical aging evaluations.

Underlying Assumptions – EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Action – Under the EQ Program, the re-analysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by re-analysis, the component must be refurbished, replaced, or re-qualified prior to exceeding the period for which the current qualification remains valid. A re-analysis is performed in a timely manner; that is, sufficient time is available to refurbish, replace, or re-qualify the component if the re-analysis is unsuccessful in extending the validity of the analysis.

Section B2.2.1, "Augmented Inspection Activities"

RAI B2.2.1-1:

Both LRAs, Section B2.2.1, need additional information regarding the operating experience for the existing augmented inspection activities at NAS 1 and 2, and SPS 1 and 2. Operating experience should include a discussion of past aging and/or failures detected, and any corrective actions resulting in program enhancements or additional programs. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information should demonstrate that there is reasonable assurance that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Dominion Response:

Augmented inspections are performed to monitor components for the presence of age-related degradation, including loss of material and cracking. A review of Dominion operating experience, including equipment failure and maintenance results, has not identified any indication of aging not being detected by inspection activities credited for license renewal. Inspection results have not identified any notable aging that warranted corrective action, or the need to trend ongoing degradation, to prevent a loss of intended function prior to the next scheduled inspection. Therefore, the results of operating experience have not generated any changes to inspection activities. If any anomalous results were found during an augmented inspection, an evaluation and any required maintenance would be initiated in accordance with the Corrective Action System which implements the requirements of 10 CFR 50, Appendix B.

An example of operating experience with augmented inspections involves the eddy-current examinations of flux thimble tubes. Strict wall-thinning limits are established for the thimble tubes such that the tubes are repositioned or taken out of service well before a potential loss of reactor coolant system pressure boundary.

Section B2.2.7, "Fire Protection Program"

RAI B2.2.7-1:

Provide the following information regarding the "Parameters Monitored and Inspected:"

a. The LRAs, Section B2.2.7, contain a statement that penetration seals are checked for an adequate amount of fire-stop material. Provide a complete description of the parameters monitored and inspection. Specifically state whether the parameters monitored and inspected include examinations for any sign of degradation such as cracking, seal separation from walls and components, separation of layers of material, rupture, and puncture of seals which are directly caused by increased hardness and shrinkage of seal material due to weathering. If not, explain the technical basis for the inspections that are performed.

b. Describe the aging management activity used to monitor the performance of the fire protection diesel-driven fire pump fuel line to ensure that it can perform the intended function. Provide sufficient detail of the AMAs used to adequately demonstrate that the applicable aging effects are being managed such that the intended function will be maintained consistent with the CLB throughout the period of extended operation.

Dominion Response:

a. As part of the Dominion Fire Protection Program, penetration seals are confirmed to be intact and free of damage, and to have an adequate amount of fire-stop material. This visual inspection ensures the absence of voids, cracks, punctures, or separation of layers for the sealing material.

b. The integrity and absence of fouling of the fuel supply line for the diesel-driven fire pump is confirmed by an operational test of the pump that is performed as part of the Dominion Fire Protection Program. The pump is run in the recirculation mode each month. The speed of the pump is verified to be within the expected range for the test, and verifies the ability of the fuel oil line to provide the expected amount of flow to the engine. A local inspection of the fire pump components, including the fuel oil line, is performed during the periodic test. Testing of the diesel-driven fire pump is consistent with NFPA-25. The run capability of the pump each month confirms the integrity and absence of fouling of the line that provides the fuel oil supply.

RAI B2.2.7-2:

Provide an aging management program that as a minimum includes a one-time non-intrusive inspection of a representative sample of fire suppression piping, near the end of the current operating term, and a second inspection within a reasonable length of time (within one refueling cycle) after the 50-year sprinkler head testing/inspection activity required by the NFPA. During these inspections, verify that excessive wall thinning has not occurred such that it may adversely affect the pressure boundary intended function of the system. In addition, verify that the inner-diameter of the pipe will provide sufficient system pressure to meet its intended function. As an alternative, an applicant can consider using its work control process as long as they can demonstrate that sufficient inspections of a representative sample of system piping is performed at an adequate frequency. The only other alternative, is to provide a technical justification, consistent with the material(s) and environment(s), that aging will not occur within the portions of this system that are within the scope of license renewal and subject to an AMR.

Dominion Response:

Pressure and flowrate testing of the fire protection system confirms that a loss of material is not degrading the ability of the system to perform its intended function. Dominion will supplement the NFPA pressure and flowrate testing credited in the Surry and North Anna license renewal applications as part of the Fire Protection Program activity with the Work Control Process activity in order to manage aging effects for the fire protection system piping. The Work Control Process, as described in Section B2.2.19 of the License Renewal Applications, provides numerous opportunities to perform internal inspections of fire protection piping. During the 7-year period between 1993 and 2000, there were in excess of 100 work orders each for Surry and North Anna for activities involving the internal surfaces of the fire protection system. These work orders provided representative samples of the materials and environments for the fire protection system. The identified frequency of work activities for the 7-year period is expected to continue into the period of extended operation. Most activities involve maintenance of valves but include internal examinations of adjacent sections of piping when disassembly is required by the Surry and North Anna maintenance programs. These inspections are performed by maintenance personnel who are VT-qualified and trained as members of a quality maintenance team (QMT). Additional description of the QMT process is provided in the response to RAI B2.2.19-3.

Findings of sedimentation or internal degradation as a result of maintenance inspections are referred to Engineering for evaluation. Any corrective action required by the engineering evaluation is implemented through the Corrective Action System in accordance with 10 CFR 50, Appendix B.

The ongoing maintenance opportunities to inspect fire protection components provide a more continuous indication for the internal condition of piping and valves than would occasional disassembly for the sole purpose of inspection.

RAI B2.2.7-3:

In the LRAs, Section B2.2.7, the discussion on monitoring and trending contains a statement that various types of fire protection equipment are visually inspected at frequencies that vary from 31 days to 3 years. More specific information is needed regarding the frequency of inspections for the applicable components. Provide the inspection/test frequencies and discuss the technical basis for the following items:

a. penetration seal inspections (including percent of each type inspected each time)

b. fire door inspections for holes in the skin, clearances, wear or missing parts

c. fire door functional tests to verify the operability of automatic hold-open, release, closing mechanisms and latches

d. yard fire hydrant visual inspections

e. fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests

f. sprinkler system inspections

Dominion Response:

The inspection and testing activities listed below are performed in accordance with the Dominion Fire Protection Program. Testing and inspection frequencies are consistent with guidance provided by NFPA.

a. Penetration seals are visually inspected to ensure adequate fill material and the absence of cracks or visible damage. At Surry, all seals are inspected every 18 months, except for those that are blocked on both sides with damming material, the removal of which could damage the seal. In these situations, the damming material (such as Marinite) is verified to be intact and free of damage. At North Anna, seals (except those with damming on both sides) are inspected on a rotating basis such that 20% of the seals are inspected every year.

b. Fire doors are visually inspected to ensure that the doors have proper clearance and are free of obstructions, are intact (i.e., no wear or missing parts), have no holes, and are capable of being closed and latched. These inspections are performed monthly.

c. Fire doors that have automatic hold-open mechanisms are functionally tested at least monthly to ensure that each auto-close mechanism is intact and capable of performing its intended function. The door-release function is tested, and the door is confirmed to be capable of closing and latching properly.

d. Visual inspections of yard fire hydrants are performed at least quarterly.

e. Fire hoses (and associated gaskets) are considered to be consumables that are not

subject to an aging management review. Fire hydrant flow tests are performed every 3 years.

f. The deluge and sprinkler systems are visually inspected every 18 months.

RAI B2.2.7-4:

Both LRAs, Section B2.2.7, need additional information regarding operating experience. Please consider any operating experience regarding NRC Generic Letter 92-08 and NRC Information Notices 88-56, 91-47, 94–28, 97-70. Discuss the extent to which the fire barrier experiences reported in these references have been incorporated in the Fire Protection Program.

Operating experience should include a discussion of past aging and/or failures detected, and any corrective actions resulting in program enhancements or additional programs. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information should demonstrate that there is reasonable assurance that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Dominion Response:

NRC Generic Letter 92-08 describes concerns with the integrity of Thermo-Lag 330-1 fire barriers used to ensure functionality of electrical cables, particularly with respect to the separation of redundant safe-shutdown trains within the same fire area. Information Notice 91-47 describes a concern at River Bend Station regarding fire endurance testing of Thermo-Lag used for the protection of cabling. While Thermo-Lag 330-1 is used as a fire barrier for a single application in the wall of a charging pump cubicle at North Anna, it is not relied upon as a fire barrier for any cabling at Surry and North Anna.

NRC Information Notices 88-56, 94-28, and 97-70 describe potential problems with fire-barrier penetration seals. Periodic surveillance is performed at Surry and North Anna to monitor penetration seals for the presence of voids, cracks, or deficiency of material. Any degradation found during these inspections is evaluated by Engineering such that repairs would be implemented through the Corrective Action System in accordance with 10 CFR 50 Appendix B.

Dominion operating experience has included findings of gaps or an insufficient amount of firestop material in penetration seals during inspections early in the plant history, indicating that these concerns were due to deficiencies in installation rather than aging. These findings were corrected. The frequency of inspection activities has been established consistent with NFPA requirements that take into account aging effects. Findings have been corrected through the Corrective Action System in accordance with 10 CFR 50, Appendix B; and no changes in the inspection practices have been determined to be necessary. Any findings of deficiencies in the future will be evaluated for the need to modify the inspection program.

Section B2.2.9, "General Condition Monitoring Activities"

RAI B2.2.9-1:

In both LRAs, Section B2.2.9, under "Monitoring and Trending," reference is made to the use of a "spaces approach" for visual monitoring. Explain what is meant by "spaces approach." Also, clarify that all supports, piping, doors and equipment in all the systems, structures and commodities included in the scope of this program are inspected at least once per refueling outage. If not, explain the inspection frequency for full coverage of all the items in the scope of this AMP and the technical basis for the approach.

Dominion Response:

The term "spaces approach" is defined in document NEI 95-10 and refers to all systems, structures, and components (SSC) in a particular area of the plant that shares a common, bounding environmental parameter such as temperature, and is in close proximity such as within a room or a portion of the floor of a building. All supports, doors, piping, and equipment in a "space" within the scope of the General Condition Monitoring activities are subject to inspection at least once per refueling outage cycle as part of engineering walkdowns.

RAI B2.2.9-2:

In both LRAs, Section B2.2.9, under "Operating Experience," additional information is needed. Provide specific information regarding the operating experience for this existing program at NAS 1 and 2 and SPS 1and 2. Operating experience should include a discussion of past aging and/or failures detected, and any corrective actions resulting in program enhancements or additional programs. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information should demonstrate that there is reasonable assurance that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Dominion Response:

The Dominion General Condition Monitoring (GCM) Activities assess and manage the aging of system components, equipment and supports that are located in normally accessible areas. The GCM Activities are a series of routine walkdown inspections that are performed by qualified personnel to monitor the condition of plant system components, equipment, and supports.

The following examples demonstrate the effectiveness of GCM in identifying aging-related problems, before loss of system intended function, and programmatic improvements.

Cracking in the Flexible Ventilation Connections

During an engineering walkdown at North Anna, cracks were identified in the ventilation system flexible connections. The flexible connections displayed signs of cracking due to thermal aging. This condition was evaluated through the Corrective Action System. The Corrective Action System required additional focused inspections in order to determine the extent of this condition. These inspections identified additional flexible connections exhibiting similar aging effects. The engineering evaluation identified the need for a preventive maintenance (PM) program enhancement to periodically inspect and replace, as necessary, the ventilation system flexible connections. The ventilation system flexible connection PM program has been implemented and has resulted in improved material condition of the flexible connections.

Loss of Material from the Flood Control Throttle Shields

Engineering walkdowns at Surry identified a loss of material from the flood-control throttle shields and associated bolting for the circulating water system expansion joints. This condition was evaluated through the Corrective Action System. The Corrective Action System required an engineering evaluation to determine the extent of the condition and cause. The engineering evaluation determined that during circulating water box maintenance activities, the cyclic wetting by brackish river water had facilitated the general corrosion degradation and that the carbon steel flood-control throttle shields should be replaced with stainless steel throttle shields. The engineering

evaluation also recommended preventive maintenance enhancements for periodic inspection of the flood-control throttle shields. A design change was implemented to replace the carbon steel flood-control throttle shields with stainless steel flood-control throttle shields. The flood-control throttle shield preventive maintenance program enhancements have been incorporated and have resulted in improved flood-control throttle shield material condition.

Loss of Material from the Service Water Vent Line

During an engineering walkdown at Surry, six corrosion areas were identified on a 3-inch service water vent pipe that was isolated and drained. This condition was evaluated through the Corrective Action System. The Corrective Action System required an ultrasonic thickness test to determine the condition of the pipe. The pipe inspections identified that through-wall indications exist in small-localized areas. The engineering evaluation identified improper material as the root cause. The service water carbon steel vent piping was replaced with shop-coated pipe and the welds were field-coated. The modification has resulted in improved material condition of the service water vent piping.

These examples demonstrate the effectiveness of Dominion's General Condition Monitoring Activities and its use of the Corrective Action System in identifying ongoing aging and effective corrective actions that prevent future degradation throughout the plant. The General Condition Monitoring Activities provide reasonable assurance that external age-related degradation will continue to be identified prior to any loss of system intended function during the period of extended operation.

RAI B2.2.9-3:

Both LRAs, Section B2.2.9, identify licensee follow-up actions. After discussions with the applicant, the staff discovered that both LRAs, Table B4.0-1, contains a comprehensive list of follow-up action items. The staff expressed the need to include these follow-up items in the FSAR Supplement. The applicant agreed to comply with the staff's request and to include these items in the FSAR Supplement. Therefore, per this RAI, the staff is requesting that the applicant describe how it intends to include this list of follow-up items, and to verify that they will include these items in their next revision of the FSAR Supplement.

Dominion Response:

Dominion will incorporate the Licensee Follow-up Actions from Table B4.0-1 of the license renewal applications into the UFSAR Supplements for the Surry and North Anna Power Stations. The follow-up actions will be presented with the appropriate Aging Management Activity summaries provided in Appendix A of the applications.

Section B2.2.17, "Service Water System Inspections"

RAI B2.2.17-1:

Both LRAs, Section B2.2.17, contain a statement that the acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Clarify whether the program also includes acceptance criteria based on effective cleaning of biological fouling organisms and maintenance of protective coatings or linings. If not, explain why such criteria are not part of the program.

Dominion Response:

The Dominion Service Water System Inspection activity provides compliance with NRC Generic Letter 89-13. The objectives of the service water inspection activity are to remove accumulations of biofouling agents, to inspect for degradation of protective coatings, and to repair degraded protective coatings. Inspection and cleaning procedures require that component surfaces be free of visible debris, adherents, slime layers, or other foreign material. A description of the service water inspection activities is provided in the introductory portion of Section B2.2.17 of the license renewal applications for Surry and North Anna.

Findings of protective coating degradation or damage to metal surfaces are referred to Engineering for evaluation. Any corrective actions required by the engineering evaluation are implemented through the Corrective Action System in accordance with 10 CFR 50, Appendix B.

Section B2.2.19, "Work Control Process"

RAI B2.2.19-1:

Both LRAs, Section B2.2.19, under "Monitoring and Trending," the applicant needs to clearly state that they withdraw their reference to EPRI Report TR-107514. Furthermore, to demonstrate that the work control process provides sufficient opportunity to adequately manage the applicable aging effects, the applicant needs to provide a summary of its operating experience for the past seven years by system and structure (that credits the work control process) that specifically shows that the work control process provides sufficient opportunity to examine the different materials and environments such that there is reasonable assurance that the applicable effects of aging will be managed such that the intended function will be maintained during the period of extended operation. To demonstrate reasonable assurance, the applicant should characterize the type of maintenance as predictive, preventive, and periodic corrective maintenance. The applicant should avoid use of one-time corrective maintenance, although multiple one-time corrective actions over the period of review for a particular system (or structure), a specific material, and a specific environment can be used as a single data point. In addition, in the NAS LRA, Page B-121, it is stated that: "As a Licensee Follow-up Action, changes will be implemented into the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. These changes will be implemented prior to the end of the current operating license." In order to understand the intent of this statement, explain the type and corresponding purpose of the changes that will be implemented. Also, explain what provisions will be provided to ensure that the referenced inspections/tests are performed by qualified personnel who have full knowledge of the type and scope of the inspections/tests to be performed.

Dominion Response:

Dominion is revising its Work Control Process activity to eliminate reference to the statistical guidance of EPRI Technical Report TR-107514. Instead, Dominion has summarized the number of inspection opportunities that exist during work control activities. This information is presented on the basis of both the systems and the material/environment combinations for which the work is performed. These summaries of inspection opportunities are presented in the response to RAI B2.2.19-3.

Inspection steps are presently included in maintenance procedures, but the level of guidance for the performance of inspections is not consistent. For the period of extended operation, consistency will be provided by changes that are being made to the maintenance procedures. The revised guidance will improve monitoring and trending capability. The additional steps being placed into preventive maintenance and corrective maintenance procedures direct maintenance personnel to visually inspect internal and external surfaces of components being disassembled (including the piping adjacent to these components) to ensure that there are no indications of loss of material (corrosion or wear), cracking, or separation of material (such as sealing

materials). Internal areas also are inspected for sedimentation or corrosion product buildup. The inspection steps direct the maintenance department personnel to notify engineering if any such conditions are found. The engineering evaluation determines the appropriate course of action through the Corrective Action System in accordance with 10 CFR 50 Appendix B.

The qualification of the maintenance department personnel is ensured through the continuing training process. Maintenance department personnel are trained in accordance with the requirements for VT inspections. Maintenance department personnel also are designated and trained as members of Quality Maintenance Teams (QMT). The QMT approach, as implemented by Dominion, involves maintenance department personnel in the role of quality control inspectors. Additional description of the QMT process is provided in the response to RAI B2.2.19-3.

RAI B2.2.19-2:

The applicant needs to provide more detailed information regarding the proposed type(s) of, and corresponding purpose(s) for, the changes to the maintenance activities discussed under the work control process. The applicant also needs to describe the qualifications of the individual performing the, and the acceptance criteria for the, visual inspections activities associated with this program.

Dominion Response:

The guidance being placed into preventive maintenance and corrective maintenance procedures directs maintenance department personnel to visually inspect internal and external surfaces of components being disassembled (including the piping adjacent to these components) to ensure that there are no indications of loss of material (corrosion or wear), cracking, or separation of material (such as sealing materials). Internal areas also are inspected for sedimentation or corrosion product buildup. The inspection steps direct the maintenance department personnel to notify engineering if any such conditions are found. Since no unique set of acceptance criteria can be established for the myriad situations that arise from inspections of components and structures, the requirement to perform an engineering evaluation of inspection results will ensure that intended functions are maintained. The engineering evaluation determines the appropriate course of action for anomalous inspection results through the Corrective Action System in accordance with 10 CFR 50 Appendix B.

The qualification of the maintenance department personnel is ensured through the continuing training process. Maintenance department personnel are trained in accordance with the requirements for VT inspections. Maintenance department personnel also are designated and trained as members of Quality Maintenance Teams (QMT). The QMT approach, as implemented by Dominion, involves maintenance department personnel in the role of quality control inspectors. Additional description of the QMT process is provided in the response to RAI B2.2.19-3.

RAI B2.2.19-3:

Both LRAs, Section B2.2.19, under, "Operating Experience," need additional information regarding the operating experience for the existing Work Control Process at NAS 1 and 2, and SPS 1 and 2.

Operating experience should include a discussion of past aging and/or failures detected, and any corrective actions resulting in program enhancements or additional programs. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information should demonstrate that there is reasonable assurance that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Dominion Response:

The Dominion Work Control Process integrates and coordinates the combined efforts of Maintenance, Engineering, Operations, and other support organizations to manage maintenance activities. Maintenance activities (e.g., work orders, corrective and preventative maintenance, periodic testing, predictive analysis) afford the opportunity to inspect numerous components and accessible piping for the purpose of determining the material condition of these system components while open for maintenance. Additionally, fluid samples are obtained for predictive analysis evaluation.

Consistent with the NRC License Renewal Safety Evaluation Report (SER) for Arkansas Nuclear One Unit 1, Dominion has determined that inspection of accessible surfaces of system components that are of the same material and exposed to the same environment can be used to evaluate potential aging of inaccessible surfaces. Thus, inspections of the surfaces in accessible areas can be used as a representative sample of inaccessible surfaces.

Visual inspections, performed by VT-qualified personnel, monitor system aging for cracking, loss of material, and change of material properties. Additionally, the Work Control Process provides visual inspections to supplement the primary, secondary, and fuel oil chemistry control programs. Maintenance uses Quality Maintenance Teams (QMT) to enhance the quality and thoroughness of maintenance activities. The QMTs are comprised of trained and certified craftsmen who have the authority to perform maintenance and to perform a quality check on the work of other maintenance personnel. QMT personnel are provided technical training, which includes inspector certification and visual testing (VT) certification in accordance with station administrative procedures. Additionally, QMT personnel are required to attend annual retraining and to re-certify their VT qualifications every three years.

Periodic testing monitors for heat transfer degradation of coolers and heat exchangers. Additionally, fluid samples (oil and coolant) are collected for analysis of contaminants and chemical properties. These tests and samples are used to monitor the physical condition of system components in support of aging mitigation programs.

The following operating experience examples demonstrate the effectiveness of the Work Control Process in identifying age-related concerns, before loss of intended function, and programmatic improvements.

Loss of Material in Extraction Steam Piping

While performing maintenance at North Anna to correct valve seat leakage on a carbon steel valve, maintenance identified a loss of material on the inside of the adjoining 2" pipe. This condition was evaluated through the Corrective Action System. The Corrective Action System required an engineering evaluation. The engineering evaluation identified erosion/corrosion (flow-accelerated corrosion) as the loss of material mechanism in the adjoining 2" pipe. This system location had not previously been identified as a potential erosion/corrosion location. As a result of the engineering evaluation the Secondary Piping and Inspection Program was revised to address erosion/corrosion in the subject location and similar locations in both units. The Secondary Piping and Inspection Program enhancements are an ongoing part of our inspection program to ensure secondary system reliability.

Loss of Material in Service Water Strainers

During preventive maintenance cleaning of the service water duplex strainers associated with the ventilation system chillers at Surry, maintenance personnel identified a loss of material from the strainer. As a result of the maintenance inspection, corrective action – an engineering evaluation – was requested. The engineering evaluation determined that there was active pitting corrosion. The engineering evaluation recommended that the strainers be coated with a compatible corrosion barrier coating and the Preventive Maintenance (PM) Program be revised. The service water strainers were coated with a corrosion-resistant coating and the PM program was revised to periodically inspect the coating and replace or repair the coating as necessary. The service water strainer coating and inspection PM have resulted in improved reliability of the service water strainers.

Loss of Material from the Main Control Room Chiller Condenser

During preventative maintenance (PM) at Surry to clean the chiller condenser tubes, the visual inspection identified that the epoxy coating on the tube sheet was damaged and that there were indications of corrosion and tube leakage. This condition was evaluated through the Corrective Action System. The Corrective Action System required an engineering evaluation. The engineering evaluation determined that a more corrosion resistant material should be used for the condenser and that additional Preventive Maintenance (PM) Program surveillances should be performed. New condensers are being fabricated with more corrosion resistant materials to replace the existing condensers and the PM program has been enhanced.

Cracking of the Residual Heat Removal Pipe

During a periodic test at Surry, a small boric acid spot was identified on a section of residual heat removal (RH) pipe at the Unit 2 Containment penetration area. This portion of piping is isolated during power operations. As a result of the small boric acid

spot, a Deviation Report (Plant Issue) was submitted to initiate the Corrective Action System, which would determine appropriate action and track the issue to resolution. Since the leakage was at the Containment penetration and could affect Containment integrity, the Corrective Action System required the plant be brought to cold shutdown. A flaw evaluation and structural assessment was conducted. Based on leak rate testing results, Containment integrity was maintained within established leakage criteria. The Materials Engineering group performed a failure analysis of the affected piping and determined that intergranular stress corrosion cracking was present on the inside surface of the piping. Engineering Mechanics performed an evaluation on minimum wall thickness requirements and compared it with the ultrasonic examination results. Ultrasonic testing and inspection were also conducted on the similar penetration on Unit 1. Engineering concluded that Unit 1 was not subject to the failure mechanisms contributing to the Unit 2 leak. As a result of the analysis, the line was replaced and an additional isolation valve was installed closer to the penetration. To date no further failures have been identified on the residual heat removal (RH) pipe at the Containment penetration area.

These examples demonstrate the effectiveness of Dominion's Work Control Process and its use of the Corrective Action System. Dominion's history of successful operation at the North Anna and Surry Power Stations demonstrates that the Work Control Process is effective in managing the aging effects of structures, systems, and components.

The attached tables demonstrate that numerous system, component, and material & environment inspection opportunities are available, as verified by the work order database (June 1993 through August 2001). Therefore, these inspection opportunities provide reasonable assurance that the applicable effects of aging will continue to be managed such that the intended functions will be maintained throughout the period of extended operation.

Work Order Inspection Opportunities for North Anna Systems		
System	**Acronym**	**Total**
Alternate AC Diesel Generator	AAC	>100
Auxiliary Steam	AS	>100
Blowdown	BD	>100
Boron Recovery	BR	>100
Chemical Volume Control	CH	>100
Chilled Water	CD	>100
Component Cooling Water	CC	>100
Containment Vacuum	CV	74[1]
Quench Spray	QS	>100
Condensate	CN	>100
Drains – Aerated	DA	>100
Drains – Building Services	DB	>100
Drains – Gaseous	DG	41[1]
Emergency Diesel Generator	EG	>100
Feedwater	FW	>100
Fire Protection	FP	>100
Fuel Oil	FO	>100
Fuel Pit Cooling	FC	13[1]
Heating and Ventilation	HV	>100
High Radiation Sampling	HRS	81[1]
Instrument Air	IA	>100
Liquid & Solid Waste	LW	>100

Note:

1 = System contains a limited number of components and has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for North Anna Materials & Environments table.

Work Order Inspection Opportunities for North Anna Systems (cont.)

System	Acronym	Total
Main Steam	MS	>100
Neutron Shield Tank	NS	6[1]
Primary Grade Water	PG	25[2]
Recirculation Spray	RS	>100
S/G Water Treatment	WT	>100
Radwaste	RW	1[1]
Reactor Coolant	RC	>100
Refueling Purification	RP	42[1]
Residual Heat Removal	RH	88[1]
Sampling	SS	>100
Secondary Vents	SV	100
Safety Injection	SI	>100
Security	SEC	26[1]
Service Air	SA	40[2]
Service Water	SW	>100
Steam Drains	SD	>100
Vacuum Priming	VP	>100

Notes:

1 = System contains a limited number of components and has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for North Anna Materials & Environments table.

2 = System has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for North Anna Materials & Environments table.

Work Order Inspection Opportunities for North Anna Stagnant Water Condition in Support of Chemistry Aging Management Activities	
Systems/Groups	**WCP Inspection Opportunities**
Reactor Coolant	>100
ESF Systems (SI, QS, RS)	>100
SPCS Systems (MS, MFW, SD)	>100
Fuel Oil System	>50

Work Order Inspection Opportunities for North Anna Civil Components		
Structures	**Acronym**	**Total**
Doors	BLD	>100
Fire Barrier Penetrations	Various	>100
Personnel Hatch O-Rings	CE	>100
Electrical Penetration O-rings	PE	>100

Work Order Inspection Opportunities for North Anna Materials & Environments

Internal Environments	Stainless Steel	Carbon Steel	Nickel-based Alloys	Copper-based Alloys	Titanium	Non Metallic
Treated Water (Borated)	> 100	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Treated Water (Low Oxygen)	59	> 100	>100[9]	N/A[1]	N/A[1]	N/A[1]
Treated Water (Saturated Oxygen)	> 100	84[5]	N/A[1]	4[2]	N/A[1]	N/A[1]
Treated Water (Corrosion Inhibitors)	> 100	N/A[1]	N/A[1]	N/A[1]	0[3]	N/A[1]
Oil (Fuel & Lube)	96	> 100	N/A[1]	> 100	N/A[1]	N/A[1]
Raw Water (Brackish)	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Raw Water (Drainage)	97	> 100	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Raw Water (Lake, Well, etc)	> 100	> 100	N/A[1]	14[4]	6[3]	N/A[1]
Air or Gas	66	> 100	N/A[1]	> 100	N/A[1]	10[7]
Atmosphere / Weather	N/A[1]	39[6]	N/A[1]	N/A[1]	N/A[1]	8[8]

Notes:

1 = Material and environment combination does not credit Work Control Process for license renewal.

2 = Population of 3 valves.

3 = Population of 2 heat exchangers installed in 1997.

4 = Population of 14 components.

5 = Population of 170 components.

6 = Population of 5 components.

7 = Population of 12 components.

8 = Population of 14 components.

9 = This grouping is for MS flow venturi erosion. The flow measurement periodic tests monitor erosion.

Work Order Inspection Opportunities for Surry Systems		
System	**Acronym**	**Total**
Alternate AC Diesel Generator	AAC	46[1]
Auxiliary Steam	AS	>100
Bearing Cooling	BC	>100
Blowdown	BD	63[1]
Boron Recovery	BR	>100
Chemical Volume Control	CH	>100
Circulating Water	CW	>100
Component Cooling Water	CC	>100
Containment Spray	CS	48[1]
Condensate	CN	>100
Drains – Aerated	DA	60[1]
Drains – Building Services	PL	>100
Drains – Gaseous	DG	50[1]
Emergency Diesel Generator	EG	>100
Feedwater	FW	>100
Fire Protection	FP	>100
Fuel Oil	EE	>100
Fuel Pit Cooling	FC	69[1]
Heating and Ventilation	VS	>100
Instrument Air	IA	>100
Main Steam	MS	>100
Neutron Shield Tank	NS	6[1]

Note:

1 = System contains a limited number of components and has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for Surry Materials & Environments table.

Work Order Inspection Opportunities for Surry Systems (cont.)

System	Acronym	Total
Primary and Secondary Plant Gas System	GN	23[1]
Primary Grade Water	PG	35[2]
Recirculation Spray	RS	>100
S/G Recirculation & Transfer	RT	18[1]
Reactor Coolant	RC	>100
Reactor Cavity Purification	RP	8[1]
Residual Heat Removal	RH	81[1]
Sampling	SS	98
Secondary Vents	SV	2[1]
Safety Injection	SI	>100
Security	SE	19[1]
Service Air	SA	24[2]
Service Water	SW	>100
Vacuum Priming	VP	>100

Notes:

1 = System contains a limited number of components and has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for Surry Materials & Environments table.

2 = System has the same material and environment combination as other systems that afford sufficient leading indicator inspection opportunities, as indicated in the Work Order Inspection Opportunities for Surry Materials & Environments table.

Work Order Inspection Opportunities for Surry Stagnant Water Condition in Support of Chemistry Aging Management Activities	
Systems/Groups	**WCP Inspection Opportunities**
Reactor Coolant	>100
ESF Systems (SI, CS, RS)	>100
SPCS Systems (MS, MFW, SD)	>100
Fuel Oil System	>100

Work Order Inspection Opportunities for Surry Civil Components		
Structures	**Acronyms**	**Total**
Doors	BS-DR	89
Doors - water-tight, gasket	BS-DR	7[1]
Fire Barrier Penetrations	Various	60
Personnel Hatch O-Rings	BS-PAH	>100
Electrical Penetration O-rings	PEN	>100
Notes: 1 = This applies to the Mechanical Equipment Room 3 door installed in 1993.		

Work Order Inspection Opportunities for Surry Materials & Environments

Internal Environments	Stainless Steel	Carbon Steel	Nickel-based Alloys	Copper-based Alloys	Titanium	Non Metallic
Treated Water (Borated)	> 100	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Treated Water (Low Oxygen)	25	> 100	N/A[1]	> 100	> 100	N/A[1]
Treated Water (Saturated Oxygen)	> 100	57[3]	N/A[1]	92[5]	N/A[1]	N/A[1]
Treated Water (Corrosion Inhibitors)	N/A[1]	N/A[1]	N/A[1]	N/A[1]	> 100	N/A[1]
Oil (Fuel & Lube)	85	> 100	N/A[1]	87	N/A[1]	N/A[1]
Raw Water (Brackish)	> 100	> 100	1[9]	> 100	> 100	N/A[1]
Raw Water (Drainage)	76	> 100	N/A[1]	3[7]	N/A[1]	N/A[1]
Raw Water (Lake, Well, etc)	> 100	> 100	N/A[1]	22[2]	N/A[1]	N/A[1]
Air or Gas	>100	> 100	N/A[1]	>100	N/A[1]	>100[8]
Atmosphere / Weather	N/A[1]	99[6]	N/A[1]	0[4]	N/A[1]	0[8]

Notes:

1 = Material and environment combination does not credit Work Control Process for license renewal.

2 = Population of 6 heat exchangers.

3 = Population of 138 components.

4 = Population of 1 component (installed 10/95).

5 = Population of 8 components.

6 = Population of 5 components.

7 = Population of 12 valves.

8 = These groupings encompass commodity items. An FAI has been issued to identify the VS system items and issue a PM to inspect them on a periodic basis.

9 = Population of 4 radiation monitors.