VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 6, 2023

10 CFR 50.90

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

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NRA/GDM: R2
Docket Nos.: 50-280
50-281
License Nos.: DPR-32
DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
LICENSE AMENDMENT REQUEST - APPLICATION OF RISK-INFORMED APPROACH FOR TORNADO CLASSIFICATION OF THE FUEL HANDLING TROLLEY SUPPORT STRUCTURE
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

By letter dated May 11, 2022, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22131A351), Virginia Electric and Power Company (Dominion Energy Virginia) submitted a license amendment request (LAR) for Surry Power Station (SPS) Units 1 and 2. The proposed amendment would apply a risk-informed approach to demonstrate the fuel handling trolley support structure (FHTSS), as designed, meets the intent of a tornado resistant structure (i.e., Tornado Criterion "'T") under the current SPS licensing basis for a 360 miles per hour (mph) maximum tornado wind speed. By letter dated July 11, 2022 (ADAMS Accession No. ML22192A075), Dominion Energy Virginia provided supplemental information in support of the LAR.

By email dated March 8, 2023 (ADAMS Accession No. ML23068A024), the NRC provided a request for additional information (RAI) to facilitate the completion of their technical review of the LAR. The response to the RAI was requested by April 7, 2023. Dominion Energy Virginia's response to the NRC RAI is provided in the attachment.

Should you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Respectfully,

James Holloway

James E. Holloway
Vice President – Nuclear Engineering and Fleet Support

Commitments contained in this letter: None

Attachment: Response to NRC Request for Additional Information

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mr. James E. Holloway, who is Vice President – Nuclear Engineering and Fleet Support, 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 6th day of April, 2023.

My Commission Expires: January 31, 2024.

Kathryn Hill Barret
Notary Public
Commonwealth of Virginia
Reg. No. 7905256
My Commission Expires January 31, 2024

Kathryn H. Barret
Notary Public

cc: U.S. Nuclear Regulatory Commission – Region II
Marquis One Tower
245 Peachtree Center Avenue, NE Suite 1200
Atlanta, GA 30303-1257

Mr. L. John Klos
NRC Project Manager – Surry
U.S. Nuclear Regulatory Commission
One White Flint North, Mail Stop 09 E-3
11555 Rockville Pike
Rockville, MD 20852-2738

Mr. G. Edward Miller
NRC Senior Project Manager - North Anna
U.S. Nuclear Regulatory Commission
One White Flint North, Mail Stop 09 E-3
11555 Rockville Pike
Rockville, MD 20852-2738

NRC Senior Resident Inspector
Surry Power Station

State Health Commissioner
Virginia Department of Health
James Madison Building – 7th floor
109 Governor Street
Suite 730
Richmond, VA 23219

Attachment

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

**Virginia Electric and Power Company
(Dominion Energy Virginia)
Surry Power Station Units 1 and 2**

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

License Amendment Request - Application of Risk-Informed Approach for Tornado Classification of the Fuel Handling Trolley Support Structure

Surry Power Station Units 1 and 2

NRC COMMENT

BACKGROUND

By letter dated May 11, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22131A351), Dominion Energy Virginia submitted a license amendment request (LAR) for Surry Power Station (SPS), Units 1 and 2. The proposed amendment would use a risk-informed approach to demonstrate that the fuel handling trolley support structure (FHTSS), as designed, meets the intent of a tornado-resistant structure under the current SPS licensing basis for a 360 miles per hour (mph) maximum tornado wind speed. The licensee provided supplemental information by letter dated July 11, 2022 (ML22192A075).

REGULATORY BASIS

The U.S. Nuclear Regulatory Commission (NRC) issued construction permits for Surry Power Station (SPS) Units 1 and 2 before May 21, 1971. Consequently, SPS Units 1 and 2 were not subject to the requirements in Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria (GDC) for Nuclear Power Plants," see SECY-92-223, "Resolution of Deviations Identified during the Systematic Evaluation Program," dated September 18, 1992 (ADAMS Accession No. ML003763736). In its letter dated May 11, 2022, the licensee stated that SPS UFSAR [3], Section 1.4.2, "Performance Standards," Section 1.4.40, "Missile Protection," Section 2.2.2.1, "Tornadoes," and Section 15.2.3, 'Tornado Criteria," meet the intent of GDC 2 and GDC 4.

SPS UFSAR, Rev. 54, (ML22283A015) Section 1.4.2, states, in part, that "Those systems and components of reactor facilities that are essential to the prevention of accidents that could affect the public health and safety or to the mitigation of their consequences are designed, fabricated, and erected in accordance with performance standards that enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena such as earthquakes, tornadoes, flooding conditions, winds, ice, and other local site effects. The design bases so established reflect (a) appropriate consideration of the most severe of these natural phenomena that have been recorded for the site and the surrounding area, and (b) an appropriate margin for withstanding forces greater than those recorded, in view of uncertainties about the historical data and their suitability as a basis for design."

SPS UFSAR Appendix 14B, states, in part, that "The analysis ensures that the Commission's General Design Criterion 4 is met, i.e., that all structures, systems, and components important to safety are designed to accommodate the effects of and are compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCAs). These structures, systems, and components are protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids that may result in equipment failures and from events and conditions outside the nuclear power unit."

Regulatory Guide 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (ML17317A256) describes an approach that is acceptable to the NRC staff for developing risk-informed applications for a licensing basis change that considers engineering issues and applies risk insights.

NRC REQUEST FOR ADDITIONAL INFORMATION

RAI APLC-1: Demonstration of RG 1.174 Acceptance Guidelines

In its submittal dated May 11, 2022, the licensee stated that the proposed approach for risk-informed analysis utilizes the acceptance criteria in RG 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (ML17317A256) similarly to how they were applied in NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," February 2001 (ML010430066).

Appendices 4C, "Pool Performance Guideline [PPG]," and 4D, "Change in Risk Associated with EP [Emergency Preparedness] Relaxations," of NUREG-1738 examine the spent fuel pool risk in decommissioning plants and states that conformance with the recommended PPG will assure that demonstrate decommissioning risk will continue to meet the Commission's quantitative health objectives (QHOs). Appendix 4C states that the concepts of RG 1.174 can be applied in the regulation of spent fuel pools. However, Appendix 4C states:

> *For decommissioning plants, the risk is primarily due to the possibility of a zirconium fire with the spent fuel cladding. The consequences of such an event do not equate directly to either a core damage accident or a large early release as modeled for an operating reactor.*

RG 1.174 provides acceptance guidelines in terms of core damage frequency (CDF), large early release frequency (LERF), change in CDF (ΔCDF), and change in LERF (ΔLERF). Appendix 4D of NUREG-1738 translates the RG 1.174 acceptance guidelines into metrics that are applicable for evaluating spent fuel pool risk. Table 4 in Appendix 4D *compares risk with RG 1.174 acceptance guidelines including early fatalities, population dose, individual early fatality risk, and individual latent cancer fatality risk.*

In its letter dated July 11, 2022, the licensee provided a justification for applying the RG 1.174 acceptance guidelines for CDF and LERF. The licensee stated that the proposed risk measure of spent fuel damage frequency (SFDF) was compared to the CDF acceptance guideline since there is no impact to CDF related to this application. The licensee also stated that the increase in LERF associated with this request was determined to be zero. Finally, the licensee stated that the frequency of dose to the public was not used in this application because SFDF and LERF were effective in characterizing the risk impact of the proposed change.

Please address the following:

a. *Demonstrate how the RG 1.174 acceptance guidelines are satisfied using the approach in NUREG-1738, which translates the RG 1.174 acceptance guidelines for applicability to changes in spent fuel pool risk measured by early fatalities, population dose, individual early fatality risk, and individual latent cancer fatality risk.*

Dominion Energy Virginia Response

RG 1.174 contains risk-informed application acceptance guidelines in terms of CDF, LERF, and the change in CDF and LERF risk metrics, and explains that these risk metrics are based on subsidiary objectives derived from the safety goals and the Quantitative Health Objectives (QHOs). RG 1.174 also states "Use of the Commission's Safety Goal QHOs in lieu of CDF and LERF is acceptable in principle, and licensees may propose their use. However, in practice, implementing RG 1.174, Rev. 3, Page 10 such an approach would require an extension to a Level 3 PRA, in which case the methods and assumptions used in the Level 3 analysis, and associated uncertainties, would require additional attention". Notwithstanding the demonstration that increases in CDF and LERF associated with the proposed change being zero provides some evidence of nuclear safety, it is recognized that the use of a Level 3 PRA analysis as additional evidence is appropriate in this case since the change requested relates to the protection of nuclear fuel outside of the protection of the containment building. A bounding Level 3 PRA calculation was performed to compare the associated risk directly with the QHOs in terms of early fatalities, population dose, individual early fatality risk, and individual latent cancer fatality risk.

Impact to Early Fatalities and Prompt Fatality Risk

As stated previously, it has been concluded that the radioactive release associated with one or more members of the FHTSS falling into the SFP would be bounded by the safety analysis acceptance criteria at the site boundary. The bounding dose level identified, assessed as approximately 3.2 rem TEDE at the site boundary, is orders of magnitude lower than the dose level of at least 200 rem that would be required for early fatality (EF) to credibly be considered a consequence of concern. The area 1 mile around the plant is uninhabited, so the dose level would be further reduced by dispersion by the point where the release could impact a populated area. Given these considerations, it is concluded there would be no early fatalities possible even in the worst-case scenario where a high wind event caused the FHTSS to collapse and impact fuel in the SFP. This means there is zero increase in individual prompt fatality risk associated with the requested licensing change for the FHTSS. This result compares favorably with the RG 1.174 equivalent limit of 8.7E-8 EF / yr. used in NUREG-1738.

Impact to Population Dose and Latent Cancer Risk

The potential impact of the bounding source term on the area around the plant was analyzed to evaluate the latent cancer risk associated with the proposed change. The dose level at the site boundary of 3.2 rem, which is the bounding term for the design basis safety analysis cask drop and fuel handling accident safety analysis, was used as the initial source term. Consistent with safety analysis dose assessment methods, the dose level was decreased linearly with distance from the plant to represent the dispersion that would take place with transport. Source terms were estimated for the range of distances out to 50 miles from the plant.

The year 2030 projected population was used from the previous Level 3 PRA analysis that was performed to support the 40 to 60 year license extension. Population trends over the last thirty years were reviewed, and exponential growth was modeled to project the population forward to year 2100. This projected population was used to assess potential dose to the population in the 50 miles around the plant.

The source term was combined with the population to estimate the integrated population dose in every direction around the plant. This resulted in a total of 1.65E5 person-rem as the bounding consequence of the high-wind induced failure of the FHTSS, which equates to an average of 0.03 rem per person. Multiplying the population dose with the SFDF frequency of 1.97E-6 gives a risk impact associated with the proposed change in terms of increase in dose of 0.325 p-rem / yr. This value compares favorably with the RG 1.174 equivalent limit of 11 p-rem / yr. used in NUREG-1738.

Specific increased risk of latent cancer fatalities (LCF) was estimated using data from the offsite consequence analysis in NUREG-1738. The bounding ratio from the cask drop sequences analyzed was found to be 1E-8 LCF / p-rem. This ratio was used to estimate an increase in LCF of 3.25E-9 LCF / yr., which compares favorably with the RG 1.174 equivalent limit of 6.9E-8 LCF / yr. used in NUREG-1738.

b. Discuss conservatisms included in the demonstration performed in response to part a such as assumptions related to the Fujita scale, failure modes and thresholds of the FHTSS, fuel damage to the spent fuel, potential radioactive release after fuel damage, and environmental conditions affecting dose to the public.

Dominion Energy Virginia Response

The risk assessment performed for this application estimated annualized increase in dose of 0.325 person-rem per year. This value falls below the population dose acceptance criteria described in NUREG-1738 but is still much higher than a best-estimate of risk because of the significant conservatisms present that have not been factored into the quantitative risk assessment. These conservatisms include:

- The initiating event frequencies were generated using the Fujita scale which is consistent with the Tornado Missile Risk Evaluator guidance from NEI 17-02. As a sensitivity, the initiating event frequencies were regenerated with the Enhanced Fujita scale using data from NUREG/CR-4461 which resulted in an estimated SFDF of 4.07E-7, a 79% decrease from the original analysis. Use of these initiating event frequencies would also decrease the annual dose and LCF impact by 79%.
- The FHTSS is assumed to fail at the median capacity or higher wind speeds, but it may not fail at these wind speeds.
- Structural collapse is assumed at the point where stresses cause plastic deformation to occur, but the structure may buckle or deform without completely collapsing.
- The FHTSS is a tall structure positioned above the narrow SFP. This geometry could result in FHTSS structural deformation or collapse in a way that does not involve any impact to the SFP.
- Fuel damage is assumed for any structural member falling into the SFP. The SFP contains a robust rack structure where fuel assemblies are stored that may reduce or prevent meaningful damage to fuel assemblies.
- The estimated annualized increase in dose of 0.325 person-rem per year is based on the dose consequences of the design basis fuel handling accident. The source term of the design basis fuel handling accident bounds the design basis source term from the cask drop analysis based upon the dose consequences of each event. The use of modern methods to evaluate the source term release from the fuel handling accident may result in lower dose consequences, which would result in a decreased estimate of population dose for this application. However, the reduction would be limited at the point the dose consequences of the cask drop event exceed the dose consequences of the revised fuel handling accident.
- The release of radioisotopes was modeled as impacting the full population in all 16 directional regions surrounding the plant. Steady straight-line winds would be required in order for a source plume to reach the population 50 miles from the plant. Straight line winds would result in a small fraction of the total population around the plant receiving a dose from the postulated release. This type of wind condition is not likely to occur coincident with a storm severe enough to cause a major tornado.

- The population trends in the areas around Surry showed a slowing trend in population growth, but the projections were based on exponential growth, which overpredicts the actual likely population used for the population dose calculations.
- The ratio of LCF / dose applied is conservative, resulting in an estimate of LCF risk impact that is higher than what would be expected if a more precise offsite dose calculation was performed.
- Finally, sufficient margin exists in the offsite consequence risk assessment such that the acceptance criteria would continue to be met with margin even if the EAB dose level was analyzed at the maximum allowable value. This means the conclusions contained in this analysis are supported for any result of cask drop and fuel handling accident dose assessment that fall within the regulatory acceptance criteria described in RG 1.183.

RAI APLC-2: Demonstration of RG 1.174 Principles of Risk-Informed Decision-Making

In its letter dated July 11, 2022, the licensee provided a summary of how the proposed change meets the five principles of risk-informed decision-making in RG 1.174. However, this summary did not provide sufficient detail for the staff to understand how all principles of risk-informed decision-making are met for the proposed change.

Please provide further justification for how the proposed change meets all five principles of risk-informed regulation in RG 1.174, including:

a. *Principle 1: The proposed licensing basis change meets the current regulations unless it is explicitly related to a requested exemption (i.e., a specific exemption under 10 CFR 50.12).*

Dominion Energy Virginia Response

The requested licensing basis change is consistent with the principles of risk-informed decision making described in Regulatory Guide 1.174.

Under the requested licensing basis change, the current regulations continue to be met. The FHTSS would continue to meet design and construction requirements in the 1963 issue of the American Institute of Steel Construction (AISC) Specification. As stated in the LAR, the FHTSS predates the GDC described in Appendix A of 10 CFR 50, but the design of the FHTSS will continue to meet the intent of GDC2 and GDC4 for protection against natural phenomena.

b. *Principle 2: The proposed licensing basis change is consistent with the defense-in-depth philosophy. This justification should address the seven considerations in RG 1.174 and include the dominant risk contributors and the plant systems and operator actions that mitigate these dominant risk contributors.*

Dominion Energy Virginia Response

The philosophy of defense-in-depth is met under this proposed change. Specifically, consistent with the principles of defense in depth described in RG 1.174:

2.b.1 A reasonable balance among the layers of defense in depth is preserved.

The dominant risk contributor related to the requested change is a high wind event that causes one or more structural members from the FHTSS to fall into region 1 of the SFP where fuel assemblies are damaged by the mechanical force of impact, causing a release of radioactive gases from fuel rods. There are many layers of defense in depth that are in place to mitigate this risk and protect the public and the environment from a radioactive release from the spent fuel pool in this scenario. These layers include:

- The fuel rod structure that is designed to contain fuel pellets and gaseous fission products
- The structure of the fuel assemblies and the rack structure of the SFP, which provide support and physical protection to the fuel rods
- The water in the SFP, which provides some shielding, containment, and filtration of fission products
- The Fuel Cooling (FC) system, which removes decay heat from the SFP water to keep the fuel from overheating
- The Beyond Design Basis / FLEX (BDB) system, which has portable pumps that can provide additional water to the SFP to maintain inventory in the event of leakage or boiling
- Diverse water sources (RWST, the BRT, Fire Protection System, ECST, ECMUT, discharge canal) which can be used to provide makeup inventory to the SFP
- The Emergency Preparedness organization, which supports emergency actions or evacuation of the public in the event of a release

In the worst-case scenario postulated where a very large tornado causes the collapse of the FHTSS and causes structural members to fall into the fuel, compromising the fuel rod, fuel assembly, and rack structures, the remaining layers of defense in depth would be unaffected and still able to mitigate potential offsite consequences. Since the postulated collapse is not able to cause a gross failure of the SFP, the inventory of water would be protected and would still serve to shield, contain, and filter a potential release. The fuel cooling system is protected from such a collapse and would still be able to remove heat from the SFP. The BDB/FLEX components are stored in a missile protected dome and would be able to be used to provide additional water inventory to the SFP if needed. The Emergency Preparedness organization would still be able to support the state in deciding to take any emergency actions. The presence of these multiple layers, which do not depend on each other for effectiveness, ensures a reasonable balance of defense in depth is maintained under the proposed licensing basis change.

2.b.2 <u>The adequate capability of design features is preserved without an overreliance on programmatic activities as compensatory measures.</u>

The primary function of the FHTSS is to support the fuel cask crane trolley while casks are being prepared, filled, and removed to avoid damage to fuel assemblies. Like all major structures, it also has a passive function to withstand the stresses from the weight of the structure and from any external forces to protect inhabitants and equipment located inside the structure. These functions are accomplished in the FHTSS by the robust design and construction of the structure and using the risk-informed approach as proposed in this LAR. The sufficiency of the design under normal loading conditions is ensured by compliance with the applicable requirements from the 1963 issue of AISC Specification. Applicable programmatic activities associated with aging management, corrective actions, design changes, and 50.59 screening are appropriately used for configuration control to ensure the design requirements continue to be met, but are not relied upon as compensatory measures to compensate for deficient design capabilities.

2.b.3 <u>Under the proposed licensing basis change, system redundancy, independence, and diversity are preserved.</u>

The requested licensing basis change preserves the redundancy, independence, and diversity of the systems used to cool the SFP.

System redundancy in the fuel cooling system is provided by two redundant pump trains. Each consists of a motor driven pump, a heat exchanger, and a flowpath from the SFP, through a pump and heat exchanger, and back to a common return line to the SFP. The motor driven pumps are powered by redundant trains of emergency power that are backed up by two different EDGs. The heat exchangers discharge heat to the Component Cooling system, which is also powered from the emergency buses and contains redundant trains.

Redundancy in the BDB/FLEX system is provided by redundant diesel driven pumps stored in a missile protected dome on site. There are numerous water sources that can be used to provide makeup flow to the SFP with the BDB pumps, including the Emergency Condensate Storage Tank, the Emergency Condensate Makeup Tank, and the Discharge Canal, which are either protected against or not susceptible to tornado missiles.

Independence is maintained between the layers of defense in depth because they do not have common dependencies that could affect multiple layers. This means a degradation or loss of any of these methods of accident mitigation leave the rest of them still capable of providing the intended function to protect the public.

Diversity is provided for SFP cooling by the different types of components available.

There are both motor driven (FC) pumps and diesel driven (BDB) pumps which are not coupled by factors that would make them susceptible to common mode failures. These components are physically separated in different buildings, so they are not vulnerable to a spatial hazard like a flood or fire.

2.b.4 Adequate defense against potential common cause failures is preserved.

There are no common cause failures that could cause a total loss of safety function of SFP inventory or SFP cooling. It is possible that a common mode failure could affect multiple FC pumps or multiple BDB pumps, but not both FC and BDB pumps. A common cause failure of two pumps in the FC system is unlikely because one pump is normally running during normal plant operation, so there would not be a demand that started both pumps, and the likelihood of a run-time failure of a running pump that could also affect the standby pump coincident with a large tornado is exceedingly low.

The requested change does not increase the likelihood of a common cause failure, nor does it leave the fuel particularly vulnerable to a common cause failure.

2.b.5 Multiple fission product barriers are maintained.

The FHTSS can withstand all weather-related events expected to occur within the life of the plant, including tornados. The primary barrier to fission product release is to maintain the current structural integrity such that fuel assemblies are never damaged by the collapse postulated in this analysis. Based on the SFDF calculated for this application of 1.97E-6/yr., there a less than one in 5000 chance that a tornado large enough to cause plastic deformation of the FHTSS will occur in the next 100 years.

In the worst-case postulated accident, it is assumed that structural members will fall into the SFP causing a loss of integrity of the fuel cladding, allowing a release of some fission products into the SFP. The water in the SFP would contain solid and particulate debris from any damaged fuel assemblies. It is also expected that the water in the SFP would filter and absorb some gaseous fission products as they moved from the damaged fuel rods at the bottom of the SFP up to the surface. The SFP cooling, inventory, and structural integrity preclude spend fuel uncovery or a fire which could allow for the transport of a much greater fraction of fission products in spent fuel assemblies.

2.b.6 Sufficient defense against human errors is preserved.

The proposed licensing basis change demonstrates the robust design of the FHTSS. As a result, no new human actions are required to preserve the layers of defense, and the probability of any existing potential human errors is unchanged. Existing administrative processes and programs will ensure design margins and adequate defense in depth are maintained.

This application proposes to maintain the current design as is on the basis that the current design supports an appropriate level of nuclear safety. Human actions are not relied upon as a compensatory measure to maintain adequate safety margins.

Human errors that could impact the inputs of the risk assessment for the FHTSS were reviewed. Appropriate procedural guidance is in place to ensure the analysis remains applicable to the as-built, as-operated plant such that the conclusions are supported going forward. For example, operating procedural guidance for abnormal environmental conditions requires that the fuel cask trolley crane be parked at the north end of the fuel building in the crane enclosure in the event of a Tornado Warning. This ensures a high wind event will not cause the fuel cask crane to fall into an analyzed location in the SFP. Further, operating procedures governing fuel placement in the SFP continue to be in place to ensure consequence assessments remain applicable. With regards to configuration control, design change guidance requires changes to the facility to be evaluated under 50.59 to assess whether the change requires prior NRC approval to make. This procedural requirement ensures the current structural design capability will not be changed or degraded by a design change unless explicitly permitted by an additional license amendment. Further, the Aging Management Program contains procedural requirements to assess SSCs, the environment that they exist and operate in, determine what aging related degradation mechanisms exist, and establish a frequency for inspections to address potential degradation associated with aging. Details on the requirements of the Aging Management Program as it applies to the FHTSS are described below in the response to RAI APLC-2 e.

2.b.7 <u>Under the proposed change, the intent of the plant's design criteria is met.</u>

The demonstrated structural capacity of the structure fully meets the intent of the design basis criteria as it is expected to withstand normal and abnormal loads experienced on site without damaging nuclear fuel in the SFP. As stated previously, the design of the FHTSS meets the intent of 10 CFR 50, Appendix A, GDC 2 and GDC 4 for protection against natural phenomena. The analyses performed to inform decision-making for the proposed change contained significant conservatism to bound uncertainties, and still determined the likelihood of failure of the FHTSS due to high winds is extremely small. The original design requirement to withstand 360 mph total wind load is excessively conservative and is not credibly expected to occur in the region in Virginia where Surry is located.

c. *Principle 3: The proposed licensing basis change maintains sufficient safety margins. This justification should identify conservatisms included in the analyses supporting the proposed change. This justification may refer to the response to the previous RAI to demonstrate how this principle is met.*

<u>Dominion Energy Virginia Response</u>

The risk assessment performed to support this request demonstrated that appropriate safety margins are maintained under this request. High-wind events that are strong enough to pose a threat to the FHTSS are of very low frequency. Since fuel cooling and SFP inventory are preserved in the event of a FHTSS structural failure due to a high wind event, such an event would not cause spent fuel to be at risk of overheating.

Safety margins are preserved by the presence of significant conservatisms that are not discretely factored into the change in risk analysis. This ensures the conclusions are well supported and the risk assessment bounds the actual expected impact, including consideration of uncertainty in parameters used to assess the risk. Conservatisms present that have not been accounted for in the quantitative risk assessment are described above in the response to RAI APLC-1 b.

Additional conservatism exists in the structural analysis that also supports robust safety margins. In particular, a number of conservative assumptions are considered in the estimation of the median wind speed capacity and for evaluation of the local effects of impacts of structural members upon their postulated failure and falling into spent fuel pool (SFP). These assumptions are summarized as follows:

- In the estimation of the median wind speed capacity for the fragility analysis of the FHTSS, it is assumed that structural members of the FHTSS would collapse once they reach their yield strengths. This is a conservative assumption because structural steel members would typically undergo plastic deformations and exhibit strain hardening behavior and resistance to the applied loads before their failure at ultimate strength.
- In the estimation of the potential damage to the SFP due to the impact of potential falling structural debris, the heaviest members (i.e., trolley girders) of the FHTSS with the worst-case angle of attack are conservatively considered. Also, conservatively, the kinetic energy of the heaviest members is calculated assuming a maximum travel distance from their installed location to the surface of the SFP floor mat.
- No credit is taken to account for energy dissipation due to travel of the postulated falling structural members through borated water inventory of the SFP before their potential impact to the reinforced concrete walls or floor mat of the SFP.
- No credit is taken to account for energy dissipation and load distribution due to impact of the postulated falling structural members to the spent fuel storage racks and spent fuel assemblies. The majority of the SFP area under the footprint of the FHTSS is occupied by the spent fuel racks that provide a suitable means to distribute the impact loads to a larger area, thus minimizing, if not fully eliminating, any possible local damage to the RC walls and floor mat and steel liner of the SFP.
- Energy dissipation through impact to the crash pads, located in the cask loading area of the SFP, is not considered, conservatively.

d. *Principle 4: When proposed licensing basis changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission's policy statement on safety goals for the operations of nuclear power plants. This justification may refer to the response to the previous RAI to demonstrate how this principle is met.*

Dominion Energy Virginia Response

The risk increase associated with the proposed change is small and consistent with the Commission's policy statement on safety goals for the operations of nuclear power plants. As described in the response to RAI APLC-1 a, the risk was analyzed conservatively in terms of the QHOs and was found to be acceptably small when compared to the QHO equivalent acceptance criteria described in NUREG-1738.

e. *Principle 5: The impact of the proposed licensing basis change should be monitored using performance measurement strategies. This justification should describe how the proposed change will be monitored (e.g., the aging management programs that ensure the structural performance of the fuel handling trolley support structure remains consistent with the as-built design).*

Dominion Energy Virginia Response

Monitoring to assure the structural performance of the FHTSS remains consistent with the current as-built design is accomplished via programmatic activities for aging management, which are incorporated into the site's Structural Monitoring Program.

The Structures Monitoring Program, which includes the FHTSS, implements the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," consistent with the guidance of NRC RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and Nuclear Management and Resources Council 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The Structures Monitoring Program also meets the requirements of 10 CFR 54.21(a)(3), which states, "For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the Current Licensing Basis (CLB) for the period of extended operation."

The existing Structures Monitoring Program at the site has been enhanced to be consistent with the requirements of NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," Section XI.S6, "Structures Monitoring."

Inspections performed under this program cover the entire Fuel Building structure, including the steel superstructure over the SFP and the attached FHTSS, as well as the fuel cask trolley crane. Qualified structural engineers are responsible for performing the inspections of plant structures, for the evaluating inspection results, for determining corrective actions as needed, and for ensuring structures inspected can meet their intended design functions.

In general, inspections include assessment of structural and support steel, as well as concrete and masonry elements. Inspections are performed on a frequency not to exceed 5 years. Inspections are documented in accordance with procedural program requirements and retained as plant records. Any deficiencies identified during inspections are assessed to determine whether corrective actions are warranted – if so, they are initiated as appropriate through the plant's corrective action program.

In conclusion, the FHTSS is monitored for aging as part of the Surry Structures Monitoring Program to ensure the structural performance remains consistent with the current as-built design. Additionally, the significance of this structure with respect to high wind events will be incorporated into the site's licensing basis (via UFSAR update), as well as design basis documentation. This will ensure that any future plant changes take into consideration the importance of this structure, and that any design changes maintain the current structural capacity and preserve risk assessment results.