VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

September 30, 2021

10 CFR 50.90

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

Serial No.:	21-138
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Docket Nos.:	50-280/281
License Nos.:	DPR-32/37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
PROPOSED LICENSE AMENDMENT REQUEST
REMOVAL OF REFUELING WATER CHEMICAL ADDITION TANK AND REPLACEMENT OF CONTAINMENT SUMP BUFFER

Pursuant to 10 CFR 50.90, Virginia Electric and Power Company (Dominion Energy Virginia) requests amendments to Surry Power Station (Surry) Units 1 and 2 Subsequent Renewed Facility Operating License Numbers DPR-32 and DPR-37, respectively, in the form of a change to the Technical Specifications (TS). The proposed amendment would revise the Surry Units 1 and 2 TS to eliminate the Refueling Water Chemical Addition Tank (CAT) and allow the use of sodium tetraborate decahydrate (NaTB) to replace sodium hydroxide (NaOH) as a chemical additive (buffer) for containment sump pH control following a loss-of-coolant accident (LOCA) at either Surry Unit 1 or 2. Marked-up TS pages and typed TS pages indicating the proposed change are provided in Attachments 2 and 3, respectively.

We have evaluated the proposed amendment request and have determined that it does not involve a significant hazards consideration as defined in 10 CFR 50.92. The basis for this determination is included in Attachment 1. We have also determined that operation with the proposed change will not result in any significant increase in the amount of effluents that may be released off-site or any significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed amendment is eligible for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed change. The proposed TS change has been reviewed and approved by the Facility Safety Review Committee.

Dominion Energy Virginia requests approval of the proposed TS change by September 30, 2022. The typical time frame for implementing license amendments is 30 days after issuance. However, removal of the CAT and installation of the NaTB buffer will occur during a different outage for each unit necessitating a different implementation schedule for Surry Units 1 and 2. Consequently, Dominion Energy Virginia requests implementation of the proposed TS changes to coincide with the completion of the fall 2022 refueling outage for Surry Unit 1 and the spring 2023 refueling outage for Surry Unit 2.

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

Respectfully,

Mark D. Sartain
Vice President – Nuclear Engineering and Fleet Support

Commitments contained in this letter: None

Attachments:

1. Discussion of Change
2. Containment Spray System Showing Current and Modified Configurations
3. Marked-up Technical Specifications Pages
4. Proposed Technical Specifications Pages

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mr. Mark D. Sartain, 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 30th day of September, 2021.

My Commission Expires: 1-31-24.

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

Notary Public

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

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

Mr. John J. 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

Attachment 1

DISCUSSION OF CHANGE

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

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DISCUSSION OF CHANGE

1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, Virginia Electric and Power Company (Dominion Energy Virginia) requests an amendment to Subsequent Renewed Facility Operating License Nos. DPR-32 and DPR-37, in the form of changes to the Technical Specifications (TS) for Surry Power Station Units 1 and 2 (Surry 1 and 2).

The proposed amendment would revise the Surry 1 and 2 TS to eliminate the Refueling Water Chemical Addition Tank (CAT) and allow the use of sodium tetraborate decahydrate (NaTB) to replace sodium hydroxide (NaOH) as a chemical additive (buffer) for containment sump pH control following a loss-of-coolant accident (LOCA) at Surry 1 and 2. This change will eliminate the need to perform inspections of the CAT and the attendant risk of personal injury due to the caustic nature of the NaOH solution while performing maintenance activities. This change will also eliminate active components from the Containment Spray (CS) system.

2.0 DETAILED DESCRIPTION

2.1 System Design and Operation

The Engineered Safeguards (ES) systems, which consist of the Safety Injection (SI) and Containment Depressurization systems, serve to cool the reactor core and return the containment to and maintain the containment at subatmospheric conditions. The ES systems are designed to minimize the design basis accident LOCA (double-ended guillotine shear of the cold leg pipe between the reactor coolant pump and the reactor vessel) by performing the following functions: 1) supply borated water to the reactor coolant system to cool the core, decrease reactivity, limit fuel rod cladding temperatures, limit the metal-water reaction, and ensure the core remains intact; 2) limit the driving potential, including differential pressure and time duration, for leakage out of the containment structure; and 3) reduce the concentration of airborne fission products available for leakage. The Engineered Safeguards systems are comprised of the SI, CS and Recirculation Spray (RS) Systems.

The SI system provides borated water to the Reactor Coolant System (RCS) from the accumulators following a LOCA. The three accumulators are self-contained and are designed to supply water as soon as the RCS pressure drops below 600 psig. Additional makeup to the RCS is provided by the High Head SI (charging) pumps and the Low Head SI pumps. The HHSI and LHSI pumps are located outside the containment, driven by electric motors, are capable of being rapidly energized or operated, and are powered from the emergency power buses. The pumps also ensure an adequate supply of borated

water for an extended period of time by recirculating water from the containment sump to the reactor core through two separate flow paths.

The CS subsystem supplies chilled borated water to the containment immediately following the receipt of a safeguards initiation signal. This subsystem includes two full-capacity, electric-motor-driven, CS pumps that are located outside the containment and are supplied with power from the emergency buses. The CS pumps supply chilled (maximum temperature of 45°F) borated water, with a boron concentration between 2,300 ppm and 2,500 ppm, from the Refueling Water Storage Tank (RWST) to the containment. Either pump is capable of furnishing sufficient spray water to prevent overpressurizing the containment structure. The CAT is balanced hydraulically with the RWST and provides a flow of NaOH solution directly to the CS pump suction via a caustic addition line to increase the alkalinity of the CS and RS to ensure effective removal of radioactive iodine and mitigate chloride stress corrosion cracking following a LOCA. The CAT contains a minimum of 3,930 gallons of NaOH solution with a concentration between 17 and 18 percent by weight.

The RS subsystem recirculates water from the containment sumps through RS heat exchangers (RSHXs) to the RS headers. Two of the four 50% design capacity, motor-driven RS pumps are located outside the containment. The four RSHXs are located inside the containment and transfer containment heat to the Service Water (SW) system.

2.2 <u>Current Technical Specifications Requirements</u>

Surry TS 3.4.A.4 currently requires the Refueling Water Chemical Addition Tank to contain at least 3,930 gallons of solution with a sodium hydroxide concentration of at least 17 percent by weight but not greater than 18 percent by weight.

Surry TS Table 4.1-2A currently requires the Refueling Water Chemical Addition Tank to be functionally tested per the Surveillance Frequency Control Program.

Surry TS Table 4.1-2B currently requires the NaOH solution contained in the Refueling Water Chemical Addition Tank to be tested for concentration per the Surveillance Frequency Control Program.

2.3 <u>Reason for the Proposed Change</u>

As part of the subsequent license renewal for Surry, the CATs are required to be inspected to identify aging effects that could impair the ability of the tank to perform its intended function, and to demonstrate that these effects will be adequately managed during the period of extended operation. NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report" (Reference 1), Section XI.M29, "Outdoor and Large Atmospheric Metallic Storage Tanks," specifies a one-time visual inspection of interior surfaces or a volumetric inspection from the outside surface capable of precisely determining wall thickness of at least 20% of the inside surface. Due to the hazardous environment internal to the CAT (NaOH solution) and the risk of causing

damage by removing external insulation to perform the required inspections in support of NUREG-2191, Section XI.M29, it is desired to remove the CAT along with its associated caustic piping and equipment and install buffering agent baskets in containment. NaTB has been selected to replace NaOH rather than trisodium phosphate (TSP) since TSP can result in more precipitates in the post-accident sump pool.

2.4 Description of the Proposed Change

The proposed change will revise Surry Units 1 and 2 TS Section 3.4, "Spray Systems," TS Table 4.1-2A, "Minimum Frequency for Equipment Tests," and TS Table 4.1-2B, "Minimum Frequencies for Sampling Tests." The revision to TS Section 3.4 will require the performance of inspections to ensure correct placement of the NaTB baskets and that the baskets are unobstructed, intact and contain the minimum required amount of NaTB. The revision to TS Table 4.1-2B will require the performance of a surveillance test to verify that a sample taken from the NaTB stored inside containment provides adequate pH adjustment of water borated to be representative of a post-LOCA sump condition.

- TS Section 3.4 will be revised to replace the Refueling Water Chemical Addition Tank requirements with the NaTB basket requirements.
- TS Table 4.1-2A will be revised to remove the Refueling Water Chemical Addition Tank testing requirements.
- TS Table 4.1-2B will be revised to replace the sampling test requirements of the Refueling Water Chemical Addition Tank with the sampling test requirements for the NaTB baskets.

3.0 TECHNICAL EVALUATION

The proposed change replaces the NaOH in the CAT with granular NaTB in baskets located in the containment. The NaOH is mixed with RWST water during the CS system spray down of containment prior to entering containment. The replacement NaTB baskets will be placed in the lower level / basement (EL. -27'-7") of the containment. Thus, mixing with RWST water will not occur until after the initial spray of containment and when the RWST water collects in the lower levels of the containment. Both buffering agents, NaOH and NaTB, are considered acceptable buffering agents to raise the pH levels of the RWST water and remove iodine from containment. The CAT and associated caustic piping and equipment will be permanently isolated from the CS system and removed.

3.1 Calculation and Plant Analysis

3.1.1 Required Amount of NaTB

The NaTB requirement is the amount of buffer required to ensure that the sump pool will remain at a pH greater than 7.0 from the time when RS is credited for iodine removal to

30 days. A minimum of approximately 10,760 lbm of NaTB is required to maintain the sump pH above 7.0. The required mass of NaTB accounts for chemical equivalence variations, and the required volume accounts for chemical density variations.

The maximum time it takes the buffer to dissolve is determined for both single-train and full Engineered Safety Feature (ESF) conditions using conservative inputs. The maximum dissolution time is determined based on the minimum rate at which the water level rises and the bounding minimum temperature profile.

The minimum required buffer quantity is analytically determined based on the maximum mass of boric acid injected into the sump following an accident together with the maximum acidic contributions and minimum basic contributions from other sources. The sump mass and boron concentration in the sump are based on the maximum mass and boron concentration of each borated water source. The required buffer quantity also accounts for the acidic contributors of released core inventory and radiolysis of water and chloride bearing cables in containment. The analytical model used to determine the buffer quantity was validated via comparison to buffer test results from plant specific testing.

The maximum sump pH following an accident is determined based on the maximum dissolved quantity at select times early in the post-LOCA transient as well as on the maximum anticipated installed mass of NaTB to ensure that maximum allowable pH of 9.0 is not exceeded. The maximum sump pH is determined using the same analytical model based on the minimum mass of boric acid injected into the sump following an accident along with the minimum acidic contributions from other sources. The sump mass and boron concentration in the sump are based on the minimum mass and boron concentration of each borated water source. Minimum acidic contributions and maximum basic contributions from other sources (e.g., core inventory and cable radiolysis) are also considered.

Various margins are incorporated into the analysis including a reduction in the minimum water level and temperature profile, an increased clearance between the bottom of the basket and the containment floor, and a reduction in the open area of the sides and bottom of the basket. These margins result in a slower exposure of the buffer in the baskets to the sump water as well as a reduced dissolution rate. The results of the analysis show that even with the conservatisms and margin, a pH greater than 7.0 is acquired from the time when RS is credited for iodine removal up to 30 days.

Testing of the buffer will be required to be performed during each outage per the TS to ensure that the chemical composition, and hence buffering ability, of the buffer does not change over time.

3.1.2 Radiological Consequences

The present method of buffer addition is to add NaOH from the CAT to the CS during the emergency core cooling system (ECCS) injection phase of the LOCA. The NaOH is mixed with water from the RWST prior to being sprayed into the containment atmosphere. The

proposed change to replace this method with NaTB stored in baskets inside containment will eliminate buffer addition to the CS during the ECCS injection phase; therefore, the CS mixture will consist of a boric acid solution. The CS pH during the injection phase may be as low as 4.25.

As indicated in NUREG-0800, Standard Review Plan (SRP), Section 6.5.2, "Containment Spray as a Fission Product Cleanup System," (Reference 2), fresh sprays (i.e., sprays with no dissolved iodine) are effective at scrubbing elemental iodine, and thus a spray additive (used to increase sump pH) is unnecessary during the initial injection phase when the spray solution is being drawn from the RWST. As described in the SRP, experiments (Reference 3) have shown that elemental iodine can be effectively scrubbed from the atmosphere with borated water, even at low pH (less than 7), e.g., experiment "Run C-1" from Reference 3 which used a boric acid solution with a pH of 5. It should also be noted that the PSICO 10 experiments (Reference 4) indicate that, "The elemental iodine removal half-times obtained by spraying service water do not differ greatly from those found by spraying thiosulfate solution."

Based on these experiments, the SRP provides an equation for calculating a first-order removal coefficient for elemental iodine that is not dependent on a spray additive for pH control but is chiefly based on the rate at which fresh-solution surface area is introduced into the containment building atmosphere (Equation 1).

$$\lambda_s = \frac{6K_gTF}{VD} \qquad \text{\{Equation 1\}}$$

where

$\lambda_s = removal\ coefficient$
$K_g = gas\ phase\ mass\ transfer\ coefficient$
$T = time\ of\ fall\ of\ the\ drops$
$F = volume\ flow\ rate\ of\ the\ spray\ pump$
$V = containment\ building\ net\ free\ volume$
$D = mass\ mean\ diameter\ of\ the\ spray\ drops$

Therefore, the use of Equation 1 for determining the elemental iodine spray removal coefficients during the injection phase (pH as low as 4.25) is considered a valid approach for modelling elemental iodine removal in containment during a LOCA event. It should also be noted, per the SRP, that Equation 1 is valid for λ_s values equal to or greater than 10 per hour and that λ_s must be limited to 20 per hour for fresh solution to prevent extrapolation beyond the existing data upon which this equation is based. For λ_s values less than 10 per hour, the SRP recommends using an analysis with a more sophisticated expression.

Based on the above, the current radiological consequences associated with a LOCA that have CS buffered with NaOH during initial injection remains unchanged with the use of NaTB stored in baskets inside containment, which results in the CS during initial injection

having a pH as low as 4.25. The NaTB buffers the containment sump water to ensure that the pH of the sump water will remain greater than 7.0 from the time when RS is credited for iodine removal.

3.1.3 Chemical Effects

WCAP-16596 (Reference 5) documents the evaluation of alternative ECCS buffering agents relative to traditional NaOH and TSP buffers. This evaluation was performed as part of Generic Safety Issue (GSI) -191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," to provide plants with options to potentially reduce their chemical precipitate source term. NaTB was recommended as an alternative to TSP since both are solids that dissolve in the post-LOCA sump and are not stored in solution. NaTB is also less likely to result in significant amounts of precipitate than TSP. In particular, calcium precipitates are more likely with TSP than with NaTB.

Post-LOCA sump buffering with NaTB will not result in any different precipitates than those that form with a NaOH buffer (i.e., only aluminum based precipitates are expected with NaTB and NaOH). Calcium based precipitates will not form with a NaTB buffer. Given that the precipitates formed with NaTB and NaOH are the same, and that less precipitate is expected with NaTB, it is also expected that the time of precipitate formation in the post-LOCA sump would be the same or greater especially when considering that NaTB also enhances aluminum solubility.

The amount of insulation that dissolves in the post-LOCA sump is not expected to change significantly with a NaTB buffer since this debris is submerged in the pool (not sprayed) and the design pool pH will either remain the same or be reduced with NaTB. Slight increases in the amount of dissolved aluminum from insulation could occur since the corrosion rate for insulation debris has a dependence on the concentration of aluminum in the pool (which will be lower overall, hence increasing the aluminum release from insulation) per WCAP-16530 (Reference 6). However, the increases in aluminum released from insulation would be more than offset by the reduction in total dissolved aluminum.

The dissolved aluminum expected in the long term post-LOCA sump can be predicted based on the Atomic Energy of Canada Limited (AECL) correlation for aluminum dissolution. The maximum allowable 30-day aluminum loading determined via the AECL strainer head loss testing is 14,200 g. The predicted dissolved aluminum quantities with NaTB are approximately 65% of this limit. When compared to an NaOH buffer, an NaTB buffer results in less aluminum dissolved in the post-LOCA environment. As such, the margin between the allowable dissolved aluminum and expected post-LOCA dissolved aluminum will increase with an NaTB buffer since less aluminum will dissolve in the sump following buffer replacement, resulting in lower strainer head losses (although the head loss reduction is not credited as part of this design change). This reduction in dissolved aluminum is due to the unsubmerged (sprayed) aluminum being subject to a much lower initial pH spray solution. Therefore, the design basis strainer head loss tests will remain applicable following NaOH replacement with NaTB.

3.1.4 Corrosion of Containment Materials

As stated in NRC Branch Technical Position 6-1 (Chapter 6 of SRP), "pH for Emergency Coolant Water for Pressurized Water Reactors," in order to reduce the probability of stress-corrosion cracking of austenitic stainless steels components, the pH of the recirculation solution should have a minimum pH of 7.0. The amount of NaTB specified in the proposed TS change will achieve a long term (> 4 hours) sump pH between 7.0 and 9.0, consistent with the current licensing basis.

For the proposed change, the pH of the spray solution during the post-LOCA injection phase will be acidic. The containment coating materials have been evaluated for a spray pH of 4.0 with an exposure time of 8 hours. The coating materials were determined to be acceptable for the proposed change since these materials exhibit fair to good resistance to chemical exposure of stronger acids, and the low pH exposure is for a relatively short (less than 8 hours) duration. The gradual increase in pH minimizes the potential for coating degradation due to acid exposure.

3.1.5 Hydrogen Generation

The amount of hydrogen generation resulting from corrosion of materials exposed to water is influenced by the pH value of the water. With the replacement of NaOH with NaTB, the pH of the recirculation spray is maintained between 7.0 and 9.0 during the long-term post-accident period which is the same as the current design pH range. Therefore, post-LOCA hydrogen will not increase as a result of the proposed change.

3.1.6 Environmental Qualification (EQ) of Equipment

The EQ program at Surry meets the requirements of 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants." Surry is licensed to implement the requirements of 10 CFR 50.49 per Division of Operating Reactors (DOR) Guidelines and IEEE Standard 323-1974, as codified by 10 CFR 50.49.

In the current design, the CS solution is alkaline due to the direct addition of NaOH to the borated solution from the RWST. Equipment in the EQ Program is qualified for a chemical spray with a pH range of 8.5 to 10.5 for the first 4 hours and a pH range of 7.0 to 9.0 from 4 hours to 120 days. In the proposed design, the CS solution during the injection mode would be acidic, consisting of the borated solution from the RWST only. The components in containment subject to the EQ Program have been identified and evaluated for the effects of a spray with a pH ranging from 4.0 to 9.0 for the first 4 hours and a pH range of 7.0 to 10.5 from 4 hours to 120 days. A pH of 10.5 was used for the equipment qualification in order to retain the qualification at the existing high end of the pH range. The evaluation considered the chemical resistance of organic materials, the corrosive effects of metallic materials exposed to the spray, and the duration of the initial acidic spray followed by the longer-term alkaline spray. The method used for the EQ evaluations relied on available industry and technical/research data regarding the chemical resistance

of materials for acidic and alkaline sprays, as well as the corrosion rate from the spray composition for the enclosures that house part of the equipment. The physical installation was evaluated to determine which parts of the component would be subjected to the direct spray. Credit is taken for housing and conduit. The evaluations concluded that EQ equipment located in the containment is qualified for the altered containment and recirculation sprays without the need for additional protection from spray.

3.2 Design Solution

3.2.1 NaTB Basket Design

The NaTB baskets are made of stainless steel and have a frame with a fine mesh and perforated metal plate enclosure. The baskets will be located in the Containment basement (El. -27'-7"). The baskets are classified as Non-Safety with Quality Attributes (NSQ), qualified for seismic restraint (II/I) and function to maintain their structural integrity and be restrained during and following a Design Basis Event. The design loads for the baskets are generated by combining the unfactored load effects of dead loading, chemical pressure loading, and seismic loading. The NaTB baskets were evaluated to maintain their structural integrity during a Design Basis Earthquake event concurrent with post-LOCA elevated temperature conditions. Additionally, consideration was given for thermal expansion and containment pressurization with the basket design due to increased temperature and pressure during a LOCA event and were determined to be acceptable. The basket locations are selected such that they are not adversely impacted by the effects of High Energy Line Break (HELB) jet impingement forces and pipe whip due to being sufficiently protected through the use of barriers, restraints, and distance. The granular NaTB is retained in the baskets until dissolved by the containment sump water, and therefore does not become a particulate debris source.

The proposed installation of NaTB baskets will result in a minor decrease in net free volume of the Containment. This decrease has been reviewed for effects on the Containment peak pressure analysis. The proposed change will not affect the calculated post-accident Containment peak pressure or the Containment pressure profile.

3.2.2 CAT Isolation and Removal

The CAT (01(02)-CS-TK-2) will be isolated from the CS system and drained. The CAT, caustic addition piping and associated equipment will be removed permanently up to the connection with the CS pump suction header lines, with the exception of the portions of the buried pipe. The portions of the associated piping that remain in place will be capped. Attachment 2 shows the current configuration of the CS system and the proposed change to permanently isolate and remove the CAT and associated piping and equipment. The proposed change will not alter the seismic classification of the remaining CS system (Seismic Class I). The associated instrumentation, indications and controls will be disconnected and removed.

Isolation and removal of the CAT eliminates the CAT liquid inventory from the post-accident containment sump water inventory; however, the minimum flood level used in the LHSI and RS pump NPSH analysis conservatively ignores the volume in the CAT. Therefore, removal of the CAT does not adversely impact the NPSH at the minimum flood level. Additionally, the installation of the NaTB baskets will result in a slightly higher (negligible) flood level which serves to maintain the margin associated with the available NPSH.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

In general, the regulations in Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 establish minimum principle design criteria for water-cooled nuclear power plants, while 10 CFR 50 Appendix B and the licensee quality assurance programs establish quality assurance requirements for the design, manufacture, construction, and operation of structures, systems, and components. The current regulatory requirements of 10 CFR 50 Appendix A that are applicable to the proposed change include: General Design Criteria (GDC) 1 (Quality Standards and Records), 19 (Control Room), 38 (Containment Heat Removal), 41 (Containment Atmosphere Cleanup), 42 (Inspection of Containment Atmosphere Cleanup Systems), and 43 (Testing of Containment Atmosphere Cleanup Systems).

During the initial plant licensing of Surry Units 1 and 2, it was demonstrated that the SI, CS and RS systems met the regulatory requirements in place at that time. The GDC included in Appendix A to 10 CFR 50 did not become effective until May 21, 1971. The Construction Permits for Surry Units 1 and 2 were issued prior to May 21, 1971; consequently, Surry Units 1 and 2 were not subject to current GDC requirements (SECY-92-223, dated September 18, 1992). Section 1.4 of the Surry Units 1 and 2 Updated Final Safety Analysis Report (UFSAR) discusses compliance with the GDC published in 1967 (Draft GDC), and the UFSAR discussion demonstrates that Surry Units 1 and 2 meet the intent of these criteria. The draft GDC pertinent to the proposed change are addressed below.

- Quality Standards (Criterion 1 – draft)

  Criterion 1 specifies: *"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 quality standards that reflect the importance of the safety function to be performed. Where generally recognized codes or standards on design, materials, fabrication, and inspection are used, they are identified. Where adherence to such codes or standards does not suffice to ensure a quality product in keeping with the safety function, they are supplemented or modified as necessary. A showing of sufficiency and applicability of codes, standards, quality assurance programs, test procedures, and inspection acceptance levels used is required."*

Structures, systems, and components of importance are designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

The Quality Assurance Program was established to provide assurance that safety-related structures, systems, and components satisfactorily perform their intended safety functions.

Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 1.

- Control Room (Criterion 11 – draft)

  Criterion 11 specifies: *"The facility shall be provided with a Control Room from which actions to maintain safe operational status of the plant can be controlled. Adequate radiation protection shall be provided to permit access, even under accident conditions, to equipment in the Control Room or other areas as necessary to shut down and maintain safe control of the facility without radiation exposure of personnel in excess of 10CFR20 limits. It shall be possible to shut the reactor down and maintain it in a safe condition if access to the Control Room is lost due to fire or other cause."*

  Calculated post-accident control room doses for the proposed change are within 10 CFR 50.67 limits.

  Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 11.

- Engineered Safety Features Basis for Design (Criterion 37 – draft)

  Criterion 37 specifies: *"Engineered safety features shall be provided in the facility to back up the safety provided by the core design, the reactor coolant pressure boundary, and their protection systems. As a minimum, such engineered safety features shall be designed to cope with any size reactor coolant pressure boundary break up to and including the circumferential rupture of any pipe in that boundary assuming unobstructed discharge from both ends."*

  The ability of the Engineered Safety Features to cool the reactor core and return the containment to subatmospheric pressure and maintain it at subatmospheric pressure is not affected by the proposed change. The required capability to control the pH of the post-LOCA containment sump fluid is maintained. The pH of the containment sump fluid is maintained between 7.0 and 9.0 during the long-term post-accident period which is the same as the current design's pH range.

  Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 37.

- Reliability and Testability Engineered Safety Features (Criterion 38 – draft)

  Criterion 38 specifies: *"All engineered safety features shall be designed to provide high functional reliability and ready testability. In determining the suitability of a facility for a proposed site, the degree of reliance upon and acceptance of the inherent and engineered safety afforded by the systems, including engineered safety features, will be influenced by the known and the demonstrated performance capability and reliability of the systems, and by the extent to which the operability of such systems can be tested and inspected where appropriate during the life of the plant."*

  Periodic surveillance testing of the NaTB stored in baskets will be performed in accordance with the TS.

  Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 38.

- Engineered Safety Features Performance Capability (Criterion 41 – draft)

  Criterion 41 specifies: *"Engineered safety features, such as emergency core cooling and containment heat removal systems, shall provide sufficient performance capability to accommodate partial loss of installed capacity and still fulfill the required safety function. As a minimum, each engineered safety feature shall provide this required safety function assuming a failure of a single active component."*

  The proposed pH control system design using NaTB is passive, so no new single failures are assumed. In addition, the quantity of NaTB in the storage baskets accounts for chemical density variations and the basket design ensures adequate dissolution of the NaTB by the post-LOCA sump fluid to achieve the desired pH value of the sump fluid. Therefore, partial loss of installed capacity is not considered a credible failure.

  Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 41.

- Engineered Safety Features Components Capability (Criterion 42 – draft)

  Criterion 42 specifies: *"Engineered safety features shall be designed so that the capability of each component and system to perform its required function is not impaired by the effects of a loss of coolant accident."*

  The NaTB baskets are fabricated of stainless steel, which is not impaired by the effects of a LOCA, and are designed to store the required amount of NaTB and ensure adequate dissolution of the NaTB by the post-LOCA sump fluid to achieve the desired pH value of the sump fluid.

Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 42.

- Control of Releases of Radioactivity to the Environment (Criterion 70 – draft)

  Criterion 70 specifies: *"The facility design shall include those means necessary to maintain control over the plant radioactive effluents, whether gaseous, liquid, or solid. Appropriate holdup capacity shall be provided for retention of gaseous, liquid, or solid effluent, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactivity effluents to the environment. In all cases, the design for radioactivity control shall be justified: (1) on the basis of 10 CFR 20 requirements for normal operations and for any transient situation that might reasonably be anticipated to occur, and (2) on the basis of 10 CFR 100 dosage level guidelines for potential reactor accidents of exceedingly low probability of occurrence except that reduction of the recommended dosage levels may be required where high population densities or very large cities can be affected by the radioactive effluents."*

  The calculated post-LOCA doses for the proposed change for Surry Unit 1 and Unit 2 comply with 10 CFR 50.67, "Accident Source Term".

  Therefore, the proposed change will not impact the ability of Surry Units 1 and 2 to comply with the requirements of Criterion 70.

<u>10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants"</u>

Environmentally qualified components were analyzed, and the evaluation concluded that the analyzed components will be capable of performing their safety functions under the short-term and long-term post-accident containment pH conditions.

<u>10 CFR 50.67, "Accident Source Term" and 10 CFR 100 "Reactor Site Criteria"</u>

The proposed buffer change from NaOH to NaTB maintains the post-LOCA offsite radiological consequences at the Exclusion Area Boundary (EAB), the Low Population Zone (LPZ), and the control room in compliance with 10 CFR 50.67 and 10 CFR 100.

<u>Quality Assurance</u>

Quality assurance criteria in 10 CFR Part 50, Appendix B, that apply to the systems and components pertinent to the proposed change include: Criteria III, V, XI, XVI, and XVII. Criteria III and V require measures to ensure applicable regulatory requirements and the design basis, as defined in 10 CFR 50.2, "Definitions," and as specified in the license application, are correctly translated into controlled specifications, drawings, procedures, and instructions. Criterion XI requires a test program to ensure that the subject systems will perform satisfactorily in service and requires that test results be documented and

evaluated to ensure that test requirements have been satisfied. Criterion XVI requires measures to ensure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected, and that significant conditions adverse to quality are documented and reported to management. Criterion XVII requires maintenance of records of activities affecting quality.

4.2 Precedents

Many operating U.S. PWR power plants have replaced either NaOH or TSP as the buffer used for containment sump pH control following a LOCA with NaTB. Some of the plants are listed below.

Plants that replaced NaOH with NaTB:

- Beaver Valley Units 1 and 2 (ML111510646 and ML082730716)
- Indian Point Unit 3 (ML081140142)

Plants that replaced TSP with NaTB:

- Arkansas Nuclear One Unit 2 (ML072890085)
- Calvert Cliffs Units 1 and 2 (ML082480671)
- Indian Point Unit 2 (ML073040292)
- Palisades Nuclear Plant (ML071830385)

4.3 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Virginia Electric and Power Company (Dominion Energy Virginia) proposes a change to the Surry Power Station (Surry) Units 1 and 2 Technical Specifications (TS) to allow the use of sodium tetraborate decahydrate (NaTB) to replace sodium hydroxide (NaOH) as a chemical additive (buffer) for containment sump pH control following a loss-of-coolant accident (LOCA).

Dominion Energy Virginia has evaluated whether or not a significant hazards consideration is involved with the proposed change in accordance with the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below.

1. **Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   Use of NaTB in place of NaOH would not involve a significant increase in the probability of a previously evaluated accident because the containment spray

additive is not an initiator of any analyzed accident. The NaTB would be stored and delivered by a passive method that does not have potential to affect plant operations. Any existing portion of the NaOH delivery system that remains in place will meet existing seismic requirements. Therefore, the change in additive, including removal of NaOH equipment from service, would not result in any failure modes that could initiate an accident.

The spray additive is used to mitigate the long-term consequences of a LOCA. Use of NaTB as an additive in place of NaOH would not involve a significant increase in the consequences of a previously evaluated accident because the amount of NaTB specified in the proposed TS would achieve a sump pH of 7.0 or greater, consistent with the current licensing basis. This pH is sufficient to achieve long-term retention of iodine by the containment sump fluid for the purpose of reducing accident related radiation dose following a LOCA.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   Regarding the proposed use of NaTB in place of NaOH, the NaTB would be stored and delivered by a passive method that does not have potential to affect plant operations. Any existing portion of the NaOH delivery system that remains in place will meet existing seismic requirements. The design basis strainer head loss tests remain applicable following NaOH replacement with NaTB. The granular NaTB is retained in the baskets until dissolved by the containment sump water, and therefore does not become a particulate debris source. Hydrogen generation would not be significantly impacted by the change. No new failure mechanisms, malfunctions, or accident initiators would be introduced by the proposed change.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed amendment involve a significant reduction in a margin of safety?**

   Response: No.

   Since the quantity of NaTB specified in the amended TS would reduce the potential for undesirable chemical effects debris loading while achieving radiation dose consequences, corrosion control and hydrogen generation effects that are comparable to NaOH, the proposed change does not involve a significant reduction in a margin of safety. The primary function of an additive is to reduce long-term

loss-of-coolant accident consequences by controlling the amount of iodine fission products released to containment atmosphere from reactor coolant accumulating in the sump during a LOCA. Because the amended TS would achieve a sump pH of 7.0 or greater using NaTB, dose related safety margins would not be significantly reduced. Use of NaTB reduces the potential for undesirable chemical effects that could interfere with recirculation flow through the sump strainers. Any existing portion of the NaOH delivery system that remains in place would meet existing seismic requirements and would not interfere with operation of the existing containment or containment spray system.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Dominion Energy Virginia concludes that the proposed amendments do not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Based on the above evaluation, Dominion Energy Virginia concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92, paragraph (c), and accordingly, a finding of no significant hazards consideration is justified.

5.0 ENVIRONMENTAL CONSIDERATION

10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusions or otherwise not requiring environmental review," addresses requirements for submitting environmental assessments as part of licensing actions. 10 CFR 51.22, paragraph (c)(9) states that a categorical exclusion applies for Part 50 license amendments that meet the following criteria:

i. No significant hazards consideration (as defined in 10 CFR 50.92(c));

ii. No significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and

iii. No significant increase in individual or cumulative occupational radiation exposure.

As demonstrated above, the proposed TS change does not involve a significant hazards consideration. The reviews and evaluations performed to support the proposed change concluded that all plant systems will continue to function as designed. Also, performance requirements for these systems have been evaluated and determined to be acceptable. No new accident scenarios, failure mechanisms, or limiting single failures are introduced as a result of the proposed change. Operation of the plant with the proposed change does not involve a significant reduction in a margin of safety.

The proposed change to revise the TS to allow the use of NaTB to replace NaOH as a buffer for containment sump pH control following a LOCA does not result in a significant change in types or amounts of effluents that may be released offsite. The use of NaTB as an additive in place of NaOH results in a sump pH of 7 or greater, consistent with the current licensing basis. This pH is sufficient to achieve long-term retention of iodine by the containment sump fluid for the purpose of reducing accident related radiation dose following a LOCA.

There is no significant increase in individual or cumulative occupational radiation exposure with the proposed change.

Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22, paragraph (c)(9). Therefore, pursuant to 10 CFR 51.22, paragraph (b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report," July 2017.

2. NUREG-0800, U.S. NRC Standard Review Plan, Section 6.5.2, "Containment Spray as a Fission Product Cleanup System", Rev. 4.

3. BNP-100, Pacific Northwest Laboratories Report, "Iodine Removal from Containment Atmospheres by Boric Acid Spray", July 1970.

4. WCAP-14542-NP, "Evaluation of the Radiological Consequences from a Loss of Coolant Accident at Indian Point Nuclear Generating Station Unit No. 2 Using NUREG-1465 Source Term Methodology," July 1996. ADAMS Accession No. ML100470750.

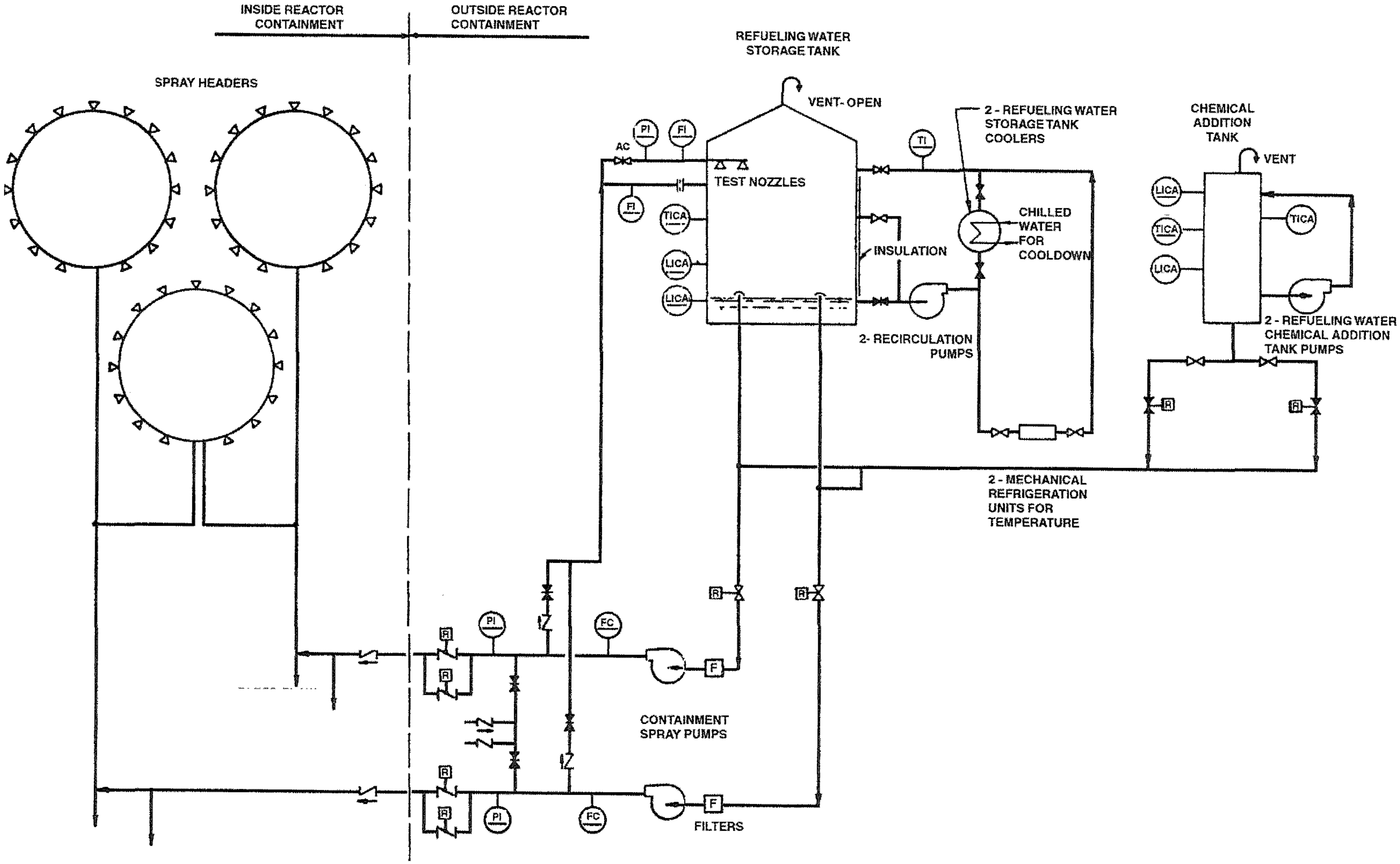
5. WCAP-16596-NP, Revision 0, "Evaluation of Alternative Emergency Core Cooling Buffering Agents", July 2006.

6. WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191," March 2008. ADAMS Accession No. ML081150379.

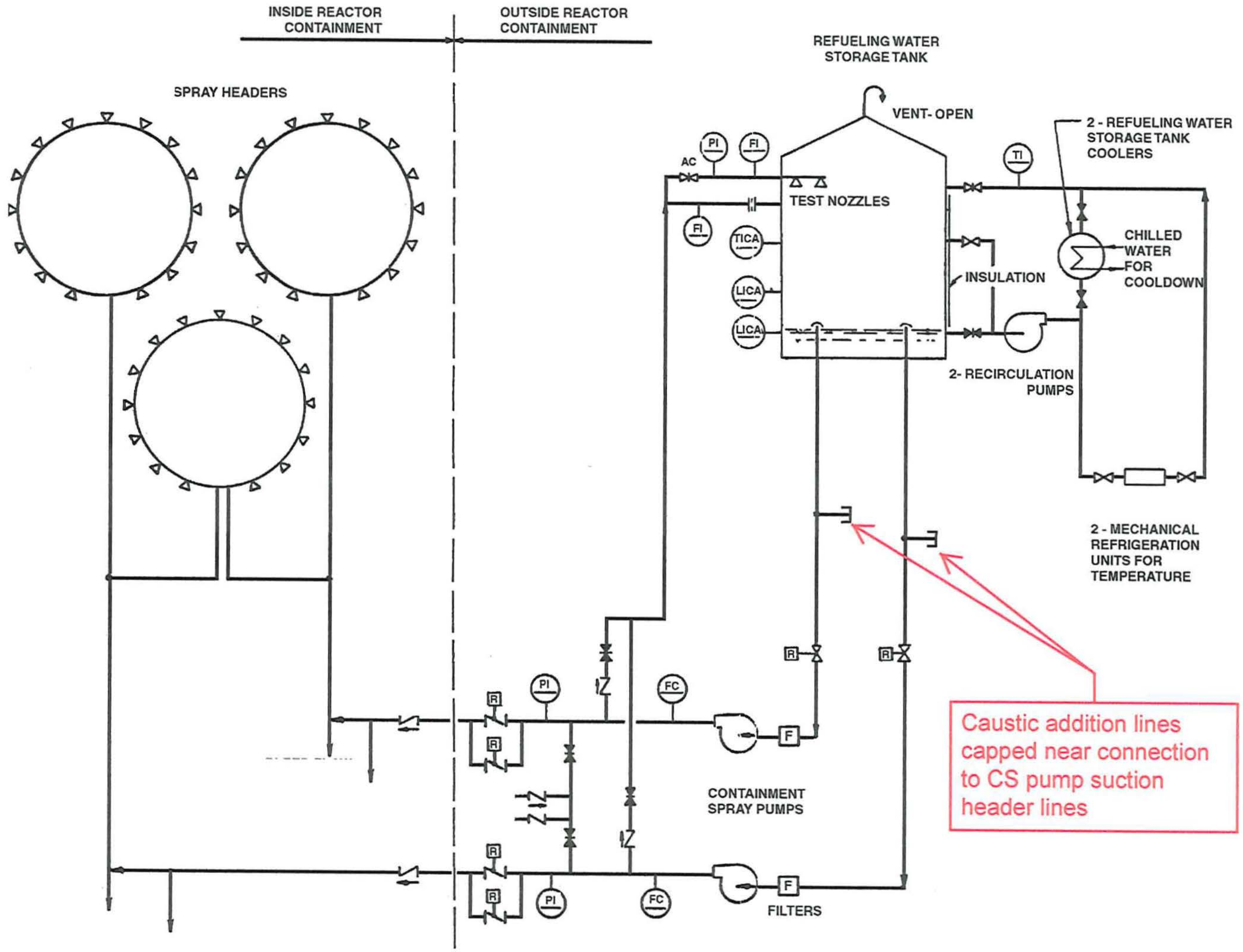
Attachment 2

CONTAINMENT SPRAY SYSTEM SHOWING CURRENT AND MODIFIED CONFIGURATIONS

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



CONTAINMENT SPRAY SYSTEM - CURRENT CONFIGURATION



CONTAINMENT SPRAY SYSTEM - MODIFIED CONFIGURATION

Attachment 3

MARKED-UP TECHNICAL SPECIFICATIONS PAGES

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

3.4 SPRAY SYSTEMS

Applicability

Applies to the operational status of the Spray Systems.

Objective

To define those limiting conditions for operation of the Spray Systems necessary to assure safe unit operation.

Specification

A. A unit's Reactor Coolant System temperature or pressure shall not be made to exceed 350°F or 450 psig, respectively, unless the following Spray System conditions in the unit are met:

1. Two Containment Spray Subsystems, including containment spray pumps, piping, and valves shall be OPERABLE.

2. Four Recirculation Spray Subsystems, including recirculation spray pumps, coolers, piping, and valves shall be OPERABLE.

3. The refueling water storage tank shall contain at least 387,100 gallons of borated water at a maximum temperature of 45°F. The boron concentration shall be at least 2300 ppm but not greater than 2500 ppm.

4. ~~The refueling water chemical addition tank shall contain at least 3930 gallons of solution with a sodium hydroxide concentration of at least 17 percent by weight but not greater than 18 percent by weight.~~

5. All valves, piping, and interlocks associated with the above components which are required to operate under accident conditions shall be OPERABLE.

The sodium tetraborate decahydrate (NaTB) baskets shall be unobstructed, in place, intact, and shall contain at least 10,760 lbm of sodium tetraborate decahydrate collectively. The NaTB in the baskets shall provide adequate pH adjustment of borated water.

TABLE 4.1-2A

MINIMUM FREQUENCY FOR EQUIPMENT TESTS

DESCRIPTION	TEST	FREQUENCY	FSAR SECTION REFERENCE
1. Control Rod Assemblies	Rod drop times of all full length rods at hot conditions	Prior to reactor criticality: a. For all rods following each removal of the reactor vessel head b. For specially affected individual rods following any maintenance on or modification to the control rod drive system which could affect the drop time of those specific rods c. SFCP	7
2. Control Rod Assemblies	Partial movement of all rods	SFCP	7
3. Refueling Water Chemical Addition Tank [struck through; marked "Deleted"]	Functional [struck through]	SFCP [struck through]	6 [struck through]
4. Pressurizer Safety Valves	Setpoint	Per the Inservice Testing Program	4
5. Main Steam Safety Valves	Setpoint	Per the Inservice Testing Program	10
6. Containment Isolation Trip	* Functional	SFCP	5
7. Refueling System Interlocks	* Functional	Prior to refueling	9.12
8. Service Water System	* Functional	SFCP	9.9
9. Residual Heat Removal System	Functional	Per the Inservice Testing Program	9.3
10. Deleted			
11. Diesel Fuel Supply	* Fuel Inventory	SFCP	8.5
12. Deleted			
13. Main Steam Line Trip Valves	Functional (Full Closure)	Before each startup (TS 4.7) The provisions of Specification 4.0.4. are not applicable	10

TABLE 4.1-2B
MINIMUM FREQUENCIES FOR SAMPLING TESTS

	DESCRIPTION	TEST	FREQUENCY	UFSAR SECTION REFERENCE
1.	Reactor Coolant Liquid Samples	Radio-Chemical Analysis (1)	SFCP (5)	
		Tritium Activity	SFCP (5)	9.1
		* Chemistry (CL, F & O_2)	SFCP (9)	4
		* Boron Concentration	SFCP	9.1
		DOSE EQUIVALENT I-131	SFCP (4)(7)	
		DOSE EQUIVALENT XE-133	SFCP (4)	
2.	Refueling Water Storage	Chemistry (Cl & F)	SFCP	6
3.	Boric Acid Tanks	* Boron Concentration	SFCP	9.1
4.	~~Chemical Additive Tank~~ NaTB Baskets	~~NaOH Concentration~~ NaTB Buffer Analysis (2)	SFCP	6
5.	Spent Fuel Pit	* Boron Concentration	SFCP	9.5
6.	Secondary Coolant	DOSE EQUIVALENT I-131	SFCP	
7.	Stack Gas Iodine and Particulate Samples	* I-131 and particulate radioactive releases	SFCP	

* See Specification 4.1.D

SFCP - Surveillance frequencies are specified in the Surveillance Frequency Control Program.

(1) A radiochemical analysis will be made to evaluate the following corrosion products: Cr-51, Fe-59, Mn-54, Co-58, and Co-60.

(2) ~~Deleted~~ A laboratory test will be performed to verify that a sample from the NaTB baskets provides adequate pH adjustment of borated water.

Attachment 4

PROPOSED TECHNICAL SPECIFICATIONS PAGES

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

3.4 SPRAY SYSTEMS

Applicability

Applies to the operational status of the Spray Systems.

Objective

To define those limiting conditions for operation of the Spray Systems necessary to assure safe unit operation.

Specification

A. A unit's Reactor Coolant System temperature or pressure shall not be made to exceed 350°F or 450 psig, respectively, unless the following Spray System conditions in the unit are met:

1. Two Containment Spray Subsystems, including containment spray pumps, piping, and valves shall be OPERABLE.

2. Four Recirculation Spray Subsystems, including recirculation spray pumps, coolers, piping, and valves shall be OPERABLE.

3. The refueling water storage tank shall contain at least 387,100 gallons of borated water at a maximum temperature of 45°F. The boron concentration shall be at least 2300 ppm but not greater than 2500 ppm.

4. The sodium tetraborate decahydrate (NaTB) baskets shall be unobstructed, in place, intact, and shall contain at least 10,760 lbm of sodium tetraborate decahydrate collectively. The NaTB in the baskets shall provide adequate pH adjustment of borated water.

5. All valves, piping, and interlocks associated with the above components which are required to operate under accident conditions shall be OPERABLE.

TABLE 4.1-2A
MINIMUM FREQUENCY FOR EQUIPMENT TESTS

	DESCRIPTION	TEST	FREQUENCY	FSAR SECTION REFERENCE
1.	Control Rod Assemblies	Rod drop times of all full length rods at hot conditions	Prior to reactor criticality: a. For all rods following each removal of the reactor vessel head b. For specially affected individual rods following any maintenance on or modification to the control rod drive system which could affect the drop time of those specific rods c. SFCP	7
2.	Control Rod Assemblies	Partial movement of all rods	SFCP	7
3.	Deleted			
4.	Pressurizer Safety Valves	Setpoint	Per the Inservice Testing Program	4
5.	Main Steam Safety Valves	Setpoint	Per the Inservice Testing Program	10
6.	Containment Isolation Trip	* Functional	SFCP	5
7.	Refueling System Interlocks	* Functional	Prior to refueling	9.12
8.	Service Water System	* Functional	SFCP	9.9
9.	Residual Heat Removal System	Functional	Per the Inservice Testing Program	9.3
10.	Deleted			
11.	Diesel Fuel Supply	* Fuel Inventory	SFCP	8.5
12.	Deleted			
13.	Main Steam Line Trip Valves	Functional (Full Closure)	Before each startup (TS 4.7) The provisions of Specification 4.0.4. are not applicable	10

TABLE 4.1-2B
MINIMUM FREQUENCIES FOR SAMPLING TESTS

	DESCRIPTION	TEST	FREQUENCY	UFSAR SECTION REFERENCE
1.	Reactor Coolant Liquid Samples	Radio-Chemical Analysis (1)	SFCP (5)	
		Tritium Activity	SFCP (5)	9.1
		* Chemistry (CL, F & O2)	SFCP (9)	4
		* Boron Concentration	SFCP	9.1
		DOSE EQUIVALENT I-131	SFCP (4)(7)	
		DOSE EQUIVALENT XE-133	SFCP (4)	
2.	Refueling Water Storage	Chemistry (Cl & F)	SFCP	6
3.	Boric Acid Tanks	* Boron Concentration	SFCP	9.1
4.	NaTB Baskets	NaTB Buffer Analysis (2)	SFCP	6
5.	Spent Fuel Pit	* Boron Concentration	SFCP	9.5
6.	Secondary Coolant	DOSE EQUIVALENT I-131	SFCP	
7.	Stack Gas Iodine and Particulate Samples	* I-131 and particulate radioactive releases	SFCP	

* See Specification 4.1.D

SFCP - Surveillance frequencies are specified in the Surveillance Frequency Control Program.

(1) A radiochemical analysis will be made to evaluate the following corrosion products: Cr-51, Fe-59, Mn-54, Co-58, and Co-60.

(2) A laboratory test will be performed to verify that a sample from the NaTB baskets provides adequate pH adjustment of borated water.