ATTACHMENT 2

NORTH ANNA NTTF 2.1: FLOODING HAZARD RE-EVALUATION INITIAL ASSESSMENT OF FLOODING HAZARD RE-EVALUATION RESULTS AND INTERIM ACTIONS PLAN

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2

I. Summary of Flooding Hazard Re-evaluation Results

The Flooding Hazard Re-evaluation Report evaluated applicable flooding hazards for the North Anna Units 1 and 2 site. Four of the re-evaluated flood hazard events, the Probable Maximum Flood (Lake Anna PMF), the Upstream Dam Failure, the Ice Induced Flooding, and the Local Intense Precipitation (LIP) events, resulted in flood water elevations higher than previously calculated for the North Anna Units 1 and 2 site. These events are considered beyond design basis events. However, the NRC has requested, for sites where the re-evaluated flood exceeds the design basis, that licensees submit an interim action plan that documents actions planned or taken to address the re-evaluated hazard with the hazard evaluation.

Lake Anna PMF

The Lake Anna PMF water level was calculated as part of the Early Site Permit (ESP) and Combined Operating License Application (COLA) for the North Anna Unit 3 Project. The North Anna Unit 3 ESP/COLA PMF was then revised for use for this North Anna Units 1 and 2 flooding re-evaluation. The revised PMF is calculated to be 0.1 foot higher than the highest lake level previously calculated for North Anna Units 1 and 2.

The North Anna Units 1 and 2 UFSAR documents the maximum Lake Anna PMF flood level at 267.3 feet mean sea level (MSL) at the site. The Units 1 and 2 flooding re-evaluation calculates the maximum PMF water level, including wind-wave effects, to be 267.4 feet MSL. In comparison, North Anna Units 1 and 2 are protected from a Lake Anna PMF by the nominal site grade and by the west dike both having a nominal finished grade elevation of 271 feet MSL.

The normal Lake Anna water elevation is 250 feet MSL. The 0.1 foot increase in calculated Lake Anna PMF water elevation is less than one percent increase above the current licensing basis (CLB) PMF water elevation. Also, the re-evaluated Lake Anna flood elevation remains more than 3 feet below the Units 1 and 2 site grade. Although the postulated PMF elevation is slightly higher than the CLB PMF for North Anna Units 1 and 2, the 0.1 foot increase is a small fraction of the available physical margin to the site grade.

Separately, the North Anna Units 1 and 2 Turbine Building basement areas are below site grade. The nominal site grade and west dike are the primary site protection features for the Turbine Building with respect to a Lake Anna PMF. However, the Turbine Building basement and several important structures, systems, and components (SSCs) within and adjacent to the Turbine Building are also flood protected to Elevation 257 feet MSL. Therefore, if the lake level exceeds the 256 feet elevation, mitigation measures are initiated through the North Anna Units 1 and 2 Technical Requirements Manual (TRM). The TRM requires the units to be taken out of service, the circulating water pumps to be secured, and the condenser isolation valves to be closed should the

lake level exceed 256 feet elevation, which is well below the re-evaluated Lake Anna PMF of Elevation 267.4 feet MSL. Therefore, there is no increased risk to SSCs within and adjacent to the Turbine Building basement from the Lake Anna PMF event.

Based on the assessment above, no new vulnerabilities have been identified and no interim actions are necessary for the Lake Anna PMF event. The slight increase in Lake Anna PMF level, however, will be included in the Integrated Assessment for North Anna Units 1 and 2.

Upstream Dam Failures

Impact to the North Anna site due to dam breaches and failures was evaluated previously in the Early Site Permit (ESP) application for the North Anna Unit 3 site adjacent to Units 1 and 2. The Upstream Dam Failure analysis identified two impounded bodies of water of significant volume upstream of the site, Lake Louisa and Lake Orange. The analysis assumed that a failure of these dams would be most critical during the probable maximum flood (PMF) event. This postulated event also conservatively assumes that the flood waves from both impounded bodies of water arrive simultaneously and unmitigated by the intervening terrain. Based on this analysis, adding the impounded water in Lake Orange and Lake Louisa to Lake Anna under PMF conditions would cause a small increase of approximately 0.4 ft above the PMF level due the large surface area of Lake Anna. The Upstream Dam Failure Analysis concludes that volume of the upstream impoundments is insufficient to cause any dramatic rise in the water levels of Lake Anna. As discussed above, because the nominal site grade at Elevation 271 feet is more than 3 feet above the PMF, there is no credible risk of flooding or other impacts to the safety-related functions of the plant due to the failures of these dams. No interim actions are necessary for the Upstream Dam Failure event. The slight increase in Lake Anna PMF level, however, will be included in the Integrated Assessment for North Anna Units 1 and 2.

Ice Induced Flooding

Impact to the North Anna site due to Ice Induced Flooding was evaluated as part of the North Anna Unit 3 ESP application. This analysis hypothesized an ice jam on the North Anna River upstream of the site measuring 10 ft in height with an impounded volume of water estimated to be 1500 acre-ft. The volume was calculated by estimating the surface area of the impoundment created by the ice dam based on the topography, 150 acres, and conservatively assuming a water depth of 10 feet throughout. The effects on Lake Anna's water level as a result of the failure of such an ice dam are bounded by the analysis presented above, which considered the failure of two upstream impoundments with a combined volume of 7671 acre-ft. As described above, it was estimated that the simultaneous failure of these dams would produce a 0.4 ft rise in Lake Anna, which would not threaten the site. The formation of an ice dam with a volume greater than the combined volume of the two upstream impoundments is not credible, given the conservatism of the volume estimate described above and that there is no record in the

area of an ice jam taller than 10 feet. Therefore, there is no risk of flooding at Units 1 & 2 due to the breaching of an ice jam formed upstream of the site.

Surface water from the NAPS site area drains to Lake Anna where it is discharged over the dam to the North Anna River downstream. The tailwater elevation in the North Anna River is on the order of 180 feet, which is substantially lower than the dam crest elevation of 265 feet and the normal operating level of 250 feet in the lake. As such, there is no risk of flooding at North Anna Units 1 and 2, where the grade elevation is at 271 feet, due to backwater effects from downstream ice jams in the North Anna River. In summary, the hydrologic setting at NAPS demonstrates that there is no discernible ice induced flood risk at the Units 1 and 2 site. No interim actions are necessary for the Ice Induced Flooding event. The slight increase in Lake Anna PMF level, however, will be included in the Integrated Assessment for North Anna Units 1 and 2.

Local Intense Precipitation (LIP)

The North Anna Units 1 and 2 Flooding Hazard Re-evaluation Report evaluated two local probable maximum precipitation (PMP) events to address worst case conditions at areas of the site with differing flood characteristics. A flow-runoff analysis using a 6-hour one square mile local PMP event was evaluated for the majority of the plant site where surface flow characteristics allow the flood water to discharge by sheet flow to Lake Anna and the waste heat treatment reservoir. The second local PMP analysis evaluated a 72-hour ten square mile local PMP event to access the impact of rainfall and runoff into the West Basin as if it were a small reservoir.

As described in the Flood Hazard Re-evaluation Report, these LIP analyses assume underground storm drains and culverts, as well as roof drains are blocked and not functioning during the local PMP events. The re-evaluated LIP flood hazard events resulted in postulated flooding elevations beyond the current licensing basis. The postulated results of these re-evaluations indicate the following:

- The maximum 6-hour one square mile local PMP water level in the ISFSI yard area is at Elevation 311.2 feet, MSL, which is 0.3 feet above the existing grade elevation. This maximum flood water level is within the available physical margin for equipment in this area. No new vulnerabilities were identified for this area and no interim actions are necessary.

- Runoff generated from the maximum 6-hour one square mile local PMP storm event north of the Turbine Building flows to the north away from the Turbine Building and out of the protected area as sheet flow. The maximum water depths during this local PMP in this area range from 1.8 to 2.8 inches with durations of less than 8 minutes. Flood depths greater than 1.0 inch in this area last less than 30 minutes. This runoff analysis calculates a slight increase in postulated flood

level in this area. However, no new vulnerabilities are identified for this area and no interim actions are necessary.

- Runoff generated from the maximum 6-hour one square mile local PMP storm event for the areas south of the Turbine Building within and close to the protected area were evaluated using four virtual flow paths. The maximum flood water depths along these virtual flow paths range from 0.3 to 2.9 feet. It is estimated that the duration of flooding conditions along the four major virtual flow paths would last about 65 minutes, with the maximum flood water depths lasting less than 4 minutes. See Section II.

- The rainfall and runoff volumes into the West Basin for the 72-hour ten square mile local PMP plus the 40% antecedent 72-hour ten square mile local PMP events would exceed the storage capacity of the West Basin and Turbine Building basement below the crest of the flood protection walls in the Turbine Building. See Section II.

II. Initial Assessment of Potential Vulnerabilities:

Handling of Vulnerabilities Identified During the Flood Hazard Re-evaluation

In accordance with the process outlined in the 10 CFR 50.54(f) Request For Information dated March 12, 2012, the flood hazard re-evaluation was to be performed using present-day regulatory guidance and methodologies applicable to new plant applications. Therefore, to the extent that existing plant evaluations do not use these assumptions and methods, any issues identified during such re-evaluations should be treated as non-current licensing basis (non-CLB) deficiencies or vulnerabilities. Non-CLB or beyond design basis vulnerabilities are defined as those features important to safety that when subject to an increased demand due to the newly calculated hazard evaluation have not been shown to be capable of performing their intended safety function(s). Such vulnerabilities are beyond the CLB for the facility and do not call into question operability. However, vulnerabilities identified during the flood hazard re-evaluation should be entered into the corrective action program and dispositioned accordingly. These conditions will also be evaluated as part of the Integrated Assessment whose results will be reported to the NRC within two years after submittal of the Flood Hazard Re-evaluation Report.

Handling of Seasonality of Probable Maximum Precipitation Events:

As documented in National Oceanic and Atmospheric Administration (NOAA) and Nuclear Regulatory Commission (NRC) Hydrometeorological Report No. 53 (HMR-53), Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, PMP estimates show a smooth variation with duration, season, and location. HMR-53 supports the observation of seasonality of

PMP events for the region of this study, which includes Virginia. The report found that, for the region of this study, for all durations, the all-season PMP will fall sometime between June and September for every point.

Also, National Rainfall Frequency studies prepared by the National Weather Service correlate storms in the Mid-Atlantic region to the tropical storm/hurricane season , which begins June 1 and ends November 1 of each year.

These studies support a timing correlation between the PMP events evaluated in the Flooding Hazard Re-evaluation Report to the tropical storm/hurricane season for the Mid-Atlantic region. Therefore, the period from November 1 to June 1 of each year has a very low probability of occurrence of a PMP event at the North Anna Power Station.

Flood Water Postulated to Overflow the Turbine Building West Parapet and Accumulate in West Basin:

During the 72-hour, ten square mile local PMP event, flood water is calculated to enter the West Basin from three sources: direct rainfall on the West Basin, a portion of the water from the Unit 2 alleyway and south yard area, and overflow water from the Turbine Building roof 6-inch parapet. The 72-hour ten square mile local PMP analysis calculates the overflow water from the Turbine Building roof as the largest contributing source of water into the West Basin.

Conservatively, the Flooding Hazard Re-evaluation LIP analysis assumed the Turbine Building roof drain system to be fully blocked. In contrast, the existing calculations for the PMP water volume entering the West Basin does not assume blockage of the Turbine Building roof drain system.

If the Turbine Building roof drains are not to be credited in the Integrated Assessment, temporary or permanent modifications are likely needed to prevent overflow from the Turbine Building roof from entering the West Basin area. For example, the Turbine Building west roof parapet may have to be raised to re-direct the water from entering the West Basin area from the Turbine Building roof. This potential vulnerability has been entered into the station corrective action program and this potential vulnerability will be addressed as a long-term corrective action by the Integrated Assessment.

In the interim, it is understood that an LIP event of such magnitude to approach the postulated accumulation of rainfall is a low probability event. Such an event would likely be associated with a significant tropical storm. Meteorological forecasting would provide sufficient warning well in advance of such an event. The Interim Actions discussed in Section III, below, will provide adequate protection until permanent solutions are implemented.

Existing Roof Loading Calculations do not Assume Roof Drains are Blocked:

In reviewing potential modifications to limit or eliminate flow of water from the Turbine Building roof to the West Basin, it was identified that existing roof loading analyses for the Turbine Building and Service Building roofs do not assume roof drains are fully blocked. A review of the existing roof loading calculation found the Turbine Building roof to be acceptable in its current configuration with the Turbine Building roof drains assumed fully blocked.

Calculations performed as part of the North Anna IPEEE evaluations demonstrated that Service Building roof loading is not a concern with the roof drains partially blocked. However, for the Service Building, if roof drains are assumed to be fully blocked, several roof beams may exceed their design capacity.

This potential vulnerability has been entered into the station corrective action program and will be addressed as a long-term corrective action by the Integrated Assessment. The Interim Actions discussed in Section III, below, will provide adequate protection until permanent solutions are implemented.

Flooding the Turbine Building Basement:

Regardless of whether modifications are installed to prevent water from the Turbine Building roof from entering the West Basin, the volume of water from direct rainfall as calculated by the 72-hour ten square mile local PMP on the West Basin is postulated to overflow the Turbine Building west flood wall and enter the Turbine Building basement. However, absent the water volume from the Turbine Building roof, the postulated water volume is within the existing flood protection for safety related equipment accessible from the Turbine Building basement. The 72-hour ten square mile local PMP re-evaluation analysis conservatively does not credit any portion of the west dike drain pipe or any sump pumps. Temporary or permanent measures may be needed to address West Basin water from entering the Turbine Building basement. This potential vulnerability has been entered into the station corrective action program and will be addressed as a long-term corrective action by the Integrated Assessment.

In the interim, it is understood that an LIP event of such magnitude to approach the postulated accumulation of rainfall is a low probability event. Such an event would likely be associated with a significant tropical storm. Meteorological forecasting would provide significant warning well in advance of such an event. The Interim Actions discussed in Section III, below, will provide adequate protection until permanent solutions are implemented.

Flooding the Station Blackout (SBO) Diesel:

The 72-hour ten square mile local PMP calculation assumes accumulated water in the west basin above 257 feet elevation enters the Turbine Building unrestricted. This is

conservative for the purpose of calculating the level of water in the Turbine Building basement. The SBO Building floor elevation is at Elevation 260 feet MSL. Therefore, this assumption is not conservative with respect to flooding of the SBO diesel generator located within the West Basin.

The SBO diesel generator is non-safety related and the SBO Building is a normal commercial building and, as such, was not designed for extreme environmental events, e.g., a local PMP event. Even so, the SBO diesel generator is an important piece of equipment and potential for flooding is described here as a vulnerability of the 72-hour ten square mile local PMP event.

This potential vulnerability has been entered into the station corrective action program and will be addressed as a long-term corrective action by the Integrated Assessment. The Interim Actions discussed in Section III, below, will provide adequate protection until permanent solutions are implemented.

Water Ponding Inside the Protected Area:

The 6-hour one square mile local PMP analysis calculates elevations of flood waters inside the protected area of between 0.3 and 2.9 feet. This analysis assumes storm drains are fully blocked. The buildings are not fully sealed to prevent flood water adjacent to the building from entering the building. However, a review of the susceptible building openings, i.e., door openings and ventilation louvers, identified only the Fuel Oil Pump House doors and/or louvers to be susceptible to postulated flood water intrusion during the peak flood period. The calculated flood water depths adjacent to other buildings and rooms containing safety related equipment are below the available physical margin for these building doors and louvers.

The issue of postulated water ponding adjacent to safety related structures has been entered into the station corrective action program as a potential vulnerability and will be addressed as a long-term corrective action by the Integrated Assessment. The Interim Actions discussed in Section III, below, will provide adequate protection until permanent solutions are implemented.

III. Interim Actions:

The 10 CFR 50.54(f) Request For Information dated March 12, 2012, requires that interim actions be identified for all plant-specific vulnerabilities discovered during the flood hazard re-evaluations. These actions are intended to provide a reasonable level of assurance that the plant will be safe during a flood event until that time when the total plant response to the re-evaluated hazard is determined by the Integrated Assessment and any necessary long term actions are implemented.

North Anna's initial response to the tragic events at Fukushima included review of emergency and abnormal procedures and conduct of flooding walkdowns to identify

gaps to the current licensing basis and potential areas where small margins may exist. These initial efforts identified numerous areas where flood protection and mitigation could be improved. These improvements provide confidence in the sites' ability to address both design basis events and beyond design basis events. In addition, the current regulatory approach to FLEX and resultant improvements in plant and industry capabilities provides additional confidence to conclude that an accident with consequences similar to the Fukushima accident is unlikely to occur in the United States.

Yard Drain Systems and Turbine Building and Service Building Roof Drain Inspections and PMs:

Dominion performed a visual inspection of the Service Building and Turbine Building roof drains and a visual inspection of the Service Building and Turbine Building roof areas for potential loose materials that could potentially block drains. This inspection was performed in February 2013. Dominion will perform these inspections again prior to June 1, 2013.

In addition, Dominion will evaluate the need for further inspections and preventative maintenance (PMs) of the yard drain systems within the North Anna protected area and the Turbine Building and Service Building roof drain systems. Periodic inspections of drains and vicinity would likely improve confidence in the ability of these systems to function if needed. Although the flooding hazard analysis report assumes the storm drains are blocked, fully functional storm drains and roof drains would provide some improved water removal capability. The evaluation will be completed by June 1, 2013 and recommended actions will be addressed through the site corrective action program.

The period prior to June 1 has a very low probability of an LIP event. National Rainfall Frequency studies correlate storms in the mid-Atlantic region to the tropical storm/hurricane season – beginning June or July thru September or October.

Dikes or Barriers:

Dominion reviewed the postulated flood water levels from a 6-hour one square mile local PMP event with respect to doors and areas where water infiltration could affect safety related equipment. The initial assessment of these buildings and areas found only the Fuel Oil Pump Houses to be susceptible to postulated water infiltration through the doors and/or louvers for a short period of time at the peak water levels. An evaluation of the need and/or potential designs for temporary or permanent barriers to prevent postulated flood water infiltration into the Fuel Oil Pump Houses will be completed prior to June 1, 2013. The evaluation results will be documented in the Corrective Action Program and will provide the schedule for implementation of modifications, if determined necessary. As described above, in Handling of Seasonality of Probable Maximum Precipitation Events, there is low risk associated with the slight delay in implementation of these temporary barriers.

Dominion will further evaluate the need for dikes or barriers with the Flooding Integrated Assessment.

West Basin Drain:

The 14-inch diameter drain pipe, gate valve, and flapper gate associated to West Basin sump drain was inspected in February 2013 and confirmed the drain pipe is open and unobstructed. The West Basin sump drain will be inspected again prior to June 1, 2013. Annual inspections can be accomplished in fair weather and do not have to be performed as storm weather approaches.

Procedure Changes:

North Anna Units 1 and 2 abnormal procedures for severe weather response including hurricane preparation will be revised to include inspection of roof and roof drains, as well as storm drain inlets. The procedure changes will be implemented by June 1, 2013.

Major tropical storm and hurricane warnings are well forecast and, thus, provide adequate time for conduct of these inspections.

IV. Planned Future Actions:

An Integrated Assessment of the Flood Hazards for North Anna Units 1 and 2 will be performed and an Integrated Assessment Report will be provided to the NRC prior to March 12, 2015.