Eugene S. Grecheck
Vice President
Nuclear Development

Dominion Energy, Inc. • Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060
Phone: 804-273-2442, Fax: 804-273-3903
E-mail: Eugene.Grecheck@dom.com

Dominion®

April 3, 2009

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. NA3-09-010R
Docket No. 52-017
COL/BCB

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 033
(PART 10 AND FSAR CHAPTERS 1, 2 AND 12)

On March 9, 2009, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 Combined License Application (COLA). The letter contained eight RAIs. The responses to the following five RAIs are provided in Enclosures 1 through 5:

- RAI Question 02.04.02-2 — Locally-Intense Precipitation Flood Event
- RAI Question 02.04.02-3 — Design Measures for PMP-Generated Flood Event (As a part of this response, a CD-ROM containing HEC-RAS computer code input files is enclosed)
- RAI Question 12.02-13 — Citation for ESP Variance
- RAI Question 14.03.07-1 — Revise Reference to Mobile LWMS
- RAI Question 14.03.07-2 — Revise Reference to Mobile SWMS

This information will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures. The responses to RAI Questions 02.02.03-5, Basis for Analysis/Screening Chemicals, 02.02.03-6, Screening Criteria for Sodium Hydroxide, and 08.02-40, Cable Submergence in the Switchyard, will be provided separately by May 31, 2009.

The HEC-RAS computer code input files are submitted in the native formats required by the software in which they may be used to support the staff's analysis. Therefore, the files on the enclosed CD-ROM are not considered documents as defined in Section 2 of NRC's "Guidance for Electronic Submissions to the NRC," Revision 4, dated October 29, 2008.

D089
NRO

Please contact Regina Borsh at (804) 273-2247 (regina.borsh@dom.com) if you have questions.

Very truly yours,

Eugene S. Grecheck

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President-Nuclear Development of Virginia Electric and Power Company (Dominion Virginia Power). He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 3rd day of April, 2009

My registration number is 7173057 and my

Commission expires: August 31, 2012

Wanda K. Marshall
Notary Public

WANDA K. MARSHALL
Notary Public
Commonwealth of Virginia
7173057
My Commission Expires Aug 31, 2012

Enclosures:

1. Response to NRC RAI Letter No. 033, RAI Question No. 02.04.02-2
2. Response to NRC RAI Letter No. 033, RAI Question No. 02.04.02-3
3. Response to NRC RAI Letter No. 033, RAI Question No. 12.02-13
4. Response to NRC RAI Letter No. 033, RAI Question No. 14.03.07-1
5. Response to NRC RAI Letter No. 033, RAI Question No. 14.03.07-2
6. CD-ROM HEC-RAS Input Files

Commitments made by this letter:

1. The information provided in the RAI responses will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures.
2. The responses to RAI Questions 02.02.03-5, 02.02.03-6, and 08.02-40 will be provided separately by May 31, 2009.

cc: U. S. Nuclear Regulatory Commission, Region II (without Enclosure 6)
T. A. Kevern, NRC
J. T. Reece, NRC (without Enclosure 6)
J. J. Debiec, ODEC (without Enclosure 6)
R. Kingston, GEH (without Enclosure 6)
P. Smith, DTE (without Enclosure 6)

ENCLOSURE 1

Response to NRC RAI Letter No. 033

RAI Question No. 02.04.02-2

NRC RAI 02.04.02-2

Staff has follow-on information requests following Dominion Letter No. 028, dated September 16, 2008 (ML082680033) and the Revision 1 update to the COL application. These requests are associated with the locally-intense precipitation flood event described in FSAR Section 2.4.2, and assurances that this event will not adversely impact Unit 3's safety-related SSCs, or those that satisfy the RTNSS criteria. Staff requests that the applicant provide the following:

(a) As indicated in Table 2.4-201 of the FSAR, Revision 1, subbasin areas have increased to a total area of 50.55 acres, from 48.78 acres in Revision 0. Also, the composite runoff coefficient has decreased. This increase in area and decrease of the runoff coefficient has increased the peak flow reported in the Revision 1 (see Table 2.4-203). For the purpose of reviewing the Revision 1 information, NRC staff request that the applicant provide updated HEC-RAS input files used to conduct the FSAR Revision 1 analyses (i.e., provide an update to the input files provided by Dominion on October 2, 2008; see ML090260661).

(b) A lateral weir structure runs parallel to the south ditch between cross-section 820 to 497 in the HEC-RAS model (Rev 0, see ML090260661). NRC staff request that the FSAR be revised to include a description of the lateral-flow structure, the expected flow path, depth and velocity of flow, erosion control measures, and a list of buildings and structures (including their RTNSS categorization, if appropriate) that are intercepted.

(c) NRC staff review of the Revision 0 HEC-RAS output noted that supercritical flow occurs in both the north ditch and south ditch, along with velocities that exceed 10 ftls. Additionally, the overland flow from the lateral weir along the south ditch could reach supercritical velocities during the PMP event. The transition of flow from supercritical to subcritical will produce a hydraulic jump. To clarify the potential impact of these supercritical flows and formation of hydraulic jumps, NRC staff request that the applicant provide a map showing the locations where supercritical flows and hydraulic jumps are likely to occur in the south ditch, north ditch, outfall channel, and associated overland-flow areas. In addition, the map(s) should indicate locations where flood events produce velocities larger than the design velocity for the channel bed material or are capable of eroding overland flow areas (i.e., where damage exceeding normal maintenance would result). At these locations, NRC staff request that the applicant describe how a potential failure of these drainage features could degrade any safety-related SSCs, or structures that satisfy RTNSS criteria.

(d) To ensure that flood events do not impact Unit 3's safety-related SSCs, or structures that satisfy RTNSS criteria, controls and requirements are necessary to ensure the north ditch, south ditch, and outfall canal remain clear of obstructions, the side-slopes remain stable, and the site drainage

system functions as described in the FSAR Section 2.4.2 for the length of the Unit 3 licensing period. NRC staff request that the applicant provide additional detail regarding Administrative Controls or surveillance requirements including the frequencies at which surveys will be conducted.

Dominion Response

(a) The HEC-RAS input files used for the local PMP analysis in FSAR Revision 1 are provided on a compact disc (Enclosure 6).

(b) The FSAR will be revised to include a description of the lateral weir structure, the expected flow path, depth and velocity of flow, erosion control measures, and the one structure (which has no RTNSS function) that may be intercepted.

(c) Figure 1 (provided for clarification on page 5 of this response) depicts the locations of supercritical flow regimes in the north and south drainage ditches, as well as over the embankment between the storm water management basin and Lake Anna in the outflow channel. The locations of potential hydraulic jumps in the north and south drainage ditches, and in the outfall channel, are also depicted on Figure 1. Although not shown on Figure 1, supercritical flow could also occur in the overland sheet flow from the lateral weir from the south ditch. Because of the low velocities and shallow depth of flow, erosion will not occur during the local PMP event as a result of overflow from the south drainage ditch.

The highest channel velocities occur in the supercritical flow areas for the north and south ditches. The maximum channel velocity is 12.9 fps. Properly sized and placed rip rap channel linings are able to withstand velocities greater than 13 fps. All drainage ditches, overflow areas and embankments at North Anna Unit 3 will be protected with channel lining or surface cover to withstand the predicted flood flow velocities resulting from the local PMP event for the Unit 3 site. Additionally, the lining for the south drainage ditch at the location of the hydraulic jump will be designed to withstand the erosive forces generated by the hydraulic jump during the local PMP event. The lining of the north ditch and storm water management basin side slopes in the vicinity of the north ditch will also be designed to withstand the erosive forces of the hydraulic jump at the inlet to the storm water management basin.

The local PMP analysis considers the outflow structure from the storm water management basin to be completely blocked and inoperable. Thus, all flow out of the basin during the local PMP event is over the embankment between the storm water basin and Lake Anna, which is denoted as the outfall channel in the HEC-RAS model. As shown in Figure 1, the embankment for the outfall channel will be provided with hardened surface protection, such as concrete lining with proper key-in or other hardened paving, designed to withstand the erosive forces associated with the supercritical flow and the potential occurrence of a hydraulic jump at the embankment section. Thus, no failures of the embankment will occur during the local PMP event.

The design features described above will prevent a failure of the Unit 3 drainage features and preclude degradation of any safety-related SSCs or structures that are required to satisfy RTNSS criteria.

(d) Dominion will meet state regulation requirements for construction and operation of North Anna Unit 3. The Code of Virginia (VA) regulations requires any land disturbing activities that exceed 10,000 square feet be permitted by a VA Department of Conservation and Recreation (DCR) Storm Water (SW) Construction permit and the locality for Erosion and Sedimentation Control (Title 10.1, Chapter 5, Article 4 of the Code of Virginia). All permittees are required to develop a construction Storm Water Pollution Prevention Plan (SWPPP) and an Erosion and Sedimentation (E&S) Control plan and submit them with the application for regulatory review and approval, respectively. The plans identify all Best Management Practices (BMPs) and discuss the inspection frequency. The VA Construction SW permit requires a biweekly site BMP inspection and requires a site inspection within 48 hours of every qualifying rain event (0.10 inches). After construction, Unit 3 SW management will be incorporated into the existing site Virginia Pollutant Discharge Elimination System (VPDES) Permit (VA0052451) and subsequent operating SWPPP.

North Anna is permitted by Virginia Department of Environmental Quality (DEQ) for industrial wastewater and storm water outfalls (VPDES permit VA0052451), which requires quarterly site inspections. Site inspections include walkdowns of areas with potential for erosion and potential to be affected by storm water, which includes the ditches, outfall channels and side slopes. In addition, the permit requires the storm water outfalls' effluent be visually monitored quarterly for color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, etc. If erosion, or any other type of pollution, has occurred that either impedes stormwater flow, or negatively impacts effluent quality, then corrective action is initiated to determine and mitigate the source of the problem.

<u>Proposed COLA Revision</u>

FSAR Section 2.4.2.3 will be revised to address Part (b) of this response, as shown on the attached markup.

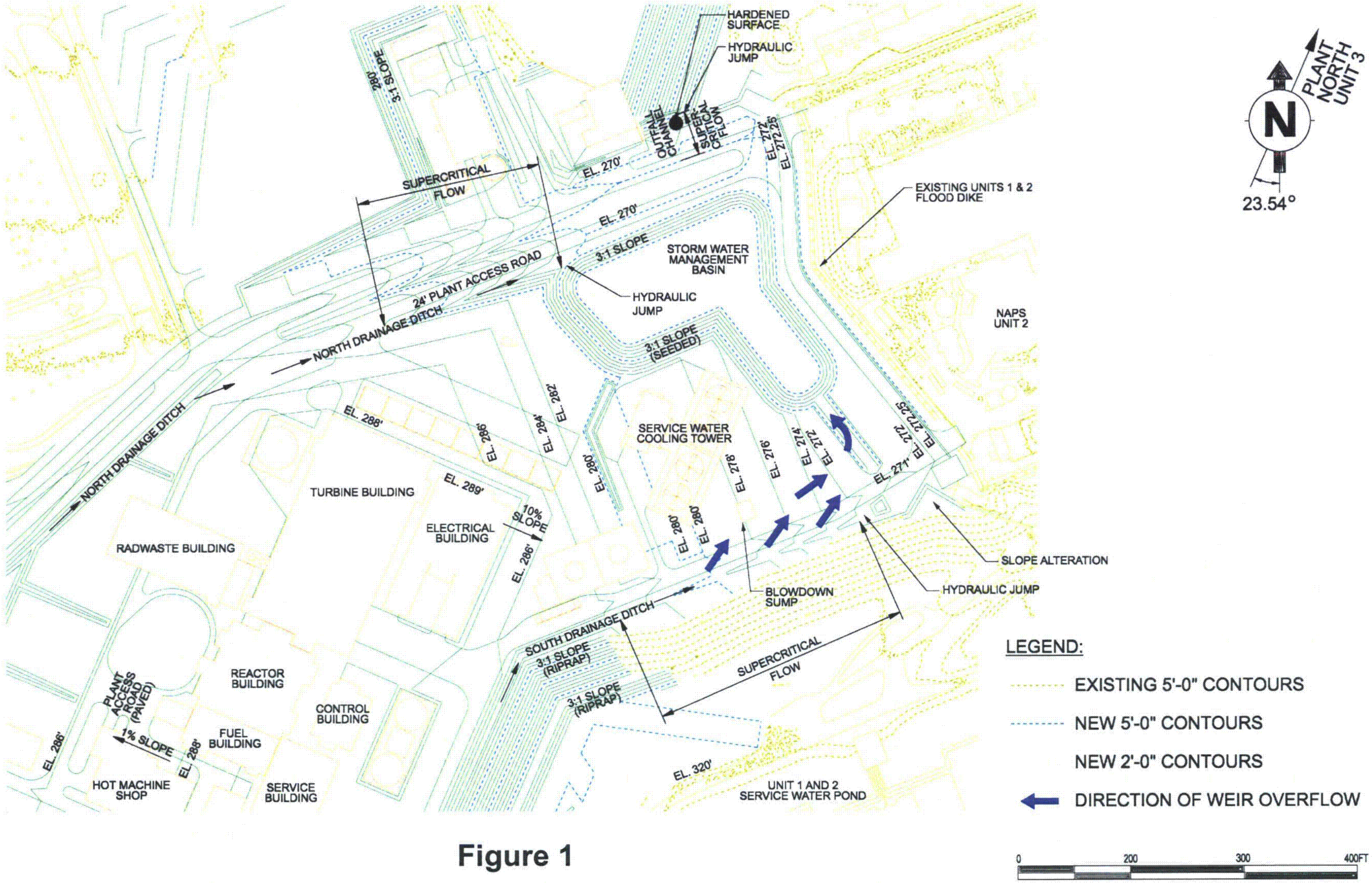

Figure 1

Supercritical Flow Regime and Hydraulic Jump Locations

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

2.4.2.3 Effects of Local Intense Precipitation

This SSAR section is supplemented as follows to show that local intense precipitation is discharged to Lake Anna and that safety-related structures are located at elevations above the maximum water surface elevation produced by local intense precipitation.

NAPS COL 2.0-13-A

The site layout, drainage facilities, and drainage areas are shown on Figure 2.4-201. The safety-related buildings, which consist of the reactor, control, and fuel buildings, are located in the center and along the high point of the power block. From the high point, the site grading falls at a 1 percent slope to drainage ditches located along the northern and southern edges of the power block. The north and south drainage ditches convey the collected runoff from the power block and surrounding areas as shown on Figure 2.4-201 to the plant storm water management basin located in the northeast corner of the site. The storm water management basin discharges to Lake Anna through a bio-retention under-drain and a riser and pipe outlet. An emergency spillway over the plant access road is also provided to discharge large storm events, such as the PMP peak discharge, to Lake Anna. In performing the runoff analysis for the PMP storm, the under-drain and riser pipe outlet were conservatively assumed to be clogged. The sub-basin drainage areas shown on Figure 2.4-201 are summarized in Table 2.4-201 and Table 2.4-202.

NAPS ESP COL 2.4-4

For typical design storm events, such as the 10-year storm, runoff from the plant area is conveyed to the north and south drainage ditches through catch basins and storm drains as shown on Figure 2.4-201. Both the north and south drainage ditches also pass through culverts at road crossings and through the switchyard area. For the PMP runoff analysis, however, all underground storm drains and culverts were conservatively assumed to be completely clogged. Therefore, all flows were assumed to be overland or in open ditches.

NAPS COL 2.0-13-A

The PMP runoff analysis was performed on the north and south drainage ditches to determine the peak water levels during the PMP event and compare them to the design plant grade elevations for the safety-related buildings. There are additional ditches in the northeast corner that convey runoff from the power block to the north ditch. However, during the PMP event, these ditches would be inundated by overflows from the north drainage ditch and they were not included in the PMP analysis.

The rational method was used to determine the peak discharges for each of the sub-basin drainage areas shown on Figure 2.4-201. Two runoff coefficients were selected to represent ground cover conditions in the sub-basins. Conservative coefficients were selected to represent saturated ground conditions and also to reflect the intense rainfall that would occur during a PMP event. For vegetated areas, a runoff coefficient of 0.9 was used. For all other areas, a runoff coefficient of 1.0 was used to reflect an impervious surface. Composite runoff coefficients were determined based on the percentage of vegetated and impervious land cover for each sub-basin outlet point. Time of concentration values were estimated for each sub-basin using Natural Resources Conservation Service methodologies (Reference 2.4-201). To account for the non-linear response for large storms such as the PMP, the estimated time of concentration values were reduced by 25 percent as per guidance from the U.S. Army Corps of Engineers (Reference 2.4-202). PMP rainfall intensities were developed from the values listed in SSAR Table 2.4.3 and are shown in Figure 2.4-202. Using a duration equal to the reduced time of concentration for each sub-basin, the PMP rainfall intensity for each sub-basin was determined from Figure 2.4-202. The PMP peak discharge for each sub-basin was determined using the sub-basin point of interest drainage area, runoff coefficient, and PMP rainfall intensity. The estimated values for each sub-basin are shown in Table 2.4-203.

The steady-state backwater method in the computer program HEC-RAS (Reference 2.4-203) was used to estimate the peak PMP water levels in the north and south drainage ditches. HEC-RAS was first used to model the PMP flows over the storm water basin emergency spillway and determine the peak PMP water level in the basin, which then became the starting water level at the downstream most cross sections for the north and south drainage ditches. Cross-section data for the storm water basin spillway (outfall) and the north and south drainage ditches are shown on Figure 2.4-203 and Table 2.4-204.

Plant access roads cross the north and south drainage ditches at three locations. At each of these locations, the culverts under the roads were assumed to be blocked for the PMP runoff analysis. Inline weirs were used in HEC-RAS to model the road crossings and the flow over the top of the roads.

During the PMP event, flows in the south drainage ditch between cross-sections 820 and 557 spill onto the plant access road along the north bank of the south drainage ditch. The spilled floodwaters will sheet flow over the road and into the open yard area adjacent to the road, east of the PSWS cooling tower basin. This flow rejoins the south ditch (downstream of the culvert under the plant access road) and discharges to the storm water management basin. A lateral weir structure has been included in the HEC-RAS computer model between cross-sections 820 and 497 along the north bank of the south drainage ditch to model the flow passing over the plant access road. The flow leaving the lateral weir is added back to the main flow path on the south drainage ditch downstream of cross-section 278.

Manning's roughness coefficients (n values) for the channel and over bank areas were assigned based on guidance provided by Chow (Reference 2.4-204). Ditch linings consist of both grass vegetation and rip rap. Manning's n values of 0.030 for grass lined ditches and 0.035 for rip rap lined ditches were used. Land cover in the ditch over bank areas consist of grass vegetation, gravel and pavement. The paved areas are usually small areas located in large gravel areas. Therefore, Manning's n values to describe pavement were not used and values describing gravel cover were used for paved areas. This is a conservative approach as Manning's n values for gravel cover are higher than those for paved areas and produce higher water levels. For the grass over bank areas, a value of 0.030 was used and a value of 0.035 was used for the gravel over bank areas.

The peak discharges listed in Table 2.4-203 were entered into the HEC-RAS model conservatively at the upstream end of each sub-basin. The results of the HEC-RAS analysis are summarized in Table 2.4-204.

NAPS ESP COL 2.4-5

The design plant grade elevation for safety-related structures is Elevation 88.4 m (290.0 ft) msl as shown in Figure 2.1-201. As shown in Table 2.4-204, all cross sections in the power block area have maximum water surface elevations below Elevation 88.4 m (290.0 ft) msl. The maximum PMP water level in the power block area is Elevation 87.54 m (287.2 ft) msl, which is 0.85 m (2.8 ft) below the design plant grade elevation for safety-related structures.

NAPS COL 2.0-13-A

At the eastern edge of the Unit 3 site where the plant access road crosses the south drainage ditch, the grade elevation at the high point between the Unit 3 site and the Units 1 and 2 site is at Elevation 82.98 m (272.25 ft) msl. The maximum water level at the inline weir is Elevation 82.94 m (272.1 ft) msl, which is 0.05 m (0.15 ft) below the high point elevation and thus all Unit 3 PMP flows will be confined to the Unit 3 site and runoff generated from Unit 3 will not impact the Units 1 and 2 site.

The flow leaving the south drainage ditch between cross-sections 820 and 557 is about 4.9 m^3/s (173 cfs). The depth of flow over the plant access road ranges between 0 and 0.19 m (0.62 ft) with an average depth of 0.12 m (0.39 ft). Water levels between cross-sections 557 and 497 are below the elevation of the road and thus no flow leaves the south ditch downstream of cross-section 557. The length of the weir between cross-sections 820 and 557 is about 79.1 m (259.4 ft). Thus, the average flow velocity over the weir length along the access road is about 0.51 m/s (1.7 fps). The maximum velocity over the road occurs between cross-sections 820 and 782. The flow passing over the road between these two cross-sections is about 0.25 m^3/s (9 cfs) with a minimum depth of flow of about 0.09 m (0.29 ft) and a weir length of about 3.7 m (12.0 ft). Thus, the average velocity between these two cross-sections is about 0.76 m/s (2.5 fps).

The normal ground cover material provided for the road and adjacent plant yard area will be able to withstand the low flood flow velocities predicted over the plant access road; thus, no erosion in these areas is anticipated. Additionally, the low velocities are such that the overflow from the road will follow the topography and flow nearly parallel to the road. It is highly unlikely that the PSWS, which is located a minimum of 21 m (70 ft) from the centerline of the road, will intersect the overflow. The flow may only be intersected by the blowdown sump structure, which does not perform a safety-related or RTNSS function, before joining the south drainage ditch downstream of the culvert under the plant access road.

Grading in the vicinity of the safety-related structures slopes away from the individual structures such that PMP ground and roof runoff will sheet flow away from each of these buildings and towards the collection ditches preventing flood flows from entering the buildings. Some ponding may occur near storm drain inlets and other depressed areas. The ponding will be temporary, however, and limited to the depressed areas. No storm drain inlets or depressed areas are located near safety-related buildings.

ENCLOSURE 2

Response to NRC RAI Letter No. 033

RAI Question No. 02.04.02-3

NRC RAI 02.04.02-3

The COL must contain information to assure that construction of Unit 3 will not impact the existing units (see 10 CFR 52.79(a)(31)). Revision 1 of the application states "at the eastern edge of the Unit 3 site where the plant access road crosses the south drainage ditch, the grade elevation at the high point between the Unit 3 site and the Units 1 and 2 site is at Elevation 82.98 m (272.25 ft) msl. The maximum water level at the inline weir is Elevation 82.94 m (272.1 ft) msl, which is 0.05 m (0.15 ft) below the high point elevation and thus all Unit 3 PMP flows will be confined to the Unit 3 site and runoff generated from Unit 3 will not impact the Units 1 and 2 site." Because the (revision 0) HEC-RAS predicted water velocities in south ditch immediately upstream of the abrupt bend near the plant access road exceed 10 ftls and because of the relatively small margin, NRC staff request that the applicant describe the design measures to ensure all discharge in the south ditch will complete the 90-degree abrupt bend during the PMP-generated flood event. This description should include how two-dimensional effects, superelevation of flow, and the potential hydraulic jump were factored into the design. In addition, describe fortification measures to prevent failure of the plant access road when the SWM basin is at the PMP-generated maximum elevation.

Dominion Response

Just upstream of where the south drainage ditch crosses the plant access road, the channel slope of the ditch is approximately 3.5%. PMP-generated flood flows in this portion of the ditch are supercritical. Before reaching the culvert, the channel slope of the ditch flattens out to nearly level and a 2.0 foot deep sump is located at the culvert entrance. During normal precipitation events, runoff collected in the south drainage ditch passes under the access road through a culvert. During the local PMP storm event, the HEC-RAS computer model assumes that the culvert is clogged and all flow passes over the plant access road at the culvert crossing. The PMP flood flow is forced above the elevation of the road crossing, resulting in a subcritical flow regime. It is therefore postulated that a hydraulic jump will occur upstream of the sump areas at the culvert crossing, which is also upstream of the abrupt bend in the south ditch.

The channel velocities in the ditch upstream of the hydraulic jump location are greater than 10 fps. However, as indicated in the HEC-RAS model results, the flow velocities for the section of the ditch upstream of the culvert crossing decrease to 2 to 3 fps in the subcritical flow regime downstream of the jump. The turbulence of the hydraulic jump dissipates much of the energy from the high velocities in the upstream portion of the ditch. To direct the flow over the road, the grading of the slope along the south side of the south drainage ditch, downstream of the hydraulic jump, will be altered as shown by the "slope alteration" in Figure 1 (provided for clarification on page 4 of this response). This slope will be protected with rip rap sufficiently sized to withstand the ditch channel velocities and turbulence associated with the hydraulic jump. The altered grading is located downstream of the hydraulic jump area. This design will confine floodwaters to the Unit 3 site and runoff will not reach the Units 1 and 2 site. The structure shown near the altered slope in Figure 1 is an existing Units 1 and 2 plant building which does not perform a safety-related function and is not credited for directing flow for Unit 3.

The conveyance flow width over the access road was conservatively restricted to 100 feet (60 feet left (west) and 40 feet right (east) of the channel centerline) in the HEC-RAS model. The actual width of water flowing over the road is about 160 feet. By restricting the flow to this width, computed water levels are higher than those that would be computed with a wider section. Even with this channel width restriction, the super-elevation at the outer bend as a result of the flow turning will be small (estimated to be on the order of 0.10 ft based on the water surface width to radius of curvature ratio of no more than one in a subcritical flow regime) due to the much lower velocities near the bend (about 2.5 fps) and will be against the altered slope shown on Figure 1.

The Unit 3 stormwater management basin is currently an existing depression area that resulted from a previous excavation. The embankment between the Unit 3 stormwater management basin and the low area adjacent to the Unit 2 turbine building is an existing safety-related flood dike protecting the Unit 2 turbine building from floodwater rising up from Lake Anna and filling the existing excavation. As such, the flood dike has been designed for exposure to floodwaters against it. The Unit 3 PMP flow velocities adjacent to the plant access road will be less than 0.5 fps. Such low velocities will not cause erosion of the embankment or plant access road and no additional fortification measures other than grass seeding or rip rap protection are required.

Proposed COLA Revision

None.

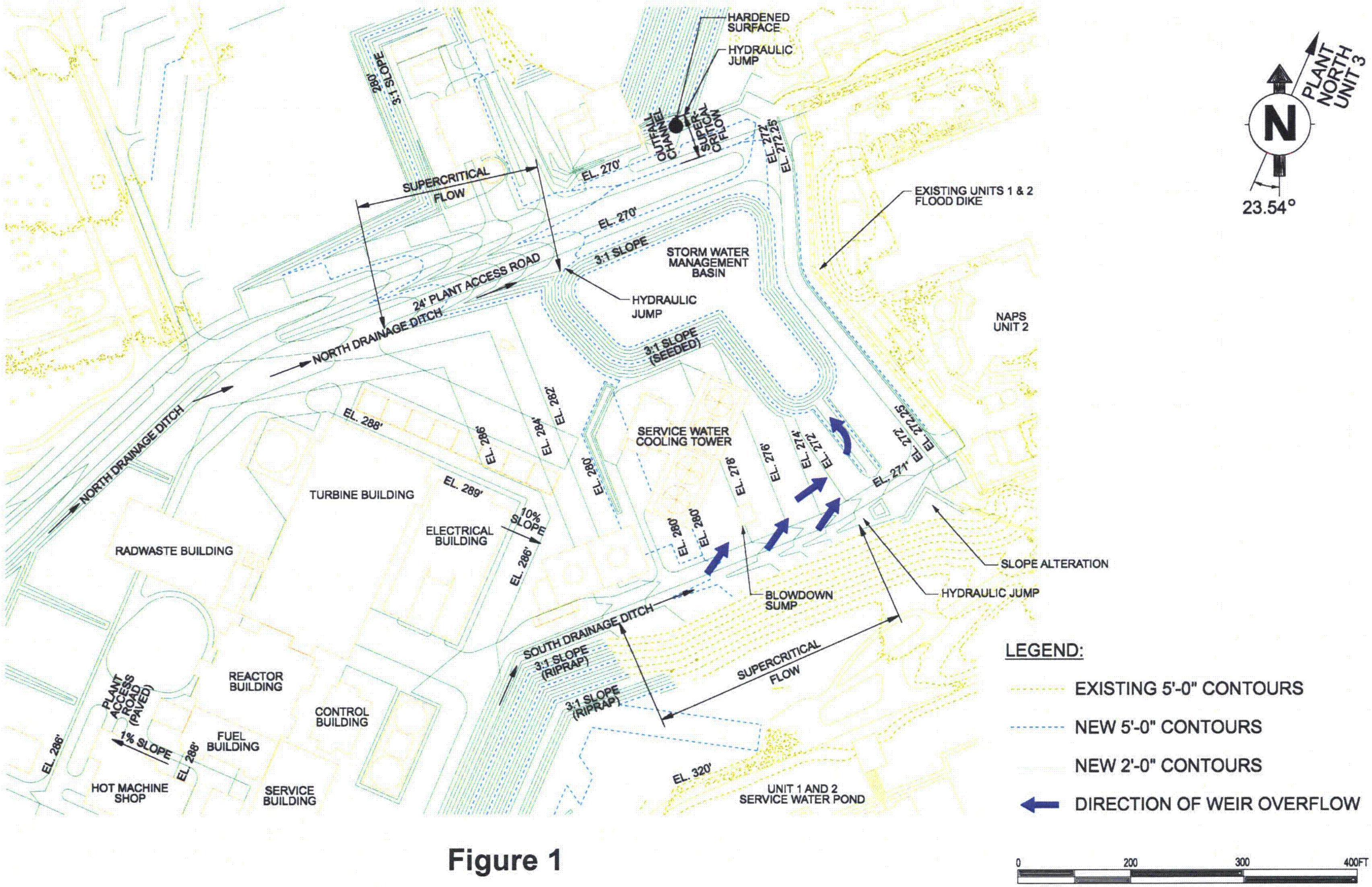

Figure 1

Supercritical Flow Regime and Hydraulic Jump Locations

ENCLOSURE 3

Response to NRC RAI Letter No. 033

RAI Question No. 12.02-13

NRC RAI 12.02-13

A review of North Anna Unit 3 FSAR, Section 12.2.2.2 (Airborne Dose Evaluation Offsite) and Section 12.2.2.4 (Liquid Doses Offsite) indicates that variance NAPS ESP VAR 12.2-4 (Existing Units' and Site Total Doses) is not identified nor referenced in addressing compliance with Part 20.1301 (e) and 40 CFR Part 190. This approach is inconsistent with the treatment of related variances identified in this section of the FSAR. The only citation of NAPS ESP VAR 12.2-4 is found in Table 12.2-203 with no details included. The applicant is requested to introduce a citation of NAPS ESP VAR 12.2-4 and supporting text in Sections 12.2.2.2 and 12.2.2.4 addressing compliance with Part 20.1301(e) and 40 CFR Part190 for radiation exposures and combined doses associated with the current operations of NAPS Units 1 and 2 and proposed operation of North Anna 3.

Dominion Response

The FSAR will be revised to include appropriate text and left margin annotations to address variance NAPS ESP VAR 12.2-4.

Proposed COLA Revision

FSAR Table 1.8-202 and Sections 12.2.2.2.4 and 12.2.2.4.4 will be revised as shown on the attached markup.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

NAPS SUP 1.8-3

Table 1.8-201 Departures from the Referenced Certified Design

Number	Subject	FSAR Section
None		

NAPS SUP 1.8-4

Table 1.8-202 Variances from the ESP and ESPA SSAR

Number	Subject	FSAR Location
NAPS ESP VAR 2.0-1a-l	Long-Term Dispersion Estimates (χ/Q and D/Q)	Section 2.3.5, Table 2.0-201
NAPS ESP VAR 2.0-2	Hydraulic Conductivity	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-3	Hydraulic Gradient	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-4	Vibratory Ground Motion	Section 2.5.2.5, Table 2.0-201
NAPS ESP VAR 2.0-5a-h	Distribution Coefficients (K_d)	Table 2.0-201
NAPS ESP VAR 2.0-6	DBA Source Term Parameters and Doses	Table 2.0-201
NAPS ESP VAR 2.0-7a-b	Coordinates and Abandoned Mat Foundations	Table 2.0-201
NAPS ESP VAR 2.4-1	Void Ratio, Porosity, and Seepage Velocity	Section 2.4.12.1.2
NAPS ESP VAR 2.4-2	NAPS Water Supply Well Information	Table 2.4-17R
NAPS ESP VAR 2.5-1	Stability of Slopes	Section 2.5.5
NAPS ESP VAR 2.5-2	Engineered Fill	Section 2.5.1.2.3.k Section 2.5.4.5.3
NAPS ESP VAR 12.2-1	Gaseous Pathway Doses	Section 12.2.2.2.6, Table 12.2-18bR
NAPS ESP VAR 12.2-2	[Deleted]	
NAPS ESP VAR 12.2-3	Annual Liquid Effluent Releases	Section 12.2.2.4.6, Table 12.2-19bR
NAPS ESP VAR 12.2-4	Existing Units' and Site Total Doses	Section 12.2.2.2.4 Section 12.2.2.4.4 Table 12.2-203

12.2.2.2.1 Compliance with 10 CFR 50, Appendix I, Sections II.B and II.C

Table 12.2-201 demonstrates that offsite doses due to Unit 3 radioactive airborne effluents comply with the regulatory dose limits in 10 CFR 50, Appendix I, Sections II.B and II.C.

NAPS ESP COL 11.1-1

12.2.2.2.2 Compliance with 10 CFR 50, Appendix I, Section II.D

Population dose is determined for the gaseous effluent releases from Unit 3 for both total body dose and thyroid dose. The total body dose is 7.7 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 28 person-rem/yr. The cost-benefit analysis performed to consider gaseous radwaste augments to reduce doses due to gaseous effluents is presented in Section 11.3. Based on the results from the cost-benefit analysis, no augments are cost-beneficial. Therefore, Unit 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.2.3 Compliance with 10 CFR 20, Appendix B, Table 2, Column 1

Table 12.2-17R provides the gaseous effluent concentrations in comparison to the 10 CFR 20, Appendix B, Table 2, Column 1 limits. The Unit 3 gaseous effluent concentrations comply with 10 CFR 20, Appendix B, Table 2, Column 1.

12.2.2.2.4 Compliance with 10 CFR 20.1301 and 20.1302

NAPS ESP VAR 12.2-4

Compliance with 10 CFR 20.1301 and 20.1302 is demonstrated in Sections 12.2.2.4.4 and 12.2.2.4.5, respectively. Compliance with 10 CFR 20.1301(e) and 40 CFR 190 is described in Section 12.2.2.4.4.

NAPS ESP COL 11.1-1

12.2.2.2.5 Comparison of ESP Application to Unit 3 Gaseous Effluent Concentrations

As described in Section 12.2.2.1, the radioactive gaseous effluent concentrations for Unit 3 are provided in Table 12.2-17R.

The radioactive gaseous effluent concentrations for the ESPA are included in ESP-ER Table 5.4-7. That table presents the composite annual release activities and activity concentrations of gaseous effluents for a single unit, but is based on a composite of possible radionuclide releases from many reactor designs. The values in that table are the maximum annual activity and corresponding concentration for each radionuclide from the many reactor designs considered.

NAPS ESP COL 11.1-1

12.2.2.4.2 **Compliance with 10 CFR 50, Appendix I, Section II.D**

Population dose is determined for the liquid effluent releases from Unit 3 for both total body dose and thyroid dose. The total body dose is 1.0 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 0.69 person-rem/yr. The cost-benefit analysis performed to consider liquid radwaste augments to reduce doses due to liquid effluents is presented in Section 11.2. Based on the above liquid effluent dose estimate values and the threshold value from the cost-benefit analysis, no augments are cost-beneficial. Therefore, Unit 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.4.3 **Compliance with 10 CFR 20, Appendix B, Table 2, Column 2**

Compliance with 10 CFR 20, Appendix B, Table 2, Column 2 is demonstrated in Table 12.2-19bR.

12.2.2.4.4 **Compliance with 10 CFR 20.1301 and 20.1302**

This section demonstrates that offsite doses due to Unit 3, combined with offsite doses due to Units 1 and 2 and the NAPS independent spent fuel storage installation (ISFSI), comply with the regulatory limits in 10 CFR 20.1301 for doses to members of the public.

Using the Unit 3-specific gaseous effluent release activities identified in Table 12.2-17R, and the Unit 3-specific liquid effluent release activities identified in Table 12.2-19bR, the total annual doses to the MEI and the population resulting from Unit 3 liquid and gaseous effluents are calculated and presented in Tables 12.2-203 and 12.2-204, respectively.

The direct radiation contribution from operation of Unit 3 is negligible. The direct dose contribution from Unit 3 at two distances is provided in DCD Table 12.2-21. That table shows the annual dose at 1000 m (0.62 mi) to be 1.66E-06 mSv/yr (1.66E-04 mrem/yr). Section 9.3.9 shows that Unit 3 uses hydrogen water chemistry, and DCD Section 12.2.1.3 explains that the direct dose contribution takes into account hydrogen water chemistry. The distance from Unit 3 to the nearest residence is 1191 m (0.74 mi) in the NW direction, as shown in Table 2.3-15R. The distance from Unit 3 to the location on the site boundary with the highest gaseous effluent annual dose is 1416 m (0.88 mile) in the ESE direction. This is the distance from Unit 3 to the site boundary, that is, the exclusion area boundary (EAB) in the direction of maximum annual χ/Q, as shown in Table 2.3-16R. These distances from Unit 3 to each type of receptor location are greater than those presented in the DCD, so the Unit 3 direct radiation dose rate at each location us even lower than the very low rate cited above for 1000 m (0.62 mi).

The total annual doses to the MEI resulting from North Anna Units 1 and 2 liquid and gaseous effluents are provided in Table 12.2-203. The values shown are representative based on review of Units 1 and 2 annual radiological environmental operating reports (e.g., Reference 12.2-203).

The direct radiation contribution from operation of Units 1 and 2 is negligible. An evaluation of operating plants by the NRC states that:

> "...because the primary coolant of an LWR is contained in a heavily shielded area, dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem/year at the site boundary."

The NRC concludes that the direct radiation from normal operation results in "small contributions at site boundaries" (Reference 12.2-204, Section 4.6.1.2). For the NAPS site, the nearest residence is at a distance typical of a site boundary evaluated by NRC. An assumed value of 1 mrem/yr is included in Table 12.2-203 to account for the dose to the MEI at the nearest residence from operation of Units 1 and 2.

Discharged fuel assemblies from NAPS Units 1 and 2 are stored in the NAPS ISFSI (Reference 12.2-205). The direct radiation contribution from operation of the NAPS ISFSI is small, both at the residence nearest to the ISFSI, which is south and slightly east of the ISFSI at about 870 m (0.54 mi), and at the closest point to the site boundary, which is south and slightly west of the ISFSI at approximately 760 m (0.47 mi). The annual contribution at the site boundary from the ISFSI is no more than 3.6E-02 mSv/yr (3.6 mrem/yr). This value is based on a conservatively estimated peak dose rate from a fully-filled ISFSI with 84 casks/modules containing NAPS Units 1 and 2 fuel assemblies and the distance from the ISFSI to the site boundary, which is shorter than that to the residence nearest the ISFSI. This ISFSI dose contribution is then conservatively applied to the MEI for the nearest residence from Unit 3, which is 1191 m (0.74 mi) in the NW direction and even further from the ISFSI.

Table 12.2-203 shows that the total NAPS site doses resulting from the normal operation of Units 1, 2, and 3 and applied at the nearest residence meet 10 CFR 20.1301(e) and are well within the regulatory limits of 40 CFR 190. These doses are applied at the distance to the nearest residence from Unit 3, that is, 1191 m (0.74 mi), but in the direction of the maximum annual χ/Q, that is, in the ESE direction, and using the maximum D/Q, which is from the NNE direction. These doses bound those at the site boundary.

NAPS ESP VAR 12.2-4

While the regulatory limits are met, the doses for total body, thyroid, and bone due to the existing units, as shown in bold in Table 12.2-203, do not fall within (are greater than) the corresponding values in ESP ER Table 5.4-11. Also, the total body and bone doses for the site, as shown in bold in Table 12.2-203, do not fall within (are greater than) the corresponding values in ESP ER Table 5.4-11.

Table 12.2-204 shows the total body doses from liquid and gaseous effluents doses attributable to Unit 3 for the population within 50 miles of the NAPS site.

12.2.2.4.5 Compliance with 10 CFR 20.1302

Surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas are conducted to demonstrate compliance with the dose limits given in 10 CFR 20.1302 for individual members of the public.

Compliance with the annual dose limit in 10 CFR 20.1302 is demonstrated by showing that the calculated total effective dose equivalent to the individual likely to receive the highest dose does not exceed the annual dose limit.

NAPS ESP COL 11.1-1

12.2.2.4.6 Comparison of ESPA to NAPS Site with Unit 3 Liquid Effluent Concentrations

As described in Section 12.2.2.4, the radioactive liquid effluent concentrations for Unit 3 are provided in Table 12.2-19bR. This table also shows the maximum activity concentration for each nuclide at the end of the discharge canal from the combined operation of Units 1, 2, and 3, and the corresponding concentration limit for the NAPS site.

The radioactive liquid effluent concentrations for the NAPS site from the combined operation of the two new units and the existing units as presented in the ESPA are included in ESP-ER Table 5.4-6. That table presents the composite annual release activities of liquid effluents for a single new unit, but based on a composite of possible radionuclide releases from many reactor designs. For all isotopes except tritium, the

ENCLOSURE 4

Response to NRC RAI Letter No. 033

RAI Question No. 14.03.07-1

NRC RAI 14.03.07-1

A review of North Anna Unit 3 FSAR, Rev. 1, Part 10: Tier 1 ITMC, Section 2.4.10 indicates that it still refers to a mobile system as being outside of the scope of the certified design. The ESBWR DCD, Rev. 5, Tier '2, Section 11.2 and DCD, Rev. 5, Tier 1 Section 2.10.1 no longer refer to the use of a mobile LWMS. Accordingly, the applicant is requested to revise the designation of the LWMS in FSAR Rev. 1, Part 10: Tier 1 Section 2.4.10 and make it consistent with the corresponding Tier 1 and 2 Sections of the ESBWR DCD, Rev. 5.

Dominion Response

The design of the Liquid Waste Management System (LWMS) is no longer conceptual and is now within the scope of the ESBWR standard plant design, as reflected in the DCD, Revision 5, Tier 2, Section 11.2. DCD Tier 1, Section 2.10.1, *Liquid Waste Management System*, addresses all necessary ITAAC for the LWMS. Therefore, COLA Part 10, *Tier 1/ITAAC*, Section 2.4.10 will be deleted.

Proposed COLA Revision

COLA Part 10, *Tier 1/ITAAC*, Section 2.4.10 will be revised as shown on the attached markup.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

2.4.8 Communications Systems (Emergency Notification System)

Addressed in Table 2.3-1, 3.0 Emergency Communications

2.4.9 Makeup Water System

No entry for this system.

2.4.10 ~~Mobile Liquid Radwaste System (portion outside scope of certified design)~~ (Deleted)

~~No entry for this system.~~

2.4.11 ~~Mobile Solid Radwaste System (portion outside scope of certified design)~~ (Deleted)

~~No entry for this system.~~

2.4.12 Hydrogen Water Chemistry System

No entry for this system.

2.4.13 Meteorological Monitoring System

No entry for this system.

ENCLOSURE 5

Response to NRC RAI Letter No. 033

RAI Question No. 14.03.07-2

NRC RAI 14.03.07-2

A review of North Anna Unit 3 FSAR, Rev. 1, Part 10: Tier 1 ITAAC, Section 2.4.11 indicates that it still refers to a mobile system as being outside of the scope of the certified design. The ESBWR DCD, Rev. 5, Tier 2, Section 11.4 and DCD, Rev. 5, Tier 1 Section 2.10.2 no longer refer to the use of a mobile SWMS. Accordingly, the applicant is requested to revise the designation of the SWMS in FSAR Rev. 1, Part 10: Tier 1 Section 2.4.11 and make it consistent with the corresponding Tier 1 and 2 Sections of the ESBWR DCD, Rev. 5.

Dominion Response

The design of the Solid Waste Management System (SWMS) is no longer conceptual and is now within the scope of the ESBWR standard plant design, as reflected in the DCD, Revision 5, Tier 2, Section 11.4. DCD Tier 1, Section 2.10.2, *Solid Waste Management System*, addresses all necessary ITAAC for the SWMS. Therefore, COLA Part 10, *Tier 1/ITAAC*, Section 2.4.11 will be deleted.

Proposed COLA Revision

COLA Part 10, *Tier 1/ITAAC*, Section 2.4.11 will be revised as shown on the attached markup.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

2.4.8 **Communications Systems (Emergency Notification System)**

Addressed in Table 2.3-1, 3.0 Emergency Communications

2.4.9 **Makeup Water System**

No entry for this system.

2.4.10 ~~**Mobile Liquid Radwaste System (portion outside scope of certified design)**~~ **(Deleted)**

~~No entry for this system.~~

2.4.11 ~~**Mobile Solid Radwaste System (portion outside scope of certified design)**~~ **(Deleted)**

~~No entry for this system.~~

2.4.12 **Hydrogen Water Chemistry System**

No entry for this system.

2.4.13 **Meteorological Monitoring System**

No entry for this system.

ENCLOSURE 6

Response to NRC RAI Letter No. 033

CD-ROM HEC-RAS Input Files