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April 10, 2012

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

Serial No. NA3-11-065R
Docket No. 52-017
COL/DWL

**DOMINION VIRGINIA POWER**
**NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION**
**SRPs 12.03 and 12.04: RESPONSE TO RAI LETTER 92**

On November 15, 2011, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 Combined License Application (COLA). The responses to the following Request for Additional Information (RAI) Questions are provided in Enclosures 1 through 8:

- RAI 5977 Question 12.03-12.04-14 CVCS Holdup Tank Return Lines
- RAI 5977 Question 12.03-12.04-15 Degasifier Subsystem Design Features
- RAI 5977 Question 12.03-12.04-16 Reuse of RCS Fluid Via Charging Pumps
- RAI 5977 Question 12.03-12.04-17 Occupational Radiation Exposure for CVCS
- RAI 5977 Question 12.03-12.04-18 Resin Fines in RCS
- RAI 5977 Question 12.03-12.04-19 Damage to RCP Seals
- RAI 5977 Question 12.03-12.04-20 Chemistry Analysis Parameters
- RAI 5977 Question 12.03-12.04-21 Chemical Drain Tank Sample Line Purge

This information will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the enclosures.

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

Very truly yours,

Eugene S. Grecheck

D089
NRO

Enclosures:

1. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-14
2. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-15
3. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-16
4. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-17
5. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-18
6. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-19
7. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-20
8. Response to NRC RAI Letter No. 92, RAI 5977 Question 12.03-12.04-21

Commitments made by this letter:

1. Incorporate proposed changes in a future COLA submission.

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 10th day of April, 2012
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

cc: U. S. Nuclear Regulatory Commission, Region II
C. P. Patel, NRC
T. S. Dozier, NRC
G. J. Kolcum, NRC

# ENCLOSURE 1

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-14

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-14**

The guidance contained in NUREG 0800 Standard Review Plan (SRP) Section 12.2 "Radiation Sources" and Regulatory Guide 1.206 "Combined License Applications for Nuclear Power Plants (LWR Edition)," section C.I.12.2.1 "Contained Sources," states that the applicant is to provide the models, parameters and bases for all values used to calculate source magnitudes used as the basis for designing the radiation protection program and for shield design calculations.

North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Revision 2 Departure DEP 9.2(1) "Replacement of Boron Recycle System with a Degasifier Subsystem" eliminated the reuse of reactor coolant water from the Chemical and Volume Control System (CVCS). NAPS COL FSAR Section 1.2.1.5.4.5 "Process Auxiliary Systems" and NAPS COL FSAR Subsection 9.3.4.2.5 "Degasifier Subsystem", state that the degasifier, a site specific component that is not described in the US-APWR Design Control Document (DCD), is installed downstream of the CVCS holdup tanks to remove dissolved gases prior to transfer to the Liquid Waste Management System.

NAPS COL FSAR Figures 9.3.4-1R "Chemical and Volume Control System Flow Diagram (Sheet 6 of 7)" and 9.3.4-1R "Chemical and Volume Control System Flow Diagram (Sheet 7 of 7)" show a return line (2790) from the degasifier to the CVCS Holdup Tanks (HUT) and a return line from the degasifier feed demineralizer (2775) to the CVCS HUTs in addition to the line from the degasifier to the Waste Holdup Tank, without providing a description of the intended use of these lines, or the potential impact on the Degasifier, associated purification media, and area dose rates.

The NAPS COL FSAR does not fully describe the impact on the contained sources in the CVCS components, the impact on area dose rates, any additional shielding requirements or any changes to radiation zones in meeting the guidance provided in RG 1.206 and SRP Section 12.2.

Please describe the purpose of these lines, the changes to the methods, models and assumptions used to determine degasifier and purification media activity, changes to shielding and the impact on radiation zones. Please revise and update the NAPS COL FSAR Sections 1.2.1.5.4.5 "Process Auxiliary Systems", 9.3.4 "Chemical and Volume Control System", 12.2 "Radiation Sources" and 12.3 "Radiation Protection Design Features" to describe the features or describe specific alternate approaches and the associated justification.

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**Dominion Response**

The two return lines shown in FSAR Figure 9.3.4-1R (Sheets 6 and 7) are not unique to the North Anna Unit 3 design. These lines exist as part of the standard design of the CVCS presented in DCD Section 9.3.4 and are shown in DCD Figure 9.3.4-1 (Sheets 6 and 7). In the Unit 3 design, the boric acid evaporator is replaced with a degasifier. In the Unit 3 degasifier configuration, these return lines provide operational flexibility for the processing of the CVCS holdup tank (HUT) contents.

The degasifier subsystem in the Unit 3 design is in the same location as the boric acid evaporator in the standard plant design. The routing of these return lines to the HUTs is the same for both subsystems and the activity levels for the return lines are bounded by the standard plant design levels since there is no concentration of the letdown water in the degasifier. Thus, keeping these lines in the Unit 3 design does not cause changes to the methods, models, and assumptions used to determine the degasifier and purification media activity selection, shielding requirements, or the building radiation zones. Therefore, no revisions to FSAR Sections 12.2 and 12.3 are required.

FSAR Section 1.2.1.5.4.5 "Process Auxiliary Systems" is a general outline of the CVCS. As a result, this section will remain as is. However, FSAR Sections 9.3.4.2.5 will be revised to include a description of the return lines.

**Proposed COLA Revision**

FSAR Section 9.3.4.2.5 will be revised as indicated 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 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.

Other gases for the oxygen gas analyzer and the automatic gas analyzers are supplied from gas cylinders located close to the analyzers.

Figure 9.3.1-201 shows the Hydrogen and Nitrogen Gas Supply Configuration.

### 9.3.1.2.2.3 Compressed Gas System

Replace the content of DCD Subsection 9.3.1.2.2.3 with the following.

The compressed gas system consists of gas sources as described in Subsection 9.3.1.2.1.3 and the distribution headers, distribution piping, and the associated valves and instrumentation.

**NAPS DEP 9.2(1)**

Replace the title and content of DCD Subsection 9.3.4.2.5 with the following.

### 9.3.4.2.5 Degasifier Subsystem

The CVCS includes a degasifier subsystem. After heat removal and purification in the CVCS, the reactor coolant is transferred to the holdup tanks where dissolved hydrogen and gaseous fission product are released into the holdup tank cover gas that is filled with nitrogen. The nitrogen cover gas is displaced by the reactor coolant hydrogen and gaseous fission product release gases. The displaced nitrogen is routed to the waste gas surge tank through the waste gas compressor. The holdup tank is operated under a slight positive pressure, and its vent header operates in conjunction with the GWMS. The maximum pressure of the vent header is determined by the pressure control system located at the inlet of the waste gas compressor.

Makeup cover gas to the holdup tank is provided by reusing the gas from the surge tank. If necessary, makeup nitrogen can be supplied through the nitrogen supply manifold.

The reactor coolant in the holdup tanks is pumped into the degasifier subsystem through the degasifier feed demineralizer and degasifier feed filter for degasification and ultimately processing through the LWMS. After degasification, the degasifier effluent is transferred into the LWMS for further treatment and release. Return lines are available from the degasifier feed demineralizer filter and from the degasifier liquid effluent line to the holdup tanks to provide additional operational flexibility for reactor coolant processing. The degasifier subsystem consists of a

# ENCLOSURE 2

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-15

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

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**QUESTION NO.: 12.03-12.04-15**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," RG 1.206 Subsection C.I.12.3 "Radiation Protection Design Features" and Standard Review Plan Section 12.3-12.4 "Radiation Protection Design Features", call for the description of design features provided for maintaining ORE ALARA.

North Anna Power Station Unit 3 (NAPS) Combined License (COL) "Departures Report" states that NAPS DEP 9.2(1) "Replacement of Boron Recycle System with a Degasifier Subsystem," replaces the Boron Recycle System with a site specific degasifier subsystem not described in the US-APWR Design Control Document (DCD). As a result, in NAPS COL FSAR Section 12.3 "Radiation Protection Design Features", references to the boric acid recycle system components were deleted but were not replaced with the descriptions of the components of the degasifier systems. For example, NAPS COL FSAR Subsection 12.3.1.1.1.2 "Balance of Plant Equipment" item C "Evaporators" was deleted without replacement by the Degasifier; NAPS COL FSAR Subsection 12.3.1.1.2.E "Equipment Layout," deleted the reference to the boric acid recycle system without adding the Degasifier subsystem and NAPS COL FSAR Subsection 12.3.2.2.5 "Auxiliary Building Shielding Design," deleted references to the boric acid recycle system without replacement with the Degasifier.

As a result, NAPS COL FSAR Section 12.3 does not include a description of the design features of the site specific degasifier subsystem, as discussed in the guidance contained in RG 1.206 and SRP Section 12.3-12.4 provided to maintain Operational Radiation Exposure ALARA consistent with the guidance of Regulatory Guide 8.8 Regulatory Position C.2. That degasifier system is not described in the US-APWR Design Control Document (DCD) either.

Please revise and update NAPS COL FSAR Subsection 12.3 to fully describe the site specific design features of the degasifier subsystem provided to maintain ORE ALARA consistent with the guidance of RG 8.8 and the requirements of 10 CFR 20.1101(b), or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

The degasifier is designed to remove dissolved gases, especially xenon and krypton, and is designed for automatic operation. The degasifier and its associated components (primarily the heat exchanger, vent condenser, and their associated piping and control instruments) are housed in a shielded cubicle. Adequate space is provided for surveillance and maintenance of the degasifier and its associated components. The letdown stream is pre-treated by filtration and ion exchange prior to going to the holdup tank (HUT). Since other sources of water can be placed into the HUT, additional demineralization and filtration are provided before the contents of the HUT enter the degasifier. Although the liquid entering the degasifier is heated, there is essentially no concentration of the liquid portion, either activity or boric acid, in the degasifier. Thus, the degasifier liquid effluent stream activity level will remain low because the influent concentration is low. A high-flow bypass line is provided for the degasifier for use when degasification of the liquid stream is not required. Valves and instruments are installed in the valve gallery with valve operation and instrument readout located in a low radiation area. Operation and maintenance procedures will require purging of all components before maintenance activities are conducted. This design approach will maintain ORE ALARA consistent with the guidance of RG 8.8 and the requirements of 10 CFR 20.1101(b).

FSAR Subsection 12.3.1.1.1.2 "Balance of Plant Equipment" will be revised to add the above description of the degasifier subsystem including the site-specific design features which are provided to maintain ORE ALARA consistent with the guidance of RG 8.8 and the requirements of 10 CFR 20.1101(b).

FSAR Subsection 12.3.1.1.2, "E. Equipment Layout," will be revised to include boric acid wastes in the list of those systems where pumps, valves, and instruments are separated from the process component because the process equipment is a major radiation source.

Also, FSAR Subsection 12.3.2.2.5 "Auxiliary Building Shielding Design" will be revised to include the degasifier as one of the major components in the Auxiliary Building with potentially high radioactivity during normal operation.

**Proposed COLA Revision**

FSAR Chapter 12 Subsections 12.3.1.1.1.2, "Balance of Plant Equipment," 12.3.1.1.2 "E. Equipment Layout," and 12.3.2.2.5, "Auxiliary Building Shielding Design" will be revised as indicated 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 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.

## 12.3 Radiation Protection Design Features

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

### 12.3.1.1.1.2 Balance of Plant Equipment

**NAPS DEP 9.2(1)**

Delete the content of item C.

Replace the title of item C. with "deleted."

**STD COL 12.3(6)**
**STD COL 12.3(7)**
**STD COL 12.3(8)**

Add the following information at the end of DCD Subsection 12.3.1.1.1.2.

**N. Mobile Liquid Waste Processing System**

The mobile liquid waste processing system is located in the Auxiliary Building, and treats the effluent prior to discharging it to the waste monitor tank. This system is designed to comply with SRP Section 12.3-12.4, RG 1.206 and RG 1.69. As described in Subsection 11.2.1.6, provisions are included to mitigate contamination, and the system complies with 10 CFR 20.1406. The mobile liquid waste processing system is located in a radiation zone III area. Shield walls are provided for the system in order to allow the surrounding area to maintain a radiation zone III designation.

**O. Blowdown Sump**

The blowdown sump is designed with minimal components and uses gravity flow to direct the sump contents into the discharge piping. There are no pumps or valves involved in this method of discharge which minimizes the operational requirements as well as the maintenance requirements to be performed by plant operators, thus reducing the occupational radiation exposure.

**NAPS DEP 9.2(1)**

**P. Degasifier**

The degasifier is designed to remove dissolved gases, especially xenon and krypton, and is designed for automatic operation. The degasifier and its associated components (primarily the heat exchanger, vent condenser, and their associated piping and control instruments) are housed in a shielded cubicle. Adequate space is provided for surveillance and maintenance of the degasifier and its associated components. The letdown stream is pre-treated by filtration and ion exchange prior to going to the holdup tank (HUT). Since other sources can be placed into the HUT, additional demineralization and filtration are provided before the

contents of the HUT enter the degasifier. Although the liquid entering the degasifier is heated, there is no concentration of the liquid portion, either activity or boron, in the degasifier. Thus, the degasifier liquid effluent stream activity level will remain low because the influent concentration is low. A high-flow bypass line is provided for the degasifier for use when degasification of the liquid stream is not required. Valves and instruments are installed in the valve gallery with valve operation and instrument readout located in a low radiation area. Operation and maintenance procedures will require purging of all components before maintenance activities are conducted. This design approach will maintain ORE ALARA consistent with the guidance of RG 8.8 and the requirements of 10 CFR 20.1101(b).

#### 12.3.1.1.2 Common Facility and Layout Designs for As Low As Reasonably Achievable

**NAPS DEP 9.2(1)**

Replace the first sentence in the last paragraph in item B with the following.

Piping that carries resin slurries is run vertically as much as possible.

**NAPS DEP 9.2(1)**

Replace the first sentence of the first paragraph in item E. with the following.

In those systems where process equipment is a major radiation source (such as fuel pit cleanup, coolant, boric acid waste, chemical waste, and miscellaneous waste), pumps, valves, and instruments are separated from the process component.

#### 12.3.1.2.1.1 Radiation Zoning

**STD COL 12.3(4)**

Replace the fourth sentence of the fourth paragraph in DCD Subsection 12.3.1.2.1.1 with the following.

Site radiation zones for plant arrangement plan under normal operation/shutdown conditions are shown in Figure 12.3-1R (COL information provided on Sheet 1 of 34).

**NAPS SUP 12.3(1)**

Add the following after the last Sentence in the fourth paragraph in DCD subsection 12.2.1.2.1.1.

Radiation zoning maps for the IRSF are shown in Appendix 11AA.

- Development of a conceptual site model (based on site characterization and facility design and construction) that aids in the understanding of the interface with environmental systems and the features that control the movement of contamination in the environment;
- Evaluating the final site configuration after construction to assist in preventing the migration of radionuclides offsite via unmonitored pathways; and
- Establishing and performing an onsite contamination monitoring program along the potential pathways from the release sources to the receptor points.

### 12.3.2.2.5 Auxiliary Building Shielding Design

**NAPS DEP 9.2(1)**

Replace the first sentence of the first paragraph with the following.

During normal operations, the major components in the A/B with potentially high radioactivity are those in the CVCS, SGBDS, degasifier, GWMS, LWMS, and SWMS.

### 12.3.2.2.8 Spent Fuel Transfer Canal and Tube Shielding Design

**STD COL 12.3(5)**

Replace the last paragraph in DCD Subsection 12.3.2.2.8 with the following.

Administrative control of the fuel transfer tube inspection and the access control of the area near the seismic gap below the fuel transfer tube will be addressed in a radiation protection program, described in Section 12.5.

### 12.3.2.3 Shielding Calculation Methods

**NAPS DEP 9.2(1)**

Replace the first sentence of the third paragraph with the following.

The geometric model assumed for shielding evaluation of tanks, heat exchangers, demineralizers, and the containment is a finite cylindrical volume with maximum source volume capacity.

# ENCLOSURE 3

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-16

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-16**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," RG 1.206 Subsection C.I.12.3 "Radiation Protection Design Features" and Standard Review Plan Section 12.3-12.4 "Radiation Protection Design Features", call for the description of design features provided for maintaining ORE ALARA.

Supplemental Response to NRC Request for Additional Information (RAI) North Anna Power Station Unit 3 (NAPS) Combined License (COL) Letter 65 RAI 5548, Question 09.03.04-1 dated June 9, 2011, states that a connection between the Chemical and Volume Control System (CVCS) Holdup Tanks (HUT) and the charging pumps was incorporated in to the plant design to allow reuse of borated water in order to reduce the operational consumption of boric acid. The RAI response further states that during refueling, the reactor coolant system (RCS) water level will be lowered by draining the RCS to one of the three available CVCS HUTs where it is stored until needed near the end of refueling operations when it can be transferred back to the RCS. This site specific intended use of the CVCS HUTs is not described in US-APWR Design Control Document (DCD) Tier 2 Revision 2 Subsection 12.2.1.1.3 "Chemical and Volume Control System" or in North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Subsection 12.2.1.1.3 "Chemical and Volume Control System," NAPS COL FSAR Subsection 9.3.4.2.6.10 "Holdup Tanks," or the NAPS COLA "Departures Report".

The NAPS COL FSAR Sections 12.2 and 12.3 do not fully describe the impact from the reuse of RCS fluid containing the fluid potentially containing activity concentrations specified in US-APWR DCD Tier 2 Revision 2 Subsection 12.2 "Radiation Sources" or the effect of the design change in combination with the expected shutdown related crud burst activity concentration. The ALARA requirements of 10 CFR 20.1101(b) are not addressed in COL FSAR Sections 12.2 "Radiation Sources" and 12.3 "Radiation Protection Design Features" for this design change.

Please revise and update the NAPS COL FSAR Sections 12.2 and 12.3 to describe this site specific intended use of the CVCS Holdup Tanks and Holdup Tank Pumps, the impact on the assumed source term in the CVCS Holdup Tanks and the impact of this use of the CVCS Holdup Tanks on the area dose rates from the new line, and ALARA requirements of 10 CFR 20.1101(b), or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

Dominion's June 9, 2011, response to RAI 5548, Question 09.03.04-1, described the re-use of RCS inventory during refueling through the use of the site-specific line connecting the Chemical and Volume Control System (CVCS) Holdup Tanks (HUTs) and the charging pumps. In conjunction with the S-COLA Departure 9.2(1) regarding the removal of a boron recovery (evaporator) system, the re-use of some portion of the RCS inventory was considered a potential cost saving option due to a reduction in boron consumption. Additional consideration by Dominion has determined that this option is not sufficiently beneficial to pursue. Therefore, Dominion no longer intends to use the CVCS HUTs to store RCS inventory during refueling for the subsequent transfer of that inventory back to the RCS via the charging pump. Accordingly, the North Anna Unit 3 site-specific piping that connects the CVCS HUTs to the suction of the charging pumps will be removed from the Unit 3 design. FSAR Figure 9.3.4-1R (Sheets 4 and 6 of 7) will be revised to show the removal of this connection.

Therefore, no revisions to FSAR Sections 12.2 or 12.3 are required to describe the use of this connection or any source terms or doses associated with it.

FSAR Revision 4, Figure 9.3.4-1R (Sheet 6 of 7) will be revised to show the following corrections:

1. The heat tracing on the return line from the degasifier feed demineralizer to the HUTs had been deleted since this piping does not contain evaporator concentrate and heat tracing is not required. However, the heat tracing was inadvertently retained on the drawing in Revision 4.

2. The valve on the holdup tank pump outlet line to the degasifier feed demineralizer (VLV-350-N) was removed in Revision 4 of this figure due to simplification of the P&ID. This valve will be added back to the figure as indicated on the attached markup.

**Proposed COLA Revision**

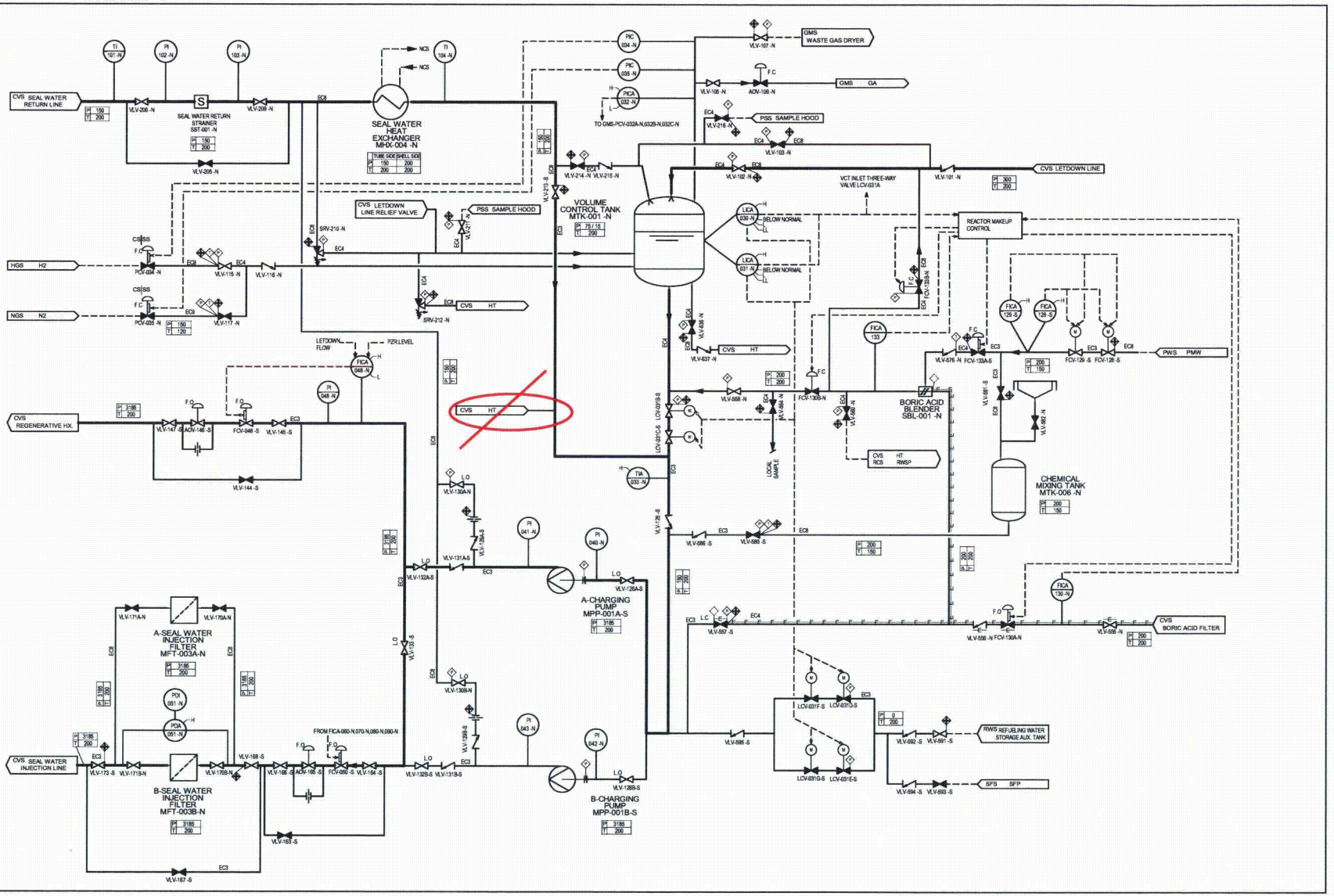
FSAR Figure 9.3.4-1R (Sheets 4 and 6) will be revised as indicated on the attached markup.

## 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 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.

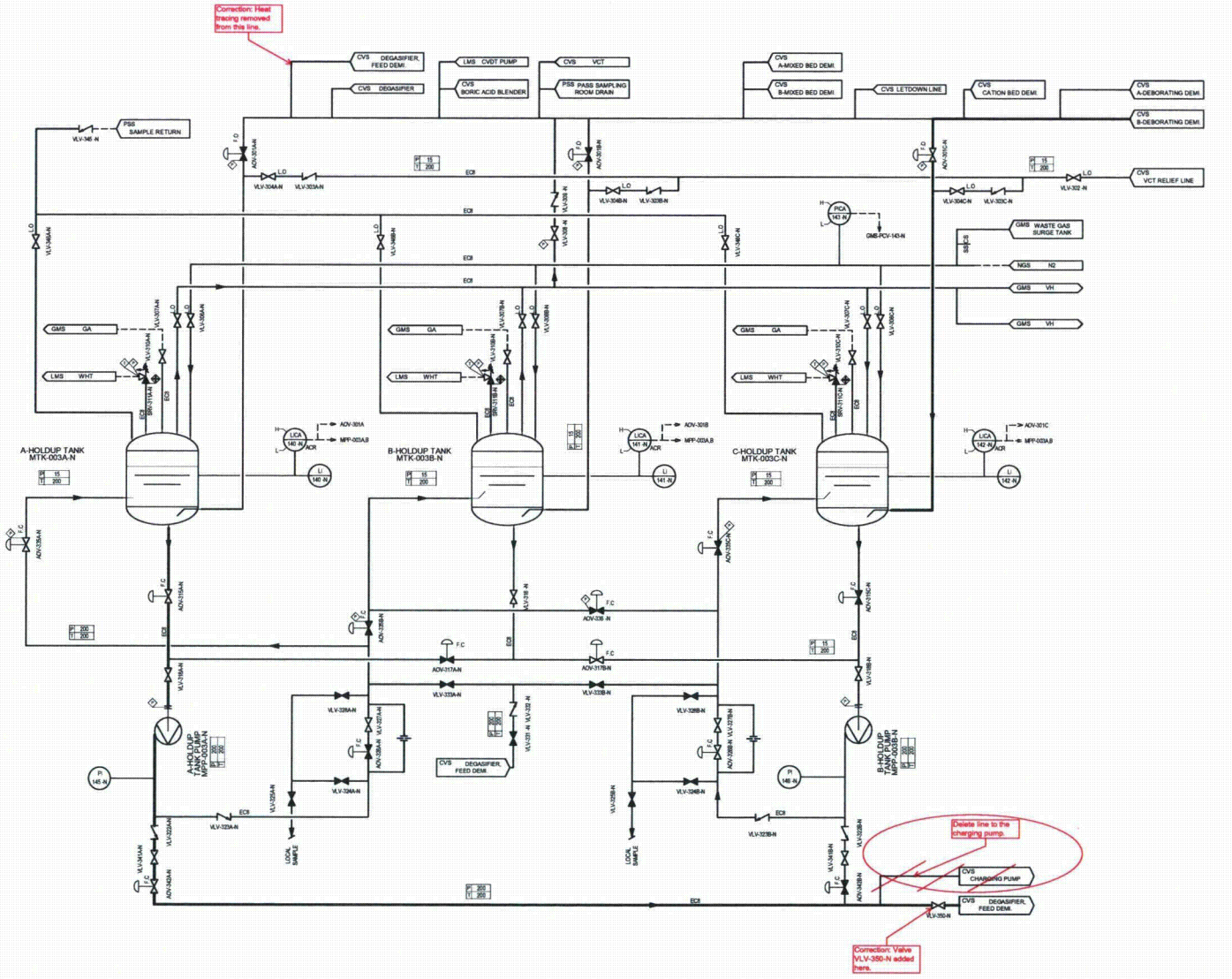
**NAPS DEP 9.2(1)**

## Figure 9.3.4-1R Chemical and Volume Control System Flow Diagram (Sheet 4 of 7)



**NAPS DEP 9.2(1)**

## Figure 9.3.4-1R Chemical and Volume Control System Flow Diagram (Sheet 6 of 7)



# ENCLOSURE 4

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-17

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-17**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," and RG 1.206 "Combined License Applications for Nuclear Power Plants" Section C.I.12.3.1 "Facility Design Features," state that areas inside the plant structures, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified. 10 CFR Part 50 "Domestic Licensing of Production and Utilization Facilities" Appendix A "General Design Criteria for Nuclear Power Plants" (GDC) Criterion 61 "Fuel storage and handling and radioactivity control," requires licensees to ensure that there is adequate shielding for routine activities in the area of the equipment.

North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Figures 9.3.4-1R "Chemical and Volume Control System Flow Diagram" Sheets 4 and 6 of 7, shows a new connection via valves VLV-351-N and VLV-352-N between the Chemical and Volume Control System (CVCS) Holdup Tanks (HUT) and the CVCS charging pump suctions, that is site specific and not described in the US-APWR Design Control Document (DCD). USAPWR Design Control Document (DCD) Tier 2 Revision 2 Figures 12.3-1 "Radiation Zones for Normal Operation/Shutdown (Sheet 15 of 34) Auxiliary Building at Elevation -26'-4"" [the location of the CVCS HUTs in the Auxiliary Building] and Figure 12.3-1 "Radiation Zones for Normal Operation/Shutdown (Sheet 4 of 34) Reactor Building at Elevation -26'-4"" [the location of the Charging pumps in the Reactor

Building], do not show a pipe chase at Elevation -26'-4" between the Charging Pumps and the CVCS HUTS.

The NAPS COL FSAR Section 9.3.4 "Chemical and Volume Control System," NAPS DEP 9.2(1) "Replacement of Boron Recycle System with a Degasifier Subsystem," and NAPS COL FSAR Chapter 12 "Radiation Protection," do not fully describe the design features (e.g. shielding, fission/activation product removal) provided to maintain ORE ALARA or to maintain the radiation zones along path of the NAPS site specific line between the CVCS HUTs and the CVCS charging pump suction as described in US-APWR Figure 12.3-1.

Please revise and update NAPS COL FSAR Section12.3 "Radiation Protection Design Features" to describe the site specific design features provided to maintain ORE ALARA, and revise NAPS COL FSAR Figure 12.3-1R "Radiation Zones for Normal Operation/Shutdown," to depict the updated radiation zones, or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

As discussed in the response to RAI 5977, Question 12.03-12.04-16 of this letter, the North Anna Unit 3 site-specific piping that connects the CVCS Holdup Tanks (HUTs) to the suction of the charging pumps will be removed from the Unit 3 design. Changes to FSAR Figure 9.3.4-1R (Sheets 4 and 6) are required to reflect this piping removal. These changes are provided in the response to Question 12.03-12.04-16.

Therefore, no revisions to FSAR Section 12.3 or Figure 12.3-1R are required to describe the site-specific design features of this connection or changes to the radiation zones associated with it.

**Proposed COLA Revision**

None.

# ENCLOSURE 5

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-18

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-18**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," and RG 1.206 "Combined License Applications for Nuclear Power Plants" Section C.I.12.3.1 "Facility Design Features," state that the design should minimize ORE through the use of maintenance requirements and chemistry controls.

US-APWR Design Control Document (DCD) Tier 2 Revision 2 Subsection 9.3.4.2.2.1 "Ionic Purification" states that reactor coolant filters are provided downstream of the demineralizers to collect particulates and resin fines. North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Figures 9.3.4-1R "Chemical and Volume Control System Flow Diagram" Sheets 4 and 6 of 7, shows a new connection between the Chemical and Volume Control System (CVCS) Holdup Tanks (HUT) and the CVCS charging pump suctions that apparently does not contain any filters. Since NAPS COL FSAR Figure 9.3.4-1R "Chemical and Volume Control System Flow Diagram (Sheet 6 of 7)" shows numerous unfiltered lines from demineralizer bed backwash retention elements returning to the CVCS HUTs, it is possible to inject resin fines contained in the CVCS HUTs directly into the Reactor Coolant System (RCS) via the normal charging flow path. The potential exists for the presence of resin fines downstream of resin retention elements and as a result, adverse impacts of resin decomposition products on RCS pressure boundary components and the adverse impact on ORE.

The NAPS COL FSAR Section 12.3 does not fully describe the design features provided to maintain ORE ALARA by preventing potential injection, and subsequent chemical degradation, of resin fines from the CVCS HUTs into the RCS.

Please revise and update NAPS COL FSAR Section 12.3 "Radiation Protection Design Features" and Subsection 9.3.4 "Chemical and Volume Control System," to describe the design features provided to prevent the introduction of resin fines from the CVCS Holdup Tanks into the Reactor Coolant System, or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

As discussed in the response to RAI 5977, Question 12.03-12.04-16 of this letter, the North Anna Unit 3 site-specific piping that connects the CVCS Holdup Tanks (HUTs) to the suction of the charging pumps will be removed from the Unit 3 design. Changes to FSAR Figure 9.3.4-1R (Sheets 4 and 6) are required to reflect this piping removal. These changes are provided in the response to Question 12.03-12.04-16.

Therefore, no revisions to FSAR Section 12.3 or Section 9.3.4 are required to describe the site-specific design features required to prevent the introduction of resin fines into the Reactor Coolant System.

**Proposed COLA Revision**

None.

# ENCLOSURE 6

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-19

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-19**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," and RG 1.206 "Combined License Applications for Nuclear Power Plants" Section C.I.12.3.1 "Facility Design Features," state that the design should minimize ORE through the use of maintenance requirements and chemistry controls.

US-APWR Design Control Document (DCD) Tier 2 Revision 2 Subsection 9.3.4.2.2.1 "Ionic Purification" which states that reactor coolant filters are provided downstream of the demineralizers to collect particulates and resin fines. North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Figures 9.3.4-1R "Chemical and Volume Control System Flow Diagram" Sheets 4 and 6 of 7, shows a new site specific connection, not described in the US-APWR DCD, between the Chemical and Volume Control System (CVCS) Holdup Tanks (HUT) and the Reactor Coolant System (RCS) CVCS line 3"-CVS-01F1, the Reactor Coolant Pump (RCP) seal water return line. The RCP seal water returns from all four RCP seal packages through the Seal Water Return filters to the Volume Control Tank without passing through any identified check valves. Any incident of backflow through the RCP seal water return line could result in flushing particulate material off of the Seal Water Return Filters into all four RCP seal packages. NAPS COL FSAR Table 9.3.4-3R "Chemical and Volume Control System Equipment Design Parameters (Sheet 1 of 6)" states that the two Holdup Tank Pumps are each rated for 130 gpm and 200 psig. Industry literature documents the adverse impact of

foreign material on the reliability of the RCP seals, which serve as RCS pressure boundary components. RCP seal degradation has an adverse impact on ALARA and ORE due to the need for increased maintenance and inspection of the RCP seals. In addition, operating experience concerning RCP seal failures show that they may result in an increase in ORE due to loss of RCS inventory into containment, and the resultant plant shutdowns to clean up the leakage, repair the seal package, and repair any other damage incurred.

The NAPS COL FSAR Section 12.3 does not fully describe the design features provided to maintain ORE ALARA by preventing foreign material damage to the RCP seal packages, due to back flow through the seal water return filters.

Please revise and update NAPS COL FSAR Section 12.3 "Radiation Protection Design Features" and Subsection 9.3.4 "Chemical and Volume Control System," to describe the design features provided to prevent potential damage to the RCP Seal Packages, and the subsequent increase in ORE, from the use of the CVCS Holdup Tank Pumps to return water to the Reactor Coolant System, or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

As discussed in the response to RAI 5977, Question 12.03-12.04-16 of this letter, the North Anna Unit 3 site-specific piping that connects the CVCS Holdup Tanks (HUTs) to the suction of the charging pumps will be removed from the Unit 3 design. Changes to FSAR Figure 9.3.4-1R (Sheets 4 and 6) are required to reflect this piping removal. These changes are provided in the response to Question 12.03-12.04-16.

Therefore, no revisions to FSAR Section 12.3 or Section 9.3.4 are required to describe the site-specific design features to prevent potential damage to the RCP Seal Packages due to foreign material from backwash through the seal water return filters.

**Proposed COLA Revision**

None.

# ENCLOSURE 7

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-20

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-20**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," RG 1.206 Subsection C.I.12.3 "Radiation Protection Design Features" describe the use of plant chemistry controls for maintaining ORE ALARA.

Supplemental Response to NRC Request for Additional Information (RAI) North Anna Power Station Unit 3 (NAPS) Combined License (COL) Letter 65 RAI 5548, Question 09.03.04-1 dated June 9, 2011, states that a connection between the Chemical and Volume Control System (CVCS) Holdup Tanks (HUT) and the suction line of the charging pumps was incorporated in to the plant design to allow reuse of borated water in order to reduce the operational consumption of boric acid. The response further states that prior to transferring the stored water back to the RCS, the holdup tank contents will be sampled, analyzed, and confirmed to meet currently applicable water quality requirements. NAPS COL FSAR Subsection 5.2.3.2.1 "Chemistry with Reactor Coolant" states that RCS reactor coolant will meet the Electric Power Research Institute (EPRI) Primary Water Chemistry Guidelines.

Industry experience demonstrates that selection and implementation of chemistry program controls impacts plant ALARA and ORE.

RCS chemistry controls are established to maintain exposures ALARA and the commitment made in NAPS COL FSAR Subsection 5.2.3.2.1 to confirm that RCS makeup water meets the requirements of the EPRI Primary Water Chemistry Guidelines are reasonable expectations.

In NAPS COL FSAR Table 9.3.2-6R "Process Grab Sample Points" sample points 17 and 18 changed from the Boric Acid Evaporator Feed Pump Discharge, to the Holdup Tank Pump Discharge, but the "Analysis" parameters were not changed to reflect the RCS coolant chemistry specifications provided in US-APWR Design Control Document (DCD) Tier 2 Revision 2 Table 9.3.4-1 "Water Chemistry Specification for the Reactor Coolant."

Please revise and update NAPS COL FSAR Table 9.3.2-6R to describe chemistry analysis parameters consistent with the requirements for RCS makeup water, or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

As discussed in the response to RAI 5977, Question 12.03-12.04-16 of this letter, the North Anna Unit 3 site-specific piping that connects the CVCS Holdup Tanks (HUTs) to the suction of the charging pumps will be removed from the Unit 3 design. Changes to FSAR Figure 9.3.4-1R (Sheets 4 and 6) are required to reflect this piping removal. These changes are provided in the response to Question 12.03-12.04-16.

Therefore, no revisions to FSAR Table 9.3.2-6R are required to correlate the chemistry analysis parameters for the HUT pump discharge to the requirements for RCS makeup water.

**Proposed COLA Revision**

None.

# ENCLOSURE 8

## Response to NRC RAI Letter 92

## RAI 5977, Question 12.03-12.04-21

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: 5977 (RAI Letter 92)**

**SRP SECTION: 12.03-12.04 – RADIATION PROTECTION DESIGN FEATURES**

**QUESTIONS for Health Physics Branch (CHPB)**

**DATE OF RAI ISSUE: 11/15/2011**

**QUESTION NO.: 12.03-12.04-21**

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide 1.206 "Combined License Applications for Nuclear Power Plants" Section C.I.12.3.1 "Facility Design Features," state that features should be provided to reduce ORE. SRP Section 9.3.2 "Process and Post-Accident Sampling Systems" states that, consistent with 10 CFR Part 50 "Domestic Licensing of Production and Utilization Facilities" Appendix A "General Design Criteria for Nuclear Power Plants" (GDC) Criterion 60 "Control of releases of radioactive materials to the environment," licensees should minimize personnel exposure by providing for flushing and draining of sample lines.

North Anna Power Station Unit 3 (NAPS) Combined License (COL) FSAR Revision 2 Departure DEP 9.2(1) "Replacement of Boron Recycle System with a Degasifier Subsystem," states that the Boron Recycle System was replaced with a degasifier subsystem and the interfaces between the affected portion of the Chemical and Volume Control System (CVCS) (i.e., the boric acid evaporator) and the Boric Acid Tanks, Primary Makeup Water Tanks and associated systems were removed.

The NAPS DEP 9.2(1) also modified Figure 9.2.6-3R "Demineralized Water System Flow Diagram," removing the demineralized water supply designated as "LMS D-9 N0-EE10158 3453," to the Chemical Drain Tank Sample line that is used for purging the sample line.

Please revise and update the NAPS COL FSAR to describe the basis for removal of the Chemical Drain Tank Sample line purge connection, how this change is consistent with stated purpose of DEP 9.2(1) provided in the NAPS COLA "Departures Report", the ALARA requirements of 10 CFR 20.1101(b) and the requirements of GDC 60 to control the release of radioactive materials to the environment by the use of purging and draining of sample lines, or describe the specific alternate approaches and the associated justification.

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**Dominion Response**

The North Anna Unit 3 FSAR Figure 9.2.6-3R "Demineralized Water System Flow Diagram" shows a demineralized water supply line to the LWMS chemical drain tank pump. This line supplies demineralized water to purge the chemical drain tank sample line as well as the chemical drain tank pump. FSAR Figure 9.2.6-3R does not show separate lines to the chemical drain tank pump and the chemical drain tank sample line as a result of simplification of the process flow diagram; however, they are part of the design. The combination of these supply lines to the chemical drain subsystem equipment is consistent with DCD Revision 3, Figure 9.2.6-3 "Demineralized Water System Flow Diagram." Therefore, this supply line is not a departure from the DCD and it is not necessary to include it in the DEP 9.2(1) "Departures Report." The use of the demineralized water supply for purging the chemical drain tank pump and sample line is consistent with the ALARA requirements of 10 CFR 20.1101(b) and GDC 60.

FSAR Revision 3, Figure 11.2-201, "Liquid Waste Management System Piping and Instrumentation Diagram (Sheet 8 of 8)" showed the supply line of demineralized water to the chemical drain subsystem. FSAR Revision 4, Figure 11.2-201 (Sheet 8 of 8) was simplified and no longer shows this water supply to the chemical drain subsystem. However, for continuity with FSAR Figure 9.2.6-3R, FSAR Figure 11.2-201 (Sheet 8 of 8) will be revised to again show the demineralized water supply line connection including those to the chemical drain tank pump and sample line.

**Proposed COLA Revision**

FSAR Figure 11.2-201 (Sheet 8 of 8) will be revised as indicated 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 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 COL 11.2(6)** **Figure 11.2-201 LWMS P&ID (Sheet 8 of 8)**