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10 CFR 50.4
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February 5, 2010

UN#10-022

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

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 171, Ultimate Heat Sink - Raw Water Supply System

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI No 171 SBPA 2674," email dated September 29, 2009

2) UniStar Nuclear Energy Letter UN#10-016, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI No. 171, Ultimate Heat Sink - Raw Water Supply System, dated January 22, 2010

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated September 29, 2009 (Reference 1). This RAI addresses Ultimate Heat Sink - Raw Water Supply System as discussed in Section 9.2 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 6.

Reference 2 provided a February 5, 2010 schedule for the response for RAI 171, Question 09.02.05-2. The enclosure provides our response to RAI 171, Question 09.02.05-2. Our response includes revised COLA content and does not include any new regulatory commitments. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

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NRO

This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 470-6317.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 5, 2010

for Greg Gibson

Enclosure: Response to NRC Request for Additional Information, RAI No. 171, Question 09.02.05-2, Ultimate Heat Sink - Raw Water Supply System, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/RDS/mdf

Enclosure

Response to NRC Request for Additional Information
RAI No. 171, Question 09.02.05-2, Ultimate Heat Sink - Raw Water Supply System,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 171, Question 09.02.05-2

The relevant Commission requirements provided for the review of the raw water supply system (RWSS), and the associated acceptance criteria, are given in Section 10.4.5, "Circulating Water System," of NUREG-0800, Standard Review Plan (SRP) Revision 3 – March 2007, because the RWSS typically provides the make-up water to the circulating water system (CWS) cooling towers. However, for this Calvert Cliffs application, the CWS makeup is a separate system from the RWSS and is included in Section 10.4.5, "Circulating Water System." The Calvert Cliffs' RWSS will be reviewed based on guidance found in SRP Sections 9.2.1,"Station Service Water System," 9.2.4, "Potable and Sanitary Water System," 9.2.5, "Ultimate Heat Sink," and 10.4.5, "Circulating Water System." Review interfaces with other NUREG-0800 sections can also be found in Section 10.4.5 of NUREG-0800. Based on SRP Section 10.4.5, staff acceptance of the design is based on compliance with the requirements of General Design Criterion (GDC) 4, "Environmental and Dynamic Effects Design Bases." Based on SRP Section 9.2.4, staff acceptance of the design is based on compliance with the requirements of GDC 60, "Control of Release of Radioactive Material to the Environment."

The staff reviewed the RWSS description in Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 FSAR Section 9.2.9, "Raw Water Supply System," FSAR Section 9.2.5, "Ultimate Heat Sink," along with Figure 9.2-7, "Raw Water and Desalinated Water Supply," and Figure 10.4-3, "Circulating Water System Makeup System (P&ID)," to confirm that the flow paths and components have been identified and described in sufficient detail to enable a full understanding of the system design and operation. The staff found that the system description and drawings are incomplete, inaccurate, or that clarification is needed with respect to the following considerations:

- CCNPP Unit 3 FSAR Table 3.2-1, "Classification Summary for Site-Specific SSC" does not have a code explanation for "UPQ," desalination/water treatment building.
- Figure 10.4-3, "Circulating Water System Makeup System (P&ID)," does not indicate the RWSS connection.
- RWSS design and operating pressure and temperature are not indicated in the application.
- RWSS design flow rates and heads of the pumps are not specified.
- RWSS normal and peak loads for each major user of the RWSS (i.e., potable water, fire protection, demineralized water, essential service water system (ESWS) cooling tower basin) are not specified
- RWSS piping materials, including buried piping materials, are not specified.
- Figure 9.2-7 does not provide specific locations of the RWSS equipment and major isolation valves to interfacing system, and does not indicate whether the system components are in the yard or buried.
- RWSS chemical treatment and revenant chemicals are not defined and have not been evaluated as non-toxic to the control room boundary.
- The applicant did not provide information about the electrical power for the RWSS. The applicant did not provide information about the electrical power for the desalinated water plant..
- RWSS component, such as RWSS pump starts, based on instrumentation and controls logic is not discussed.
- CCNPP Unit 3 COL Application, Part 10, Table 2.3-25, "Raw Water Supply System Inspection, Tests, Analysis, and Acceptance Criteria," does not have meter numbers.

The applicant is requested to provide the above information.

Response

Note: The above bullets in the NRC question are numbered as parts 1 through 11 below.

1. CCNPP Unit 3 FSAR Table 3.2-1, "Classification Summary for Site-Specific SSC" does not have a code explanation for "UPQ," desalination/water treatment building.

Response for Part 1:

As previously provided in the response to RAI 109, Question 03.02.01-3[1], FSAR Table 3.2-1, Note 3 will be updated to include UPQ, Water Treatment Building.

[1] G. Gibson (UniStar Nuclear Energy) to Document Control Desk (U.S. NRC), Letter UN#09-323, Response to RAI 109, Question 03.02.01-3, Seismic Classification, dated July 30, 2009.

2. Figure 10.4-3, “Circulating Water System Makeup System (P&ID),” does not indicate the RWSS connection.

Response for Part 2:

FSAR Figure 10.4-3 indicates the RWSS connection as “Desal Plant.” FSAR Section 9.2.9 describes ‘raw water’ as the term usually applied to untreated water. At Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3, ‘raw water’ is supplied from the Circulating Water System Makeup Water System (which draws water from the Chesapeake Bay) and is directed to the desalinization plant.

3. RWSS design and operating pressure and temperature are not indicated in the application.

Response for Part 3:

The design pressure and temperature for the RWSS is 130 psig (8.97 bars) and 100° F (37.8° C), respectively. Operating pressure(s) and temperature(s) are enveloped by the design pressure and temperature.

FSAR Section 9.2.9.2 will be revised to include this information.

4. RWSS design flow rates and heads of the pumps are not specified.

Response for Part 4:

FSAR Section 9.2.9.2 states that the Circulating Water Makeup System is the source of water to the desalination plant for processing. FSAR Section 9.2.9.3 states that the desalinated water flowrate (called production rate) is a nominal 1225 gpm (4637 lpm). This is based upon the water being desalinated, resulting in a 40% nominal recovery rate of desalinated water.

FSAR section 9.2.9.3 will be revised to include the following information:

The two 100% capacity desalinated water transfer pumps have been sized based upon a total developed head (TDH) of a nominal 200 ft (61 m) at a nominal 790 gpm (2992 lpm) each. This includes consideration of the normal demands of the desalinated water users and those simultaneous peak demands (i.e., 4 ESW cooling towers simultaneously in operation). Each of the desalinated users' headers have been sized to accommodate peak flowrates with the desalinated water transfer pumps' suction and discharge piping sized to accommodate peak flowrates for the required demands.

5. RWSS normal and peak loads for each major user of the RWSS (i.e., potable water, fire protection, demineralized water, essential service water system (ESWS) cooling tower basin) are not specified.

Response for Part 5:

Normal and peak loads for major RWSS users are summarized below from COLA Part 3, Environmental Report Table 3.3-1, under the water stream heading "Chesapeake Bay Water Demand for Desalinization":

	Average Flow gpm/lpm	Maximum Flow gpm/lpm
Potable & Sanitary Water	93/352	216/818
Fire Water Distribution	5/19	625/2,365
Demineralized Water	80/303	80/303
ESW Water Basins	629/2,381	1,490/5,640

6. RWSS piping materials, including buried piping materials, are not specified.

Response for Part 6:

Materials such as fiberglass reinforced plastic (FRP) or high density polyethylene (HDPE) are being evaluated for the RWSS underground piping along with aboveground materials, such as glass fiber reinforced epoxy or steel. RWSS components will be fabricated from corrosion resistant materials (such as FRP, HDPE or equivalent for underground, and glass fiber reinforced epoxy, steel or equivalent for aboveground). Appropriate corrosion inhibitors will be specified for the system.

FSAR Section 9.2.9.3 will be revised to include the following information:

The RWSS piping, tanks, pumps and other system components' materials are compatible with the Chesapeake Bay water quality prior to treatment and desalinated water quality for the remainder of the system. As such, RWSS components will be fabricated from corrosion resistant materials (such as FRP, HDPE or equivalent for underground, and glass fiber reinforced epoxy, steel or equivalent for aboveground). Appropriate corrosion inhibitors will be specified for the system.

7. Figure 9.2-7 does not provide specific locations of the RWSS equipment and major isolation valves to interfacing system, and does not indicate whether the system components are in the yard or buried.

Response for Part 7:

FSAR Figure 9.2-7 will be updated to indicate the RWSS equipment and major isolation valves to the interfacing systems and, where a building is not indicated, the components (i.e., piping) are outside in the yard area or buried.

See updated Figure 9.2-7 in this Enclosure (COLA Impact page 41).

8. RWSS chemical treatment and revenant chemicals are not defined and have not been evaluated as non-toxic to the control room boundary.

Response for Part 8:

FSAR Section 9.2.9.2 will be updated to include the following chemical treatment and relevant chemicals for the desalination process:

- Sodium Bisulfite for dechlorination upstream of the RO membranes.
- Sulfuric Acid: continuous feed to the pretreated water prior to desalination for pH adjustment.
- Scale inhibitor: proprietary (supplier-specific) - continuous feed to the pretreated water prior to desalination.

The chemicals used in the circulating water, circulating water makeup, UHS cooling towers and RWSS chemical treatment have been defined and evaluated to determine minimum safe distances from the control room boundary (toxicity evaluation) and nearest safety related structure (explosions, flammable vapor cloud and flammable vapor cloud delayed ignition). The following chemical quantities and associated storage locations were used in the analysis:

Chemical	Maximum Quantity in Largest Container (gallons)
Storage Location: Plant Intake	
Sodium Hypochlorite	20,000
Storage Location: CW Cooling Tower	
Sodium Hypochlorite	40,000
Sulfuric Acid	25,000
Sodium Bisulfite	5,000
Scale Inhibitor/Dispersant[a]	10,000
Non Oxidizing Biocide[b]	1,000
Storage Location: UHS Cooling Towers	
Sodium Hypochlorite	2,000
Sodium Bisulfite	350
Scale Inhibitor/Dispersant[a]	350
Non Oxidizing Biocide[b]	350
Storage Location: Desalination Building	
Sodium Bisulfite	1,000
Antiscalant (Sodium hexametaphosphate)	350
Sulfuric Acid	7,500

[a] The material safety data sheet (MSDS) for the proprietary scale inhibitor/dispersant lists the composition/hazardous ingredient as 2-Phosphono-1,2,4-butane tricarboxylic acid, 10 to 30 percent by weight. It is conservatively assumed that the entire quantity of this chemical mixture is 2-Phosphono-1,2,4-butane tricarboxylic acid.

[b] The MSDS for the proprietary non oxidizing biocide lists the composition/hazardous ingredients as Alkyl dimethyl benzyl ammonium chloride, 50 percent by weight, and ethanol, 10 percent by weight. Alkyl dimethyl benzyl ammonium chloride does not have a determined toxicity limit or flammable limits. Ethanol has both a determined toxicity limit and flammable limits. Therefore the percentage by weight that is ethanol will be considered and this quantity is evaluated as pure ethanol.

Each identified chemical was evaluated to ascertain which materials had a defined toxicity limit and/or defined flammability ranges and whether each had a potential to explode. The results of the screening analysis are presented in Table 1 below.

Table 1: Chemical Screening/ Disposition

Chemical	Quantity (gallons)	Physical State	Toxicity Limit (IDLH)	LFL/UFL (%)	Vapor Pressure	Disposition
Storage Location: Plant Intake						
Sodium Hypochlorite [1]	20,000	Liquid Solution	10 ppm as Cl_2	NF	17.5 mmHg @ 68F	The quantity and location is bounded by the 40,000 gallon tank located at the CW Tower [3]
Storage Location: CW Cooling Tower						
Sodium Hypochlorite [1]	40,000	Liquid Solution	10 ppm as Cl_2	NF	17.5 mmHg @ 68F	Toxicity
Sulfuric Acid [2]	25,000	Liquid Solution	15 mg/m^3	NF	0.001 mmHg @ 68F	No further analysis. Low vapor pressure.
Sodium Bisulfite	5,000	Liquid Solution	5 mg/m^3 (TLV-TWA)	NF	Solid--in a solution	No further analysis. TWA established for solid – not applicable to solution.
Scale Inhibitor/Dispersant (assume 2-Phosphono-1,2,4-butane tricarboxylic acid)	10,000	Liquid Solution	NE	NF	Solid--in a solution	No further analysis. No toxicity limit established.
Non Oxidizing Biocide (assume ethanol)	1,000	Liquid	3,300 ppm as ethanol	3.3/19	44 mmHg @ 68F	Toxicity/Flammability/ Explosion

Table 1: Chemical Screening/ Disposition (Continued)

Storage Location: UHS Cooling Towers						
Sodium Hypochlorite [1]	2,000	Liquid Solution	10 ppm as Cl_2	NF	17.5 mmHg @ 68F	Toxicity
Sodium Bisulfite	350	Liquid Solution	5 mg/m^3 (TLV-TWA)	NF	Solid--in a solution	No further analysis. TWA established for solid – not applicable to solution.
Scale Inhibitor/Dispersant (assume 2-Phosphono-1,2,4-butane tricarboxylic acid)	350	Liquid Solution	NE	NF	Solid--in a solution	No further analysis. No toxicity limit established.
Non Oxidizing Biocide (assume ethanol at weight percent)	350	Liquid	3,300 ppm as ethanol	3.3/19	44 mmHg @ 68F	Toxicity/Flammability/ Explosion
Storage Location: Desalination Building						
Sodium Bisulfite	1,000	Liquid Solution	5 mg/m^3 (TLV-TWA)	NF	Solid--in a solution	No further analysis. TWA established for solid – not applicable to solution.
Antiscalant (Sodium Hexametaphosphate)	350	Liquid Solution	NE	NF	Solid--in a solution	No further analysis. No toxicity limit established.
Sulfuric Acid [2]	7,500	Liquid	15 mg/m^3	NF	0.001 mmHg @ 68F	No further analysis. Low vapor pressure.

Table 1: Chemical Screening/ Disposition

Note: NE = Not Established, NF = Not Flammable, LFL=Lower Flammable Limit, UFL=Upper Flammable Limit, IDLH=Immediately Dangerous to Life and Health, TLV-TWA = Threshold Limit Value – Time Weighted Average

[1] Sodium Hypochlorite does not have a determined IDLH value listed in NIOSH; however, MSDS's have listed a toxicity limit for Sodium Hypochlorite as 10 ppm--as chlorine. Speculation exists on the exact chlorine species that are present in the vapor. The vapor pressures of sodium hypochlorite solutions are less than the vapor pressure of water at the same temperature. However, because of the potential for sodium hypochlorite to decompose and release chlorine gas upon heating, sodium hypochlorite was conservatively evaluated for toxicity.

[2] Sulfuric acid has a very low vapor pressure and therefore an air dispersion hazard resulting from the formation of a toxic vapor cloud is not a likely route of exposure.

[3] The plant intake, where the 20,000 gallon tank of sodium hypochlorite is stored, is further from the control room than the CW cooling tower, where the 40,000 gallon tank of sodium hypochlorite is stored. Therefore, the 20,000 gallon tank is bounded by the 40,000 gallon tank.

Results:

Explosion (TNT Mass Equivalency) Analysis:

The chemical identified for further analysis with regard to explosion potential was the non-oxidizing biocide (ethanol 10 percent by weight). There are three tanks of the non-oxidizing biocide (ethanol 10 percent by weight) stored near CCNPP Unit 3: a 1,000 gallon tank to be located near the CW cooling tower and two 350 gallon totes, one each to be located near each set of UHS cooling towers. A conservative analysis using TNT equivalency methods was used to determine safe distances, the minimum separation distance required for an explosive force to not exceed 1 psi peak incident pressure for the identified chemical. It was assumed for the TNT analysis, that only the percentage of the contents of the non-oxidizing biocide tank that is ethanol (i.e., 42.66 gallons of ethanol for a 350 gallon non-oxidizing biocide tote) was evaluated. The determined safe distance for a 1,000 gallon tank (10 percent ethanol by weight) is 58 feet. The determined safe distance for a 350 gallon tote (for 10 percent ethanol by weight) is 41 feet.

Flammable Vapor Clouds and Explosive Vapor Clouds Delayed Ignition Analysis:

The chemical identified for further analysis with regard to forming a flammable vapor cloud capable of delayed ignition was the non-oxidizing biocide (ethanol 10 percent by weight). The ALOHA dispersion model was used to determine the distance the vapor cloud could travel prior to reaching the LFL boundary. In each instance, for the 1,000 gallon tank (10% ethanol by weight or 122 gallons) to be located near the CW cooling tower and for the two 350 gallon totes (10% ethanol by weight or 42.66 gallons), one each to be located near each set of UHS cooling towers, the distance to the LFL is less than 33 feet. (Tables 2 and 3 below)

The ALOHA dispersion model was also used to determine the safe distance (i.e., the minimum distance required for an explosion to have less than 1 psi peak incident pressure) for the non-oxidizing biocide (ethanol 10 percent by weight). The determined safe distance for the 1,000 gallon tank is 36 feet; and for the 350 gallon tote, no detonation/explosion occurs because not enough vapor is released from the spill for a vapor cloud explosion to occur. (Tables 2 and 3 below)

Toxicity Analysis:

The chemicals identified for further analysis with regard to the potential of forming a toxic vapor cloud following an accidental release were the non-oxidizing biocide (ethanol 10 percent by weight) and sodium hypochlorite. The ALOHA dispersion model was used to determine the distance, under a spectrum of meteorological conditions, that the formed vapor cloud could travel prior to reaching the IDLH.

Non-oxidizing biocide (ethanol 10 percent by weight):
While the proprietary biocide does not have an IDLH limit or other determined toxicity limit, one of the components, ethanol, has an IDLH limit. The determined safe distance, the maximum distance a vapor cloud can travel before it disperses enough to fall below the IDLH limit, for the 1,000 gallon tank (10 percent ethanol by weight or 122 gallons of ethanol) is 75 feet. The determined safe distance for a 350 gallon tote (10 percent ethanol by weight or 42.66 gallons of ethanol), is 45 feet (Tables 2 and 3 below). These determined safe distances are conservative as they do not take into account the indoor air concentration.

Sodium Hypochlorite:

Sodium hypochlorite does not have a determined IDLH value listed in NIOSH. However, material safety data sheets have listed a toxicity limit for sodium hypochlorite as 10 ppm, as chlorine. While, the vapor pressure of sodium hypochlorite solutions are less than the vapor pressure of water at the same temperature, because of the potential for sodium hypochlorite to decompose and release chlorine gas upon heating, sodium hypochlorite was conservatively evaluated for toxicity. Since sodium hypochlorite does not exist in the ALOHA chemical library, its chemical properties (listed below) were added into the chemical library in order to add sodium hypochlorite as a new chemical.

- Molecular weight: 74.44 g/mol
- Boiling point: 373.15 K
- Critical pressure: 7,711,000 Pa (as chlorine)
- Critical temperature: 417.15 K (as chlorine)
- Freezing point: 270.15 K
- Gas heat capacity: 454.46 J/kg-K @ 305.59 K (as chlorine)
- Liquid heat capacity: 997.18 J/kg-K @ 298.15 K (as chlorine)
- IDLH: 10 ppm (as chlorine)

There are four tanks of sodium hypochlorite that will be stored near CCNPP Unit 3: a 20,000 gallon tank located near the Plant Intake structure, a 40,000 gallon tank located near the CW cooling tower and two 2,000 gallon tanks, one each located near each set of UHS cooling towers. A scenario involving the 20,000 gallon sodium hypochlorite tank was not analyzed because this tank is bounded by the 40,000 gallon tank located near the CW cooling tower (the smaller tank is further from the control room). The determined safe distance from the control room air intake, the maximum distance a vapor cloud can travel before it disperses enough to fall below the IDLH limit, for the 40,000 gallon tank is 396 feet. The determined safe distance from the control room air intake for a 2,000 gallon tank, is 93 feet (Tables 4 and 5 below). These determined safe distances are conservative, as they do not take into account the indoor air concentration.

The results of these analyses indicate that toxic vapor clouds resulting from chemical spills of the above onsite chemicals will not adversely affect the safe operation of CCNPP Unit 3. Therefore no changes are required to the conclusions made in FSAR Section 2.2.3.1.

Table 2: ALOHA Results for Non-oxidizing Biocide (as ethanol) – CW Cooling Tower – 1,000 Gallons[a]

Stability Class	Surface Wind Speed (m/s)	Distance to IDLH (ft)	Distance to UFL (ft)	Distance to LFL (ft)	Distance to 1 psi (ft)
A	1.5	< 33	< 33	< 33	No explosion
B	1.5	< 33	< 33	< 33	No explosion
C	3	< 33	< 33	< 33	No explosion
C	5.5	< 33	< 33	< 33	No explosion
D	3	< 33	< 33	< 33	No explosion
D	5.5	< 33	< 33	< 33	No explosion
E	1	63	*	*	No explosion
E	2	36	< 33	< 33	No explosion
F	1	75	*	< 33	36
F	2	66	*	*	No explosion
F	3	63	<33	<33	No explosion

* Note: The concentration is never reached in the vapor cloud.
[a] The actual quantity of ethanol analyzed (10 percent by weight) was 122 gallons.

Table 3: ALOHA Results for Non-oxidizing Biocide (as ethanol) – UHS Cooling Towers – 350 Gallons[a]

Stability Class	Surface Wind Speed (m/s)	Distance to IDLH (ft)	Distance to UFL (ft)	Distance to LFL (ft)	Distance to 1 psi (ft)
A	1.5	< 33	< 33	< 33	No explosion
B	1.5	< 33	< 33	< 33	No explosion
C	3	< 33	< 33	< 33	No explosion
C	5.5	< 33	< 33	< 33	No explosion
D	3	< 33	< 33	< 33	No explosion
D	5.5	< 33	< 33	< 33	No explosion
E	1	36	*	*	No explosion
E	2	< 33	< 33	< 33	No explosion
F	1	45	*	< 33	< 33
F	2	45	< 33	< 33	No explosion
F	3	39	<33	< 33	No explosion

* Note: The concentration is never reached in the vapor cloud.
[a] The actual quantity of ethanol analyzed (10 percent by weight) was 42.66 gallons.

Table 4: ALOHA Results for Sodium Hypochlorite – CW Cooling Tower – 40,000 Gallons

Stability Class	Surface Wind Speed (m/s)	Distance to IDLH (ft)
A	1.5	228
B	1.5	228
C	3	228
C	5.5	228
D	3	228
D	5.5	228
E	1	228
E	2	228
F	1	396
F	2	384
F	3	369

Table 5: ALOHA Results for Sodium Hypochlorite – UHS Cooling Towers – 2,000 Gallons

Stability Class	Surface Wind Speed (m/s)	Distance to IDLH (ft)
A	1.5	51
B	1.5	51
C	3	51
C	5.5	51
D	3	51
D	5.5	51
E	1	51
E	2	51
F	1	93
F	2	90
F	3	84

9. The applicant did not provide information about the electrical power for the RWSS. The applicant did not provide information about the electrical power for the desalinated water plant.

Response for Part 9:

FSAR Section 9.2.9.2 will be updated to state that two separate normal power supplies are provided to the desalinization building to allow RWSS equipment supporting desalination to remain operational if one power supply is lost. The RWSS and desalinated water plant are not credited to be available during a Loss of Offsite Power or Station Blackout event.

10. RWSS component, such as RWSS pump starts, based on instrumentation and controls logic is not discussed.

Response for Part 10:

FSAR Section 9.2.9 states that the supply of raw (brackish) water is supplied to the RWSS by the circulating water makeup pumps; there is no separate RWSS supply pump. Instrumentation and controls (I&C) logic for the circulating water makeup pumps is provided in FSAR Section 10.4.5.

The raw (desalinated) water supply system pumps that transport water to various system users are the desalinated water transfer pumps. Their current I&C logic is one of the two 100% capacity desalinated water transfer pumps will be manually started if the system is not operational. As stated in FSAR Section 14.2.14.1, the standby pump will automatically start on low discharge pressure or the standby pump will automatically start if the running pump is tripped.

FSAR Section 9.2.9.3 will be revised to remove "desalinated water transfer pumps – Potable Water," which are part of the Potable and Sanitary Water System, and not part of the RWSS.

11. CCNPP Unit 3 COL Application, Part 10, Table 2.3-25 (2.4-25), "Raw Water Supply System" Inspection, Tests, Analysis, and Acceptance Criteria," does not have meter numbers.

Response for Part 11:

The metric equivalents of the values contained in COLA Part 10, Appendix B, Table 2.4-25 will be provided as follows:

300,000 gallons (1.14 million liters) and 625 gallons (2366 liters) per minute.

COLA Impact

FSAR Section 2.2.2.1 will be updated as follows in a future COLA revision (Only the affected text is shown):

2.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

2.2.2 DESCRIPTIONS

2.2.2.1 Description of Facilities

In accordance with 10 CFR 50.34 (CFR, 2007c) and Regulatory Guide 1.206 (NRC, 2007b), three facilities, along with the onsite chemicals and chemical storage facilities associated with Unit 3, were identified for review: CCNPP Units 1 and 2; DCPLNG; and Patuxent River Naval Air Station, a military installation.

FSAR Section 2.2.3.1.1 will be updated as follows in a future COLA revision (Only the affected text is shown):

2.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

2.2.3.1 Determination of Design-Basis Events

2.2.3.1.1 Explosions

The allowable and actual distances of hazardous chemicals transported or stored were determined in accordance with NRC Regulatory Guide 1.91, Revision 1, Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants (NRC, 1978a). Regulatory Guide 1.91 cites 1 psi (6.9 kPa) as a conservative value of peak positive incident overpressure, below which no significant damage would be expected. Regulatory Guide 1.91 defines this safe distance by the relationship $R \geq kW^{1/3}$ ~~1/3~~ where R is the distance in feet from an exploding charge of W pounds of TNT; and the value k is a constant. The TNT mass equivalent, W, was determined following guidance in NUREG-1805 (NRC, 2004a), where $W = M_{Vapor} * \Delta H_C * Y_f/2000$ and M_{Vapor} is the flammable vapor mass, ΔH_C is the heat of combustion and Y_f is the explosion yield factor.

Pipelines

The DCPLNG facility operates a pipeline corridor that passes with in the vicinity of the CCNPP site. Section 2.2.3 addresses the overall risk from the D~~O~~CPLNG facility and pipeline. Experiments have indicated that detonations of mixtures of methane (greater than 85%) with air do not present a credible outdoor explosion event. (FMIC, 2005) Further, there have been no reported vapor cloud explosions involving natural gas with high methane content-there have been numerous reports of vapor clouds igniting resulting in flash fires without overpressures. (FMIC, 2005) Therefore, an outdoor natural gas explosion resulting from a ruptured gas pipeline is considered an unlikely event. Thus, the ignition of a natural gas cloud within ~~in~~ a confined or congested space, such as woodlands, which may produce damaging explosion overpressures, was considered the bounding event and is presented in Section 2.2.3.1.2. Therefore, it was concluded that damaging overpressures from an explosion from a rupture in the DCPLNG pipeline would not adversely affect the operations of CCNPP Unit 3.

Onsite Chemicals

~~CCNPP Unit 3 is located in close proximity to the existing CCNPP Units 1 and 2, and their associated chemical storage locations. The chemicals utilized in CCNPP Unit 3 will be similar to the chemicals utilized in CCNPP Units 1 and 2, and are not stored closer to safety-related CCNPP Unit 3 structures than the minimum separation distance.~~ The hazardous materials stored onsite that were identified for further analysis with regard to explosion potential were: gasoline, hydrazine (35% solution), dimethylamine (2% solution), and hydrogen stored at Units 1 & 2. One of the water treatment chemicals, a non-oxidizing biocide containing ethanol, and g~~G~~as cylinders containing argon-methane, hydrogen, and oxygen ~~which will be~~ stored ~~at~~ near Unit 3 were also analyzed for explosion potential.

The 4,000 gallon (15,140 L) onsite gasoline tank is an underground storage tank. Therefore, it was assumed that the explosion would be bounded by an event involving a 3,500 gallon (13,250 l) gasoline delivery tanker, either in route, or during or following a filling operation. A conservative analysis using TNT equivalency methods as described in Section 2.2.3.1 was used to determine safe distances for the storage of the identified hazardous materials.

Oxygen is not explosive by ignition, however gas cylinders have the potential for explosion due to overpressure. Therefore, the equivalent mass of TNT from oxygen was calculated using this methodology (NRC, 1985).

The results using this methodology indicate that the minimum separation distances (i.e., safe distances) are less than the shortest distance to a safety-related CCNPP Unit 3 structures and the storage location of any of the identified chemicals. Therefore, an explosion from any of the onsite hazardous materials evaluated would not adversely affect operation of CCNPP Unit 3. The safe distance for gasoline is 196 ft (60 m); for hydrazine (35% solution), 114 ft (35 m); for dimethylamine (2% solution), 85 ft (26 m); for hydrogen, 224 ft (68 m). Gasoline is stored approximately 310 ft (94 m); hydrazine (35% solution) approximately 891 ft (272 m); dimethylamine (2% solution) approximately 462 ft (141 m); and hydrogen 745 ft (227 m); from the nearest safety-related structure for CCNPP Unit 3 (Table 2.2-9). ~~The location of t~~ The non-oxidizing biocide containing ethanol and the argon-methane gas ~~cylinder~~, hydrogen gas ~~cylinder~~, and oxygen gas cylinders ~~is not yet~~ are ~~determined. These chemicals must be~~ stored at distances greater than those reported in Table 2.2-9.

FSAR Section 2.2.3.1.2 will be updated as follows in a future COLA revision (Only the affected text is shown):

2.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

2.2.3.1 Determination of Design-Basis Events

2.2.3.1.2 Flammable Vapor Clouds (Delayed Ignition)

~~Ammonium hydroxide was analyzed across a spectrum of meteorological conditions.~~

The analyzed effects of flammable vapor clouds and vapor cloud explosions from internal and external sources are summarized in Table 2.2-9 and are described in the following sections relative to the release source.

Onsite Chemicals

~~CCNPP Unit 3 is located in close proximity to the existing CCNPP Units 1 and 2 and its associated chemical storage locations. The chemicals utilized in CCNPP Unit 3 will be similar to the chemicals utilized in CCNPP Units 1 and 2, and are not stored closer to safety-related CCNPP Unit 3 structures than the minimum separation distance. Gas cylinder storage, unique to chemical storage for Unit 3, has been identified for analysis.~~ The hazardous materials stored at the CCNPP Units 1 and 2 site that were identified for further analysis with regard to the potential of delayed ignition and explosion of flammable vapor clouds were: gasoline; hydrazine (35% solution); dimethylamine (2% solution); and hydrogen. One of the water treatment chemicals, a non-oxidizing biocide containg ethanol, and aArgon-methane and hydrogen gas cylinders stored at Unit 3 were identified for further analysis.

As described previously in Section 2.2.3.1.2, the ALOHA dispersion model was used to determine the distance a vapor cloud can travel before reaching the LFL boundary (i.e., the safe distance for exposure to thermal radiation heat flux) once a vapor cloud has formed from release of the identified chemical. The distances to the LFL boundary from the release point for the identified chemicals are: gasoline, 234 ft (71 m); hydrazine (35% solution), less than 33 ft (10 m); dimethylamine (2% solution), 45 ft (14 m); hydrogen; 492 ft (150 m); argon-methane gas cylinder 69 ft (21 m); and hydrogen gas cylinder 75 ft (23 m). Each of these distances is less than the distance from a potential release site to the nearest safety-related CCNPP Unit 3 structure. The non-oxidizing biocide containing ethanol and ~~location of~~ the argon-methane gas ~~cylinder~~ and hydrogen gas cylinders are ~~is not yet determined therefore they should be~~ stored at distances greater than those reported ~~above and~~ in Table 2.2-9.

FSAR Section 2.2.3.1.3 will be updated as follows in a future COLA revision (Only the affected text is shown):

2.2 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

2.2.3.1 Determination of Design-Basis Events

2.2.3.1.3 Toxic Chemicals

Highways

The methodology presented in Section 2.2.3.1.3 was used to determine the distance from the release site to the point where the toxic vapor cloud reaches the IDLH boundary. For gasoline and gasoline (aviation) the time weighted average (TWA) and short term exposure (STEL) toxicity limits were conservatively used since no IDLH value is available for either of these hazardous materials. The TWA is the average value of exposure over the course of an 8 hour work shift. The STEL is a 15 minute TWA concentration that may not be exceeded, even if the 8 hour TWA is within the standards.

The maximum concentration of the evaluated chemicals attained in the control room, under worst case meteorological conditions, during the first hour of the release was also determined for the identified hazardous materials. In each scenario, it was conservatively estimated that the transport vehicle lost the entire contents, 50,000 pounds (22,680 kg), as provided in Regulatory Guide 1.91 (NRC, 1978a). The results indicate that any toxic vapor clouds that form after an accidental release on MD 2/4 and travel toward the control room will not cause an airborne concentration above the IDLH limit (or TWA/STEL in the case of gasoline or aviation gasoline) in the control room.

Therefore, toxic vapor clouds resulting from chemical spills on MD 2/4 will not adversely affect the safe operation of CCNPP Unit 3. The effects of toxic chemical releases are summarized in Table 2.2-10.

Onsite Chemical Storages

The hazardous materials stored onsite that were identified for further analysis with regard to the potential of the formation of toxic vapor clouds formed after an accidental release are: gasoline; ammonium hydroxide (28% solution); sodium hypochlorite; hydrazine (35% solution); monoethanolamine; dimethylamine (2% solution); hydrochloric acid (30% solution); hydrogen (asphyxiant) and liquid nitrogen (asphyxiant). Two water treatment chemicals, a non-oxidizing biocide containing ethanol and sodium hypochlorite, gGas cylinders stored at CCNPP Unit 3 containing argon, argon-methane, hydrogen, and nitrogen, which are all asphyxiants, were identified for further analysis for the formation of toxic/asphyxiating vapor clouds.

As described in Section 2.2.3.1.3, the identified hazardous materials~~, with the exception of gasoline,~~ were analyzed utilizing the ALOHA dispersion model to determine whether the formed vapor cloud will reach the control room intake and what the concentration of the toxic chemical will be in the main control room after an accidental release.

Hydrogen and liquid nitrogen concentrations were determined at the control room after a release of the largest vessel. In each case, the concentration at the CCNPP Unit 3 control room of the asphyxiants located at CCNPP Unit 1 and 2, (~~1.91~~53.0 ppm for hydrogen, and ~~474~~ 635 ppm for liquid nitrogen,) would not displace enough oxygen for the CCNPP Unit 3 main control room to become an oxygen-deficient environment. Similarly, ~~the concentration of~~ the asphyxiants ~~at the control room~~ associated with the gas cylinder storage at CCNPP Unit 3, are stored farther than the determined safe distance (the distance to where the vapor cloud would travel prior to falling below a concentration which could result in the displacement of a significant fraction of the control room air--defined by the OSHA) under worst case meteorological conditions (~~45.7~~ 42 ft ~~ppm~~ for argon gas ~~cylinder, 154 ppm for~~ and argon-methane gas cylinders, ~~147 ppm~~ 39 ft for hydrogen gas cylinders, and ~~129 ppm~~ 36 ft for nitrogen gas cylinders) ~~would not displace enough oxygen for the CCNPP Unit 3 control room to become an oxygen-deficient environment~~.

With the exception of ammonium hydroxide and the 3,500 gallon (13,250 l) gasoline delivery truck, the remaining chemical analyses indicate that the control room would remain habitable for the worst case release scenario. The worst case release scenario in these analyses included a total loss of the largest vessel into an unconfined puddle under determined worst case meteorological ~~stable atmospheric~~ conditions.

FSAR Table 2.2-2 will be updated as follows in a future COLA revision:

Table 2.2-2 – {CCNPP Units 1, 2 and 3 Onsite Chemical Storage}

Material	Toxicity Limits (IDLH)	Quantity	Largest Container	Location	Shipping Mode	Annual Frequency
			CCNPP Unit 3			
Argon (gas cylinder)	Asphyxiant	270 scf (7.65 Nm^3) (see Note 2)	1.76 cu ft cylinders (see Note 2)	Central Gas Supply Systems Building	N/A (see Note 3)	N/A (see Note 3)
Argon-Methane (gas cylinder)	Asphyxiant	282 scf (7.99 Nm^3) (see Note 2)	1.76 cu ft cylinders (see Note 2)	Central Gas Supply Systems Building	N/A (see Note 3)	N/A (see Note 3)
Hydrogen (gas cylinder)	Asphyxiant	278 scf (7.87 Nm^3) (see Note 2)	1.76 cu ft cylinders (see Note 2)	Central Gas Supply Systems Building	N/A (see Note 3)	N/A (see Note 3)
Nitrogen (gas cylinder)	Asphyxiant	235 scf (6.65 Nm^3) (see Note 2)	1.76 cu ft cylinders (see Note 2)	Central Gas Supply Systems Building	N/A (see Note 3)	N/A (see Note 3)
Oxygen (gas cylinder)	Asphyxiant	282 scf (7.99 Nm^3) (see Note 2)	1.76 cu ft cylinders (see Note 2)	Central Gas Supply Systems Building	N/A (see Note 3)	N/A (see Note 3)
Sodium Hypochlorite	10 ppm as Cl_2	20,000 gal (75,700 l) Plant Intake / 40,000 gal (151,400 l) CW / (2) 2,000 gal (7,600 l) UHS	40,000 gal (15,000 l)	CW Cooling Tower	N/A (see Note 3)	N/A (see Note 3)
Sulfuric Acid	15 mg/m^3	25,000 gal (94,600 l) CW / 7,500 gal (28,400 l) Desalination Building	25,000 gal (94,600 l)	CW Cooling Tower	N/A (see Note 3)	N/A (see Note 3)
Sodium Bisulfite	5 mg/m^3 (TLV-TWA)	5,000 gal (18,900 l) CW / (2) 350 gal (1,300 l) UHS / 1,000 gal (3,800 l) Desalination Building	5,000 gal (18,900 l)	CW Cooling Tower	N/A (see Note 3)	N/A (see Note 3)
Scale Inhibitor /Dispersant (2-Phosphono-1,2,4-butane tricarboxylic acid)	None established	10,000 gal (37,900 l) CW / (2) 350 gal (1,300 l) UHS	10,000 gal (38,000 l)	CW Cooling Tower	N/A (see Note 3)	N/A (see Note 3)
Non-Oxidizing Biocide (ethanol)	3,300 ppm as ethanol	1,000 gal (3,800 l) CW / (2) 350 gal (1,300 l) UHS	1,000 gal (3,800 l)	CW Cooling Tower	N/A (see Note 3)	N/A (see Note 3)
Antiscalant (Sodium Hexametaphosphate)	None established	350 gal (1,300 l) Desalination Building	350 gal (1,300 l)	Desalination Building	N/A (see Note 3)	N/A (see Note 3)

FSAR Table 2.2-5 will be updated as follows in a future COLA revision:

Table 2.2-5 – {Onsite Chemical Disposition}

Material	Toxicity Limit (IDHL)	Flammability	Explosion Hazard?	Vapor Pressure	Disposition
Hydrochloric Acid	50 ppm	Not flammable	None listed	7.929 psi @ 100°F/ 54.7 kPa @ 37.8°C	Toxicity Analysis
			CCNPP Unit 3		
Argon	None estab.	Not flammable	None listed	Not available	Toxicity-consider as asphyxiant
Argon-Methane (considered as methane	None estab.	5-15%	May explode	31.580 psi @ 240°F/ 217 kPa @ 115.5°C	Toxicity-consider as asphyxiant Flammability Analysis Explosion Analysis
Hydrogen	None estab.	4.0-75%	Vapor may explode	29.030 @ 418°F/ 200 kPa @ 214°C	Toxicity-consider as asphyxiant Flammability Analysis Explosion Analysis
Nitrogen gas	None estab.	Not flammable	None listed	65.820 psi @ 294°F/ 453.8 kPa @ 145.5°C	Toxicity-consider as asphyxiant
Oxygen	None estab.	Not flammable	May explode	36.260 psi @ 280°F/ 250 kPa @ 137.8°C	Explosion Analysis
Sodium Hypochlorite	10 ppm as Cl_2	Not flammable	None listed	17.5 mmHg @ 68F	The 20,000 gallon tank located at the plant intake is bounded by the 40,000 gallon tank located at the CW Tower (The 20,000 gallon tank is further away from the control room HVAC intakes.)
Sulfuric Acid	15 mg/m^3	Not flammable	None listed	0.001 mmHg @ 68F	No further analysis required - low vapor pressure (Note 1)
Sodium Bisulfite	5 mg/m^3 (TLV-TWA)	Not flammable	None listed	N/A-solid in a solution	No further analysis required.
Scale Inhibitor /Dispersant (2-Phosphono-1,2,4-butane tricarboxylic acid)	None estab.	Not flammable	None listed	N/A-solid in a solution	No further analysis required.
Non-Oxidizing Biocide (ethanol)	3,300 ppm as ethanol	3.3-19%	Vapor may explode	44 mmHg @ 68F	Toxicity Analysis Flammability Analysis Explosion Analysis
Antiscalant (Sodium Hexametaphosphate)	None estab.	Not flammable	None listed	N/A-solid in a solution	No further analysis required.

FSAR Table 2.2-8 will be updated as follows in a future COLA revision:

Table 2.2-8—{Explosion Event Analysis}

Source	Pollutant Evaluated	Quantity	Heat of Combustion (Btu/lb)/(kJ/kg)	Distance to Nearest CCNPP Unit 3 Safety Related Structure	Distance at 1 psi (6.9 kPa) Peak incident Pressue
Maryland Route 2/4	Gasoline (Note 1)	8,500 gal/ 32,000 l	18,720/ 43,514	6,119 ft/ 1.9 km	263 ft/ 50.2 m
	Gasoline (aviation) (Note 1)	8,500 gal/ 32,000 l	18,720/ 43,514		260 ft/ 79.2 m
	Propane (Note 2)	50,000 lbs/ 19,782 kg			3,559 ft/ 1.1 km
Pipeline - DCPLNG	Liquefied Natural Gas (Note 3)				
Navigable Waterway	Gasoline (Notes 1 and 4)	5,200,000 lbs/ 2,400,000 kg	18,720/ 43,514	11,678 ft/ 3.6 km	1,222 ft/ 372.5 m
	Benzene (Notes 1 and 4)	5,200,000 lbs/ 2,400,000 kg	17,460/ 4,585		1,076 ft/ 328 m
	Toluene (Notes 1 and 4)	5,200,000 lbs/ 2,400,000 kg	17,430/40,572		1,072 ft/ 326.7 m
On-Site (CCNPP Units 1 & 2)	Gasoline (Notes 1 and 5) (3,500 gal (15,900 l) tank truck) (Notes 1 and 3)	3,500 gal/ 13,250 l	18,720/ 43,514	310 ft/ 94.5 m	196 ft/ 59.7 m
	Hydrazine (35% solution) (Note 1)	350 gal/ 1,325 l	8,345/19,397	891 ft/ 271.6 m	114 ft/ 34.7 m
	Dimethylamine (2% solution) (Note 1)	350 gal/ 1,325 l	16,800/39,051	462 ft/ 140.8 m	85 ft/ 25.9 m
	Hydrogen (Note 2)	460 cu ft/ 13 cu m	50,080/116,411	745 ft/ 271.6 m	224 ft/ 68.3 m
On-Site (CCNPP Unit 3)	Argon - Methane (considered as methane (Note 2)	282 scf/ 7.99 Nm^3	21,517/ 50,029	~~233 ft/ 71 m~~ (Note 9)	119ft/ 36.2 m
	Hydrogen (Note 2)	278 scf/ 7.87 Nm^3	50,080/120,000	~~233 ft/ 71 m~~ (Note 9)	133 ft/ 40.5 m
	Oxygen (Note 2)	282 scf/ 7.99 Nm^3	N/A (Note 6)	~~233 ft/ 71 m~~ (Note 9)	41 ft/ 13 m
	Non-Oxidizing Biocide (ethanol) (Note 7)	1,000 gal/ 3,800 l	11,570/ 26,880 kJ/kg	(Note 9)	58 ft/ 17.7 m
	Non-Oxidizing Biocide (ethanol) (Note 8)	350 gal/ 1,300 l	11,570/ 26,880 kJ/kg	(Note 9)	41 ft/ 12.5 m
Nearby facilities	DCPLNG (associated hazards) (Note 3)				

scf: Standard cubic feet

Nm^3: Normal cubic meter

Note 1: For atmospheric liquids, the storage vessel was assumed to contain the quantity of fuel vapors in air at the upper explosive limit.

Note 2: For compressed or liquefied gases, the entire content of the storage vessel was conservatively assumed as the flammable mass.

Note 3: The DCPLNG pipeline explosion and all explosive hazards from the DCPLNG facility are bounded by the DCPLNG pipeline vapor cloud explosion.

Note 4: The maximum quantity shipped per shipment for gasoline, benzene, and toluene was not available. Therefore, it was assumed that the maximum quantity was 5.2 million lbs. (2.4 million kg) (CRS)

Note 5: The 4,000 gallon gasoline tank is an underground storage tank. The toxicity event is bounded by the 3,500 gallon gasoline delivery tank truck.

Note 6: Oxygen is not explosive by ignition and has no reported heat of combustion; therefore it was analyzed for explosion by overpressure (USCG, 2007).

Note 7: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 122 gal/ 462 l.

Note 8: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 42.66 gal/ 161.3 l.

Note 9: The evaluated pollutant is stored at a distance greater than the reported safe distance (the minimum distance required for an explosion to have less than 1 psi peak incident pressure).

FSAR Table 2.2-9 will be updated as follows in a future COLA revision:

Table 2.2-9—{Flammable Vapor Cloud Events (Delayed Ignition) and Vapor Cloud Explosion Analysis}

Source	Pollutant Evaluated & Quantity	Distance to Nearest CCNPP Unit 3 Safety Related Structure	Distance to UFL	Distance to LFL	Safe Distance for Vapor Cloud Explosions	Peak Over pressure at Nearest CCNPP Unit 3 Safety Related Structure
Maryland Route 2/4	Gasoline (8,500 gal)/ 32,176 l (Note 7)	6,119 ft/ 1,865 m to Ultimate Heat Sink (UHS)	234 ft/ 71.3 m	393 ft/ 119.8 m	999 ft/ 304.5 m	Not Significant (Note 5)
	Gasoline (aviation) (8, 500 gal)/ 32,176 l (Note 7)		237 ft/ 72.2 m	414 ft/ 126.2 m	1,002 ft/ 305.4 m	Not Significant (Note 5)
	Propane (50,000 lbs)/ 22,680 kg (Note 8)		1,167 ft/ 356 m	2,361 ft/ 720 m	4,185 ft/ 1,276 m	0.526 psi (3.63 kPa)
Waterway (Chesapeake Bay)	Gasoline (5,200,000 lbs)/ 2,360,000 kg (Note 6)	11,678 ft/ 3,560 m to UHS makeup intake water structure	783 ft/ 356 m	1,464 ft/ 1,276 m	3,312 ft? 1,009 m	0.159 psi (1.10 kPa)
	Benzene (5,200,000 lbs)/ 2,360,000 kg (Note 6)		951 ft/ 290 m	2,172 ft/ 662 m	4,095 ft (1,284 m)	0.209 psi (1.44 kPa)
	Toluene (5,200,000 lbs)/ 2,360,000 kg (Note 6)		696 ft/ 212 m	1,302 ft/ 397 m	2,604 ft (794 m)	0.115 psi (0.793 kPa)
	Ammonia (1,200,000 lbs)/ 544,311 kg (Note 3)		4,746 ft/ 1,447 m	6,864 ft/ 2,092 m	10,032 ft/ 3,058 m	0.684 psi/ 4.72 kPa
On-Site (CCNPP Units 1 & 2)	Gasoline (3,500 gal) / 13,249 l (Note 4)	310 ft/ 94.5 m	144 ft/ 44m	234 ft/ 71 m	648 ft/ 198 m	5.62 psi/ 38.7 kPa (Note 1)
	Hydrazine (35% solution) (350 gal)/1,325 l	891 ft/ 272 m	<33 ft/ <10.1 m	<33 ft/ <10.1 m	No explosion	No explosion
	Dimethylamine (Note 9) (2% solution) (350 gal)/1,325 l	462 ft/ 141 m	<33 ft/ <10.1 m	45 ft (14 m)	180 ft/ 55 m	0.282 psi/ 1.94 kPa
	Hydrogen (460 cu ft)/ 13 cu m	745 ft/ 227.1 m	108 ft/ 33 m	492 ft/ 150 m	738 ft/ 225 m	0.984 psi/ 6.78 kPa
On-Site (CCNPP Unit 3)	Argon - Methane (Note 10) (282 scf)/ 7.99 Nm^3 (considered as methane	(Note 15)	39 ft/ 11.9 m	69 ft/ 21 m	126 ft/ 38 m	~~0.24 psi/ 1.69 kPa~~ (Note 15)
	Hydrogen (Note 11) (278 scf)/ 7.87Nm^3	(Note 15)	<33 ft/ <10.1 m	75 ft/ 23 m	138 ft/ 42 m	~~0.17 psi/ 1.2 kPa~~ (Note 15)
	Non-Oxidizing Biocide (ethanol) / 1,000 gal/ 3,800 l (Note 12)	(Note 15)	(Note 13)	≤ 33 ft/ ≤ 10 m	36 ft/ 11 m	(Note 15)
	Non-Oxidizing Biocide (ethanol) / 350 gal/ 1,300 l (Note 14)	(Note 15)	(Note 13)	≤ 33 ft/ ≤ 10 m	≤ 33 ft/ ≤ 10 m	(Note 15)

scf: Standard cubic feet
Nm^3: Normal cubic meter
Note 1: This event was determined not to be a credible event based on an event probability of less than 1 E-7. Refer to Section 2.2.3.2.4 for the analysis of this event.

Note 2: Overall risk of fatality from DCPLNG facility and associated pipeline to CCNPP Site was evaluated to be 2.3E-9 per year (present operations) and 6.6E-9 per year (planned expansion). (The risk of physical damage to CCNPP Unit 3 is lower) The impact from blast overpressures was taken into account in developing this risk.

Note 3: The annual quantity of ammonia transported in proximity to the CCNPP Unit 3 site is 2.0 million pounds (0.9 million kg). The frequency of transport was not available; consequently, it was conservatively assumed that the entire 2.0 million pounds (0.9 million kg) was transported in one shipment and released. A 0.6 reduction factor was applied to the 2.0 million pounds (0.9 million kg) in the analysis to account for the high rate at which ammonia dissolves in water as ALOHA does not account for this phenomena.

Note 4: The 4,000 gallon gasoline tank is an underground storage tank. Therefore, the toxicity event is bounded by the 3,500 gallon gasoline delivery tank truck.

Note 5: ALOHA output results indicate "not significant" when the peak overpressure is <0.1 psi.

Note 6: The maximum quantity shipped for gasoline, benzene, and toluene was not available. Therefore, it was assumed that the maximum quantity was 5,200,000 lbs. (CRS, 2005)

Note 7: Gasoline and aviation gasoline were modeled in ALOHA as n-heptane. N-heptane is used as a substitute for gasoline because the molecular weight and physical properties are similar.

Note 8: The worst case combination of stability class and wind speed is F stability and a wind speed of 3m/sec for propane.

Note 9: The worst case combination of stability class and wind speed is E stability and a wind speed of 1m/sec for dimethylamine.

Note 10: The worst case combination of stability class and wind speed is E stability and a wind speed of 1m/sec for argon-methane.

Note 11: The worst case combination of stability class and wind speed is E stability and a wind speed of 1m/sec for the CCNPP Unit 3 hydrogen.

Note 12: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 122 gal/ 462l.

Note 13: The concentration is never reached in the vapor cloud.

Note 14: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 42.66 gal/ 161.3 l.

Note 15: The evaluated pollutant is stored at a distance greater than the reported safe distance for either the flammable vapor cloud accident category (the distance to the outer edge of the LFL section of the vapor cloud) or the reported safe distance for the vapor cloud explosion accident category (the minimum distance required for an explosion to have less than 1 psi peak incident pressure should a vapor cloud detonate).

FSAR Table 2.2-10 will be updated as follows in a future COLA revision:

Table 2.2-10—{Toxic Vapor Cloud Analysis}

Source	Chemical	Quantity	IDHL	Distance to CCNPP Unit 3 Control Room Intake	Distance to IDHL (Note 1)	Maximum Control Room Concentration (Note ~~8~~ 2)
Maryland 2/4	Gasoline	8,500 gal/ 32,200 l	300 ppm TWA/ 500 ppm STEL (Note ~~7~~ 3)	6,531 ft/ 1,991 m	~~1,965 ft/ 599 m~~ 1,752 ft/ 534 m	~~>1 hr~~ (Note 4) 9.44 ppm
	Gasoline (aviation)	8,500 gal/ 32,200 l	300 ppm TWA/ 500 ppm STEL (Note ~~7~~ 3)		~~1,965 ft/ 599 m~~ 1,752 ft/ 534 m	~~>1 hr~~ (Note 4) 9.45 ppm
	Propane	50,000 lbs/ 22,700 kg	2,100 ppm		5,022 ft/ 1,531 m	114 ppm
	Ammonium Hydroxide (19% solution)	50,000 lbs/ 22,700 kg	300 ppm for ammonia		8,448 ft/ 2,575 m	~~30.6 ppm~~ 70.9 ppm (Note 5)
Waterway (Chesapeake Bay)	Gasoline	5,200,000 lbs/ 24,000,000 kg	300 ppm TWA/ 500 ppm STEL (Note 7)	11,701 ft/ 3,566 m	~~7,392 ft/ 2,235 m~~ 6,336 ft/ 1,931 m	~~>1 hr (Note 4)~~ 18.5 ppm
	Benzene (Note ~~5~~ 6)	560,000 lbs/ 254,000 kg	500 ppm		~~10,560 ft/ 3,219 m~~ 5,808 ft/ 1,770 m	~~>1 hr (Note 4)~~ 33.0 ppm
	Toluene (Note ~~5~~ 6)	560,000 lbs/ 254,000 kg	500 ppm		~~7,920 ft/ 2,414 m~~ 4,551 ft/ 1,387 m	~~>1 hr (Note 4)~~ 19.7 ppm
	Ammonia	16,000 lbs/ 7,257 kg (Note ~~6~~ 7)	300 ppm		18,480 ft/ 5,633 m	~~>1 hr (Notes 1 and 4)~~ 83.5 ppm (Notes 5 and 8)
On-Site (CCNPP Units 1 & 2)	Ammonium Hydroxide (28% solution)	8,500 gal/ 32,176 l	300 ppm as ammonia	2,994 ft/ 913 m	13,200 ft/ 4,023 m	704 ppm (Note ~~2~~ 9)
	Gasoline (Note ~~3~~ 10)	3,500 gal/ 13,250 l	300 ppm TWA/ 500 ppm STEL	617 ft/ 188 m	1,230 ft/ 375 m	343 ppm (Note ~~2~~ 9)
	Sodium Hypochlorite	8,500 gal/ 32,176 l	10 ppm as chlorine	2,472 ft/ 753 m	~~189 ft/ 58 m~~ 174 ft/ 53 m	~~0.036 ppm~~ 0.0490 ppm (Note 4)
	Hydrazine (35% solution)	350 gal/ 1,325 l	50 ppm	1,489 ft/ 454 m	~~1,275 ft/ 389 m~~ 1,197 ft/ 365 m	~~9.73 ppm~~ 10.1 ppm (Note 5)
	Monoethanolamine	350 gal/ 1,325 l	30 ppm	2,889 ft/ 881 m	~~36 ft/ 11 m~~ 135 ft/ 41 m	~~0.005 ppm~~ 0.0784 ppm (Note 5)
	Dimethylamine (2% solution)	350 gal/ 1,325 l	500 ppm	2,889 ft/ 881 m	288 ft/ 88 m	0.743 ppm
	Hydrochloric Acid (30% solution)	3,000 gal/ 11,360 l	50 ppm	2,994 ft/ 913 m	~~2,040 ft/ 622 m~~ 3,102 ft/ 945 m	~~4.67 ppm~~ 14.1 ppm (Note 5)
	Hydrogen	460 cu ft/ 13 cu m	Asphyxiant	2,994 ft/ 913 m	Asphyxiant	~~1.91 ppm~~ 53.0 ppm
	Liquid Nitrogen	11,300 gal/ 42,775 l	Asphyxiant	2,994 ft/ 913 m	Asphyxiant	~~474 ppm~~ 635 ppm (Note 5)
On-Site (CCNPP Unit 3)	Argon	270 scf/ 7.64 Nm^3	Asphyxiant	~~233 ft/ 71 m~~ (Note 14)	Asphyxiant 42 ft/13m	~~45.7 ppm~~ (Note 11)
	Argon - Methane (considered as methane)	282 scf/ 7.99 Nm^3	Asphyxiant	~~233 ft/ 71 m~~ (Note 14)	Asphyxiant 42 ft/13m	~~154 ppm~~ (Note 11)

Source	Chemical	Quantity	IDHL	Distance to CCNPP Unit 3 Control Room Intake	Distance to IDHL (Note 1)	Maximum Control Room Concentration (Note 8 2)
	Hydrogen	278 scf/ 7.87 Nm^3	Asphyxiant	233 ft/ 71 m (Note 14)	Asphyxiant 39 ft/12m	147 ppm (Note 11)
	Nitrogen	235 scf/ 6.65 Nm^3	Asphyxiant	233 ft/ 71 m (Note 14)	Asphyxiant 36 ft/11m	129 ppm (Note 11)
	Sodium Hypochlorite	40,000 gal/ 150,000 l	10 ppm as Cl_2	(Note 14)	396 ft/ 121 m	(Note 14)
	Sodium Hypochlorite	2,000 gal/ 7,600 l	10 ppm as Cl_2	(Note 14)	93 ft/ 28 m	(Note 14)
	Non-Oxidizing Biocide (ethanol)	1,000 gal/ 3,800 l (Note 12)	3,300 ppm as ethanol	(Note 14)	75 ft/ 23 m	(Note 14)
	Non-Oxidizing Biocide (ethanol)	350 gal/ 1,300 l (Note 13)	3,300 ppm as ethanol	(Note 14)	45 ft/ 14 m	(Note 14)

TLV-TWA: Threshold Limit Value-Time-Weighted Average
STEL: Short term exposure limit
IDLH: Immediately Dangerous to Life and Health threshold value
scf: Standard cubic feet
Nm^3: Normal cubic meter

Note 1: The maximum ammonia control room concentration was not reached within 1 hour for ammonia. This event was evaluated to not to be a credible event based on event frequency. Refer to Section 2.2.3.3.3 for the analysis of this event.

Note 2: The ammonia spill event was determined not to be a credible event, in accordance with Regulatory Guide 1.78, based on event frequency. Refer to Section 2.2.3.1.3 for the analysis of this event.

Note 3: The 4,000 gallon gasoline tank reported in Table 2.2-2 is an underground storage tank. Therefore, the toxicity event is bounded by the 3,500 gallon gasoline delivery tank truck.

Note 4: ALOHA does not report values after 1 hour because it assumes that the weather conditions or other release circumstances are likely to change after an hour. The distance from the postulated spill location and the control room is much greater than the distances to the IDLH for gasoline, benzene, and toluene, such that significant concentrations of these chemical in the control room would not be expected to result.

Note 5: For benzene, and toluene a combined total of 28,000 short tons/year are shipped by barge. It is conservatively assumed that they are shipped in equal quantities (14,000 short tons per year each) and that they each have the minimum 50 shipments (Regulatory Guide 1.78) and each shipment contains the same quantity, 560,000 lbs each.

Note 6: The amount of ammonia transported by barge near the plant is 1,000 short tons. It is conservatively assumed that there are 50 shipments per year (Regulatory Guide 1.78), with each shipment, therefore, containing 40,000 lbs. This quantity was reduced further because of the high rate at which ammonia dissolves in water. A 0.60 partition coefficient was assigned, reducing the volume to 16,000 lbs.

Note 7: For gasoline and gasoline (aviation) the time weighted average (TWA) and short term exposure limit (STEL) were conservatively used as no IDLH is available for either of these hazardous materials.

Note 8: The concentrations reported represent indoor concentrations. The air exchange rate of 0.45 air exchanges per hour that was used in the ALOHA model was calculated from the control room volume and the rate of fresh air intake.

Note 1: The reported value for the distance to the IDLH (or other determined toxicity limit) is the resultant distance to the IDLH for the determined worst case meteorological conditions for each postulated event. The worst case meteorological conditions were based upon those meteorological conditions yielding the highest concentration in the control room during a postulated event.

Note 2: The concentrations reported represent indoor concentrations. The air exchange rate of 0.45 air exchanges per hour that was used in the ALOHA model was calculated from the control room volume and the rate of fresh air intake. Unless noted, the worst case combination of stability class and wind speed is F stability and a wind speed of 1 m/sec.

Note 3: For gasoline and gasoline (aviation) the time weighted average (TWA) and short term exposure limit (STEL) were conservatively used as no IDLH is available for either of these hazardous materials.

Note 4: The worst case combination of stability class and wind speed is F stability and a wind speed of 3 m/sec.

Note 5: The worst case combination of stability class and wind speed is F stability and a wind speed of 2 m/sec.

Note 6: For benzene, and toluene a combined total of 28,000 short tons/year are shipped by barge. It is conservatively assumed that they are shipped in equal quantities (14,000 short tons per year each) and that they each have the minimum 50 shipments (Regulatory Guide 1.78) and each shipment contains the same quantity, 560,000 lbs each.

Note 7: The amount of ammonia transported by barge near the plant is 1,000 short tons. It is conservatively assumed that there are 50 shipments per year (Regulatory Guide 1.78), with each shipment, therefore, containing 40,000 lbs. This quantity was reduced further because of the high rate at which ammonia dissolves in water. A 0.60 partition coefficient was assigned, reducing the volume to16,000 lbs.

Note 8: This event was evaluated to not be a credible event based on screening criteria for event frequency in accordance with Regulatory Guide 1.78. Refer to Section 2.2.3.1.3 for the analysis of this event.

Note 9: An additional probabilistic evaluation was conducted for this postulated event and this spill event was determined not to be a credible event, in accordance with Regulatory Guide 1.78 risk frequency evaluation requirements. Refer to Section 2.2.3.1.3 for the analysis of this event.

Note 10: The 4,000 gallon gasoline tank reported in Table 2.2-2 is an underground storage tank. Therefore, the toxicity event is bounded by the 3,500 gallon gasoline delivery tank truck.

Note 11: The reported distance to the IDLH for this asphyxiant is the distance at which the concentration outside the control room is such that enough oxygen may become displaced to create an oxygen deficient atmosphere.

Note 12: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 122 gal/ 462 l.

Note 13: The actual quantity of ethanol analyzed (10 percent by weight of non-oxidizing biocide) was 42.66 gal/ 161.3 l.

Note 14: The evaluated chemical is stored at a distance greater than the reported safe distance (the distance the chemical cloud could travel before it disperses enough such that the concentration in the vapor cloud falls below the IDLH limit, other determined toxicity limit concentration, or at a level where an oxygen deficient atmosphere is plausible). For these evaluated chemicals the control room air exchange rate was not accounted for in the analyses.

FSAR Section 9.2.9.1 will be updated as follows in a future COLA revision:

9.2.9 RAW WATER SUPPLY SYSTEM

9.2.9.1 Design Basis

No cross connections exist between raw Chesapeake Bay water supplied to the desalinization plant and any system with the potential to carry radioactive material. This design requirement satisfies Criterion 60 of Appendix A to 10 CFR 50 (CFR, 2008).

Raw water from the Circulating Water System Makeup Water System is supplied to the desalinization plant. Desalinated water is then supplied to the demineralized water, potable water, fire protection, and essential service water (except under emergency operating conditions) systems during periods of normal power operation, shutdown, maintenance and construction. The emergency makeup to essential service water is provided by a dedicated, safety-related system. The UHS Makeup Water System is discussed in Section 9.2.5.

The proposed chemical treatment and relevant chemicals for the desalination process are as follows:

- Sodium Bisulfite for dechlorination upstream of the RO membranes.
- Sulfuric Acid: continuous feed to the pretreated water prior to desalination for pH adjustment.
- Scale inhibitor: proprietary (supplier-specific) - continuous feed to the pretreated water prior to desalination.

FSAR Section 9.2.9.2 will be updated as follows in a future COLA revision (Only the affected text is shown):

9.2.9 RAW WATER SUPPLY SYSTEM

9.2.9.2 System Description

During normal operation, desalinated water demand is approximately 812 gpm (3,073 lpm). Peak demand of approximately ~~24002,416 gpm~~ ~~(91009,145 lpm)~~ <u>1580 gpm (5980 lpm)</u> occurs for approximately 4 to 6 hours during normal plant shutdown/cooldown operations, and is driven by additional makeup to the ESWS. <u>The makeup for this type of peak demand is met from the desalinated water storage tanks.</u>

<u>The current computation for design pressure and temperature for the RWSS is 130 psig (8.97 bars) and 100° F (37.8° C), respectively.</u>

<u>Two separate normal power supplies shall be provided to the desalinization/water treatment building to allow RWSS equipment supporting desalination to remain operational if one power supply is lost. The RWSS and desalinated water plant are not credited to be available during a Loss of Offsite Power or Station Blackout event.</u>

FSAR Section 9.2.9.3 will be updated as follows in a future COLA revision (Only the affected text is shown):

9.2.9 RAW WATER SUPPLY SYSTEM

9.2.9.3 Component Descriptions

Desalinated Water Transfer Pumps

These are horizontal centrifugal pumps that forward water to the supplied systems. Each pump is equipped with a discharge check valve, suction and discharge isolation valves, and a recirculation line for maintaining system pressure while meeting minimum flow requirements. Two 100% capacity transfer pumps supply the demands of essential service water, fire protection and feed to the demineralized water system. A second pair of 100% capacity pumps is provided for potable water demand. Duplicate full capacity transfer pumps makes online inspection and maintenance of these pumps possible without unduly affecting system operation.

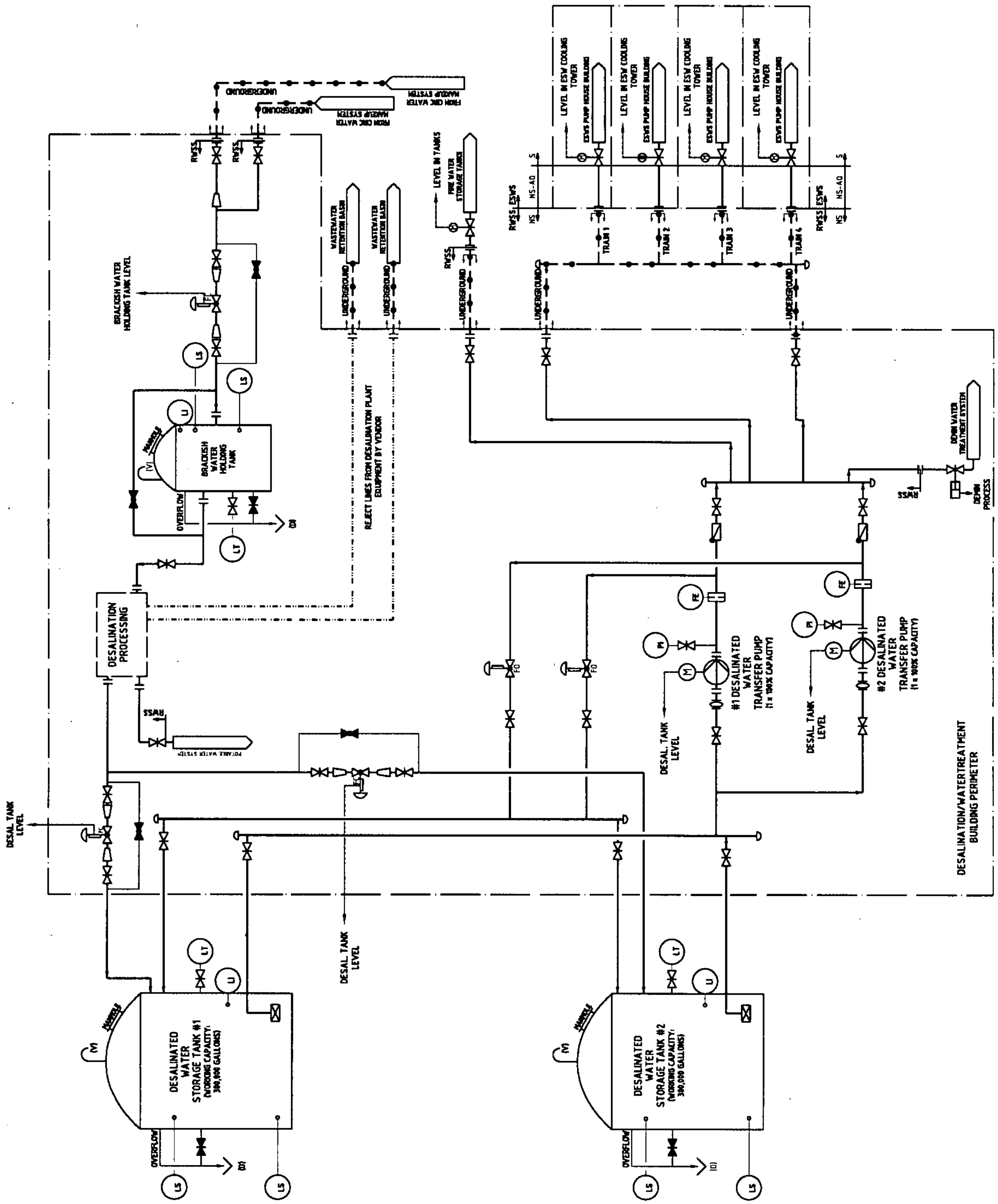
The two 100% capacity desalinated water transfer pumps have been sized based upon a total developed head (TDH) of a nominal 200 ft (61 m) at a nominal 790 gpm (2992 lpm) each. This includes consideration of the normal demands of the desalinated water users and those simultaneous peak demands that have been deemed credible (i.e., 4 ESW cooling towers simultaneously in operation). Each of the desalinated users' headers have been sized to accommodate peak flowrates with the desalinated water transfer pumps' suction and discharge piping sized to accommodate peak flowrates for the required demands.

Desalinated Water Distribution Piping and Valves

The piping and valves which connect the system components to each other and to the supplied systems are made of materials compatible with the process fluid.

The RWSS piping, tanks, pumps and other system components' materials are compatible with the Chesapeake Bay water quality prior to treatment and desalinated water quality for the remainder of the system. As such, RWSS components will be fabricated from corrosion resistant materials (such as FRP, HDPE or equivalent for underground, and glass fiber reinforced epoxy, steel or equivalent for aboveground). Appropriate corrosion inhibitors will be specified for the system.

FSAR Figure 9.2-7 will be replaced with the following figure in a future COLA revision:



COLA Part 10, Table 2.4-25 will be updaed as follows figure in a future COLA revision:

Table 2.4-25—{Raw Water Supply Systems Inspections, Tests, Analyses, and Acceptance Criteria}

	Commitment Wording	Inspection, Test, or Analysis	Acceptance Criteria
1	The Raw Water Supply System delivers makeup water to the Fire Water Distribution System's fire water storage tanks in accordance with guidance provided in RG 1.189, Rev. 1 (i.e., capable of delivering at least 300,000 gallons (1.14 million liters) within an 8-hour period).	A test of the as-built system will be performed.	The as-built Raw Water Supply System delivers a total flow rate of ≥ 625 gallons (2366 liters) per minute to the as-built fire water storage tanks.