Ronald B. Clary
Vice President
New Nuclear Deployment

SCE&G®
A SCANA COMPANY

January 21, 2010
NND-10-0012

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

ATTN: Document Control Desk

Subject: Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Combined License Application (COLA) - Docket Numbers 52-027 and 52-028
Response to NRC Request for Additional Information (RAI) Letter No.075 Related to Evaluation of Potential Accidents

Reference: Letter from Chandu P. Patel (NRC) to Alfred M. Paglia (SCE&G), Request for Additional Information Letter No. 075 Related to SRP Section 2.2.3 for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application, dated December 4, 2009.

The enclosure to this letter provides the South Carolina Electric & Gas Company (SCE&G) response to the RAI items included in the above referenced letter. The enclosure also identifies any associated changes that will be incorporated in a future revision of the VCSNS Units 2 and 3 COLA.

Should you have any questions, please contact Mr. Alfred M. Paglia by telephone at (803) 345-4191, or by email at apaglia@scana.com.

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

Executed on this 21st day of January, 2010.

Sincerely,

Ronald B Clary

Ronald B. Clary
Vice President
New Nuclear Deployment

JMG/RBC/jg

Enclosure

D083
NRO

c:

Luis A. Reyes
Joseph M. Sebrosky
John Zeiler
Stephen A. Byrne
Jeffrey B. Archie
Ronald B. Clary
Bill McCall
William M. Cherry
Randolph R. Mahan
Kathryn M. Sutton
Amy M. Monroe
Courtney W. Smyth
Frederick P. Hughes
William E. Hutchins
William A. Fox
Grayson Young
FileNet

NRC RAI Letter No. 075 Dated December 4, 2009

SRP Section: 02.02.03 – Evaluation of Potential Accidents

QUESTION for Siting and Accident Conseq Branch (RSAC)

NRC RAI Number: 02.02.03-1

FSAR Section 2.2.3.1.3.3, Railroad Tank Car Shipment, reviews potential hazardous chemical releases from nearby railroads. Although Cyclohexylamine was reviewed as a potential toxic hazard and explosive hazard, Ethanol and Isopropanol were reviewed as potential explosive hazards only even though all three chemicals are considered both toxic and explosive hazards. Please explain why Ethanol and Isopropanol are not analyzed and covered in FSAR Table 2.2-209 and FSAR Section 2.2.3.1.3.3.

VCSNS RESPONSE:

Ethanol and isopropanol chemicals are currently listed in the VCSNS Units 2 and 3 FSAR Table 2.2-206 with a note indicating that a toxicity screening was performed and it was determined that the weights and distance requirements for these chemicals to the control room were met in accordance with the guidance provided in Regulatory Guide 1.78. Thus, no further analysis of these chemicals was warranted for toxicity at the time of Revisions 0 and 1 of the VCSNS COLA.

However, an update to the control room air exchange rate (0.95 air exchanges per hour) has prompted further evaluation involving the release of toxic chemicals transported on the railroad in the vicinity of VCSNS Units 2 and 3. The revised screening evaluation revealed that ethanol and isopropanol no longer meet the toxicity screening requirements based on weighted air exchange rates, toxicity limits, and distances from the control room as presented in Regulatory Guide 1.78. Subsequently, an updated analysis has been performed for each identified chemical transported by rail having a specified toxicity limit with the potential to form a vapor cloud—chlorodifluoromethane, cyclohexylamine, ethanol, and isopropanol.

The ALOHA air dispersion model was used to predict both the distance each toxic cloud could travel before it disperses enough to fall below the determined toxicity limit and the concentration of the chemical in the control room following a chemical release. The toxicity analyses conducted using the ALOHA model included a meteorological sensitivity analysis—i.e., the model was run across a spectrum of standard meteorological conditions (selected stability class, wind speed, time of day, and cloud cover based on the defined Pasquill meteorological stability classes.) Other inputs/assumptions for the ALOHA model included:

- Ground Roughness: "Urban or Forest" was selected based on the terrain between the release location and control room. (The VCSNS site is over 150 feet higher in elevation than the spill location, with two hillsides between the spill location and the receptor.)

- Puddle Diameter: 320 feet. Immediately to the west of the rail is the Broad River and other than a 686,496 square foot wetland area to the east of the rail in the vicinity of VCSNS Units 2 and 3, any railcar derailment which would cause a rail tank car to release its content towards the east, would result in a release onto an area that almost immediately abuts a hillside, causing the spill to flow towards the Broad River. Therefore, the largest width of this wetland area, approximately 320 feet, was used for the puddle diameter.

The results for the identified chemicals transported by rail—chlorodifluoromethane, cyclohexylamine, ethanol (ethyl alcohol), and isopropanol (isopropyl alcohol) are presented in Table 1, Table 2, Table 3, and Table 4, respectively. (The highlighted row on each table indicates the reported value in FSAR Table 2.2-209 for each chemical based upon the selected worst-case meteorological condition.)

Table 1: Chlorodifluoromethane Results

Stability Class	Surface Wind Speed (m/s)	Cloud Cover	Time	Temperature	Quantity Spilled (gal)[1]	Distance to Control Room (feet)	Toxicity--Distance to STEL[2] (feet)	Maximum Concentration in Control Room[3] (ppm)
A	1.5	0%	12:00 PM	94.2°F	34,500	4,200	4,746	229
B	1.5	50%	12:00 PM	94.2°F	34,500	4,200	5,241	285
B	2	0%	12:00 PM	94.2°F	34,500	4,200	4,374	191
C	3	50%	12:00 PM	94.2°F	34,500	4,200	3,807	148
C	5.5	0%	12:00 PM	94.2°F	34,500	4,200	2,898	97.1
D	5.5	50%	12:00 PM	94.2°F	34,500	4,200	3,120	109
D	3	50%	5:00 AM	94.2°F	34,500	4,200	4,158	174
E	2	50%	5:00 AM	94.2°F	34,500	4,200	6,336	405
F	1	0%	5:00 AM	94.2°F	34,500	4,200	9,504	930
F	1	0%	5:00 AM	25°C	34,500	4,200	9,504	931
F	1.5	0%	5:00 AM	94.2°F	34,500	4,200	8,976	914
F	2	0%	5:00 AM	94.2°F	34,500	4,200	8,448	736
F	3	0%	5:00 AM	94.2°F	34,500	4,200	6,864	442

[1] Chlorodifluoromethane is a liquefied compressed gas, and due to its boiling point, it was assumed that the total quantity was released and immediately formed a vapor cloud. Therefore, the total quantity was released over a 10 minute period as a direct source over the ground surface.

[2] Toxicity Limit: 1,250 ppm—Short term exposure limit (STEL). In the case of chlorodifluoromethane, there is no Immediately Dangerous to Life and Health (IDLH) standard set by the National Institute of Occupational Safety and Health (NIOSH), so the toxicity limit is based upon the 15-minute STEL. The STEL is a 15-minute time weighted average exposure that should not be exceeded at any time during a workday.

[3] The selected worst-case meteorological condition was based upon those meteorological conditions which yielded the greatest concentration in the control room during the postulated scenario.

Table 2: Cyclohexylamine Results

Stability Class	Surface Wind Speed (m/s)	Cloud Cover	Time	Temperature	Quantity Spilled (gal)	Distance to Control Room /Auxiliary Bldg. (feet)	Toxicity--Distance to TWA[1] Limit (feet)	Maximum Concentration in Control Room[2] (ppm)
A	1.5	0%	12:00 PM	94.2°F	34,500	4,200	4,044	4.36
B	1.5	50%	12:00 PM	94.2°F	34,500	4,200	5,268	7.24
B	2	0%	12:00 PM	94.2°F	34,500	4,200	5,001	6.77
C	3	50%	12:00 PM	94.2°F	34,500	4,200	6,336	11.1
C	5.5	0%	12:00 PM	94.2°F	34,500	4,200	2,703	2.33
D	5.5	50%	12:00 PM	94.2°F	34,500	4,200	4,086	5.11
D	3	50%	5:00 AM	94.2°F	34,500	4,200	6,336	10.9
E	2	50%	5:00 AM	94.2°F	34,500	4,200	6,864	10.8
F	1	0%	5:00 AM	94.2°F	34,500	4,200	7,392	9.22
F	1	0%	5:00 AM	25°C	34,500	4,200	5,808	5.97
F	1.5	0%	5:00 AM	94.2°F	34,500	4,200	7,920	13.1
F	2	0%	5:00 AM	94.2°F	34,500	4,200	8,448	15.1
F	3	0%	5:00 AM	94.2°F	34,500	4,200	9,504	17.5[3]

[1] Toxicity Limit: 10 ppm –Time-weighted average (TWA). In the case of cyclohexylamine, there is no Immediately Dangerous to Life and Health (IDLH) standard set by the National Institute of Occupational Safety and Health (NIOSH), so the toxicity limit is based upon the TWA. The TWA is an average value of exposure over the course of an 8-hour work shift. (There is no ceiling limit identified by the Occupational and Safety and Health Administration (OSHA) for cyclohexylamine.)

[2] The selected worst-case meteorological condition was based upon those meteorological conditions which yielded the greatest concentration in the control room during the postulated scenario.

[3] Because the toxicity limit was an 8-hour time weighted average limit, an evaluation was done to determine if it is plausible that the 8-hour TWA limit might be exceeded under the determined worst-case meteorological conditions. This evaluation took into account several factors: (1) the indoor and outdoor concentration curves generated by ALOHA for the worst case release scenario; (2) the assumption that the release occurred over a 60 minute period—that is, the formed puddle continued to evaporate unabated over a 60 minute period; (3) the time it would take the formed vapor cloud to travel past the control room; and (4) the control room air exchange rate—that is, the time it would take the outdoor air to replace the indoor air in the control room after the vapor cloud had past the control room. Based upon this evaluation, the 8-hour TWA would not be exceeded.

Table 3: Ethanol (Ethyl Alcohol) Results

Stability Class	Surface Wind Speed (m/s)	Cloud Cover	Time	Temperature	Quantity Spilled (gal)	Distance to Control Room /Auxiliary Bldg. (feet)	Toxicity-- Distance to IDLH[1] Limit (feet)	Concentration in Control Room[2] (ppm)
A	1.5	0%	12:00 PM	94.2°F	34,500	4,200	438	32.4
B	1.5	50%	12:00 PM	94.2°F	34,500	4,200	459	44.4
B	2	0%	12:00 PM	94.2°F	34,500	4,200	432	45.1
C	3	50%	12:00 PM	94.2°F	34,500	4,200	399	55.1
C	5.5	0%	12:00 PM	94.2°F	34,500	4,200	159	9.79
D	5.5	50%	12:00 PM	94.2°F	34,500	4,200	201	21.8
D	3	50%	5:00 AM	94.2°F	34,500	4,200	396	46.2
E	2	50%	5:00 AM	94.2°F	34,500	4,200	543	54.6
F	1	0%	5:00 AM	94.2°F	34,500	4,200	903	54.3
F	1	0%	5:00 AM	25°C	34,500	4,200	651	35.8
F	1.5	0%	5:00 AM	94.2°F	34,500	4,200	831	73.8
F	2	0%	5:00 AM	94.2°F	34,500	4,200	774	80.2
F	3	0%	5:00 AM	94.2°F	34,500	4,200	657	80.4

[1] Toxicity Limit: 3,300 ppm—Immediately Dangerous to Life and Health (IDLH) standard set by the National Institute of Occupational Safety and Health (NIOSH).

[2] The selected worst-case meteorological condition for the toxicity evaluation was based upon those meteorological conditions which yielded the greatest concentration in the control room during the postulated scenario. In each case, the concentration in the control room at the end of 60 minutes was declining and the outdoor concentration was below the determined toxicity limit.

Table 4: Isopropanol (Isopropyl Alcohol) Results

Stability Class	Surface Wind Speed (m/s)	Cloud Cover	Time	Temperature	Quantity Spilled (gal)	Distance to Control Room /Auxiliary Bldg. (feet)	Toxicity-- Distance to IDLH[1] Limit (feet)	Concentration in Control Room[2] (ppm)
A	1.5	0%	12:00 PM	94.2°F	34,500	4,200	531	25.6
B	1.5	50%	12:00 PM	94.2°F	34,500	4,200	558	33.0
B	2	0%	12:00 PM	94.2°F	34,500	4,200	534	35.6
C	3	50%	12:00 PM	94.2°F	34,500	4,200	483	44.2
C	5.5	0%	12:00 PM	94.2°F	34,500	4,200	162	8.07
D	5.5	50%	12:00 PM	94.2°F	34,500	4,200	231	17.9
D	3	50%	5:00 AM	94.2°F	34,500	4,200	483	36.4
E	2	50%	5:00 AM	94.2°F	34,500	4,200	642	41.1
F	1	0%	5:00 AM	94.2°F	34,500	4,200	993	>1hour[3]
F	1	0%	5:00 AM	25°C	34,500	4,200	744	25.1
F	1.5	0%	5:00 AM	94.2°F	34,500	4,200	960	54.6
F	2	0%	5:00 AM	94.2°F	34,500	4,200	897	60.1
F	3	0%	5:00 AM	94.2°F	34,500	4,200	786	62.5

[1] Toxicity Limit: 2,000 ppm—Immediately Dangerous to Life and Health (IDLH) standard set by the National Institute of Occupational Safety and Health (NIOSH).

[2] The selected worst-case meteorological condition for the toxicity evaluation was based upon those meteorological conditions which yielded the greatest concentration in the control room during the postulated scenario.

[3] ALOHA does not model releases after one hour because meteorological conditions are likely to change after one hour. (ALOHA 2007) (Additionally, RG 1.78 –states that "the probability of a plume remaining within a given sector for a long period of time is quite small" and the *Handbook of Chemical Hazard Analysis Procedures* states that "the direction wind is rarely steady over any significant period of time and that the wind direction tends to shift back and forth between various directions"—the hazard zone boundary arcs used in this manual are for one hour durations.) (NRC 2001) (EPA 1989)

References:

(ALOHA 2007) U.S. EPA and NOAA, *ALOHA® User's Manual*, February 2007.

(EPA 1989) U.S. EPA, U.S. DOT, FEMA, *Handbook of Chemical Hazard Analysis Procedures,* pages 3-25 through 3-26, 1989.

(NRC 2001) U.S. NRC, Regulatory Guide 1.78, *Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release*, Revision 1, December 2001.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

The following COLA revisions to FSAR Subsection 2.2.3.1.3 and Table 2.2-209 incorporate and modify those previously provided in the response to RAI 06.04-3 (SCE&G Letter NND-09-0145, dated June 1, 2009 (ML0901550369)). The COLA revisions below are limited to those necessary to respond to RAIs 02.02.03-1 and 02.02.03-2. A supplemental response to RAI 06.04-3 will be provided by February 15, 2010, to reflect additional COLA revisions based on updates to the VCSNS Units 2 and 3 chemical hazard analyses, including the revised control room air exchange rate.

VCSNS COLA Part 2 will be revised in a future update as indicated below:

For the VCSNS Units 2 and 3 COLA revisions below, the statement of the revision to be made is done in bold and italics and the change itself is in regular font with red strikeouts being used to denote deleted text. New text being added to the VCSNS Units 2 and 3 FSAR is denoted by green, underlined text.

The 4th, 5th, and 6th paragraphs of Subsection 2.2.3.1.3 have been revised to reflect updated chemical hazard analyses.

The IDLH is defined by the National Institute of Occupational Safety and Health as a situation that poses a threat of exposure that is likely to cause death or immediate or delayed permanent adverse health effects, or one that could prevent escape from such an environment. The IDLHs determined by the National Institute of Occupational Safety and Health are established such that workers are able to escape such environments without suffering permanent health damage. Where an IDLH was unavailable for a toxic chemical, the time-weighted average, threshold limit value, or short term exposure limit (STEL), ~~or temporary emergency exposure limit (TEEL),~~ promulgated by the Occupational Safety and Health Administration or adopted by the American Conference of Governmental Hygienists ~~or the TEEL, adopted by the U.S. DOE,~~ were used as the toxicity concentration level.

~~Conservative meteorological assumptions were used: F (stable) stability class with a wind speed of 1 m/sec; ambient temperature of 25°C; relative humidity of 50%; cloud cover of 50%; and atmospheric pressure of one atmosphere. A Pasquill stability category F and a wind speed of 1 m/sec typically represent the worst 5% of meteorological conditions observed at most nuclear plant sites (Reference 231). It was further assumed that the toxic vapor cloud traveled downwind directly toward the control room.~~

~~For each of the identified chemicals with the exception of ammonium hydroxide, it was conservatively assumed that the entire contents of the vessel leaked, forming a 1-centimeter-thick puddle, where accommodated by the model. For those identified hazardous materials in the gaseous state, it was conservatively assumed that the entire contents of the vessel or pipeline were released over a 10-minute period into the atmosphere as a continuous direct source (Reference 229).~~ The effects of toxic chemical releases from onsite (Unit 1) and offsite sources are summarized in Table 2.2-209 and are described in the following subsections relative to the release sources. A discussion about the Units 2 and 3 onsite chemicals, identified in Table 6.4-201, is provided in Subsection 2.2.2.2.1.1.

Subsection 2.2.3.1.3.3 has been revised to reflect updated chemical hazard analyses.

2.2.3.1.3.3 Railroad Tank Car Shipment

As described in Subsection 2.2.2.6, Norfolk Southern's rail line passes approximately 4,200 feet west from the Unit 3 auxiliary building (location of control room intake). ~~Based on Regulatory Guide 1.91, the maximum cargo in a single railroad box car is approximately 132,000 pounds.~~

Following the methodology described in Subsection 2.2.3.1.3 and Regulatory Guide 1.78, an analysis was conducted to identify which chemicals shipped by rail have the potential of forming a toxic vapor cloud that eventually reaches the control room. The hazardous ~~material~~ materials shipped by rail that ~~was~~ were identified for further analysis with regard to the potential of the formation of toxic vapor clouds formed following an accidental release ~~was~~ were chlorodifluoromethane, cyclohexylamine, ethanol, and isopropanol.

As described in Subsection 2.2.3.1.3, the identified hazardous ~~material~~ materials ~~was~~ were analyzed using the ALOHA dispersion model to determine whether the formed vapor cloud would reach the control room intake and what the concentration of the toxic ~~chemical~~ chemicals would be in the control room following an accidental release. The ~~cyclohexylamine concentration~~ concentrations were ~~was~~ determined at the control room following a release from the largest storage vessel. ~~The chemical analysis indicates that the control room can safely remain habitable for the worst-case toxic release scenario. While the distance from the source to the selected toxicity limit for cyclohexylamine is greater than the distance to the Unit 3 control room, the concentration inside the control room never reaches the toxicity limit.~~

In evaluating the ~~cyclohexylamine railroad tanker spill~~ identified toxic chemical scenarios, the following inputs were used ~~in the model~~:

- ~~Pasquill Stability Class F selected to represent the worst 5% of meteorological conditions observed.~~ A meteorological sensitivity analysis was performed. The model was run across a spectrum of standard meteorological conditions (selected stability class, wind speed, time of day, and cloud cover based on the defined Pasquill meteorological

stability classes). The spectrum of meteorological conditions includes the most stable meteorological class, F, allowable with the ALOHA model (Reference 216). The F stability class was modeled at 1, 1.5, 2, and 3 m/s.

- ~~A low wind speed of 1 meter per second selected to represent the worst 5% conditions. Low wind speed conditions prevent the vapor cloud from dispersing as it travels.~~

- ~~The time of day selected was 12:00 p.m. on July 1, 2006. This day and time were chosen because temperatures are highest in the summer during the midday. Higher temperatures lead to a higher evaporation rate, and thus, a larger vapor cloud.~~

- It was conservatively assumed that the maximum quantity in the largest container was 34,500 gallons (263,000 pounds) (Reference 240).

- ~~The tank was filled to capacity and a catastrophic tank failure was assumed where the total amount of the substance leaked forming a 1-centimeter-thick puddle. A 1-centimeter-thick puddle allows for greater evaporation, and thus, a larger vapor cloud.~~ The total quantity of the vessel is assumed to be instantaneously spilled forming a puddle. The area of the puddle is estimated by assuming that the representative diameter of the puddle is equal to the width of the wetland low area adjacent to the railroad tracks. The largest width of this flat area is approximately 320 feet. For those identified hazardous materials in the gaseous state, it is conservatively assumed that the entire contents of the vessel are released over a 10-minute period into the atmosphere.

- ~~There are no physical obstructions that interfere with the toxic vapor cloud from reaching the control room intake.~~

~~In addition to the assumptions listed, ALOHA takes into account the control room ventilation rate to determine the control room concentrations during the first hour. This dispersion model does not report values after one hour because it assumes that the weather conditions or other release circumstances surrounding the toxic cloud are likely to change one hour after accidental release (Table 2.2-209).~~

~~Therefore, the~~The chemical ~~analysis~~ analyses for chlorodifluoromethane, cyclohexylamine, ethanol, and isopropanol indicate ~~indicates~~ that the control room can safely remain habitable for the worst-case toxic release scenario. Therefore, the formation of a toxic vapor cloud following an accidental release of the analyzed hazardous materials shipped by rail would not adversely affect the safe operation or shutdown of Units 2 and 3.

Subsection 2.2.4 has been revised to delete References 229 and 231, which are no longer used, and add a new Reference 240 to reflect the updated chemical hazard analyses.

~~229. Title 40 Code, *Worst-Case Release Scenario Analysis*, Title 40 Code of Federal Regulations Part 68.25, June 1996.~~Not Used.

~~231. U.S. Atomic Energy Commission, *Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criteria* 19, Murphy, K. G., and K.M. Campe., U.S. Atomic Energy Commission, 13th AEC Air Cleaning Conference, 1974.~~Not Used.

240. Title 49 Code, *Tank car capacity and gross weight limitation,* Title 49 Code of Federal Regulations, Transportation Part 179—Specifications for Tank Cars, Subpart B—General Design Requirements, September 9, 1970.

The chlorodifluoromethane, cyclohexylamine, ethanol and isopropanol chemical entries in FSAR Table 2.2-206 have been revised to reflect updated chemical hazard analyses.

Table 2.2-206 (Sheet 1 of 2)
Potential Hazardous Material, Railway Transportation, Disposition

Material	Explosion Hazard?	Flammability	Toxicity Limit (IDLH)	Vapor Pressure	Disposition
FAK-Hazardous Materials	Category too Broad to Analyze				
Air Bag Modules	None listed	Not flammable	None established	Not available	No further analysis required
Chlorodifluoromethane	None listed	Not flammable	~~None established~~ 1250 ppm STEL[a]	47.96 psi @ 10°F	No further analysis required
Calcium Hypochlorite	None listed	Not flammable	None established	Not available-solid	No further analysis required
Alkyl Sulfonic Acid	None listed	Not flammable	None established	Not available	No further analysis required
Ethanol	Vapor may explode	3.3%-19%	3300 ppm[a]	44 mmHg @ 68°F	Explosion Analysis Flammability Analysis
Corrosive Solid, Acidic	Category too Broad to Analyze				
Engines, Internal					
Isopropanol	Vapor may explode	2.0%-12.7%	2000 ppm[a]	33 mmHg @ 68°F	Explosion Analysis Flammability Analysis
Environmentally Hazardous	Category too Broad to Analyze				
Paraformaldehyde	None listed	Flammable solid	~~100mg/m^3 TEEL-3[b]~~ None established	Not available-solid	No further analysis required[c]
Calcium Hypochlorite, Dry	None listed	Not flammable	None established	Not available	No further analysis required
Battery Fluid, Acid (as sulfuric acid)	None listed	Not flammable	15 mg/m^3	1 mmHg @ 145.8°C (295°F)	No further analysis required[c]
Alkylphenols, Solid	None listed	Not flammable	None established	Not available-solid	No further analysis required
Articles, Pressurized	Category too Broad to Analyze				
2-Bromo-2-Nitropropane	Powders, dust may explode[d]	Flammable-solid	None established	Not available-solid	No further analysis required
Corrosive Liquid, Basic	Category too Broad to Analyze				
Environmentally Hazardous					
Fireworks					
Combustible Liquids					
Organophosphorus	None listed	None listed	None established	Not available-solid	No further analysis required[c]
Cyclohexylamine	Vapor may explode	1.5%–9.4%	~~30 ppm TEEL-3[b]~~	11 mmHg @ 68°F	Explosion Analysis

			10 ppm TWA[(b)]		Flammability Analysis
					Toxicity Analysis

Table 2.2-206 (Sheet 2 of 2)
Potential Hazardous Material, Railway Transportation, Disposition

Material	Explosion Hazard?	Flammability	Toxicity Limit (IDLH)	Vapor Pressure	Disposition
Vehicle, Flammable Liquid	Category too Broad to Analyze				
Aerosols	Category too Broad to Analyze				

(a) ~~Toxicity screening performed, weights and distance requirements to control room met in accordance with Regulatory Guide 1.78, no further analysis warranted for toxicity.~~ Short term exposure limit (STEL).

(b) ~~Temporary emergency exposure limit (TEEL)~~ Time-weighted average (TWA).

(c) Chemicals with vapor pressure less than 10 torr, 0.193 psi or solids were not considered for flammable vapor cloud or toxicity analysis. Chemicals at this low of a vapor pressure are not very volatile. That is, under normal conditions, chemicals cannot enter the atmosphere fast enough to reach concentrations hazardous to people and, thus, are not considered to be an air dispersion hazard.

(d) Assuming a 100% TNT (mass) equivalence for solid energetic materials, a 132,000-pound boxcar load of this solid meets the safe distance requirements established in Regulatory Guide 1.91(c)(1), and no further consideration need be given to the effects of blast in plant design.

(References 205, 215, 216, 220, and 232)

FSAR Table 2.2-209 has been revised to include table entries for chlorodifluoromethane, ethanol, and isopropanol chemicals and the entry for cyclohexylamine has been revised based on updated chemical hazard analyses.

Table 2.2-209
Potential Design Basis Events, Toxic Clouds

Source	Chemical	Quantity	IDLH	Distance to Unit 2 control room (ft)[d]	Distance to Unit 3 control room (ft)[d]	Distance to IDLH (ft)	~~Maximum Control Room Concentration~~
Norfolk Southern Railroad Line	Chlorodifluoromethane	34,500 gallons	1,250 ppm STEL[c]		4,200	9,504[f]	
	Cyclohexylamine	~~132,000 lbs~~ 34,500 gallons	~~30 ppm TEEL-3[c]~~ 10 ppm TWA[e]			~~4,818~~ 9,504[g]	~~5.5 ppm~~
	Ethanol	34,500 gallons	3,300 ppm			657	
	Isopropanol	34,500 gallons	2,000 ppm			786	
Onsite (~~Includes~~ Unit 1)	28% Ammonium Hydroxide	56,000 lbs	300 ppm	4,264		~~12,672~~ 4,041	~~291 ppm[c]~~
	Carbon Dioxide	20,000 lbs	40,000 ppm	3,999		1,452	~~393 ppm~~
	Chlorine	50 lbs	10 ppm	4,264		2,220	~~0.225 ppm~~
	Gasoline[a] (50,000 lbs tanker truck)	50,000 lbs	300 ppm TWA[e]	2,362		1,932	~~24.1 ppm~~
	35% Hydrazine (as 100%)	280 lbs	50 ppm	3,600		411	~~0.132 ppm~~
	Nitrogen	4,000 lbs	Asphyxiant	4,624		Asphyxiant	~~96.2 ppm~~
	Sodium Hypochlorite 12%	45 lbs	10 ppm	3,600		<33	~~Not Significant~~
Nearby Facilities	Fuel Oil[b]	800,000 gal	None Listed		7,267	Never exceeds IDLH	~~0.672 ppm~~
Highway - Bounded by onsite gasoline tanker truck							

(a) Onsite delivery tanker truck that refuels the Gasoline UST at Unit 1.
(b) Tank location is 7,267 feet from Unit 3, near the Parr Combustion Turbines.
(c) ~~Temporary emergency exposure limit (TEEL)~~ Short term exposure limit (STEL)
(d) ~~ALOHA does not report values after 1 hour because it assumes that the weather conditions or other release circumstances are likely to change after the first hour.~~ Distance from source is provided for the most limiting Unit only.
(e) Time-weighted average (TWA)
(f) Although this distance is greater than the distance to the STEL limit during the postulated scenario, the maximum concentration reached in the control room, 931 ppm, does not exceed the STEL limit.
(g) In the case of cyclohexylamine, the maximum concentration reached in the control room during the postulated scenario was 17.5 ppm. While the maximum concentration exceeds the value for the TWA limit, because the toxicity limit is an 8-hour time-weighted average limit, an evaluation was done to determine if it is plausible that the 8-hour TWA limit might be exceeded under the determined worst-case meteorological conditions. This evaluation took into account several factors: (1) the indoor and outdoor concentration curves generated by ALOHA for the worst-case release scenario; (2) the assumption that the release occurred over a 60-minute period—that is, the formed puddle continued to evaporate unabated over a 60-minute period; (3) the time it would take the formed vapor cloud to travel past the control room; and (4) the control room air exchange rate—that is, the time it would take the outdoor air to replace the indoor air in the control room after the vapor cloud has past the control room. Based upon this evaluation, the 8-hour TWA would not be exceeded.

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 075 Dated December 4, 2009

SRP Section: 02.02.03 – Evaluation of Potential Accidents

QUESTION for Siting and Accident Conseq Branch (RSAC)

NRC RAI Number: 02.02.03-2

VCSNS Units 2 and 3 FSAR Revision 1, Section 2.2.3.1.3, "Toxic Chemicals," states: "The effects of toxic chemicals releases from onsite and offsite sources are summarized in Table 2.2-209 and are described in the following subsections relative to the release sources." Unit 2 and Unit 3 site specific chemicals are omitted from the following sections and Table 2.2-209 "Potential Design Basis Events, Toxic Clouds" does not list any of the site specific chemicals stored at either Unit 2 or Unit 3. Unit 2 and 3 site specific chemicals are listed in FSAR Table 6.4-201 "Onsite Chemicals." Please clarify why no Unit 2 or Unit 3 site specific chemicals are listed in either FSAR Table 2.2-209 or the follow-up sections of Section 2.2.3.1.3.

VCSNS RESPONSE:

The list of onsite chemicals for VCSNS Units 2 and 3 is provided in FSAR Table 6.4-201, "Onsite Chemicals." This table was added in Revision 1 of the VCSNS FSAR, to incorporate standard information related to the AP1000 DCD onsite chemicals based on Bellefonte (BLN) response to RAI 02.02.03-10, dated February 20, 2009 (BLN RAI Letter No. 137 - ML090550126). The AP1000 standard or VCSNS Units 2 and 3 site-specific onsite chemicals are not listed in FSAR Table 2.2-209, "Potential Design Basis Events, Toxic Clouds," consistent with the standard supplement provided in the BLN RAI response.

FSAR Subsection 2.2.3.1.3.1, "Unit 1 Onsite Chemicals" describes the analysis of the VCSNS Unit 1 Onsite Chemicals as listed in Table 2.2-205, "Unit 1 Onsite Chemicals, Disposition." The results of the analysis for the Unit 1 chemicals are provided in FSAR Table 2.2-209, which will be clarified to indicate the items identified as onsite chemicals are for Unit 1 only (see Associated VCSNS COLA Revisions in response to RAI 02.02.03-1).

The last sentence in FSAR Subsection 2.2.3.1.3, which states: "The effects of toxic chemicals releases from onsite and offsite sources are summarized in Table 2.2-209 and are described in the following subsections relative to the release sources," will be clarified to indicate this statement refers to VCSNS Unit 1 onsite chemicals. A new sentence will be added to FSAR Subsection 2.2.3.1.3 to refer to the FSAR Subsection 2.2.2.2.1.1 for the discussion of the Units 2 and 3 onsite chemicals.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

VCSNS COLA Part 2 will be revised in a future update as indicated below:

The statement of the revision to be made is done in bold and italics and the change itself is in regular font with red strikeouts being used to denote text that is being removed from Revision 1 of the VCSNS Units 2 and 3 FSAR. New text being added to the VCSNS Units 2 and 3 FSAR is denoted by green, underlined text.

The last sentence of the 6th paragraph in Subsection 2.2.3.1.3 has been clarified and a new sentence added to this paragraph to indicate the FSAR subsection that provides a discussion of the Units 2 and 3 onsite chemicals.

The effects of toxic chemical releases from onsite (Unit 1) and offsite sources are summarized in Table 2.2-209 and are described in the following subsections relative to the release sources. A discussion about the Units 2 and 3 onsite chemicals, identified in Table 6.4-201, is provided in Subsection 2.2.2.2.1.1.

ASSOCIATED ATTACHMENTS:

None

NRC RAI Letter No. 075 Dated December 4, 2009

SRP Section: 02.02.03 – Evaluation of Potential Accidents

QUESTION for Siting and Accident Conseq Branch (RSAC)

NRC RAI Number: 02.02.03-3

DCD Table 6.4-1 lists onsite chemicals on a per unit basis. These chemicals are also listed in FSAR Table 6.4-201 on a per unit basis. Since VCSNS is a multi unit station, is there any case where the chemicals for more than one unit are stored in a common storage facility? If so, were the combined quantities evaluated in an appropriate analysis?

VCSNS RESPONSE:

There are no plans to store the chemicals listed in Table 6.4-1 and Table 6.4-201 in a common storage facility.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

No COLA revisions have been identified as a result of this response.

ASSOCIATED ATTACHMENTS:

None