Calculation Cover Sheet

Subject	ALOHA® Railroad Calculation	Project	V.C. Summer COL Units 2 & 3
Discipline	Nuclear/Environmental	Job No.	25242
		Calc. No.	25242-ENV-011
		Sheet	1 of 50

Calculation Status Designation	Preliminary	Confirmed with Preliminary Information	Confirmed	Superseded	Voided
			X		

Computer Program/Type	SCP	Program No.	Version/Release	Operating System
ALOHA	X	EV150	5.4.1	Windows XP

Nuclear Quality Classification	Safety-Related	Augmented Quality	Nonsafety-Related
	X		

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This calculation has been reviewed by Bechtel Power Corporation and any proprietary information has been removed. Wherever proprietary information has been removed, brackets have been inserted containing the statement "Proprietary Information Deleted"

Record of Revisions

Rev. No.	Reason for Revision	Total No. of Sheets	Last Sheet No.	By	Checked	Approved/ Accepted	Date
001	Update calculation for new control room air exchange rate, addition of a meteorological sensitivity study, and update of chemical list. Major revisions were made to the calculation and write-up, therefore, revisions bars extend throughout much of the calculation	138 + 1 CD	Att. 1, pg. Att. 1	MCR	YJL	NJC	12/29/09
000	Issuance of original calculation.	46	Att. H, pg. 2	SWS	JMS	RJK/DP	10/12/07

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A. PURPOSE

Regulatory Guide 1.206 (RG 1.206), Combined License Applications for Nuclear Power Plants, requires that design-basis events be identified along with the potential effects of those accidents on the nuclear power plant, in terms of the design parameter or physical phenomena (e.g. overpressure missile energies or concentration of flammable or toxic releases). Design-basis events are defined as those accidents, internal and external to the nuclear power plant, that have a probability of occurrence on the order of magnitude of 10^{-7} per year or greater and potential consequences serious enough to affect the safety of the plant to the extent that the guidelines in 10 CFR Part 100, Reactor Site Criteria, could be exceeded (NRC 2007). The expected rate of occurrence exceeding the guidelines in 10 CFR Part 100, on the order of magnitude of 10^{-6} per year, is acceptable if, when combined with reasonable qualitative argument, the realistic probability can be shown to be lower.

The site characteristics that could affect the safe design and siting of the plant are required to be identified in Chapter 2 of the Final Safety Analysis Report (FSAR) in a COL application. The purpose of Section 2.2 of the FSAR is to establish whether the effects of potential accidents in the vicinity of the site resulting from industrial, transportation, and military installations and operations should be considered design-basis events. RG 1.206 requires that when determining design-basis events to be included in FSAR Chapter 2, Section 2.2.3, that the following accident categories be considered:

1. explosions—detonations of high explosives, munitions, chemicals, or liquid and gaseous fuels for facilities and activities in the vicinity of the plant or on-site;
2. flammable vapor clouds (delayed ignition)—assuming no immediate explosion occurs, accidents involving the release of flammable liquids or vapors that result in the formation of unconfined vapor clouds from on-site storage facilities and nearby mobile and stationary sources;
3. toxic chemicals from on-site storage facilities and nearby mobile and stationary sources –if toxic chemicals are known or projected to be on-site or in the vicinity of a nuclear plant or to be frequently transported in the vicinity of the plant, releases of those chemicals should be evaluated –for each postulated event, the evaluation should determine a range of concentrations at the site for a spectrum of meteorological conditions, and these toxic chemical concentrations are to be used to evaluate control room habitability;
4. fires—accidents leading to high heat fluxes or smoke, and nonflammable gas- or chemical-bearing clouds from the release of materials as the consequence of fires in the vicinity of the plant—the dispersal analysis should include a spectrum of meteorological conditions to determine the concentrations of nonflammable material that could reach the site;
5. collisions with intake structures—for nuclear power plants located on navigable waterways, the probability and potential effects of impact on the plant cooling water intake structure and enclosed pumps from accidents from barges or ships that normally pass the site, including any explosions incident to the collision should be evaluated; and

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6. Liquid spills—an evaluation of the effect of a release of oil or corrosive, cryogenic, or coagulant liquids that may be drawn into the plant's intake structure and circulating water system.

The purpose of this calculation is to analyze postulated events involving the release of toxic and/or flammable chemicals transported on the railroad in the vicinity of V. C. Summer Units 2 & 3 (accident categories 2 and 3). The Norfolk Southern Railroad owns/operates a main rail where the closest approach to the nearest V.C. Summer control room, Unit 3, and nearest safety related structure, Unit 3 Auxiliary Building, is approximately 4200 feet. This analysis will determine whether the potential consequences from each postulated event are serious enough to affect the safety of the plant to the extent that the guidelines in 10 CFR Part 100 could be exceeded.

Where a determination has been made that the postulated event may have the potential consequences which could lead to radiological consequences in excess of the exposure guidelines in 10 CFR Part 100, a probabilistic evaluation will be required to ascertain if the event should be considered a design-basis event (an accident that has the probability of occurrence on the order of magnitude of 10^{-7} per year or greater and potential consequences serious enough to affect the safety of the plant to the extent that the guidelines in 10 CFR Part 100 could be exceeded).

Note, the remaining accident categories related to the transport of chemicals in the vicinity of V. C. Summer Units 2 & 3 (explosions, fires, collisions with intake structures, and liquid spills), are either evaluated in separate calculations, engineering studies, or in FSAR Section 2.2. Additionally, all accident categories regarding the storage of chemicals onsite (except those chemicals considered as standard in FSAR Table 6.4-201), off-site chemical storage, transportation, and military installations are evaluated in separate calculations, engineering studies, or in FSAR Section 2.2.

B. REASONS FOR REVISIONS

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D. METHOD

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F. CALCULATIONS/RESULTS

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G. CONCLUSIONS

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Postulated events involving the release of chemicals from the transport of hazardous chemicals by rail in the vicinity of V.C. Summer Units 2 & 3 were analyzed to determine whether the consequences from each postulated event may lead to an exceedance in the guidelines in 10 CFR Part 100. For the accident categories evaluated, toxicity, and flammable vapor clouds (delayed ignition), the minimum safe distance from the control room or nearest safety-related structure to the location that the analyzed chemical can be transported by rail was determined. For toxicity, this distance is represented by the maximum distance at which the Immediately Dangerous to Life or Health (IDLH) value or other toxicity limit exists for a given chemical. For the flammable vapor cloud accident category, this distance is represented by the distance to the outer edge of the LEL section of the vapor cloud. And, for vapor cloud explosions, this distance is represented by the maximum distance at which the peak over pressure is less than or equal to 1 psi. Additionally, in accordance with RG 1.206 and RG 1.78, a determination of the maximum concentration reached in the control room was also ascertained to determine if the potential existed for an exceedance of the IDLH or other toxicity limit for control room habitability.

The results of the toxicity analysis indicate that for the chemicals analyzed the control room would remain habitable for the worst-case release scenarios. The maximum control room concentration for each of these chemicals was less than each chemical's designated toxicity limit. Therefore, the concentration in the control room will be less than the toxicity limit and no further analysis is required. Additionally, there were no chemicals analyzed which would cause an oxygen-deficient environment in the control room. These distances reported do not take into account variables such as building wake, intake height, terrain effects, and wind rose data. Additionally, conservative meteorological conditions were assumed. Therefore, these results are very conservative.

The results of the flammable vapor cloud analysis and vapor cloud explosion analysis indicate that the distance to the nearest safety related structure from the postulated release point did not exceed the minimum safe distance. Therefore, there were no postulated events where the transport distance was closer than the calculated safe distances to the postulated release point on the rail, i.e, no accidents were identified whose consequences would be serious enough to affect the safety of the plant.

A probabilistic evaluation was performed for scenarios involving the transport of liquid hazardous materials on the main rail in the vicinity of the V.C. Summer Units 2 & 3 for possible incorporation of a qualitative discussion. The probabilistic evaluation was warranted for rail transport in the vicinity of V. C. Summer Units 2 & 3, because the data provided by Norfolk Southern included only the top 25 commodities transported by rail in the vicinity of the proposed V.C. Summer Units 2 & 3. It is plausible that other inhalation hazards are transported in the vicinity but are not transported frequently enough to make the top 25 commodity report. Thus, each potential scenario/event could not be evaluated analytically to determine if that postulated scenario involving the release of a potential toxic or flammable chemical may have consequences serious enough to affect the safety of

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the plant. This probabilistic evaluation determined the frequency that a chemical would need to be transported in the vicinity of V.C. Summer Units 2 & 3 to exceed the probability of occurrence on the order of magnitude of 10^{-6} per year. The results of the analysis indicate that an event would not be considered a design basis event for any hazardous chemical transported by rail at a frequency of less than 1,135 trips (for events involving the release of 34,500 gallons or less with potential consequences serious enough to affect the safety of the plant) or 378 trips per year (for events involving the release of 1,750 gallons or less with potential consequences serious enough to affect the safety of the plant) in the vicinity of V.C. Summer Units 2 & 3. This provides a further basis for providing a qualitative argument in determining whether a potential design-basis event may exist. However, a comparison will still need to be made to actual frequency data before a final conclusion can be drawn regarding the probabilistic evaluation and due to the lack of information provided by Norfolk Southern, this evaluation will only apply to liquids.

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Figure 1: Railroad Distance to Control Room and Nearest Safety Related Structure

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Figure 3: Cross-Section of Topography Between Spill Area and Proposed Site

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Figure 4: Cyclohexylamine Control Room Concentration (F Stability Class, 3 m/s wind speed, 94.2°F)

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Appendix A: Chemical Screening Analysis

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Appendix B: Hazardous Materials, Carlisle, SC Summary Top 25 Commodities Loaded Shipments Latest 12 Months Ending April 30, 2006

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Appendix B: Hazardous Materials, Carlisle, SC Summary Top 25 Commodities Loaded Shipments Latest 12 Months Ending April 30, 2006

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Appendix C: Hazardous Materials Location W122 Blair SC Summary Top 25 Commodities Loaded Shipments Latest 12 Months Ending July 31, 2009

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Appendix C: Hazardous Materials Location W122 Blair SC Summary Top 25 Commodities Loaded Shipments Latest 12 Months Ending July 31, 2009

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Appendix C: Hazardous Materials Location W122 Blair SC Summary Top 25 Commodities Loaded Shipments Latest 12 Months Ending July 31, 2009

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BECHTEL	**Calculation Sheet**	Project	V.C. Summer COL Units 2 & 3
		Job No.	25242
Subject	ALOHA® Railroad Calculation	Calc. No.	25242-ENV-011
		Sheet No.	Att. 1 of Att.1
By	Mary C. Richmond Date 11/13/2009	Sheet Rev.	001

Attachment 1: Data CD: ALOHA® Modeling Runs

[Proprietary Information Deleted]

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