2.2 Nearby Industrial, Transportation, and Military Facilities

The plant has inherent capability to withstand certain types of external accidents due to the specified design conditions associated with earthquakes, wind loading, and radiation shielding. Acceptability for external accidents associated with VCSNS Units 2 and 3.

The determination of the probability of occurrence of potential accidents which could have severe consequences is based on analyses of available statistical data on the occurrence of the accident together with analyses of the effects of the accident on the plant's safety-related structures and components. If an accident is identified for which the probability of severe consequences is unacceptable, specific changes to the AP1000 are identified. The criteria for not requiring changes to the AP1000 design is that the total annual frequency of occurrence is less than 10^{-6} per year for an external accident leading to severe consequences. The following accident categories are considered in determining the frequency of occurrence, as appropriate:

Explosions – Accidents involving detonations of high explosives, munitions, chemicals, or liquid and gaseous fuels will be considered for facilities and activities in the vicinity of the plant where such materials are processed, stored, used, or transported in quantity.

The AP1000 includes onsite storage facilities for compressed and liquid hydrogen. Accidents involving accidental detonations of hydrogen from these storage facilities are evaluated as part of the AP1000 certified design. It is not required to provide analyses of accidents involving these storage facilities provided that the locations and size of the storage facilities are consistent with the safe distances defined by the AP1000 certified design. The bulk gas storage area for the plant gas system (PGS) is located sufficiently far from the nuclear island that an explosion would not result in damage to safety-related structures, systems, and components.

Evaluation of potential explosions due to exposure of chemical storage tanks to exterior fires has determined that all of these postulated accidents are safe distances away from safety-related items.

The AP1000 certified design does not include liquid oxygen or propane storage facilities.

Flammable Vapor Clouds (Delayed Ignition) – Accidental releases of flammable liquids or vapors that result in the formation of unconfined vapor clouds in the vicinity of the plant.

A flammable vapor cloud (delayed ignition) due to the accidental release of hydrogen from the PGS bulk gas storage area is evaluated as part of the AP1000 certified design. A detonation of such a hydrogen vapor cloud would not result in damage to safety-related structures, systems, and components. No other chemical has the possibility of developing unconfined flammable vapor clouds.

Toxic Chemicals – Accidents involving the release of toxic chemicals from nearby mobile and stationary sources.

Fires – Accidents leading to high heat fluxes or smoke, and to nonflammable gas or chemical-bearing clouds from the release of materials as the consequence of fires in the vicinity of the plant.

Airplane Crashes – Accidents involving aircraft crashes leading to missile impact or fire in the vicinity of the plant.

The safe distance for material in onsite storage facilities for explosions, flammable vapor clouds, and fires is tabulated in Table 2.2-1.

The purpose of this section is to establish whether the effects of potential accidents on site or in the vicinity of the site from present and projected industrial, transportation, and military installations and operations should be used as design basis events for plant design parameters related to the selected accidents. To meet the guidance in Regulatory Guide 1.206, all facilities and activities within 5 miles of VCSNS Units 2 and 3 were considered. Facilities and activities at greater distances were included as appropriate to their significance.

2.2.1 Locations and Routes

Potential hazard facilities and routes within the vicinity (five miles) of Units 2 and 3 and airports within 10 miles of Units 2 and 3 were identified, along with significant facilities at a greater distance in accordance with Regulatory Guides 1.206, 1.91, and 4.7, and relevant sections of 10 CFR Parts 50 and 100.

Four industrial facilities that lie within 5 miles of Units 2 and 3 have been identified. These facilities include Unit 1, which has been in operation since 1984, the Fairfield Pumped Storage Facility, the Parr Hydro, and the Parr Combustion Turbines. Figure 2.2-201 is a site vicinity map that identifies the industrial facilities, transportation routes (road and rail), and pipelines within 5 miles of Units 2 and 3.

An evaluation of nearby facilities within 5 miles of Units 2 and 3 revealed that there are no military installations. The closest military base is Fort Jackson located in Columbia, South Carolina, approximately 24 miles southeast of Units 2 and 3.

Figure 2.2-202 shows the airport and both airway routes within 10 miles of Units 2 and 3.

The items shown on the figures are described in Subsection 2.2.2, along with mining and quarrying operations, which are discussed in Subsection 2.2.2.2.2. Military facilities are discussed in Subsection 2.2.2.2.3, while pipelines are addressed in Subsection 2.2.2.3. Evaluation of potential accidents near Units 2 and 3 are addressed in Subsection 2.2.3.

2.2.2 Descriptions

Descriptions of the industrial, transportation, and military facilities located in the vicinity of Units 2 and 3 are provided in this section. The facilities described include those facilities identified in Subsection 2.2.1 that potentially pose hazards to Units 2 and 3.

2.2.2.1 Description of Facilities

SCE&G maintains a variety of industrial facilities for plant operation in Fairfield County. Four facilities within 5 miles were identified for review:

- Unit 1
- Fairfield Pumped Storage Facility
- Parr Hydro
- Parr Combustion Turbines

Table 2.2-201 provides a concise description of each facility, including its primary function and major products, as well as the number of individuals employed.

2.2.2.2 Description of Products and Materials

A more detailed description of each of these facilities, including a description of the products and materials regularly manufactured, stored, used, or transported, is provided in the following subsections.

2.2.2.2.1 SCE&G Facilities

2.2.2.2.1.1 Units 2 and 3

The AP1000 standard chemicals are described in Table 6.4-1. Table 6.4-201 provides specific information about these chemicals for Units 2 and 3 including chemical names or limiting types, location, and quantities. These chemicals, except as noted, have been evaluated as part of the AP1000 standard design. All of the chemicals have been evaluated and found not to present a hazard to the control room operators or to safety-related systems, structures, or components. Therefore, no further analysis is required.

2.2.2.2.1.2 Unit 1

Unit 1 is a 1000 MWe pressurized water reactor licensed by the NRC that has been in commercial operation since 1984. Units 2 and 3 are both located in the Unit 1 vicinity, as shown in Figure 2.2-201. The center of the Unit 2 containment is located approximately 4,550 feet south-southwest from the center of the Unit 1 containment building, and the center of Unit 3 containment is located 900 feet south-southwest from the center of the Unit 2 containment. Table 2.2-202 identifies the chemicals stored at the Unit 1 facility (Reference 223).

2.2.2.2.1.3 Fairfield Pumped Storage Facility

The Fairfield Pumped Storage Facility is a hydroelectric plant that produces 576 MW of electricity. It is located near Unit 1, approximately 0.5 mile east of the Broad River and approximately 1.5 miles northwest of Units 2 and 3. Its primary purpose is to pump water from the Parr Reservoir to the Monticello Reservoir for storage and later release for hydroelectric generation. There are no significant quantities of hazardous materials stored at this facility which would pose a hazard to the personnel of Units 2 and 3 greater than the hazard of those chemicals stored at Unit 1, listed in Table 2.2-202. Thus, no further analysis is required.

2.2.2.2.1.4 Parr Hydro

Parr Hydro is a hydroelectric facility that produces 14 MW of electricity located along the Broad River approximately 1.7 miles southwest of Units 2 and 3. There are no significant quantities of hazardous materials stored at this facility. Thus, no further analysis is required.

2.2.2.2.1.5 Parr Combustion Turbines

Parr Combustion Turbines are located along the Broad River near the Parr Hydro facility approximately 1.7 miles southwest of Units 2 and 3.

A natural gas pipeline and an 800,000-gallon fuel oil storage tank surrounded by a dike capable of containing the tank contents plus 10% (880,000 gallons) are located approximately 6,944 feet and 7,267 feet, respectively, southwest of Unit 3. Both of these fuel sources are used by the Parr Combustion Turbines. These fuel sources are evaluated in Subsection 2.2.3.

2.2.2.2.2 Mining Facilities

There are no active mining or quarry activities taking place within 5 miles of Units 2 and 3. However, a number of local facilities outside of the 5-mile radius continue to maintain active mining permits but are inactive in operations. The permitted facilities are listed as Hanson Aggregates Southeast Inc., (Permit Number I-00797), Martin Marietta Materials Inc., which holds two permits (permit numbers I-00100 and I-00101), and Quality Stone Inc., (Permit Number I-001380) (References 225 and 237). All blasting activities at the quarries are contracted to an outside independent licensed party with no explosive storage taking place in Fairfield, Newberry, or Richland counties. Considering that the distance of the facilities are beyond the 5-mile radius, their safety hazard to Units 2 and 3 are regarded as being insignificant. Thus, no further analysis is required.

2.2.2.2.3 Military Facilities

There are no military facilities within 20 miles of Units 2 and 3. The nearest military facility to the site is Fort Jackson, which is approximately 24 miles southeast of the site (References 230, 233, and 234). Considering the large distance from the site to the nearest military facilities, no further evaluation is required.

2.2.2.3 Description of Pipelines

There is one natural gas transmission pipeline, as shown in Figure 2.2-201. A more detailed description of the pipeline is presented in the following subsection, including the pipe size, age, operating pressure, depth of burial, location and type of isolation valves, and type of gas presently carried.

2.2.2.3.1 SCE&G Pipeline

A buried natural gas pipeline owned by SCE&G extends from the southeast to the Parr Combustion Turbines, as shown on Figure 2.2-201. The closest approach of the pipeline to Units 2 and 3 occurs near the Parr Combustion Turbines, at a distance of approximately 6,944 feet southwest of Unit 3. The line was installed to transport natural gas as a fuel source for the Parr Combustion Turbines. The 12-inch diameter pipeline is more than 30 years old, buried at a depth of 3 feet with a maximum operating pressure of 700 psi. Isolation of the line is obtained with a 12-inch Cameron ASA 600 ball valve located approximately 13,800 feet south of Unit 1. There is no gas storage at the Parr Combustion Turbines other than what is in the pipeline. There are no plans to use the pipeline for the transport of materials other than natural gas (Reference 217).

2.2.2.4 Description of Waterways

The Broad River is the most prominent hydrologic feature in the vicinity of Units 2 and 3. The Broad River is located approximately 1 mile west of Units 2 and 3. While no commercial navigation takes place on the Broad River, it is used for recreational purposes.

The Monticello Reservoir, which provides cooling water to all three VCSNS units, is located approximately 1 mile north of Units 2 and 3. The raw water system intake structure for Units 2 and 3 is a nonsafety-related structure located along the bank of the Monticello Reservoir. Like the Broad River and Parr Reservoir, the Monticello Reservoir is also used as a recreational resource by the local population (References 226 and 227).

Since neither the Broad River, Parr Reservoir, nor the Monticello Reservoir is used as commercial transport waterways, the potential safety effect to the site is regarded as being insignificant. Thus, no further analysis is necessary.

2.2.2.5 Description of Highways

Access from Columbia to the site is via highway from SC 215 or I-26 to US 176 and then to SC 213, as shown in Figure 2.2-201 and Figure 2.2-203. SC 213 and SC 215 merge near the center of Jenkinsville and continue northbound for approximately 3.2 miles, at which point the routes split up with SC 215 continuing on in a northerly direction while SC 213 veers off to the northeast. Merged SC 213/215, at approximately 7,661 feet east of the center of Unit 2, is the nearest approach of any state highway to the site (Reference 208).

A traffic corridor analysis study was performed for the purpose of identifying hazardous chemicals, such as chlorine, at nearby fixed facilities whose transportation routes may pass within the vicinity of Units 2 and 3. The criterion for this study was based on Federal Highway Administration guidance to assess vulnerability zones and apply methodologies. The corridor analysis for Units 2 and 3 applied a modified sketch planning tool to represent the chemicals located near the facility. The methodology consisted of: (1) plotting all of the chemical sites identified by EPA, (2) categorizing them along the viable corridors, and then, (3) ascertaining the proximity of these corridors into routes along nearby zones that could be used as an approach to the plant site as illustrated in Figure 2.2-203.

The results of this study conclude that no routes passed near (within 5 miles) of the plant. The closest approach is on I-26. Use of an alternate route is not likely when direct interstate routes or U.S. highways are provided and contain the predominant fixed locations.

The only hazardous material potentially transported on SC 215 that was identified for further analysis was gasoline. An underground storage tank present at Unit 1 located approximately 2,362 feet from Unit 2 is filled by delivery tanker trucks capable of transporting 50,000 pounds of gasoline. The location of the delivery tanker truck that services the underground storage tank is closer to Unit 2 than that of the highway distance of approximately 7,661 feet. Therefore, a hazardous analysis for gasoline is bounded by an onsite delivery truck hazard and not as a highway hazard. Thus, no further analysis for highways is necessary.

2.2.2.6 Description of Railroads

The Norfolk Southern Railroad is located within 5 miles of Units 2 and 3, as shown in Figure 2.2-201. The Norfolk Southern Railroad line parallels the Broad River west of the site, along the east bank of the Broad River from Spartanburg, South Carolina toward Columbia, South Carolina, approximately 4,200 feet west of the Unit 3 auxiliary building. This line provides rail access to the site by having a spur track owned by SCE&G leading off the main line from a switch southwest of the site. No passenger traffic uses this line. Table 2.2-203 identifies the top 25 commodities shipped through Alston, South Carolina, between April 2005 and April 2006 (Reference 220).

2.2.2.7 Description of Airports

A review of airport facilities within 10 miles of the site has identified only one helipad, located at the Unit 1 site. The location of airports and significant flight paths occurring in a general area of the site are shown in Figure 2.2-202. Airport facilities located close to Units 2 and 3, along with their significance factor, are listed in Table 2.2-204 and described below in order of proximity to the site (Reference 210 and 235).

2.2.2.7.1 Summer Station Helipad

Summer Station (SC63) is a private, unattended 30-foot by 30-foot concrete paved helipad located approximately 4,550 feet northeast of the site. This helipad is a privately owned facility used primarily for medical or emergency evacuation of personnel. Yearly operations are approximately five or less per year (Reference 222). Because of its infrequent use and limited capabilities, it is not considered a

safety hazard to the site. Thus, no analysis is necessary.

2.2.2.7.2 Fairfield County Airport

The Fairfield County Airport (FDW) is a public airport located approximately 11.42 miles east-northeast from the site, thus making it the nearest airport to Units 2 and 3. It consists of an asphalt paved runway (4/22) approximately 5,003 feet long and 100 feet wide with a heading of 043 magnetic, 038 true (Runway 4) and 223 magnetic, 218 true (Runway 22). Twenty-eight aircraft are based on the field; of these, 25 are single-engine while 3 are multiengine airplanes. Average daily aircraft operations for year 2005 were approximately 47 operations per day (References 209 and 211). Based on the significance factor listed in Table 2.2-204, this airport is not considered a safety hazard to the site. Thus, no further analysis is required.

2.2.2.7.3 Shealy Airport

Shealy Airport (SC14) is a privately owned, continuously attended airport located approximately 14 miles southwest of the site. It consists of a turf-surfaced runway (12/30) approximately 1,700 feet long and 85 feet wide. Four single-engine airplanes are based on the field (Reference 221). Based on the significance factor listed in Table 2.2-204, this airport is not considered a safety hazard to the site. Thus, no further analysis is required.

2.2.2.7.4 Newberry County Airport

Newberry County Airport (27J) is a public airport attended to between 0800 and 1700 Monday through Friday, located approximately 18 miles west of the site. It consists of an asphalt/aggregate paved runway (4/22) approximately 3,498 feet long by 60 feet wide with a heading of 042 magnetic, 037 true (Runway 4) and 222 magnetic, 217 true (Runway 22). Twenty-two aircraft are based on the field. Of these, 18 are single-engine, 2 are multiengine, and 2 are ultralights. Average daily aircraft operations for the year ending in 2005 were approximately 43 operations per day (References 211 and 218). Based on the significance factor listed in Table 2.2-204, this airport is not considered a safety hazard to the site. Thus, no further analysis is required.

2.2.2.7.5 Columbia Metropolitan Airport (CAE)

Columbia Metropolitan Airport (CAE) is a continuously attended public airport located approximately 22 miles southeast of the site. It has two paved asphalt runways and one helipad. The primary instrument runway (11/29) is an asphalt/grooved runway approximately 8,601 feet long by 150 feet wide with a heading of 110 magnetic, 105 true (Runway 11) and 290 magnetic, 285 true (Runway 29). Runway 5/23 is an asphalt/concrete runway approximately 8,001 feet long and 150 feet wide with a heading of 50 magnetic, 45 true (Runway 5) and 230 magnetic, 225 true (Runway 23). Helipad H1 is a 50-foot by 50-foot concrete paved pad. One hundred aircraft are based on the field of which 60 are single-engine, 25 are multiengine, 14 are jet airplane, and 1 military aircraft operated by the South Carolina Army National Guard. Average daily aircraft operations for a year ending in 2005 were approximately 315 operations per day (References 202, 203, 204, and 211). Based on the significance factor listed in Table 2.2-204, this airport is not considered a safety hazard to the site. Thus, no further analysis is required.

2.2.2.7.6 Aircraft and Airway Hazards

Regulatory Guide 1.206 and NUREG-0800 require that the risk due to aircraft hazards be sufficiently low. Furthermore, aircraft accidents that could lead to radiological consequences in excess of the exposure guidelines of 10 CFR 50.34(a)(1) with a probability of occurrence greater than an order of 10^{-7} per year should be considered in the design of the units.

Section 3.5.1.6 of NUREG-0800 provides three acceptance criteria for the probability of aircraft accidents to be less than an order of magnitude of 10^{-7} per year by inspection (Reference 239):

- The plant-to-airport distance, D, is between 5 and 10 statute miles, and the projected annual number of operations is less than 500 D^2, or the plant-to-airport distance D is greater than 10 statute miles, and the projected annual number of operations is less than 1000 D^2.
- The plant is at least 5 miles from the nearest edge of military training routes, including low-level training routes, except for those associated with use greater than 1,000 flights per year.
- The plant is at least 2 miles beyond the nearest edge of a federal airway, holding pattern, or approach pattern.

There is one low altitude federal airway (18,000 feet MSL and lower) that is inside 5 miles of the site. Airway V53 passes approximately 2.25 miles southwest of the site on a heading of 331° from the Columbia Metropolitan Airport (CAE). Airway V155, which is also within the vicinity of the site, passes approximately 8.5 miles southeast of the site (Reference 235). Federal airways are typically 8 nautical miles wide extending 4 nautical miles from the centerline. Since the centerline of Airway V53 is approximately 2.25 miles from the site, this indicates that the third criterion in Section 3.5.1.6 of NUREG-0800 is not met. In the case of Airway V155, the 8.5 mile separation provides sufficient distance to meet the acceptance criteria of NUREG-0800 (Reference 207).

Therefore, a calculation to determine the probability of an aircraft accident that could possibly result in radiological consequences to the site was performed for Airway V53 following NUREG-0800, Section 3.5.1.6 and DOE Standard 3014-96. The calculated result determined that the probable accidental rate of an aircraft affecting the site would be on the order of 3.64×10^{-8} per year. When estimating the number of flights along Airway V53, the fractions of the types of aircraft using the airway were assumed to be the same as the fractions using Columbia Metro. This is a conservative assumption since general aviation aircraft mainly fly under visual flight rules or instrument flight rules condition and under new FAA regulations, most commercial and military aircraft will fly point to point rather than in specific airways. Thus, the presence of Airway V53 is not considered to be a safety concern since the probable accidental rate calculated is less than 10^{-7} per year.

2.2.2.8 Projections of Industrial Growth

The Newberry County Office of Economic Development has revealed that there is an industrial park located at the junctions of I-26 and SC 219 and a new industrial park at I-26 and SC 773. The Fairfield County Office of Economic Development has revealed that there is an industrial park at I-77 and SC 200 and a new industrial park at I-77 and SC 34 (Reference 208). Since these facilities are outside of the 5-mile radius of the site, no further analysis is necessary.

The VCSNS site is located in a sparsely populated area, with abandoned industrial development inside the 10-mile radius. Industrial growth in the Winnsboro area of Fairfield County, located approximately 15 miles east-northeast of the site, has gone away from mining to light industry with four new light manufacturing facilities moving into the county. Economic growth potential exists in nearby Newberry County in the I-26 corridor at the intersection of SC 219 at I-26 where Newberry Industrial Park is located. Access via I-77 and I-26 to the Winnsboro and Newberry areas provides potential growth opportunities to the respective communities (Reference 219).

2.2.3 Evaluation Of Potential Accidents

The consideration of a variety of potential accidents to be considered as design basis events, and their effects on the plant or plant operation, is included in this section. General Design Criterion 4, *Environmental and Dynamic Effects Design Bases, of Appendix A, General Design Criteria for*

Nuclear Power Plants, of 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities, requires that nuclear power plant structures, systems, and components important to safety be appropriately protected against dynamic effects resulting from equipment failures that may occur in the nuclear power plant, as well as events and conditions that may occur outside the nuclear power plant.

2.2.3.1 Determination of Design Basis Events

Design basis events internal and external to the site are defined as those accidents that have a probability of occurrence on the order of magnitude of 10^{-7} per year or greater with the potential consequences serious enough to affect the safety of the plant to the extent that the requirements in 10 CFR Part 100 could be exceeded. The following accidental categories were considered in selecting design basis events: explosions, flammable vapor clouds with delayed ignition, toxic chemicals, fires, collisions with intake structure, and liquid spills.

2.2.3.1.1 Explosions

Accidental explosions that might involve detonations of high explosives, munitions, chemicals, or liquid and gaseous fuels were considered for facilities and activities in the vicinity of the plant or on site, where such materials are processed, stored, used, or transported in quantity. The effects of explosions are a concern in analyzing structural response to blast pressures. The effects of blast pressure from nearby railways, highways, or facilities to critical plant structures were evaluated to determine if the explosion would have an adverse effect on plant operation or would prevent a safe shutdown.

The allowable and actual distances of hazardous chemicals transported or stored were evaluated in accordance to Regulatory Guide 1.91, Rev. 1, *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants,* and FM Global *Guidelines for Evaluating the Effects of Vapor Cloud Explosions Using TNT Equivalency Method* (Reference 212). Regulatory Guide 1.91 cites 1 psi as a conservative value of peak positive incident overpressure, below which no significant damage would be expected.

Conservative assumptions were used in determining the safe distance and the minimum separation distance required for an explosion to have less than 1 psi peak incident pressure. In each of the explosion scenario analyses, the volume of vapor at the upper flammability limit, in accordance with NUREG-1805 (§15.12[3]), capable of occupying the largest vessel considered available for combustion, and an explosion yield factor of 100% was applied to account for an in-vessel confined explosion (Reference 238). In fact, only a minor portion of the vapor in the flammability limits would be available for combustion, and potential explosion, and a 100% yield factor is not obtainable.

Table 2.2-202 represents a tabulated list of chemicals that are stored at the Unit 1 site, while Table 2.2-203 represents the chemicals that are transported by railway from and to storage facilities near Units 2 and 3. The chemicals in these two tables were subsequently evaluated in Table 2.2-205 and Table 2.2-206 to determine which of the hazardous chemical materials had the potential of exploding and presenting a hazard to either Units 2 or 3.

The hazardous effects due to a postulated explosion are described in the following sections and summarized in Table 2.2-207.

2.2.3.1.1.1 Unit 1 Onsite Chemicals

As shown in Figure 2.2-201, Units 2 and 3 are located relatively close to Unit 1. The hazardous materials stored on site that were identified from Table 2.2-205 for further analysis with regard to explosion potential were gasoline and hydrazine (35% solution).

There is an underground storage tank at the Unit 1 site that is refueled by tanker trucks capable of transporting and delivering 50,000 pounds of gasoline.

The location of the gasoline fuel tanker truck unloading area is approximately 2,362 feet north of the nearest safety related structure—the Unit 2 auxiliary building—while the hydrazine (35% solution) chemical is stored approximately 3,600 feet north of the Unit 2 auxiliary building.

A conservative analysis using TNT equivalency methods as described in Subsection 2.2.3.1.1 was used to determine safe distances for the storage of the identified hazardous materials. The results, calculated using the methodology described in Subsection 2.2.3.1.1 and Regulatory Guide 1.91, indicate that the safe distances of an explosion caused by the onsite chemicals are less than the distance between the chemical storage location and the nearest safety-related structure of Unit 2.

The safe distances for gasoline and hydrazine are 260 feet and 52 feet, respectively, from the point of explosion. Therefore, an explosion from any of the onsite materials evaluated would not adversely affect the safe operation or shutdown of Units 2 and 3.

2.2.3.1.1.2 Pipelines

As described in Subsection 2.2.2.3, SCE&G maintains a pipeline near the Parr Hydro facility that provides natural gas to the Parr Combustion Turbines. The nearest safety-related structure, the Unit 3 containment, is located approximately 6,944 feet from a potential gas pipeline break point. Calculated results, as shown in Table 2.2-207, are that the explosion point of a 10-minute assumed flammable release will have a peak incident pressure of less than 1 psi at a distance of 6,284 feet from the origin of the explosion. Therefore, there would be no significant effect on Units 2 and 3 as a result of a natural gas explosion.

2.2.3.1.1.3 Railroad Tank Car Shipment

As described in Subsection 2.2.2.6, Norfolk Southern's rail line passes approximately 4,200 feet west of the nearest safety-related structure—the Unit 3 auxiliary building. Based on Regulatory Guide 1.91, the maximum explosive cargo in a single railroad box car is approximately 132,000 pounds.

The hazardous materials shipped by rail that were identified for further analysis with regard to explosion potential are: ethanol, isopropanol, and cyclohexylamine. A conservative analysis using TNT equivalency methods described in Subsection 2.2.3.1.1 was used to determine safe distances for the identified hazardous materials. The results indicate that the safe distances are less than the minimum separation distance from the nearest safety-related structure—the Unit 3 auxiliary building—to the rail line. The safe distance for ethanol is 317 feet; for isopropanol, 316 feet; and for cyclohexylamine, 363 feet (Table 2.2-207). All of these chemicals are transported approximately 4,200 feet from the nearest safety-related structure—the Unit 3 auxiliary building. Therefore, an explosion from any of the transported rail hazardous materials evaluated would not adversely affect the safe operation or shutdown of Units 2 and 3.

2.2.3.1.1.4 Nearby Facilities

An alternative fuel to the Parr Combustion Turbines, other than the natural gas pipeline described in Subsection 2.2.3.1.1.2 is the fuel from the fuel oil storage tank. This tank has a storage capacity limited to 800,000 gallons and is located approximately 7,267 feet south of the Unit 3 containment, the nearest safety-related structure. The distance that will have a peak incident pressure of 1 psi was determined as being 1,456 feet from the explosion point. Therefore, the distance to the fuel oil storage tank used by the Parr Combustion Turbines meets the safe distance requirements defined by Regulatory Guide 1.91.

2.2.3.1.2 Flammable Vapor Clouds (Delayed Ignition)

Flammable substances in a liquid or gaseous state can potentially form an unconfined vapor cloud that then drifts and disperses as it travels downwind before a delayed ignition of the vapor cloud occurs. For the vapor cloud to become flammable, an ignition must take place between the upper flammability limit and lower flammability limit. The speed at which the flame front moves through the cloud determines whether it is a deflagration or a detonation. If the vapor cloud burns fast enough to create a detonation, an explosion force is generated.

The potential onsite chemicals (Table 2.2-205), and hazardous materials transported by the Norfolk Southern Railroad rail line (Table 2.2-206) were evaluated to determine which hazardous materials had the potential to form a flammable/explosive vapor cloud. Except for fuel oil, for those chemicals with an identified flammability range, the areal locations of hazardous atmospheres (ALOHA) air dispersion computer software model was used to determine the distances where the vapor cloud may exist between the upper flammability limit and lower flammability limit, thus presenting the possibility of ignition and potential thermal radiation effects.

With the exception of the fuel oil, ALOHA was used to model the worst-case accidental vapor cloud explosion, including the safe distances and overpressure effects at the nearest safety-related structure. To model the worst-case scenario for an accidental vapor cloud explosion in ALOHA, ignition by detonation was selected as the ignition source. The safe distance is measured as the distance from the spill site to the location where the pressure is at or below 1 psi. The following meteorological assumptions were used as inputs to the ALOHA computer modeling software:

- F (stable) stability class with a wind speed of 1 m/sec (2.2 mph) and ambient temperature of 25°C (77°F)
- Relative humidity at 50% with the cloud cover at 50%
- Atmospheric pressure at 1 atmosphere

F stability represents the worst 5% of meteorological conditions observed at most nuclear plant sites. For each of the identified chemicals, it was conservatively assumed that the depth of the puddle that forms from the leaked vessel is
1-centimeter-thick, thus providing a significant surface area to maximize evaporation and the formation of a vapor cloud.

In the case of fuel oil, a dense gas dispersion computer model (DEGADIS) was used in place of ALOHA to quantify the mass of the vapor present at the lower flammability limit and the distance the cloud traveled before reaching the lower flammability limit. The safe distance for explosion was then determined using TNT equivalent methodologies presented in Regulatory Guide 1.91 as well as FM Global's *Guidelines for Evaluating the Effects of Vapor Cloud Explosions Using TNT Equivalency Method* (Reference 212).

The hazardous effects due to a flammable/explosive vapor cloud are described in the following subsections and summarized in Table 2.2-208.

2.2.3.1.2.1 Unit 1 Onsite Chemicals

Units 2 and 3 are close to the Unit 1 chemical storage locations. The hazardous materials stored on site that were identified for further analysis with regard to forming a flammable vapor cloud capable of delayed ignition following an accidental release of the hazardous material were gasoline and hydrazine (35% solution). As described in Subsection 2.2.3.1.2, the ALOHA dispersion model was used to determine the distance a vapor cloud can travel to reach the lower flammability limit

boundary once a vapor cloud has formed from an accidental release of the identified chemical. It was conservatively assumed that the entire contents of the gasoline and hydrazine vessels leaked forming a 1-centimeter-thick puddle. The results indicate that any plausible vapor cloud that could form and mix sufficiently under stable atmospheric conditions would be below the lower flammability limit boundary before reaching the nearest safety-related structure—the Unit 2 auxiliary building. The distance to the lower flammability limit boundary for gasoline is 387 feet and for hydrazine, the distance to the lower flammability limit boundary is less than 33 feet. Gasoline is stored approximately 2,362 feet from the Unit 2 auxiliary building, and hydrazine approximately 3,600 feet from the Unit 2 auxiliary building (Table 2.2-208).

A vapor cloud explosion analysis was also completed as detailed in Subsection 2.2.3.1.1.2 to obtain safe distances. The results indicate that the safe distances, the minimum distance required for an explosion to have less than a 1 psi peak incident pressure, are less than the shortest distance to the nearest safety-related structure for Units 2 and 3—the Unit 2 auxiliary building—and the storage location of these chemicals. The safe distance for the 50,000-gallon gasoline tank is 981 feet; and for hydrazine, no explosion occurs. In the case of hydrazine, no explosion occurs because the vapor pressure for hydrazine is sufficiently low that not enough of a vapor is released from the spill for a vapor cloud explosion to occur. Gasoline is stored at approximately 2,362 feet; and hydrazine approximately 3,600 feet from the nearest safety-related structure—the Unit 2 auxiliary building. Therefore, a flammable vapor cloud with the possibility of ignition or explosion formed from the storage of the onsite chemicals analyzed would not adversely affect the safe operation or shutdown of Units 2 and 3 (Table 2.2-208).

2.2.3.1.2.2 Pipelines

As described in Subsection 2.2.2.3, SCE&G maintains a pipeline near the Parr Hydro facility that provides natural gas to the Parr Combustion Turbines. Unit 3 is located approximately 6,944 feet from the gas pipeline break point. To conservatively evaluate the consequences from a potential flammable vapor cloud or vapor cloud explosion from a natural gas transmission pipeline, a worst-case scenario was considered involving the release of natural gas directly into the atmosphere resulting in a vapor cloud. As the modeled vapor cloud travels towards Units 2 and 3, it is possible that the cloud concentration could become flammable along its path. The results indicate that under this scenario, the flammable vapor cloud does not exist at distances beyond 574 feet (distance to lower flammability limit) downwind from the pipe break and the ensuing explosion produces a peak incident pressure of 1 psi at a distance of 1,103 feet. Therefore, the safe distance for the vapor cloud explosion is 1,677 feet. This distance is significantly less than the distance from the pipeline to the nearest safety-related structure for Unit 2 and 3. Therefore, a flammable vapor cloud ignition or explosion from a rupture in the SCE&G natural gas transmission pipeline would not adversely affect the safe operation or shutdown of Units 2 and 3 (Table 2.2-208).

2.2.3.1.2.3 Railroad Tank Car Shipment

As described in Subsection 2.2.2.6, Norfolk Southern Railroad's rail line passes approximately 4,200 feet away from the nearest safety-related structure—the Unit 3 auxiliary building. Based on Regulatory Guide 1.91, the maximum explosive cargo in a single railroad box car is approximately 132,000 pounds.

The hazardous materials shipped by rail that were identified for further analysis with regard to forming a flammable vapor cloud capable of delayed ignition following an accidental release of the hazardous material were ethanol, isopropanol, and cyclohexylamine.

As described in Subsection 2.2.3.1.2, the ALOHA dispersion model was used to determine the distance a vapor cloud can travel to reach the lower flammability limit boundary once a vapor cloud has formed from an accidental release of the identified chemical. It was conservatively assumed that

the entire contents of the ethanol, isopropanol, and cyclohexylamine vessels leaked forming a 1-centimeter-thick puddle. The results indicate that any plausible vapor cloud that could form and mix sufficiently under stable atmospheric conditions would be below the lower flammability limit boundary before reaching the nearest safety-related structure for Unit 2 or 3—the Unit 3 auxiliary building. The distance to the lower flammability limit boundary for ethanol is 396 feet. For isopropanol the distance to the lower flammability limit boundary is 513 feet, and for cyclohexylamine, the distance to the lower flammability limit boundary is 222 feet (Table 2.2-208).

A vapor cloud explosion analysis was also completed as detailed in Subsection 2.2.3.1.2 to obtain safe distances. The results indicate that the safe distances, the minimum distance required for an explosion to have less than a 1 psi peak incident pressure, are less than the shortest distance to the nearest safety-related structure for Unit 2 or 3—the Unit 3 auxiliary building—and the shipping rail of these chemicals. The safe distance for the ethanol tank is 897 feet; for isopropanol it is 1,074 feet; and for cyclohexylamine it is 543 feet. Each of these chemicals is transported by rail at approximately 4,200 feet from the nearest safety-related structure—the Unit 3 auxiliary building. Therefore, a flammable vapor cloud with the possibility of ignition or explosion formed from the shipment of the transported chemicals analyzed would not adversely affect the safe operation or shutdown of Units 2 and 3 (Table 2.2-208).

2.2.3.1.2.4 Nearby Facilities

An alternative fuel to the natural gas pipeline for the Parr Combustion Turbines is the fuel from the fuel oil storage tank. This tank has a storage capacity of 800,000 gallons and is located approximately 7,267 feet south of Unit 3. Using the DEGADIS model, the flammable mass was estimated by the given worst-case meteorological conditions. The plume’s vapor concentration never reaches the lower flammability limit and, therefore, never becomes flammable or explosive. Therefore, the distance from the fuel oil storage tank used by the Parr Combustion Turbines meets the safe distance requirements as defined under Regulatory Guide 1.91.

2.2.3.1.3 Toxic Chemicals

Accidents involving the release of toxic chemicals from onsite storage facilities and nearby mobile and stationary sources were considered. Toxic chemicals known to be present on site or in the vicinity of Units 2 and 3, or to be frequently transported in the vicinity, were evaluated. NRC Regulatory Guide 1.78, *Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release,* Revision 1, requires evaluation of control room habitability following a postulated external release of hazardous chemicals from mobile or stationary sources, onsite or offsite.

The potential onsite chemicals (Table 2.2-205), and those transported by railroad (Table 2.2-206) were evaluated to determine which hazardous materials should be analyzed with respect to their potential to form a toxic vapor cloud following an accidental release.

The ALOHA air dispersion model was used to predict the concentrations of toxic chemical clouds as they disperse downwind for all facilities and sources except for the fuel oil, which was analyzed using the Toxic Dispersion Model (TOXDISP), Revision 3. The maximum distance a cloud can travel before it disperses enough to fall below the Immediately Dangerous to Life and Health (IDLH) concentration in the vapor cloud was determined using ALOHA. The ALOHA model was also used to predict the concentration of the chemical in the control room following a chemical release to ensure that, under worst-case scenarios, control room operators will have sufficient time to take appropriate action.

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), promulgated by the Occupational Safety and Health Administration or adopted by the American Conference of Governmental Hygienists were used as the toxicity concentration level.

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.

2.2.3.1.3.1 Unit 1 Onsite Chemicals

As shown in Figure 2.2-201, Units 2 and 3 are located relatively close to Unit 1. The hazardous materials stored on site that were identified from Table 2.2-205 for further analysis with regard to a toxic vapor cloud were: 28% ammonium hydroxide, carbon dioxide, chlorine, gasoline, hydrazine (35% solution), nitrogen, and sodium hypochlorite (12% solution).

As described in Subsection 2.2.3.1.3, the identified hazardous materials 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 would be in the control room following an accidental release. Nitrogen concentration was determined at the control room following a release from the largest storage vessel. In this case, the concentration of asphyxiant at the control room (96.2 ppm of nitrogen) would not displace enough oxygen for the control room to become an oxygen-deficient environment, nor would it be otherwise toxic at this concentration (Reference 228). The remaining chemical analysis indicates that the control room can safely remain habitable for the worst-case toxic release scenario.

- In evaluating the 28% ammonium hydroxide storage tank spill the following inputs were used in the model:
- Pasquill Stability Class F selected to represent the worst 5% of meteorological conditions observed.
- 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.
- The tank was filled to capacity and a catastrophic tank failure was assumed where the total amount of the substance leaked into a basin with an equivalent radius of 6.1 meters. The ammonium hydroxide storage tank is located within a dammed area with a trough draining to the waste neutralizing basin. The total dammed area, including the drain troughs and waste neutralizing basin, has an equivalent radius of 6.1 meters. Assuming that the entire contents of the tank would be contained in the dammed area is conservative given that any fluid within the dammed area would actually drain to a waste neutralizing basin consisting of a 15 foot deep reservoir with a large liquid inventory. This would serve to dilute the ammonium hydroxide, thus lowering its vapor pressure and thereby reducing the amount that evaporates.

- 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 formation of a toxic vapor cloud following an accidental release of the analyzed hazardous materials stored on site would not adversely affect the safe operation or shutdown of Units 2 and 3.

2.2.3.1.3.2 Pipelines

As described in Subsection 2.2.2.3, SCE&G maintains a pipeline near Parr Hydro that provides natural gas to the Parr Combustion Turbines. There is no IDLH or other toxicity limit established for natural gas. Therefore, no further evaluation is required.

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).

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 materials shipped by rail that were identified for further analysis with regard to the potential of the formation of toxic vapor clouds formed following an accidental release were chlorodifluoromethane, cyclohexylamine, ethanol, and isopropanol.

As described in Subsection 2.2.3.1.3, the identified hazardous materials 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 chemicals would be in the control room following an accidental release. The concentrations were determined at the control room following a release from the largest storage vessel.

In evaluating the identified toxic chemical scenarios, the following inputs were used:

- 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.

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

- 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.

The chemical analyses for chlorodifluoromethane, cyclohexylamine, ethanol, and isopropanol indicate 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.

2.2.3.1.3.4 Nearby Facilities

An alternative fuel to the natural gas pipeline for the Parr Combustion Turbines is the fuel from the fuel oil storage tank. This tank has a storage capacity of 800,000 gallons and is located approximately 7,267 feet south from Unit 3. The TOXDISP model was used to estimate vapor concentrations at distances and elevations away from the spill given favorable atmospheric conditions. The program estimates pollutant emission rates of normal and low boiling point chemicals. Using worst-case meteorological conditions, the vapor toxicity concentration level that reaches the control room was calculated as being 0.672 ppm, well below the 100 ppm threshold limit value-time-weighted average concentration recommended for this fuel type. Therefore, the toxicity from the failure of the fuel oil storage tank used by the Parr Combustion Turbines meets the safe toxicity limit requirement of Regulatory Guide 1.78.

2.2.3.1.4 Forest Fire Smoke and Heat Fluxes

Accidents were considered in the vicinity of Units 2 and 3 that could lead to high heat fluxes or smoke, and nonflammable gas or chemical-bearing clouds from the release of materials as a consequence of fires.

Large amounts of vegetation are in the vicinity of Units 2 and 3 and a wildfire could occur. An analysis following methodology in NUREG-1805 was performed to determine the incident heat flux on the Units 2 and 3. The following conservative assumptions were used in calculating the incident heat flux:

- The wildfire was assumed to occur at plant elevation.
- The closest forest area with a significant fire line is that due west of the southernmost unit, Unit 3.
- It was assumed that the wildfire is burning toward the plant (transmission lines) in a uniform fire line perpendicular to the line identifying the closest separation. This fire line is conservatively confined to 1,000 feet, running north to south along the western edge of the transmission line. This area is assumed to continuously and simultaneously burn at peak output.
- Tree heights are conservatively assumed to be 82 feet.
- The flame height calculated is conservatively assumed to be the height of the calculated flame in addition to the tree height.
- The wildfire postulated was assumed to have a spread rate of 0.5 m/s.

The incident heat flux at the closest structure, the firewater storage tank of Unit 3 located 1,050 feet from the postulated fire was calculated to be 1.287 kW/m^2. Therefore, given the low incident heat flux calculated, the long separation distances to safety-related structures, and the various conservatisms, a wildfire would not affect the safe operation or shutdown of Units 2 and 3.

The South Carolina Forestry Commission has a statewide wildland fire prevention, detection and control network in place. This system actively controls wildfire prevention on both public and

commercial land within the state through the use of controlled burns, a network of wildfire fighters, government entities and fire stations, and an education program. This system will serve to limit the number of offsite forest fires that could generate enough smoke to inhibit operations at the site. Also, Section 9.4 describes the operation of the HVAC system in the event that smoke is detected at an air intake which will protect operators from any smoke resulting from forest fires.

Due to the lack of facilities with hazardous materials that could create non-flammable gases or chemical bearing clouds as a result of a forest fire located within 5 miles of the site as described in Subsection 2.2.2, these clouds are not considered to be a concern.

2.2.3.1.5 Collision with Intake Structure

As discussed in Subsection 2.2.2.4, commercial tankers or shipping barges do not navigate the Monticello Reservoir. Taking into account the small size of recreational water vehicles that can navigate on the reservoir, a potential does exist for a collision to take place at the intake structure. However, since the intake system is a nonsafety-related structure, further analysis as to what kind of possible effect a collision would have on the continuing safe plant operation is not necessary.

2.2.3.1.6 Liquid Spills

The accidental release of oil or liquids that may be corrosive, cryogenic, or coagulant were considered to determine if a potential exists for such liquids to be drawn into the plant’s intake structure and circulating water system or otherwise affect the plant’s safe operation. As discussed in Subsection 2.2.2.4, commercial tankers or shipping barges do not navigate the Monticello Reservoir. Therefore, no significant corrosive, cryogenic, or coagulant spills could be drawn into the nonsafety-related intake structure.

2.2.3.1.7 Radiological Hazards

The hazard due to the release of radioactive material from Unit 1 as a result of normal operations or an unanticipated event would not threaten safety of Units 2 and 3. Smoke detectors, radiation detectors, and associated control equipment are installed at various plant locations as necessary to provide the appropriate operation of the systems. Radiation monitoring of the main control room environment is provided by the radiation monitoring system. The habitability systems for the AP1000 reactor are capable of maintaining the main control room environment suitable for prolonged occupancy throughout the duration of the postulated accidents that require protection from external fire, smoke, and airborne radioactivity. Automatic actuation of the individual systems that perform a habitability systems function is provided. In addition, safety-related structures, systems, and components for the AP1000 reactor have been designed to withstand the effects of radiological events and the consequential releases that would bound the contamination from a release from either of these potential sources.

2.2.3.1.8 Effects of Design Basis Events

In evaluating the potential hazards in the vicinity of Units 2 and 3, conservative assumptions were made and accepted NRC guidance was used to calculate the consequences of events and releases. No events were identified that had a probability of occurrence of greater than 10^{-7} per year, or potential consequences serious enough to affect the safety of Units 2 and 3. Based on this, it is concluded that the guidelines in 10 CFR Part 100 would not be exceeded. Therefore, there are no accidents or events associated with nearby industrial, transportation, or military facilities that are considered to be design basis events.

2.2.4 Combined License Information for Identification of Site-Specific Potential Hazards

Site-specific information related to the identification of potential hazards within the site vicinity is addressed in Subsections 2.2.1, 2.2.3, 2.2.2.2.3, 2.2.2.5, and 2.2.2.7.6. The site-specific information provides a review of aircraft hazards, information on nearby transportation routes, and information on potential industrial and military hazards.

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Table 2.2-1
AP1000 OnSite Explosion Safe Distances

Material	Explosion Minimum Safe Distance[1] (feet)	Flammable Vapor Cloud Safe Distance[1] (feet)	AP1000 Distance to SSC (feet)
Liquid Hydrogen, H_2	577	175	635
Pressurized Gaseous Hydrogen, H_2	6	Not Applicable	10
Hydrazine, N_2H_4	45	Not Applicable	176
Morpholine, $O(CH_2CH_2)_2NH$	66	Not Applicable	176
3-Methoxy propylamine (MOPA), $C_4H_{11}NO$	87	Not Applicable	176
No. 2 Diesel Fuel Oil	280	Not Applicable	318
Waste Oil	102	Not Applicable	201

Note:
1. Safe distance is to nearest point of nuclear island SSC.

Table 2.2-201
Description of Facilities, Products, and Materials

Facility	Concise Description	Primary Function	Approximate Number of SCE&G Employees	Major Products or Materials
VCSNS	Unit 1 is a 1,000 MWe pressurized water reactor licensed by the NRC	Nuclear Power Generator	650	Electric Power
Fairfield Pumped Storage Facility	A 576 MWe[(a)] hydroelectric pumped storage facility used to pump water from the Broad River to the Monticello Reservoir	Hydroelectric Power Generator	34	Electric Power
Parr Hydro	A 14 MWe hydroelectric facility	Hydroelectric Power Generator	2	Electric Power
Parr Combustion Turbines	Turbines using natural gas or fuel oil	Combustion Power Generator	2	Electric Power

(a) recently uprated

(Reference 224)

Table 2.2-202
Unit 1 Onsite Chemical Storage

Material	Physical State	Toxicity Limit (IDLH)	Max. quantity in largest container (lb)	Location	Shipping Mode
1-Bromo-3-Chloro-5,5-Dimethylhydantoin	Solid	None established	32,000	SWB	Ground
Aluminum Welding	Solid	None established	200	WHS A & B	Ground
28% Ammonium Hydroxide	Liquid	300 ppm as ammonia	56,000	WT-436N	Ground
Butylated Triphenylphosphate	Liquid	None established	440	OSA	Ground
Carbon Dioxide	Gas	40,000 ppm	20,000	TB South	Ground
Chlorine	Gas	10 ppm	50	CL Shed	Ground
Depositrol BL5300	Solid	500 mg/m^3 (as phosphonic acid)	32,000	SWB	Ground
Fuel Oil	Liquid	None established	4,000,000	ABST D/G B, ABN	Ground
Ethylene Glycol	Liquid	None established	450	OSA	Ground
Gasoline	Liquid	300 ppm (TWA)[a]	50,000[b]	AMA, GSA	Ground
Highly Refined Base Oil (Lubricating Oil)	Liquid	None established	269,900	TB-South, TB-412, OSA	Ground
Mineral Oil	Liquid	2,500 mg/m^3	440	WHS E	Ground
Trixylenyl Phosphate	Liquid	None established	7,600	TB-412, OSA	Ground
Hydrazine 35%	Liquid	50 ppm	280	WHS E, WT-436	Ground
Kerosene	Liquid	100 mg/m^3(TWA)[a]	68,700	AMA	Ground
Lead	Solid	100 mg/m^3	55	Lead Storage, WHS E	Ground
Nitrogen	Gas	Asphyxiant	4,000	Nitrogen Farm CSR, RCL	Ground
Sodium Hydroxide	Liquid	None established	400,000	WT-436N, AB-West, WHS E, SCL, SWB	Ground
Sodium Hypochlorite 12%	Liquid	10 ppm for chlorine	45	CPW, WHS E, WT-436	Ground
Spectrus CT1300	Liquid	None established	32,000	SWB	Ground
Steel Welding Rods	Solid	None established	2,000	WHS B	Ground
Sulfuric Acid	Liquid	15 mg/m^3	120,000	WT-436, WHS E, CHS, SCL	Ground
Transformer Oil	Liquid	None established	120,000	Transformer Area	Ground
Tungsten Welding Rods	Solid	None established	20	WHS B	Ground

(a) Time-weighted average (TWA)
(b) Onsite delivery tanker truck which refuels the gasoline underground storage tank at Unit 1

ABST = auxiliary boiler storage tank
AMA = auto maintenance area
CHS = chemical storage area
CL = chlorine
CPW = Construction Potable Water Building
CSR = cylinder storage racks
OSA = oil storage area
RCL = radiological chemical lab
SCL = secondary chemistry lab
SWB = Service Water Building
TB = Turbine Building
WHS = Warehouse A, B, E
WT = water treatment
(References 205, 206, 213, 214, 215, 216, 223, and 232)

Table 2.2-203
Top 25 Commodities Shipped Via NSRC Railroad Past Alston, South Carolina, April 2005–April 2006

HMRC	Proper Shipping Name	Class	Pkg. Group	HAZ. Zone	UN/NA
4950150	FAK-Hazardous Materials	FAK	—	—	N/A
4950130	FAK-Hazardous Materials	FAK	—	—	N/A
4966333	Air Bag Modules	9	III	—	UN3268
4904520	Chlorodifluoromethane	2.2	—	—	UN1018
4918795	Calcium Hypochlorite	5.1	II, III	—	UN2880
4931310	Alkyl Sulfonic Acids	8	III	—	UN2586
4909118	Ethanol	3	II, III	—	UN1170
4931461	Corrosive Solid, Acidic	8	I, II, III	—	UN3260
4961166	Engines, Internal	9	N/A	—	UN3166
4909205	Isopropanol	3	II	—	UN1219
4960131	Environmentally Hazardous	9	III	—	UN3082
4917404	Paraformaldehyde	4.1	III	—	UN2213
4918715	Calcium Hypochlorite, Dry	5.1	II, III	—	UN1748
4930216	Battery Fluid, Acid	8	II	—	UN2796
4931458	Alkylphenols, Solid	8	I, II, III	—	UN2430
4904305	Articles, Pressurized	2.2	N/A	—	UN3164
4917349	2-Bromo-2-Nitropropane	4.1	III	—	UN3241
4935263	Corrosive Liquid, Basic	8	I, II, III	—	UN3267
4960133	Environmentally Hazardous	9	III	—	UN3077
4903520	Fireworks	1.4G	II	—	UN0336
4914128	Combustible Liquids	CL	III	—	NA1993
4925291	Organophosphorus	6.1	III	—	UN2783
4935212	Cyclohexylamine	8	II	—	UN2357
4941147	Vehicle, Flammable Liquid	9	N/A	—	UN3166
4904258	Aerosols	2.2	N/A	—	UN1950

(Reference 220)

Table 2.2-204
Aircraft Operations, Significance Factors

Airport	General Activation Operations (Annually)	Distance From Site	Significance Factor[(a)]
Unit 1 Helipad	5	4,550 feet	—
Fairfield County Airport	17,000	11.42 miles	130,416
Shealy Airport	N/A	14 miles	196,000
Newberry County Airport	15,600	18 miles	324,000
Columbia Metropolitan Airport	114,902	22 miles	484,000

(a) 500d^2 movements per year for sites within 5-10 miles and 1,000d^2 movements per year for sites outside 10 miles, where "d" is in miles.

(References 202, 203, 209, 211, 218, 221, and 222)

Table 2.2-205 (Sheet 1 of 2)
Unit 1 Onsite Chemicals, Disposition

Material	Explosion Hazard?	Flammability	Toxicity Limit (IDLH)	Vapor Pressure	Disposition
1-Bromo-3-Chloro-5,5-Dimethylhydantoin	None listed	Not flammable	None established	Not available-solid	No further analysis required
Aluminum Welding	None listed	Not flammable	None established.	Not available-solid	No further analysis required
28% Ammonium Hydroxide	None listed	Not flammable	300 ppm as Ammonia	Not available	Toxicity Analysis
Butylated Triphenylphosphate	None listed	Not flammable	None established	<0.033 mmHg @150°C	No further analysis required
Carbon Dioxide	None listed	Not flammable	40,000 ppm	907.3 psi @ 75°F	Toxicity Analysis
Chlorine	None listed	Not flammable	10 ppm	74.04 psi @ 50°F	Toxicity Analysis
Depositrol BL5300 (as phosphonic acid)	None listed	Not flammable	500 mg/m^3	Not available-solid	No further analysis required
Fuel Oil	None listed	1.3%-6.0%	None established	0.100 psi @ 100°F	No further analysis required—low vapor pressure[a]
Ethylene Glycol	None listed	3.2%-upper explosive limit not listed	None established	0.005 psi @ 100°F	No further analysis required—low vapor pressure[a]
Gasoline	Vapor may explode	1.4%-7.4%	300 ppm (TWA)[b]	292 mmHg @ 81.4°F	Explosion Analysis Flammability Analysis Toxicity Analysis
Highly Refined Base Oil (Lubricating Oil)	None listed	Not flammable	None established	0.100 psi @ 100°F	No further analysis required—low vapor pressure[a]
Mineral Oil	None listed	Not flammable	2,500 mg/m^3	0.100 psi @ 100°F	No further analysis required—low vapor pressure[a]
Trixylenyl Phosphate	None listed	Not flammable	None established	Not available	No further analysis required
Hydrazine 35%	Vapor may explode	4.7%-100%	50 ppm	0.567 psi @ 100°F	Explosion Analysis Flammability Analysis Toxicity Analysis
Kerosene	None listed	0.7%–5%	100 mg/m^3 (TWA)[b]	0.099 psi @ 100°F	No further analysis required—low vapor pressure[a]
Lead	None listed	Not flammable	100 mg/m^3	Not available-solid	No further analysis required - low vapor pressure[a]
Nitrogen	None listed	Not flammable	Asphyxiant	760 mmHg @ –196°C	Toxicity-considered as asphyxiant
Sodium Hydroxide	None listed	Not flammable	None established	Not available	No further analysis required

Table 2.2-205 (Sheet 2 of 2)
Unit 1 Onsite Chemicals, Disposition

Material	Explosion Hazard?	Flammability	Toxicity Limit (IDLH)	Vapor Pressure	Disposition
Sodium Hypochlorite 12%	None listed	Not flammable	10 ppm for chlorine	Not available	Toxicity Analysis
Spectrus CT1300	None listed	Not flammable	None established	Not available	No further analysis required
Steel Welding Rods	None listed	Not flammable	None established	Not available-solid	No further analysis required
Sulfuric Acid	None listed	Not flammable	15 mg/m^3	0.001 mmHg @ 68°F	No further analysis required—low vapor pressure[(a)]
Transformer Oil	None listed	Not flammable	None established	0.100 psi @ 100°F	No further analysis required—low vapor pressure[(a)]
Tungsten Welding Rods	None listed	Not flammable	None established.	Not available-solid	No further analysis required

(a) 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.

(b) Time-weighted average (TWA)

(References 201, 205, 206, 213, 214, 215, 216, 223, and 232)

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	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	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	33 mmHg @ 68°F	Explosion Analysis Flammability Analysis
Environmentally Hazardous	Category too Broad to Analyze				
Paraformaldehyde	None listed	Flammable solid	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]

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

Material	Explosion Hazard?	Flammability	Toxicity Limit (IDLH)	Vapor Pressure	Disposition
Cyclohexylamine	Vapor may explode	1.5%–9.4%	10 ppm TWA[(b)]	11 mmHg @ 68°F	Explosion Analysis
					Flammability Analysis
					Toxicity Analysis
Vehicle, Flammable Liquid	Category too Broad to Analyze				
Aerosols	Category too Broad to Analyze				

(a) Short term exposure limit (STEL).
(b) Time-weighted averaged (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)

Table 2.2-207
Potential Design Basis Events, Explosions

Source	Pollutant Evaluated	Quantity	Heat of Combustion (Btu/lb)	Distance to nearest safety-related structure of Unit 2 (ft)	Distance to nearest safety-related structure of Unit 3 (ft)	Distance for Explosion to have less than 1 psi of Peak Incident Pressure (ft)
Pipeline - SCE&G	Natural Gas[(a)]	1,265,386 lb			6,944	6,284
Norfolk Southern Railroad Line	Ethanol	132,000 lbs	11,570		4,200	317
	Isopropanol		12,960			316
	Cyclohexylamine		18,000			363
Onsite (Includes Unit 1)	Gasoline[(b)] (50,000 lb tanker truck)	50,000 lbs	18,720	2,362		260
	35% Hydrazine (as 100%)	280 lbs	8,345	3,600		52
Nearby Facilities	Fuel Oil[(c)]	800,000 gal	18,400		7,267	1,456
Highway - Bounded by onsite gasoline tanker truck						

(a) This is based on a 10-minute release.
(b) Onsite delivery tanker truck that refuels the gasoline underground storage tank at Unit 1.
(c) Tank location is 7,267 feet from Unit 3, near the Parr Combustion Turbines.

Table 2.2-208
Potential Design Basis Events, Vapor Cloud Explosions and Flammable Vapor Clouds (Delayed Ignition)

Source	Pollutant Evaluated	Quantity	Distance to Nearest Safety-Related Structure of Unit 2 (ft)	Distance to Nearest Safety-Related Structure of Unit 3 (ft)	Distance to UFL (ft)	Distance to LFL (ft)	Safe Distance for Vapor Cloud Explosions (ft)	Peak Over Pressure at Nearest Safety-Related Structure
Pipeline- SCE&G	Natural Gas	1,370.09 lbs		6,944		575	1,677	No significant overpressure
Norfolk Southern Railroad Line	Ethanol	132,000 lbs		4,200	231	396	897	0.117
	Isopropanol				273	513	1,074	0.142
	Cyclohexylamine				Never reached	222	543	No significant overpressure
Onsite (Includes Unit 1)	Gasoline[(a)] (50,000 lbs tanker truck)	50,000 lbs	2,362		228	387	981	0.271
	35% Hydrazine (as 100%)	280 lbs	3,600		<33	<33	No explosion	No explosion
Nearby Facilities	Fuel Oil[(b)]	800,000 gal		7,267			Never reaches LFL	Not available
Highway - Bounded by onsite gasoline tanker truck								

(a) Onsite delivery tanker truck that refuels the gasoline underground storage tank at Unit 1.
(b) Tank location is 7,267 feet from Unit 3, near the Parr Combustion Turbines.

LFL = lower flammability limit
UFL = upper flammability limit

Table 2.2-209 (Sheet 1 of 2)
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)
Norfolk Southern Railroad Line	Chlorodifluoromethane	34,500 gallons	1,250 ppm STEL[(c)]		4,200	9,504[(f)]
	Cyclohexylamine	34,500 gallons	10 ppm TWA[(e)]			9,504[(g)]
	Ethanol	34,500 gallons	3,300 ppm			657
	Isopropanol	34,500 gallons	2,000 ppm			786
Onsite (Unit 1)	28% Ammonium Hydroxide	56,000 lbs	300 ppm	4,264		4,041
	Carbon Dioxide	20,000 lbs	40,000 ppm	3,999		1,452
	Chlorine	50 lbs	10 ppm	4,264		2,220
	Gasoline[(a)] (50,000 lbs tanker truck)	50,000 lbs	300 ppm TWA[(e)]	2,362		1,932
	35% Hydrazine (as 100%)	280 lbs	50 ppm	3,600		411
	Nitrogen	4,000 lbs	Asphyxiant	4,624		Asphyxiant
	Sodium Hypochlorite 12%	45 lbs	10 ppm	3,600		<33
Nearby Facilities	Fuel Oil[(b)]	800,000 gal	None Listed		7,267	Never exceeds IDLH
Highway - Bounded by onsite gasoline tanker truck						

Table 2.2-209 (Sheet 2 of 2)
Potential Design Basis Events, Toxic Clouds

(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) Short term exposure limit (STEL)
(d) 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 passed the control room. Based upon this evaluation, the 8-hour TWA would not be exceeded.

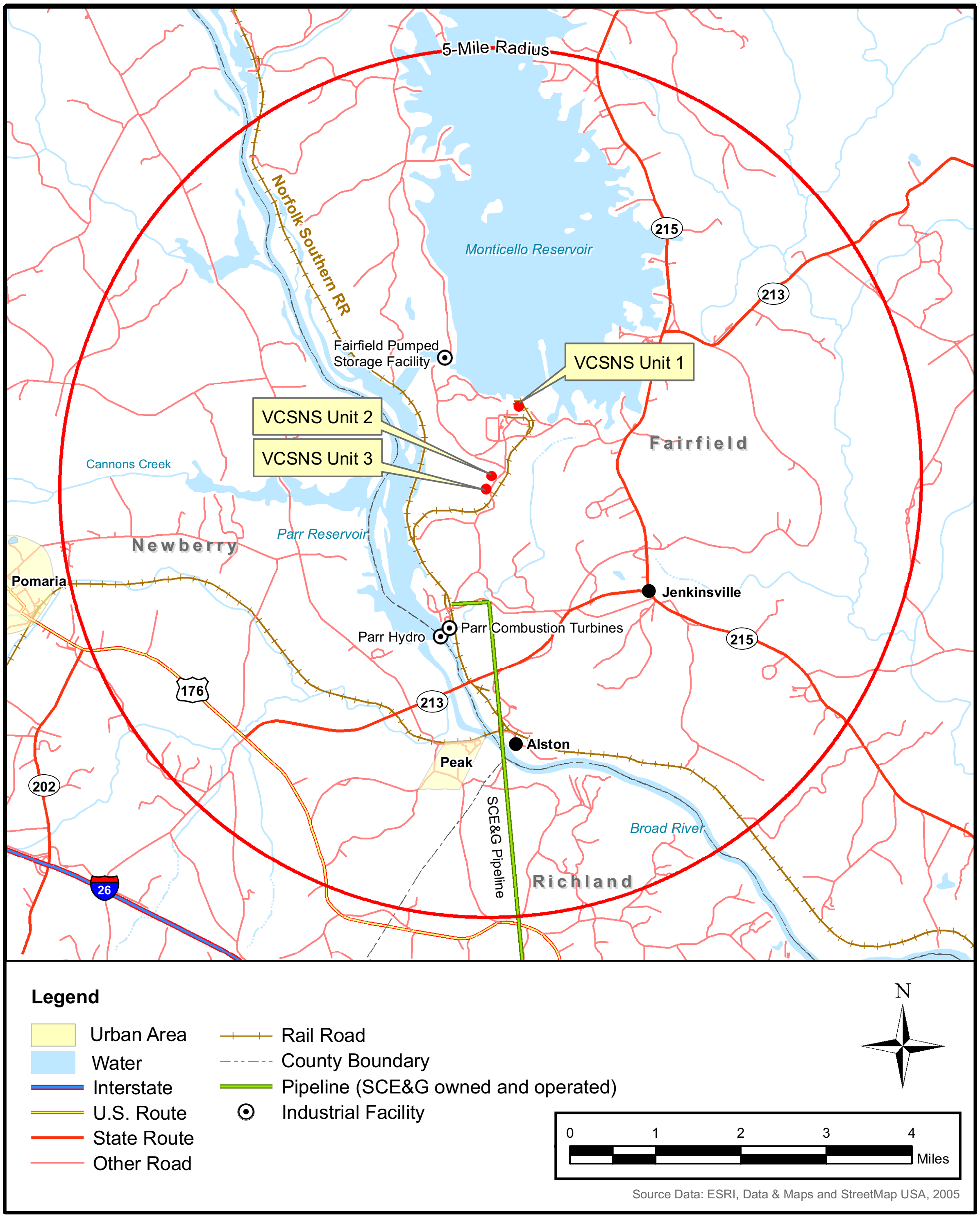

Figure 2.2-201 Site Vicinity Map of Industrial Facilities inside a 5-Mile Radius of Units 2 and 3

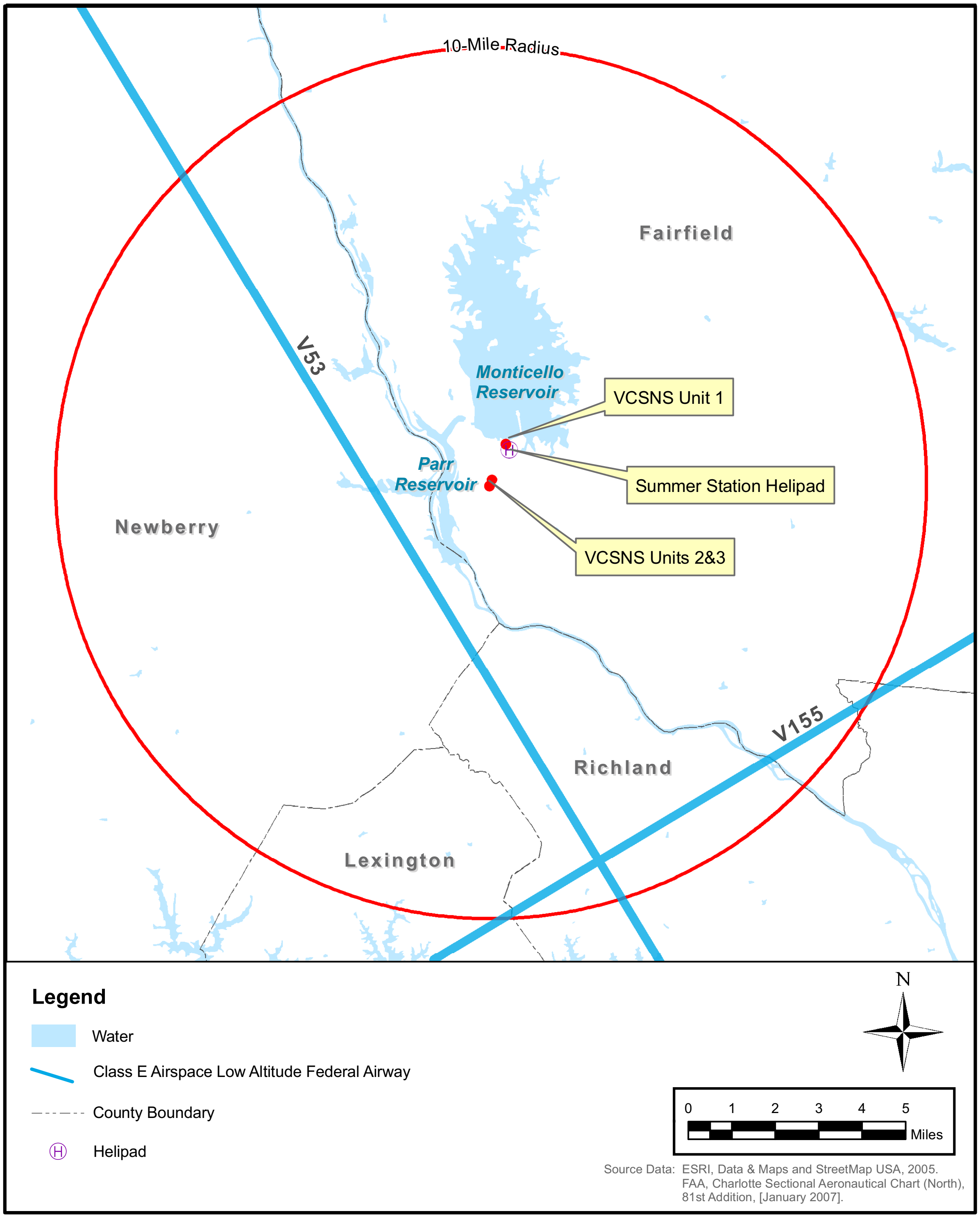

Figure 2.2-202 Airport and Airway Locations

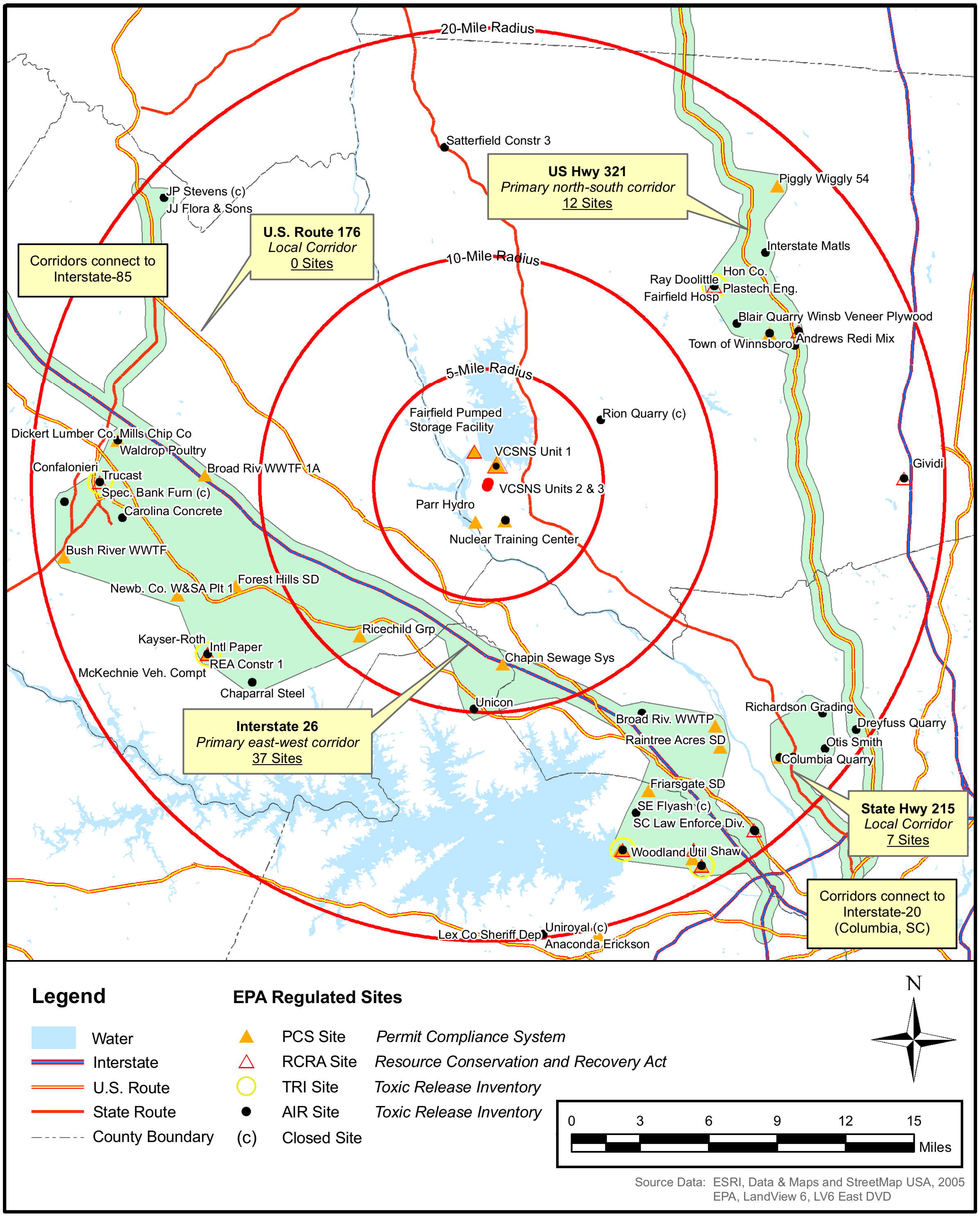

Figure 2.2-203 Corridor Analysis Study Map