2.2 Identification of Potential Hazards in Site Vicinity

2.2.1 Location of Nearby Industrial, Transportation, and Military Facilities

Within a 5-mile vicinity of the VEGP site, there are several major industrial facilities, one railroad, and one highway with commercial traffic. Specifically, the following transportation routes and facilities are shown on the indicated figures:

- Plant Wilson (see Figure 2.2-201)
- Savannah River Site (see Figure 2.2-202)
- Georgia State Highway 23 (see Figure 2.2-203)
- CSX Railroad (see Figure 2.2-201)
- A coal-fired steam plant operated by Washington Savannah River Company in D-Area of the SRS
- VEGP Unit 1 and Unit 2

Figures 2.2-202 and 2.2-203 show the location of major industrial facilities, military bases, highway transportation routes, airports, railroads, and pipelines within a 25-mile radius of the site. In addition, Figure 2.2-202 shows nearby airways and military operation areas.

Items illustrated on the maps are described in Subsection 2.2.3. The only military facility within a 50-mile radius is Fort Gordon. The Fort Gordon U.S. Army Signal Corps training facility is barely within 25 miles of the VEGP site. The only major storage facility within 25 miles of the VEGP site, other than those at the SRS and at Chem-Nuclear Systems, is a group of oil storage tanks associated with the existing combustion turbine generators for Plant Wilson on the VEGP site.

2.2.2 Descriptions

2.2.2.1 Industrial Facilities

The Burke County Comprehensive Plan: 2010, Part 1 (Reference 207) shows a relatively slow, stable population growth pattern for the county. This is indicative that the nearby industries have not experienced much growth.

The Comprehensive Plan also reveals that services and manufacturing industries dominate the top 10 employers in the county. Southern Nuclear and Samson Manufacturing Company (curtains and draperies) are the largest Burke County employers. Nearby industries also include the Chem-Nuclear Systems radioactive waste disposal site (18 miles away in South Carolina) operated by Duratek; Unitech Services Group nuclear laundry facility (21 miles away in South Carolina); and the facilities of the SRS (also in South Carolina). Table 2.2-201 lists the largest employers for the three-county region, based on recent data obtained for Burke County (Reference 208) in Georgia, and nearby Aiken and Barnwell counties in South Carolina **(**Reference 203**;** Reference 206**)**.

There currently are no projected major increases to industrial, military, or transportation facilities within a 25-mile radius of the VEGP site except for the development of the site for VEGP Units 3 and 4.

2.2.2.1.1 Savannah River Site

The SRS borders the Savannah River for approximately 17 miles opposite the VEGP site. It occupies an approximately circular area of 310 square miles (198,344 acres) encompassing parts of Aiken, Barnwell, and Allendale counties in South Carolina (Reference 230). The SRS is owned by the DOE and operated by an integrated team led by Washington Savannah River Company (WSRC). The site is a closed government reservation except for through traffic on South Carolina Highway 125 (Savannah River Site Road A) and the CSX Railroad.

The SRS processes and stores nuclear materials in support of the national defense and U. S. non-proliferation efforts. The site also develops and deploys technologies to improve the environment and treat nuclear and hazardous wastes left from the Cold War. (Reference 230)

The following is a list of current and near-term operating facilities at the SRS and the activities conducted at these facilities (Reference 230; Reference 213):

- Separations facilities for processing irradiated materials (H Area).
- Waste management facilities that process, dispose or ship solid radioactive waste, hazardous waste, mixed waste, transuranic waste, and sanitary waste (E Area).
- The Defense Waste Processing Facility is processing high-level radioactive waste into stable borosilicate glass for disposal (S Area).
- The Savannah River National Laboratory (a process development laboratory to support production operations and containing two test reactors) and administrative facilities (A Area).
- The L Area Disassembly Basin which provides receipt and interim storage of research reactor fuel (L Area).
- Tritium Extraction Facility to extract tritium from fuel rods irradiated at TVA's reactors and to load the extracted tritium into canisters for shipment to the Department of Defense. Expected to begin operation in fiscal year 2007.
- Replenishment of tritium – recycling, purifying, and reloading nuclear weapons reservoirs.
- MOX Fuel Fabrication Facility (to be constructed) to manage and convert excess weapons-grade plutonium to a form that can be used in commercial nuclear power plants.
- Stabilization, management, and storage of plutonium materials (K Area).
- Salt Waste Processing Facility to remove radioactive constituents from high-level waste (under construction).
- A variety of non-nuclear facilities necessary for plant operations.

Five nuclear production reactors and several small test reactors are deactivated and are awaiting decommissioning and decontamination.

The major waste storage areas for high-level waste are adjacent to the two separations areas and consist of two tank farms linked to the separations areas and to each other by pipelines with secondary containment. In addition, the SRS uses engineered concrete vaults and engineered trenches for the permanent disposal of solid low-level radioactive waste (Reference 230). The

deactivated reactors, separations areas, and waste storage areas are at least 4 miles from the nearest VEGP site boundary.

2.2.2.1.2 Unitech Services Nuclear Laundry Facility

Although not located within 5 miles of the VEGP site, the Unitech Services Nuclear Laundry Facility, located in the Barnwell County Industrial Park, is described due to its relative proximity to and association with the SRS (Figure 2.2-203). It was constructed by Unitech Service Group to provide radiological laundry, decontamination and respirator services. The facility has about 50 employees as of May 2006 (Reference 225).

2.2.2.1.3 Chem-Nuclear Systems

Chem-Nuclear Systems developed, constructed, and operates the largest radioactive waste disposal site in the country near Barnwell, South Carolina (Figure 2.2-203). This site contains 308 acres, of which 235 have been deeded to the State of South Carolina as a designated exclusion area. Waste receipts are in the form of solids only; no liquids are accepted. Since the disposal facility began operation in 1971, about 28 million cubic feet, or 90 percent of the available disposal volume, have been used (Reference 210). The facility handles approximately 400 shipments of low-level spent fuel per year. The products and materials associated with Chem-Nuclear Systems are described in Table 2.2-202 (Reference 224).

2.2.2.1.4 Georgia Power Company's Plant Wilson

Plant Wilson is located approximately 6,000 feet east-southeast from the proposed VEGP Units 3 & 4 footprint. The existing combustion turbine plant is an electrical peaking power station of Georgia Power Company. The plant consists of six combustion turbines with a total rated capacity of 351.6 MW. The storage capacity of the fuel storage tanks is 9,000,000 gallons.

2.2.2.1.5 VEGP Units 1 and 2

The existing VEGP Units 1 and 2 reactors are located about 3,600 ft and 3,900 ft, respectively, west of the Savannah River. For these units, the exclusion area is the same as that for the proposed units and it is defined as an irregular shaped area which generally conforms to the site's boundary lines. There are no residents within the exclusion area, and there are no highways, railways, or waterways crossing the area. Besides the activities at Plant Wilson, the only other activities that may occur within the exclusion area that are unrelated to plant operations are those associated with the operation of the Visitor's Center. VEGP has made arrangements to control and, if necessary, evacuate the exclusion area in the event of an emergency.

2.2.2.2 Mining Activities

There are no mining activities within 5 miles of the VEGP site.

2.2.2.3 Roads

The nearest highway with commercial traffic is Georgia State Highway 23 (Figure 2.2-203). Segments of Georgia State Highways 23, 80, and 56 Spur are located within a 5-mile radius of the site. Other than traffic volumes, the Georgia Department of Transportation does not maintain data on the products and materials carried over these roads. However, major commercial traffic occurs only on State Highway 23, which serves as a major link between Augusta and Savannah. The heaviest truck traffic along State Highway 23 near the site consists primarily of timber and wood products and materials. State Highways 80 and 56 Spur serve primarily as minor transportation routes for local

traffic. Available statistical data on personal injury accidents on these roads between 1999 and 2003 are presented in Table 2.2-203 (Reference 218).

2.2.2.4 Railroads

CSX is the nearest railroad with commercial traffic and is approximately 4.5 miles northeast of the VEGP site. CSX runs through and services the SRS. Major chemical substances identified as being carried by the CSX Railroad include cyclohexane, anhydrous ammonia, carbon monoxide, and elevated temperature material liquids (ETML). (Reference 220)

Burke County has two local Norfolk Southern rail lines, one through Waynesboro and one through Midville. These are approximately 12 miles west of the VEGP site.

2.2.2.5 Waterways

The Savannah River above the VEGP site (River Mile 151) is primarily used for recreational purposes since 1979, with the closing of the New Savannah Bluff Lock and Dam (River Mile 187) to commercial traffic (Reference 226). No commercial facilities or barge slips/docks are visible on satellite imagery between the VEGP site and the New Savannah Bluff Lock and Dam. This section of the river is primarily forested and otherwise undeveloped land to the river's edge.

Downstream of the VEGP site, barge traffic may be present closer to the Port of Savannah (River Mile 21). In 2005, no barge traffic was reported to the Army Corp of Engineers Waterborne Commerce Statistics Center in New Orleans, Louisiana (Reference 227). In 2004, only 13 commercial vessels were recorded (Reference 219). These vessels were reported to contain a total of less than 500 tons of non-explosive residual fuel oil (less than a full barge load).

Therefore, the current use of the river and the lack of commercial facilities and barge slips/docks upstream of the plant indicate that there is no current or projected barge traffic on the Savannah River past the VEGP site. Based on the above information, SNC has determined that evaluation of hazardous shipments by barge is not necessary for VEGP Units 3 and 4.

2.2.2.6 Airports, Airways, and Military Training Routes

2.2.2.6.1 Airports

There are no airports within 10 miles of the VEGP site. The closest airport, Burke County Airport, is approximately 16 miles west-southwest of the VEGP site. It has a 4,035-foot asphalt runway oriented 250° WSW – 70° ENE. The airport, which has a non-directional radio beacon for runway approach, is used by single-engine private aircraft and by crop-dusting operations. There are only two multi-engine and five single-engine aircraft based at the field. The average number of operations (landings and takeoffs are counted separately) is about 57 per week. Most operations are transient general aviation; only about 33 percent are local general aviation (Reference 209).

The closest commercial airport is Augusta Regional Airport at Bush Field, which is located approximately 17 miles north-northwest of the VEGP site. It has an 8,000-foot primary runway oriented 170° SSE – 350° NNW and a 6,000-foot crosswind runway oriented 80° ENE – 260° WSW. FAA information effective April 13, 2006, indicates that 17 aircraft are based on the field. Ten of these are single-engine airplanes, four are multi-engines airplanes, and three are jet-engine airplanes. The average number of operations is about 91 per day. Most (40 percent) are general transient aviation, 24 percent are air taxi, 12 percent are local general aviation, 14 percent are commercial, and 10 percent are military (Reference 205). Based on the historical flight data recorded prior to 2005, projections for air traffic at Bush Field up to fiscal year 2025 are given in Table 2.2-204

(Reference 204). Approach and departure paths at Bush Field are not aligned with the VEGP site; and no regular air traffic patterns for Bush Field extend into airspace over the VEGP site.

A small un-improved grass airstrip is located immediately north of the VEGP site (north of Hancock Landing Road and west of the Savannah River). At its closest point, the airstrip is more than 1.4 mile from the power block of the new units. This privately owned and operated airstrip has a 1,650-foot turf runway oriented 80° East – 260° West. Thus take-offs and landings are tangential to the site property and oriented away from the plant. While no FAA traffic information is available for this airstrip, informal communication with the owner/operator revealed that the airstrip is for personal use and the associated traffic consists only of small single-engine aircraft (Reference 222). In addition, there is a small helicopter landing pad on the VEGP site. This facility exists for corporate use and for use in case of emergency. The traffic associated with either of these facilities may be characterized as sporadic. Therefore, due to the small amount and the nature of the traffic, these facilities do not present a safety hazard to the VEGP site.

2.2.2.6.2 Airways

The centerline of Airway V185 is approximately 1.5 miles west of the VEGP site (Figure 2.2-202). Additionally, Airway V417 is about 12 miles northeast of the VEGP site, and Airway V70 is approximately 20 miles south of the VEGP site (Figure 2.2-202) (Reference 217). Due to its close proximity to the VEGP site, an evaluation of hazards from air traffic along the V185 airway is presented in Subsection 3.5.1.6. That evaluation shows that the presence of Airway V185 is not a safety concern for the VEGP site.

2.2.2.6.3 Military Training Routes

In August 2005, Shaw Air Force Base (AFB), South Carolina, issued a draft Environmental Impact Statement (EIS) (Reference 223) regarding implementing airspace modifications to the Gamecock and Poinsett Military Operation Areas (MOAs) in South Carolina and the Bulldog MOAs in Georgia. The west edge of the Poinsett MOA is about 75 miles east-northeast of the VEGP site. The Gamecock MOAs are east of the Poinsett MOA. The proposed Gamecock E MOA would be created to form a “bridge,” allowing maneuvering and training between the Gamecock MOAs and the Poinsett MOA. The east edge of the Bulldog MOAs is about 11 miles west of the VEGP site (see Figure 2.2-202). Because of the relatively long distances between the VEGP site and these MOAs, and their related training routes, no aircraft accident analysis is required for flight activities associated with these MOAs and their related training routes.

Under the proposed action, the airspace structure at Bulldog A MOA would be expanded to the east under the Bulldog B “shelf” to match the boundary of the existing Bulldog B. Mainly, the current 500-foot msl floor as allowed at Bulldog A would be laterally expanded into Bulldog B. Because the current Bulldog B floor is 10,000 feet msl, this lateral expansion would increase the airspace volume in the Bulldog MOAs. The overall distance from the MOA boundary to the VEGP site is unchanged.

Military aircraft in the Bulldog MOAs are expected to come mainly from Shaw AFB (about 32 miles east of Columbia, South Carolina) and McEntire Air National Guard Station (about 13 miles east-southeast of Columbia). Among the military training routes, VR97-1059 is located closest to the VEGP site. The distance between the centerline of VR97-1059 and the VEGP site is about 18 miles (Figure 2.2-202). The maximum route width of VR97-1059 is 20 nautical miles (NM); therefore, the width on either side of the route centerline is assumed to be 10 NM (11.5 miles). The VEGP site is located more than 6 miles from the edge of this training route. Additionally, the total number of military aircraft using route VR97-1059 is approximately 833 per year (Reference 223).

According to RS-002, *Processing Applications for Early Site Permits*, May 2004 (RS-002), the aircraft accident probability for military training routes is considered to be less than 10^{-7} per year if the

distance from the site is at least 5 statute miles from the edge of military training routes, including low-level training routes, except for those associated with a usage greater than 1,000 flights per year, or where activities may create an unusual stress situation.

In summary, the MOA use is projected to remain relatively unchanged and no modifications are proposed to the military routes. The VEGP site is located more than 5 statute miles from the edge of VR97-1059, and the total military flights using the same route is less than 1,000 per year; therefore, no aircraft accident analysis is required for flights using VR97-1059 (Reference 223).

2.2.2.7 Natural Gas or Petroleum Pipelines

Three pipelines are within 25 miles of the VEGP site (Figure 2.2-203); however, none are located within 10 miles of the VEGP site.

Pipeline 1, located approximately 21 miles northeast of the VEGP site, is an 8-inch-diameter line constructed in 1959. It operates at a maximum pressure of 750 psi; is buried 3 feet deep; has 8-inch Rockwell isolation valves at 25-mile intervals; and carries natural gas. It is not used for storage.

Pipeline 2, located approximately 19 miles southwest of the VEGP site, has a 14-inch-diameter line constructed in 1954 and a 20-inch-diameter line constructed in 1977. Both lines are buried 3-feet deep; operate at a maximum pressure of 1,250 psi; have buried Rockwell isolation valves every 8 to 9 miles; and carry natural gas. They are not used for storage.

Pipeline 3, located approximately 20 miles northwest of the VEGP site, has two 16-inch-diameter lines constructed in 1953 and 1957. Both operate at a maximum pressure of 1,250 psi; are buried 3 feet deep; have buried Rockwell isolation valves every 8 to 9 miles; and carry natural gas.

Because the pipelines identified are well over 10 miles from the VEGP site, there is no need to identify the locations of individual pipeline valves.

2.2.2.8 Military Facilities

There are no military facilities within 5 miles of the VEGP site.

2.2.2.9 VEGP Units 1 and 2 Storage Tanks/Chemicals

Chemicals currently stored at the VEGP site are presented in Table 2.2-205.

2.2.3 Evaluation of Potential Accidents

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 VEGP Units 3 and 4 is covered in this subsection.

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.

Analyses were performed in order to evaluate the impact on the VEGP Units 3 & 4 following potential accidents resulting in an explosion or flammable cloud or toxic chemical releases within a 5-mile radius of the VEGP site. The postulated accidents that would result in an explosion or chemical release were analyzed at the following locations:

- Nearby transportation routes (Savannah River, Highway 23, and CSX Railroad)
- Nearby chemical and fuel storage facilities (Savannah River Site, Plant Wilson)
- Onsite chemical storage tanks
- Other nearby fire sources

The existing analysis of potential hazards to the Units 1 and 2 was reviewed for applicability to the Units 3 and 4. That analysis evaluated postulated releases of flammable materials and toxic gases

transported or stored at industrial facilities within a 5-mile radius of the VEGP site. In addition, new chemicals, which have been identified as being associated with Units 1 and 2, were subsequently evaluated or analyzed to determine their impact to Units 3 and 4. As described below, in each case, these analyses concluded that the potential for hazard is minimal and will not affect safe operation of Units 3 and 4.

2.2.3.1 Explosion and Flammable Vapor Clouds

The effects of explosion and formation of flammable vapor clouds from the nearby sources are evaluated below.

2.2.3.1.1 Truck Traffic

Segments of Georgia State Highways 23, 80, and 56 Spur are located within a 5-mile radius of the VEGP site. Major commercial traffic occurs only on State Highway 23, which serves as a major link between Augusta and Savannah, Georgia.

An analysis of truck-borne hazards that was performed for Units 1 and 2 identified that chlorine (1 ton), anhydrous ammonia (6 tons), liquid nitrogen (6,500 gallons), phosphoric acid (200 lb), nitric acid (5,000 gallons), and diesel oil (6,000 gallons) were transported on nearby Highway 23. At its nearest point, Highway 23 passes about 4.7 miles from the center point of the Units 1 and 2 control rooms. The allowable and actual distances of hazardous chemicals transported on highways were evaluated according to NRC Regulatory Guide 1.91, Revision 1, *Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants*. Regulatory Guide 1.91 cites 1 psi as a conservative value of peak positive incident overpressure, below which no significant damage would be expected. The analysis demonstrated that truck-borne substances transported within a 5-mile radius of the VEGP Units 1 and 2, as well as explosions and flammable vapor clouds induced by these chemicals, would not adversely affect safe operation of the units.

The six chemicals identified above in the analysis of truck traffic were obtained from the original design basis analysis for Units 1 and 2 and were based on a 1975 study performed by the Georgia Institute of Technology for Georgia Power Company. The original study is no longer available, and these chemicals have been re-evaluated as described below.

SNC has obtained the EPA Tier II reports for Burke and Richmond Counties in Georgia, identifying those facilities in the vicinity of the plant that have permits for storing hazardous materials (Reference 216). These reports, along with the EPA Landview 6 database, were used to confirm and/or update the list of chemicals for analysis. (Reference 215) The sites identified from these sources containing chemicals within a 20-mile radius of the VEGP site are depicted on Figure 2.2-204.

A traffic corridor evaluation has been performed to determine whether there are any new or additional chemicals transported by truck within 5 miles of the site related to the facilities described above. The evaluation shows that even fewer chemicals pass by the site now than assumed in the previous analysis performed for the existing units.

Only two EPA regulated sites exist that would likely use State Route 23 to transport materials and equipment. These sites are construction-related sites and are located 7 to 10 miles south of the VEGP site. Neither of these sites currently uses any of the previously identified chemicals, nor have they been identified to use or cause the transport of any hazardous chemicals other than fuel oil or gasoline. The remaining sites are all outside the 5-mile corridor and are likely to transport their materials and equipment via other, more direct, routes, rather than along State Route 23. These remaining sites, therefore, do not warrant further analysis.

The use of bulk anhydrous ammonia has been discontinued at the plant site. Since there are no other users of this chemical in the vicinity of this site, the issue of transportation of this chemical along the roadways or to the site does not require further analysis. (Anhydrous ammonia is still being transported by rail car, and is evaluated in Subsection 2.2.3.1.4).

SNC's re-evaluation concluded that the only remaining hazardous chemicals transported by truck in the vicinity of the site are gasoline and diesel/fuel oil.

For an 8,500 gallon truck on State Road 23 at the closest approach distance of approximately 4.2 miles (22,000 ft), the following calculations were performed in accordance with Regulatory Guide 1.91:

- TNT equivalent safe distance for an explosion of a gasoline vapor cloud
- TNT equivalent safe distance for an explosion of gasoline vapor in a truck

The gasoline truck analysis for the vapor cloud explosion used the industry standard program DEGADIS to calculate the distance from the site of the spill to the boundaries of the upper and lower flammability limits and to obtain the flammable mass within the vapor plume. The concentrations were compared to the lower flammability limits for the respective chemical to determine the maximum distance for the flammable vapor cloud. The input parameters were:

- Quantity of gasoline in the truck = 50,000 lb (56,165 lb TNT equivalent)
- Physical property data:
  - Molecular weight = 95 g/mole
  - Diffusion coefficient = 0.05 cm^2/sec
  - Vapor pressure = 305 mm Hg
  - Boiling point temperature = 130°C
  - Specific gravity = 0.732
- The meteorological conditions assumed were:
  - Stability class = F (stable)
  - Wind speeds = 1 m/s up to 2.5 m/s

For an explosion from an 8,500 gallon truck, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 1,723 feet.

For an explosion from a flammable vapor cloud, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 1,279 feet. The outer edge of the lower flammability limit (LFL) of the flammable portion of the gasoline vapor cloud is 1200 ft downwind from the road. If the blast occurs at the outer edge of the vapor cloud, which is a conservative assumption, then the maximum distance for which a peak incident of 1 psi would occur is the sum of the two distances, or 2,479 ft from the road.

The distance between State Road 23 and Units 3 and 4 is approximately 4.2 miles. This distance is far greater than either of the above calculated critical distances. Therefore, there will not be any impact on Unit 3 or 4 from an explosion of gasoline from a truck or vapor cloud.

The size of gasoline delivery trucks on State Road 23 ranges from 4,000 to 8,500 gallons, so the assumption of an 8,500-gallon truck in the analysis is conservative and bounding.

In addition to road transit, gasoline is delivered to the site by a tank wagon (10-wheel truck) containing a maximum volume of 4,000 gallons. The closest distance from the site delivery route to the power block circle is approximately 2,000 feet.

For an explosion from a 4,000 gallon truck, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 1,340 feet.

For an explosion from a flammable vapor cloud, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 920 feet. The outer edge of the lower flammability limit (LFL) of the flammable portion of the gasoline vapor cloud is 738 ft downwind from the road. If the blast occurs at the outer edge of the vapor cloud, which is a conservative assumption, then the maximum distance for which a peak incident of 1 psi would occur is the sum of the two distances, or 1,658 ft from the road.

As discussed above, since the closest distance from the site delivery route to the power block circle is approximately 2,000 feet, and the 1 psi blast pressure distances for the truck explosion and the vapor cloud explosion are 1,340 ft and 1,658 ft from the road, respectively, there will not be any impact on Unit 3 or 4 from an accident involving the 4,000 gallon gasoline tank wagon.

Since transported diesel/fuel oil is not flammable and is much less volatile than gasoline, the gasoline truck analysis becomes bounding in the evaluation of truck-borne hazards.

The quantity of chemical (diesel and gasoline), distance to Units 3 and 4, the TNT equivalent safe distance (beyond which the blast pressure would be less than 1 psi), the distance from the point of the spill to the point where the vapor concentration is equal to the lower flammability limit, and the lower flammability limit concentrations are shown below:

Chemical	Quantity	Distance to Units 3 and 4	TNT Equivalent Distance	Distance to Lower Flammability Limit	LFL
#2 Diesel	6,000 gal.	~4.2 mi (22,693 ft)	Not applicable	Not applicable	13,000 ppm
#2 Diesel	4,000 gal.	2,000 ft	Not applicable	Not applicable	13,000 ppm
Gasoline	50,000 lb 8,500 gal.	~4.2 mi (22,693 ft)	1,723 ft	1,200 ft	14,000 ppm
Gasoline	23,530 lb 4,000 gal.	2,000 ft	1,340 ft	738 ft	14,000 ppm

2.2.3.1.2 Pipelines and Mining Facilities

No natural gas pipeline or mining facilities are located within 10 miles of the VEGP site. No pipelines carrying potentially hazardous materials are located within 5 miles of the VEGP site. Therefore, the potential for hazards from these sources are minimal and will not adversely affect safe operation of the plant.

2.2.3.1.3 Waterway Traffic

As discussed in Subsection 2.2.2.5, there is no barge traffic past the VEGP site. Therefore, there are no chemicals transported by barge that require evaluation.

2.2.3.1.4 Railroad Traffic

The only railroad within a 5-mile radius of the VEGP site is the CSX Railroad (approximately 4.5 miles northeast of the center point between Units 1 and 2), which runs through, and services, the SRS. A hazards analysis performed for VEGP Units 1 and 2 showed that explosions and flammable vapor clouds induced by chemicals carried by this rail line will not adversely affect safe operation of Units 1 and 2. The critical distance (given by $kW^{1/3}$ in Regulatory Guide 1.91) that could cause overpressures of 1 psi to safety-related structures is approximately 2,291 feet. This scenario is caused by the explosion of a 26-ton ammonia railroad tank car (assumed to contain 132,000 pounds TNT equivalent). Because of the relatively long distance (approximately 4.5 miles) between the railroad and the VEGP site, if an explosion occurred due to an accident involving an ammonia railroad tank car, it would occur at a distance great enough not to pose an overpressure hazard to the safety-related structures. Since the proposed VEGP Units 3 and 4 will be located farther away from the railroad line than Units 1 and 2, the possibility of adverse effects from explosions and flammable vapor clouds is even smaller for the new units.

More recent information obtained from CSX (Director of Infrastructure Security) (Reference 220) indicates that the top four substances carried by CSX during 2005, which qualified as DOT hazardous chemicals, are cyclohexane (64%), anhydrous ammonia (9%), carbon monoxide (3%), elevated temperature material liquids (ETMLs) (3%).

Evaluations were made for each of the above chemicals. Some of these chemicals were already analyzed in a previous analysis for effect on Units 1 and 2, and some were evaluated specifically for their potential effect on Units 3 and 4. In each case, the evaluations concluded that the potential hazard from the chemicals is minimal and will not affect the safe operation of the new units.

Accidental spills of carbon monoxide or ETMLs are not expected to create an explosion or vapor hazard for the site. Carbon monoxide, which can cause asphyxiation, will quickly vaporize and dissipate before coming close to the VEGP plant limits. ETMLs, also referred to as elevated temperature goods, are not necessarily flammable. ETMLs are DOT Class 9 materials, and the main hazard they present is the potential to cause contact burns due to the elevated temperature of the substance. Because of the long distance separation between the CSX Railroad and the new units, no direct contact with these substances is expected. Therefore, no adverse impact is expected from the accidental releases of the ETML substances.

Cyclohexane (used in the manufacture of nylon, paint, resin, etc.) is a hazardous chemical that was not previously considered in the Unit 1 and 2 analyses, so a new analysis has been performed for Units 3 and 4.

For a 67-ton rail car at the closest approach distance of approximately 4.5 miles (23,760 ft), the following calculations were performed in accordance with Regulatory Guide 1.91:

- TNT equivalent safe distance for an explosion of cyclohexane vapor in a rail tank car
- TNT equivalent safe distance for an explosion of a cyclohexane vapor cloud

The cyclohexane rail car analysis for the vapor cloud explosion used the industry standard program DEGADIS to calculate the distance from the site of the spill to the boundaries of the upper and lower flammability limits and to obtain the flammable mass within the vapor plume. The concentrations

were compared to the lower flammability limits for the respective chemical to determine the maximum distance for the flammable vapor cloud. The input parameters were:

- Quantity of cyclohexane vapor in the rail car = 48.8 lb (117.5 lb TNT equivalent)
- Physical property data:
  - Molecular weight = 84.16 g/mole
  - Diffusion coefficient = 0.076 cm^2/sec
  - Molecular volume = 133.2
  - Boiling point temperature = 80.7°C
  - Specific gravity = 0.779
- The meteorological conditions assumed were:
  - Stability class = F (stable)
  - Wind speeds = 1 m/s up to 2.5 m/s

For the explosion from a rail car, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 220 feet.

For an explosion from a flammable vapor cloud, the TNT equivalent safe distance beyond which the blast pressure would be less than 1 psi was calculated to be 451 feet. The outer edge of the lower flammability limit (LFL) of the flammable portion of the cyclohexane vapor cloud is 575 ft downwind from the railroad line. If the blast occurs at the outer edge of the vapor cloud, which is a conservative assumption, then the maximum distance for which a peak incident of 1 psi would occur is the sum of the two distances, or 1,026 ft from the rail car.

The distance between the closest point of the rail line and Units 3 and 4 is approximately 4.5 miles. This distance is far greater than either of the above calculated critical distances. Therefore, there will not be any impact on Unit 3 or 4 from an explosion of cyclohexane from a rail car or vapor cloud.

2.2.3.2 Hazardous Chemicals

Regulatory Guide 1.78 requires evaluation of control room habitability for a postulated release of chemicals stored within 5 miles of the control room. As described in Subsection 2.2.2, no manufacturing plants, chemical plants, storage facilities, or oil or gas pipelines are located within 5 miles of the VEGP site. Therefore, three scenarios were evaluated:

1. Potential hazards from chemicals transported on routes within a 5-mile radius of the site, at a frequency of 10 or more per year, and with weights outlined in Regulatory Guide 1.78
2. Potential hazards from major depots or storage areas
3. Potential hazards from onsite storage tanks

Each hazard is discussed and evaluated below. The VEGP Units 1 and 2 analysis was reviewed for applicability to Units 3 and 4 for the effects from each of these hazards. The review determined that

the impact to the new units for each of these postulated events is bounded by the impact to Units 1 and 2.

2.2.3.2.1 Release of Hazardous Chemicals Due to a Transportation Accident

As previously discussed, three routes (Georgia State Highways 23, 80, and 56) pass within 5 miles of the VEGP site. Of these three routes, major commercial traffic occurs only on State Highway 23, which serves as a major link between Augusta and Savannah. In addition, rail traffic exists within the 5-mile radius of the plant.

As discussed in Subsection 2.2.2.5, there is no barge traffic past the VEGP site. Therefore, there are no chemicals transported by barge that require evaluation.

The hazardous chemical sources due to a transportation accident were analyzed. The results of the analysis indicated that control rooms of VEGP Units 3 and 4 would remain habitable for all transported chemicals as discussed below.

In the analysis for truck traffic, methods specified in NUREG-0570 were used to estimate vapor emission rates and their dispersion. As discussed in Subsection 2.2.3.1.1, the only hazardous chemicals transported by truck in the vicinity of the VEGP site are gasoline and diesel/fuel oil.

The table below shows, for each chemical transported by truck, the key input parameters and the results of the evaluation using the methodology of NUREG-0570.

Chemical	Quantity	Distance to Control Room	Wind Speed	Stability	Control Room Concentration	Toxicity Limit
#2 Diesel	6,000 gal.	~4.2 mi (22,693 ft)	0.5 m/s	G	0.057 ppm	300 ppm
#2 Diesel	4,000 gal.	2,000 ft	1 m/s	F	Bounded by gasoline	300 ppm
Gasoline	50,000 lb 8,500 gal.	~4.2 mi (22,693 ft)	1 m/s	F	34.9 ppm	300 ppm
Gasoline	23,530 lb 4,000 gal.	2,000 ft	1 m/s	F	95.1 ppm	300 ppm

Therefore, no adverse impact to VEGP Units 3 and 4 is expected from the accidental release of gasoline or diesel/fuel oil.

For a postulated accident on a rail line, cyclohexane and ammonia were evaluated. The potential adverse impact caused by accidental release of cyclohexane was analyzed for the ESP because it was not previously evaluated, it is flammable, and it has an established toxic threshold limit value (TLV). Using approaches specified in NUREG-0570, the analysis has concluded that the accidental release of cyclohexane from a railcar will not have adverse effects to the control room operators. The meteorological conditions used in the ESP analysis were based on guidance provided in Regulatory Guide 1.78. Regulatory Guide 1.78 describes a simplified procedure for calculating weights of hazardous chemicals for control room evaluations. In that simplified procedure, stable atmospheric stability (F stability) is used because it represents the worst 5% meteorology observed at the majority of nuclear plant sites per Regulatory Guide 1.78. Therefore, in the ESP analysis, stable atmospheric meteorological conditions (F stability with a wind speed of 1 m/s) were assumed.

The assumed railcar capacity (67 tons) is similar to that described in Regulatory Guide 1.91. With a control room air intake height about 60 ft above grade, the control room outside concentration was estimated to be 0.12 g/m^3 (34.3 ppm). The immediate danger to life and health (IDLH) value of cyclohexane is 1,300 ppm (Reference 211). Since the control room outside concentration was

estimated to be only 34.3 ppm, the accidental release of the cyclohexane tank car will not cause adverse effects to the control room operators.

The evaluation of ammonia was originally performed for Units 1 and 2, and it has been extended to Units 3 and 4. Assuming the release from a rail car containing 26 tons of anhydrous ammonia, the evaluation showed that the Units 1 and 2 control room concentration at 2 minutes after odor detection is 112 ppm, without taking credit for control room isolation. This concentration is much lower than the IDLH value of 300 ppm. In accordance with Regulatory Guide 1.78, the evaluation assumed 2 minutes is sufficient time for a trained operator to put a self-contained breathing apparatus into operation, if they are to be used.

For ammonia and cyclohexane, the factors for estimating the concentration of each chemical at the control room air intake are:

Compound	Quantity	Distance from Railroad to Control Room	Wind Speed	Stability Class	Concentration of Compound at Control Room Air Intake, ppm	IDLH Toxicity Limit, ppm
Ammonia	26 tons	4.5 miles	1 m/s	G	112 @ 2 min	300
Cyclohexane	67 tons	4.5 miles	1 m/s	F	34.3	1,300

In addition the AP1000 design provides manual actuation to initiate the emergency habitability system. Protective measures (including manual actuation of the main control room habitability system) required to be taken by the control room operators are evaluated in accordance with Subsection 6.4.7.

Therefore, no adverse impact to VEGP Units 3 and 4 is expected from the accidental release of ammonia or cyclohexane.

2.2.3.2.2 Potential Hazard from Major Depots or Storage Areas

There are no major depots within 5 miles of the VEGP site. The only chemical storage areas within 5 miles of the VEGP site exist at the SRS and the Wilson combustion turbine plant.

The original analysis (performed for Units 1 and 2) had determined that SRS had the potential to use chlorine and ammonia at the D-Area, which is approximately 4.5 miles distant from Units 1 and 2. However, the 2004 Tier II EPA report for this site (Reference 216), and recent communications with SRS management, have indicated that ammonia and chlorine are no longer in use at D-Area (Reference 228), (Reference 214). The area has been remediated, and nearly all of the facilities have been removed. The only chemicals used at the site, according to the recent Tier II report, are chlorine softener chemicals and biocide, which are used in the waste treatment process to eliminate the bacteria in the water. There were no chemicals identified that would be hazardous to the VEGP site or would require further evaluation.

The chemicals stored at the Plant Wilson combustion turbine plant (6,000 feet from the new AP1000 units' power block), consist of fuel oil, sulfuric acid, and several other chemicals kept in small quantities. These chemicals have low volatility and toxicity, and there would be no potential hazard to the new AP1000 unit control rooms habitability from these substances. The three No. 2 fuel oil tanks located at east of the Service Building for the combustion turbine plant have a capacity of 3,000,000 gallons each (Reference 221). The tanks are surrounded by a dike, which would prevent a fuel leak from spreading into a large spill area. An analysis, based on the methodology of NUREG-0570, has

shown that a postulated release of fuel oil from an accidental spill at Plant Wilson will result in a concentration of less than 50 ppm at the air intake for the control room for Unit 3 or 4.

	Quantity	Wind Speed	Stability	Distance to Control Room	Concentration of Vapor at Control Room Air Intake	Toxicity Limit
Fuel Oil	3,000,000 gallons	1 m/s	F	Approximately 5,500 ft	< 50 ppm	300 ppm

Therefore, the Plant Wilson fuel oil storage tanks do not pose a hazard to VEGP Units 3 and 4.

2.2.3.2.3 Potential Hazard from Onsite Storage Tanks

The storage facilities for VEGP Units 1 and 2 are listed in Table 2.2-205. Many of the chemicals listed in that table are excluded from further consideration due to their properties (e.g., low volatility or low toxicity) or due to the relatively small quantities that are stored. The guidelines and methodologies of NUREG-0570 were used to determine the release rates and concentrations of toxic gases at the control room air intake for existing VEGP Units 1 and 2. This analysis shows that the control room would remain habitable for most release scenarios without any operator action and that there would be sufficient time for control room operators to take emergency action (donning emergency breathing apparatus) for the remaining release scenarios. For all releases except hydrazine, the average concentration over an 8-hour period would never exceed the long-term toxicity limit. Where the long-term limit would be exceeded, it has been shown by calculation for VEGP Units 1 and 2 that at least 2 minutes would be available between detection and the time the short-term toxicity limit (as defined in Regulatory Guide 1.78) would be reached. Since hydrazine is stored northeast of the VEGP Unit 1 reactor, this chemical would be separated by a minimum of about 1,800-feet from Units 3 and 4. Therefore, the impact on the new Units 3 and 4 due to an accidental hydrazine release will be expected to be smaller than that for existing Units 1 and 2, and will be evaluated at the time of the COL in accordance with DCD COL Information Item 6.4-1.

The impact on the new Units 3 and 4 due to an accidental hydrazine release is evaluated in Subsection 2.2.3.2.3.1 below.

2.2.3.2.3.1 Hydrazine Hazard from Onsite Storage Tanks

Impact on safety related structures and control room habitability for Units 3 and 4 due to accidental releases from or explosion in the 6,644 gallon Units 1 and 2 hydrazine tank is evaluated below.

The Areal Locations of Hazardous Atmospheres (ALOHA) code (Reference 202) and the TNT equivalency method is used to determine the minimum safe distances for hydrazine that is stored onsite at VEGP. These minimum safe distances for Unit 3 control room are then compared to the distances from where hydrazine is stored to Unit 3. Since the Unit 4 control room is further west of Unit 3, the evaluation is based on Unit 3 only and then the results are applied to Unit 4. The four scenarios evaluated are: toxicity of a vapor cloud, flammability of a vapor cloud, explosive vapor cloud, and a tank explosion.

The assumptions for the three vapor cloud scenarios include the following:

- Hydrazine is a 35% hydrazine solution.
- Atmospheric air flow is turbulent in only one direction (no cross flow) such that the released gases spread downstream in a Gaussian manner.

- Total quantity of hydrazine is released and forms an evaporating puddle with a depth of 1 cm (NUREG-0570). This provides a significant surface area to maximize evaporation and the formation of a vapor cloud.

- Ambient temperature is 95.1°F for daytime releases and 70.1°F for nighttime releases, the relative humidity is 50%, and the atmospheric pressure is 1 atmosphere (40 CFR 68.22).

- A sensitivity study was performed to determine the worst-case meteorological conditions (wind speed and stability class). The worst-case scenario is a wind speed of 2 m/s and stability class “F”.

- Ground roughness is “Urban or Forest” which most accurately represents site conditions.

- Cloud cover selected is based on the appropriate stability class and wind speed (Reference 202).

- Time of accidental release is 12:00 pm on July 21, 2008 for daytime releases and 5:00 a.m. on July 21, 2008 for nighttime releases. The date was selected because it coincides with the highest daily maximum temperature, and 12:00 p.m. was selected because solar radiation is highest during midday. Higher solar radiation leads to a higher evaporation rate and thus a larger vapor cloud. Five o’clock (5:00) a.m. on July 21, 2008 was selected to provide a realistic meteorological condition for the more stable stability classes. ALOHA requires manual override if 12:00 p.m. is used with stability classes “E” and “F”, or “D” with a wind speed of 3 m/s (Reference 202).

- Wind input height is 10 meters. ALOHA calculates a wind profile based on where the meteorological data is taken. ALOHA assumes that the MET station is at a height of 10 meters. The National Weather Service usually reports wind speeds from the height of 10 meters.

- There is no temperature inversion.

- It is not known how long after a release ignition occurs for vapor cloud explosions. Therefore, the “unknown” time of vapor cloud ignition option was selected for this case. ALOHA will run explosion scenarios for a range of ignition times that encompass all of the possible ignition times for a scenario. ALOHA takes the results from all of these scenarios and combines them on a single Threat Zone plot.

- Type of vapor cloud ignition is “ignited by detonation.” This is the worst case scenario for an accidental explosion.

The assumptions for the tank explosion (TNT mass equivalency) scenario include the following:

- Vapor space is assumed to be the tank volume at the upper flammability limit of hydrazine.

- Air temperature is 32.2°F, the lowest mean daily minimum temperature, which corresponds to an air density of 0.081 lb/ft3.

- Detonation occurs inside the tank.

- Vapor explosion is treated as if it is completely confined. Thus, a yield factor of 100% is used for the confined vapor explosion (NUREG-1805).

Toxicity of a Hydrazine Vapor Cloud

For assessing the toxicity of a vapor cloud from hydrazine release, it is necessary to determine the maximum distance at which the Immediately Dangerous to Life or Health (IDLH) value exists (Regulatory Guide 1.78). This distance represents the minimum safe distance from the hydrazine storage area that a nuclear power plant can operate. The distance depends on the prevailing meteorological conditions, wind speed, relative humidity, atmospheric pressure, ambient temperature, toxicity and the quantity of hydrazine released. It is also necessary to determine the resulting concentration of hydrazine inside the control room to ascertain the effects of a toxic vapor on the operators. ALOHA calculated both the inside and outside concentrations of the control room over time (0 to 1 hour). For this evaluation, a release of 6,644 gallons of 35% hydrazine solution is assumed.

The hydrazine tank is located east of the Unit 1 Turbine Building, 2,200 feet from the Unit 3 control room. The evaluation considers a control room air exchange rate of 0.95 exchanges per hour, and an IDLH for hydrazine of 50 ppm. The maximum vapor cloud distance to the IDLH is calculated to be 927 feet (the resulting maximum concentration at the control room air intake is 15.4 ppm). The maximum concentration of hydrazine inside the control room is calculated to be 7.76 ppm. The resulting hydrazine concentrations inside the Units 3 and 4 control rooms are within the IDLH limit value of 50 ppm.

Results indicate that operators in the Units 3 and 4 control rooms are not impacted by the potential toxicity from a hydrazine vapor cloud.

Flammability of a Hydrazine Vapor Cloud

For assessing the flammability of a vapor cloud from a hydrazine release, the ALOHA air dispersion model is used to determine the distances where the vapor cloud may exist between the upper flammability limit (UFL) and lower flammability limit (LFL) (40 CFR 68.22). Once the concentration of the hydrazine vapor cloud is above the UFL or below the LFL, the vapor is no longer flammable.

For this evaluation, a release of 6,644 gallons of 35% hydrazine solution is analyzed for potential flammable hydrazine vapor threats.

Hydrazine has an LFL of 4.7% and a UFL of 99.9%. The distance from the leak source to the LFL is 54 feet. Though ALOHA does report a distance to the LFL, the vapor cloud does not ever exceed the LFL for any scenario. The distance that is reported is the same for every situation due to near field patchiness. It is further shown that the LFL is never exceeded because, as shown below, no explosions occur, even though a detonation was chosen in every instance.

The distance from the hydrazine storage tank to where the hydrazine vapor cloud exists between the UFL and the LFL is less than the distance from the storage tank to the Units 3 and 4 control rooms. Therefore, results indicate that there is no potential flammable, hydrazine vapor cloud reaching safety related structures or the operators in the Units 3 and 4 control rooms.

Explosive Hydrazine Vapor Cloud

For assessing the explosion from a vapor cloud due to hydrazine release, it is necessary to determine the “safe distance”, the minimum distance required for an explosion to have less than or equal to 1 psi peak incident pressure (Regulatory Guide 1.91). This is the minimum safe distance for no impacts from an explosion of a hydrazine vapor cloud. A peak overpressure of 1 psi will shatter glass but not significantly cause structural damage to buildings (Regulatory Guide 1.91). The peak overpressure to the Unit 3 control room is also established. For this evaluation, a release of 6,644 gallons of 35% hydrazine solution is analyzed for potential explosive vapor threats.

The ALOHA analysis indicates that the vapor cloud does not reach the LFL and, therefore, does not explode. Since there is no explosion, the safety related structures and operators working in the Units 3 and 4 control rooms are not impacted.

Hazard from a Tank Explosion

The methodology presented below is for a confined explosion occurring within some form of a storage container (i.e. tank). Since only vapor will burn or explode, the methodology employed considers the maximum vapor within the hydrazine storage tank as explosive (equivalent TNT). For atmospheric liquid storage, this maximum vapor would involve the container to be completely empty of liquid and filled only with air and chemical vapor at UFL conditions (NUREG-1805). Due to complete confinement and the use of only the UFL vapor mass, a 100% yield factor is attributed to the explosion (NUREG-1805). The equivalent mass of TNT is calculated by taking into account the product of the vapor mass (within the flammable range), heat of combustion, and the explosion yield factor. Once the equivalent mass of TNT is calculated, a radial distance generating a 1 psi peak incident pressure ("safe distance") is calculated by taking the product of the factor 45 and the cube root of the equivalent mass of TNT (Regulatory Guide 1.91).

The evaluation is based on a vapor-filled 6,644 gallon hydrazine tank. For the assumed atmospheric conditions, a heat of combustion of 8,345 Btu/lb, and a vapor specific gravity of 1.1, the mass of flammable hydrazine in the tank is 79 pounds. The resulting equivalent mass of TNT is calculated to be 330 pounds, and the resulting "safe distance" is 311 feet.

Results from the TNT equivalency method indicate that there are no potential explosive vapor threats from hydrazine storage tanks to safety related structures or operators in the Units 3 and 4 control rooms.

As shown in Table 2.2-205, some chemicals previously used for Units 1 and 2 have recently been replaced. Phosphoric acid (Nalco 3DT177) is one of the new chemicals used for the existing Units 1 and 2 that was identified to be toxic. This material is stored in a 5050-gallon tank located between the two existing cooling towers at a distance of approximately 3,200 feet from the air intake for the Unit 3 control room (the closest of the new control rooms to the chemical source). An analysis has shown that under stable atmospheric conditions (F stability) the phosphoric acid concentration outside the new control room air intake would be 94 $\mu g/m^3$, which is much lower than the 8-hour TLV of 1 mg/m^3 and the short term exposure limit of 3 mg/m^3 (Reference 211) following an accidental release. Since this material is not flammable, the explosion effect was not evaluated. Another chemical shown in Table 2.2-205, that was evaluated for Units 1 and 2 is methoxypropylamine (MPA). This chemical is stored in a tank outside the turbine building and in a smaller tank inside the turbine building. The evaluation for Units 1 and 2 considered the failure of the smaller tank, inside the turbine building, due to its proximity to the control room air intake. For that evaluation, the failure assumed a 400 gallon release, 59 meters away from the control room air intake. For a wind speed of 2.5 m/s and a G stability class, the concentration outside the control room intake was calculated to be 1.5 ppm. The STEL for this chemical is 15 ppm. Due to the distance between the new Units 3 and 4 and the existing Units 1 and 2, the effects of accidental MPA release at Units 1 and 2 will be expected to be less than that for the existing Units 1 and 2.

2.2.3.2.3.2 Other Chemical Hazards from Onsite Storage Tanks

Table 6.4-201 provides specific information about the chemicals described in Table 6.4-1. This includes chemical names or limiting types and quantities. Except as noted, these chemicals have been suggested by Westinghouse for use in the AP1000 and have been evaluated in conjunction with AP1000 standard design and found not to present a hazard to the control room operators or to safety-related systems, structures, or components. In some instances, alternative chemicals to those proposed by Westinghouse have been suggested. These chemicals are comparable in function to

those proposed by Westinghouse and are the same as those already in use for similar applications in VEGP Units 1 and 2. These chemicals also 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.

2.2.3.3 Fires

In the vicinity of the VEGP site, the following potential fire hazards exist:

a. Fire due to a transportation accident

b. Forest fire

c. Fire due to an accident at offsite industrial storage facilities

d. Fire due to an onsite storage tank spill

An analysis was performed for VEGP Units 1 and 2 which evaluated the potential fire hazards identified above. Items a, c and d above have been addressed in previous sections. For each event, the analysis concluded that combustion products would not reach concentrations in the VEGP Unit 1 and 2 control room that approached toxicity limits.

An analysis of a postulated forest fire indicates that toxic chemicals (such as CO, NO_2 and CH_4) emitted from the forest fire, located approximately 1,800 feet from the Units 1 and 2 control room, produce negligible concentrations outside the Units 1 and 2 control room air intakes due to the relatively high buoyancy of the plume. In addition, due to the long distance separating the tree line from the control room, the analysis indicates that there would not be any adverse heat impact in the form of heat flux from the forest fire. The temperature rise for each event was calculated to be insignificant when compared with fuel oil fires for causing thermal damage to any safety-related structures at VEGP Units 1 and 2. For all of the fire events evaluated, the location of the new AP1000 units on the VEGP site is the same distance from the source of the fire as the existing VEGP Units 1 and 2, or is further removed, and therefore the same conclusions concerning impact may be made**. I**n addition the design of the control room HVAC for the AP1000 includes smoke detectors. Any smoke detected from an onsite or offsite fire would initiate isolation of the control room HVAC prior to toxicity limits being exceeded.

The specific application to Units 3 and 4 of these forest and industrial fire evaluations is further described below.

2.2.3.3.1 Forest Fires

The surrounding plant terrain is characterized by gently rolling hills and is approximately 30-percent farmland, with the remainder primarily wooded areas. The nearest forest to the Units 1 and 2 control room is the Sandhill-Upland hardwood pine forest with an assumed total area of approximately 3,169 acres and an assumed distance of 1,836 feet away. Based on historical data on forest fires from the state of Georgia, the average size of a forest fire typically is approximately 11.4 acres. The rate of spread is conservatively assumed to be 8 feet per minute with a duration of 4 hours.

The toxic chemicals emitted from a forest fire are CO, NO_2, and CH_4. The emission concentrations in the control room air intake were calculated using the infinite line source diffusion equation with the wind direction perpendicular to the line source and blowing directly toward the control room intake, and the Briggs plume rise equation, which accounts for the buoyancy effect from the heat of the fire.

For Units 1 and 2, calculations were performed to demonstrate that the pollutant concentrations outside the control room air intake for a variety of wind speeds (from 0.25 to 10 m/sec) and the Pasquill stability category G are effectively zero. Therefore, the release of toxic combustion products from the onsite forest fire did not pose a hazard to the Units 1 and 2 control room operators.

Using the methodology described in NUREG/CR-1748, the heat flux and resultant temperature rise on plant structures due to a forest fire were also evaluated for Units 1 and 2. The calculated temperature rise (~46.5°C) is less than the allowable temperature rise (bulk 194°C and local 361°C). Therefore, a forest fire will not cause thermal damage to VEGP safety-related structures, based on the distance from the forest.

The centerline of VEGP Units 3 and 4 is approximately 2,100 feet west and 400 feet south of the center of the Unit 2 containment building. The Unit 4 containment is approximately 800 feet west of the Unit 3 containment. It is assumed that the distance from the nearest forest to VEGP Units 3 and 4 is the same as that from the forest to VEGP Units 1 and 2. Since Units 3 and 4 are approximately adjacent to Units 1 and 2 and the vegetation in the vicinity remains the same even after revegetation of the Units 3 and 4 construction site, the toxic chemicals emitted from a forest fire and the emission concentrations in the control room would have the same effect for Units 3 and 4. Therefore, the release of toxic combustion products from the onsite forest fire does not pose a hazard to the Units 3 and 4 control room operators.

2.2.3.3.2 Fire Due to an Accident at Offsite Industrial Storage Facility

Georgia Power Company's combustion turbine plant (Plant Wilson) is located approximately 1,350 meters from the VEGP Units 1 and 2 control room. Of the chemicals and toxic substances stored at this location, diesel fuel oil and miscellaneous oils are flammable. Based on a previous evaluation, a diesel fuel oil fire at Plant Wilson bounds the impacts from any fires of miscellaneous oils stored at Plant Wilson. One of the three tanks containing no. 2 diesel fuel oil is assumed to burn. The entire tank volume of 3×10^6 gallons is spilled into a dike area of 8,756 m^2.

The primary products of combustion emitted from a diesel fuel oil fire at Plant Wilson are CO, CO_2, CH_4, NO_2, SO_2, and SO_3. The toxicity limits in ppm for these constituents are 50 (CO), 5,000 (CO_2), 1.43×10^5 (CH_4), 2 (SO_2 and SO_3), and 3 (NO_2). Using the Briggs plume rise equations and by assuming the maximum burning rate of 0.12 inches/min, the maximum emission rate, duration of fire (8 hours), class A stability, and wind speeds (0.25-10 m/s), it was determined that the resulting concentrations of the primary products of combustion outside the Units 1 and 2 control room air intakes would not approach the above listed toxicity limits.

Using the methodology described in NUREG/CR-1748, the heat flux and resultant temperature rise on the VEGP structures due to a diesel fuel oil fire at Plant Wilson were also evaluated for the Units 1 and 2 control rooms. The calculated temperature rise (115°C) is less than the maximum allowable temperature rise (bulk 194°C and local 361°C). Since a fire at Plant Wilson is limiting (the largest source at the closest distance to the VEGP site), it is concluded that source fires and vapor cloud fires resulting from a delayed ignition at nearby industrial facilities will not cause thermal damage to safety-related structures at VEGP Units 1 and 2.

Units 3 and 4 are located at a farther distance from Plant Wilson than Units 1 and 2. Drawing from the conclusion based on the previous evaluation of Units 1 and 2, any industrial fire due to diesel oil or miscellaneous oils stored at Plant Wilson would not have an impact on control room habitability or cause thermal damage to safety-related structures at Units 3 and 4.

2.2.3.4 Radiological Hazards

The hazard due to the release of radioactive material from either VEGP Units 1 and 2 or the facilities at SRS, as a result of normal operations or an unanticipated event, would not threaten safety of the new units. 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 (RMS). The habitability systems for the AP1000 are capable of maintaining the main control room environment suitable for prolong 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 have been designed to withstand the effects of radiological events and the consequential releases which would bound the contamination from a release from either of these potential sources. (Reference 229)

The effect on the control rooms of VEGP Unit 3 and 4 of a postulated design basis accident (DBA) in Unit 1 or 2 was evaluated based on a LOCA in Unit 1 or 2, at uprated conditions, using the releases produced from the alternate source term (AST) methodology. The dose at the Unit 3 and 4 control rooms were determined considering the time-dependent source terms, the atmospheric dispersion factors (χ/Q values), the assumed occupancy rates, the volume of the control room, the HVAC filtration and flow rates, and the operator breathing rates. The χ/Q values from the containment of Unit 2 to the Units 3 and 4 control room air intakes were conservatively calculated using the same methodology and meteorology as was used to calculate the control room χ/Q values presented in Subsection 2.3.4. Breathing rates were assumed to be constant for the control room operators for the duration of the period evaluated. The occupancy rate in the control room was assumed to be 100 percent for the first 24 hours and then decreasing to 60 percent for the next 3 days and then to 40 percent over the remainder of the 30 day period. The resultant dose from this analysis is comparable to the dose reported in Table 15.6.5-3 for a postulated LOCA in the AP1000 and is less than the GDC 19 limits.

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 2.2.3.2.3.1, 2.2.3.2.3.2, 2.2.3.3, and 2.2.3.4.

2.2.5 References

201. Murphy, K.G., and K.M. Campe, “Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19,” U.S. Atomic Energy Commission, 13th Air Cleaning Conference, 1974.

202. U.S. Environmental Protection Agency, “ALOHA (Areal Location of Hazardous Atmospheres),” Version 5.4.1, February 2007.

203. **(Aiken 2005)** Aiken County Top Employers, http://www.sces.org/lmi/data/top/aiken.htm, accessed August 8, 2005.

204. **(APO 2006)** *APO Terminal Area Forecast Summary Report*, Forecast issued February 2006, Federal Aviation Administration Augusta Regional Airport at Bush Field, Augusta, Georgia, http://www.apo.data.faa.gov/, accessed at May 2, 2006.

205. **(FAA 2006)** FAA airnav.com information on Augusta Regional Airport at Bush Field, Augusta, Georgia (effective April 13, 2006), http://www.airnav.com/airport/AGS, accessed April 21, 2006.

206. **(Barnwell 2005)** Barnwell County Top Employers, http://www.sces.org/lmi/data/top/barnwell.htm, accessed August 25, 2005.

207. **(Burke 1991)** Burke County Comprehensive Plan: 2010, Part 1: *Inventory and Assessment*, 1991.

208. **(Burke 2005)** Georgia Snapshots, Burke County, Community Profiles, http://www.dca.state. ga.us/snapshots/PDF/Burke.pdf, accessed August 26, 2005.

209. **(Burke Airport 2006)** Burke County Airport, Waynesboro, Georgia, http://www.airnav.com/ airport/KBXG, accessed April 21, 2006.

210. **(Chem-Nuclear 2006)** Chem-Nuclear System, LLC, http://www.chemnuclear.com/disposal.html, accessed March 18, 2006.

211. **(CHRIS 1999)** Chemical Hazards Response Information System (CHRIS), U.S. Coast Guard, 1999.

212. **(DOE 1999)** *Savannah River Site Generic Safety Analysis Report* by Westinghouse Savannah River Company for the U. S. Department of Energy, 1999.

213. **(DOE 2006)** Characteristics of Spent Nuclear Fuel Management, U. S. Department of Energy, Office of Environmental management, Historical Document, http://web.em.doe.gov/eis/s27.html, accessed March 18, 2006.

214. **(DOE 2007)** DOE Savannah River Operations Office letter from Cindy M. Brizes (Emergency Management Program Manager) to Charles Pierce (SNC ESP Manager) regarding “Emergency Preparedness for Savannah River Site (SRS) Hazardous Materials,” January 22, 2007.

215. **(EPA 2003)** Landview 6 DVD from U. S. Census Bureau depicting EPA regulated sites, July 2003.

216. **(EPA 2006d)** Georgia Tier II facilities CAMEO 1.1.3; December 1, 2006.

217. **(FAA 2005)** Atlanta Sectional Aeronautical Chart, Federal Aviation Administration, National Aeronautical Charting Office, 74th Edition, March 17, 2005.

218. **(GDT 2005)** Georgia Department of Transportation, “*Updates on Traffic Accidents – Burke Co. Georgia*”, Email from D. Brantley, Office of Traffic Safety and Design to K. Patterson, Tetra Tech NUS, Inc., May 31, 2005.

219. **(IWR 2004)** Waterborne Commerce of the United States, Calendar Year 2004, Part 1 – Waterways and Harbors Atlantic Coast, Department of the Army, Corp of Engineers, Institute for Water Resources, IWR-WCUS-04-1, 2004.

220. **(Murta 2006)** Personal communication from T. Murta (CSX) to R. Kannor (Bechtel), May 24, 2006.

221. **(Plant Wilson 2006)** Wilson Plant Emergency and Hazardous Chemical Inventory, February 2006.

222. **(Rhodes 2006)** 3GA7 Rhodes Air Ranch, http://www.fboweb.com/fb40/pu/ai/ad.aspx?adtident=3GA7, accessed July 12, 2006.

223. **(Shaw 2005)** Draft Environmental Impact Statement (EIS) for the Airspace Training Initiative, Shaw Air Force Base, South Carolina, August 2005.

224. **(Still 2005)** Letter from J. Still, Licensing Manager, Chem-Nuclear Systems, Inc. to K. Patterson, Project Manager, Tetra Tech NUS, Inc., June 8, 2005.

225. **(Unitech 2006**) Unitech Services Group, http://www.u1st.com , accessed May 16, 2006.

226. **(USACE 2000)** New Savannah River Bluff Lock and Dam Project, Savannah River, Georgia and South Carolina, Section 216, Disposition Study, Final Report, U. S. Army Corps of Engineers, September 2000.

227. **(USACE 2007)** Personal communication from A. Tujaque (USACE) to A. Farber (Bechtel), February 28, 2007.

228. **(Van Pelt 2006)** Personal communication from R. Van Pelt (SRS) to R. Kannor (Bechtel), December 4, 2006.

229. **(Westinghouse 2005)** AP1000 Document APP-GW-GL-700, *AP1000 Design Control Document*, Revision 15, Westinghouse Electric Company, LLC, 2005.

230. **(WSRC 2006)** Savannah River Site Fact Sheets, Washington Savannah River Company, January 2006.

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
Nearby Largest Employers

Burke County, GA	Aiken County, SC	Barnwell County, SC
Burke County Hospital	Westinghouse Savannah River	Dixie Narco Inc.
Kwikset Corporation	Aiken County Board of Education	Barnwell School District #45
Management Analysis & Utilization Inc.	Bechtel Savannah River Company	Ness Motley Loadholt Richardson
Samson Manufacturing Inc.	Avondale Mills Inc.	Sara Lee Sock Company Inc.
Southern Nuclear Operating Co. Inc.	Kimberly-Clark Corporation	Excel Comfort Systems Inc.

Table 2.2-202
Description of Products and Materials: Chem-Nuclear Systems, Inc.

Products or Materials	Status	Annual Amounts	Shipment
Isotopes – Including Co-60 (by far largest quantity), Fe-55, and Ni-63	Stored	0.50×10^6 ft^3 (7/1/04-6/30/05) 0.45×10^6 ft^3 (7/1/05-6/30/06) 0.40×10^6 ft^3 (7/1/06-6/30/07) 0.35×10^6 ft^3 (7/1/07-7/30/08)	400/year; average volume - 150 ft^3; largest volume for a single shipment - 8,000 ft^3

Note: The above materials are transported via highway.

Table 2.2-203
Burke County, Georgia, Transportation Accident Data Within 5 Miles of the VEGP Site

	1999	2000	2001	2002	2003
State Route 80					
Accidents					
Injuries	5	0	10	3	3
Fatalities	0	0	0	0	0
State Route 23					
Accidents					
Injuries	14	3	9	15	12
Fatalities	3	0	0	0	0
State Route 56C					
Accidents					
Injuries	0	0	0	0	0
Fatalities	0	0	0	0	0

Table 2.2-204
Bush Field (Augusta) Terminal Area Forecast Fiscal Years 1990–2025 Total Flights

Year	Total[a]
1990	47981
1991	38455
1992	37682
1993	36246
1994	33057
1995	34008
1996	33346
1997	34459
1998	34428
1999	37631
2000	36961
2001	35222
2002	34617
2003	33916
2004	35561
2005	27917
2006	28330
2007	28753
2008	29184
2009	29625
2010	30074
2011	30532
2012	31001
2013	31479
2014	31967
2015	32305
2016	32647
2017	32995
2018	33347
2019	33703
2020	34065
2021	34430
2022	34801
2023	35178
2024	35558
2025	35945

[a] Itinerant Operations (air taxi + commercial air carrier + general aviation + military)

Table 2.2-205
VEGP Units 1 and 2 Onsite Chemical Storage

Material	Quantity	Location
Kitchen Grease	550 gallons	Underground tank east of service building
No. 2 Diesel Fuel	1,500 gallons	South of PESB
No. 2 Diesel Fuel	160,000 gallons*	East of U1 diesel generator building
No. 2 Diesel Fuel	160,000 gallons*	West of U2 diesel generator building
Hydrazine	6,000 gallons	East of turbine building
Methoxypropylamine	400 gallons	Turbine building
Methoxypropylamine	12,780 gallons	East of turbine building
Clean Lube Oil	30,000 gallons	East of turbine building
Dirty Lube Oil	30,000 gallons	East of turbine building
No. 2 Diesel Fuel	100,000 gallons	East of turbine building
No. 2 Diesel Fuel	560 gallons	Fire protection pumphouse
No. 2 Diesel Fuel	560 gallons	Fire protection pumphouse
Main Turbine Lube Oil	12,800 gallons	Turbine building
Main Turbine Lube Oil	12,800 gallons	Turbine building
SGFP Lube Oil	2,800 gallons	Turbine building
SGFP Lube Oil	2,800 gallons	Turbine building
EHC Fluid	1,600 gallons	Turbine building
EHC Fluid	1,600 gallons	Turbine building
No. 2 Diesel Fuel	1,250 gallons	U1 diesel generator building
No. 2 Diesel Fuel	1,250 gallons	U1 diesel generator building
No. 2 Diesel Fuel	1,250 gallons	U2 diesel generator building
No. 2 Diesel Fuel	1,250 gallons	U2 diesel generator building
Unleaded Gasoline	6,000 gallons	East of receiving warehouse
No. 2 Diesel Fuel	3,000 gallons	East of receiving warehouse
Sodium Hypochlorite	6,700 gallons	Main Cooling towers
Dispersant**	4,400 gallons	Main Cooling towers
MS Corrosion Inhibitor***	5,050 gallons	Main Cooling towers
Copper Corrosion Inhibitor****	2,200 gallons	Main Cooling towers
Kerosene	7,000 gallons	Fire training area
Sodium Hypochlorite	250 gallons	East of plant potable water storage tank
Boric Acid	46,000 gallons	U1 aux building
Boric Acid	46,000 gallons	U2 aux building
Used Oil	4,000 gallons	NW of admin support building
Used Oil	5,000 gallons	NW of admin support building
Sodium Bromide	4,000 gallons	Main Cooling towers
Nalco STABREX	6,700 gallons	Main Cooling towers
Sodium Hypochlorite	200 gallons	Plant potable water building
Sodium Phosphate, Tribasic	200 gallons	Plant potable water building
Copper Corrosion Inhibitor****	200 gallons	U1 NSCW tower chemical addition building
Copper Corrosion Inhibitor****	200 gallons	U2 NSCW tower chemical addition building
Ammonium Bisulfite	200 gallons	Circulating water dechlorination building

* Actually two 80,000 gallon tanks that are interconnected and function as one tank.
** Currently using Nalco 3DT102, swapping to Nalco 3DT190 during summer 2006.
*** Currently using Nalco 73297, swapping to Nalco 3DT177 during summer 2006.
**** Currently using Nalco 1336.

Table 2.2-206
Not Used

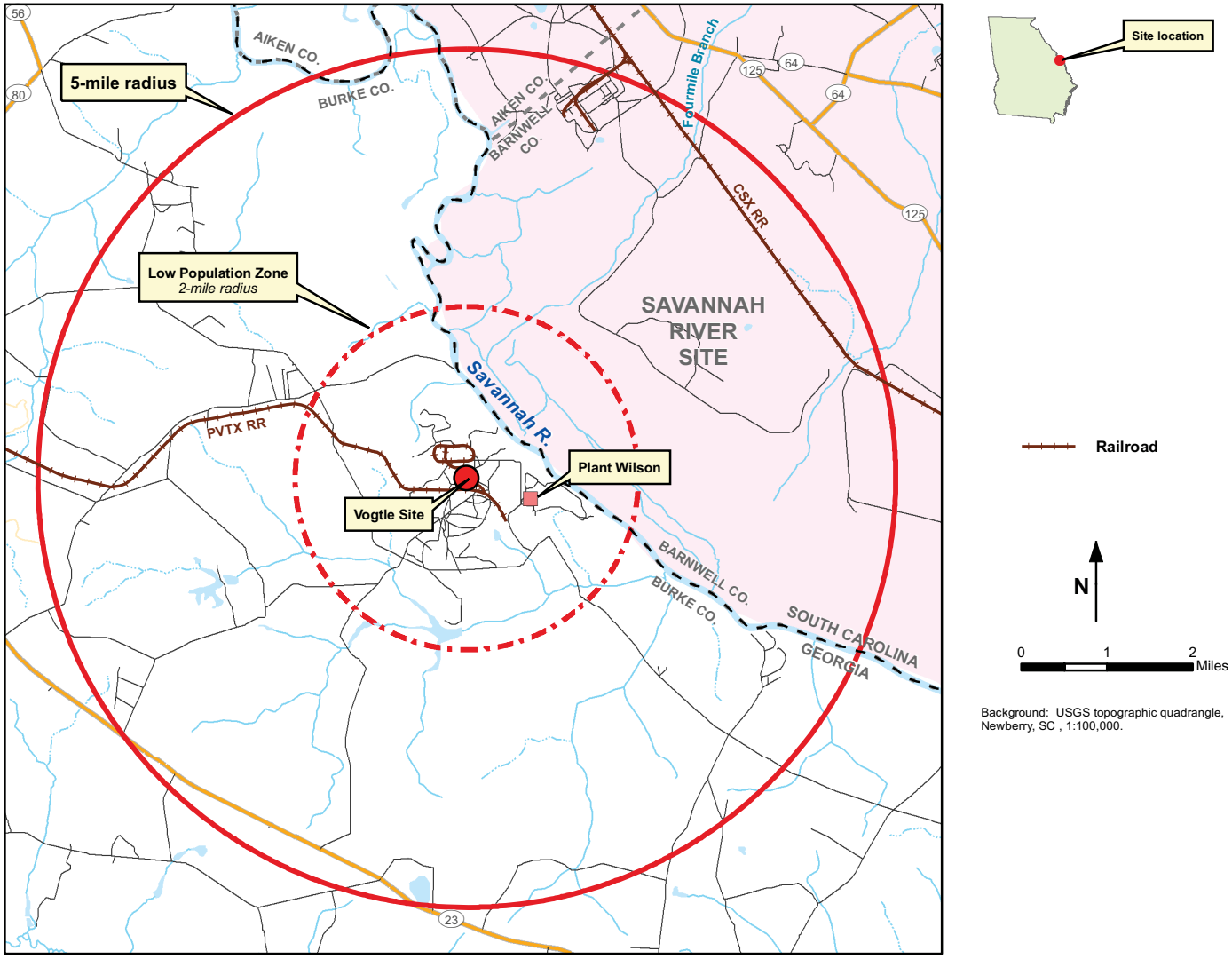

Figure 2.2-201
Site Vicinity Map

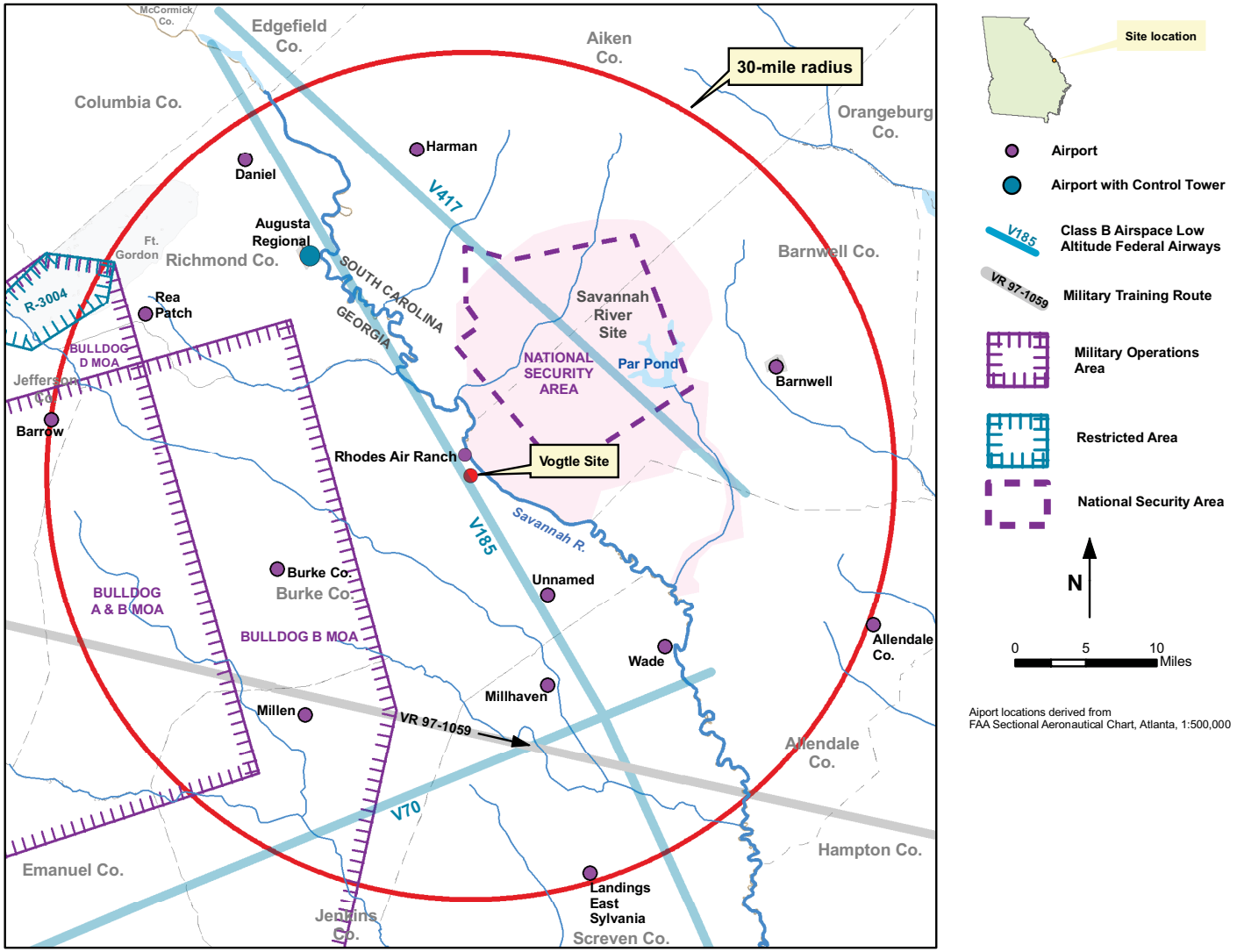

Figure 2.2-202
Airports Within 30 Miles of VEGP

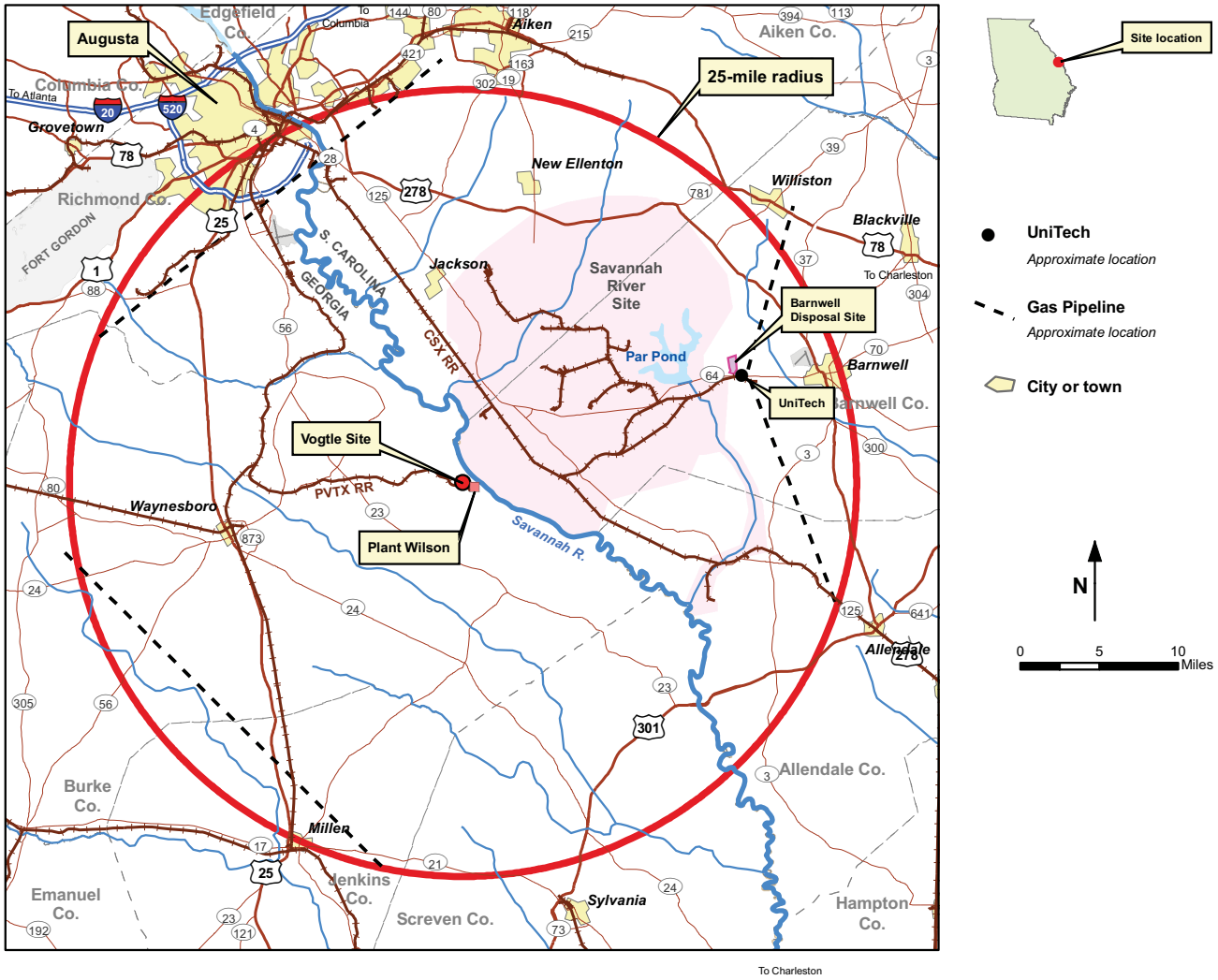

Figure 2.2-203
Industrial Facilities Within 25 Miles of VEGP

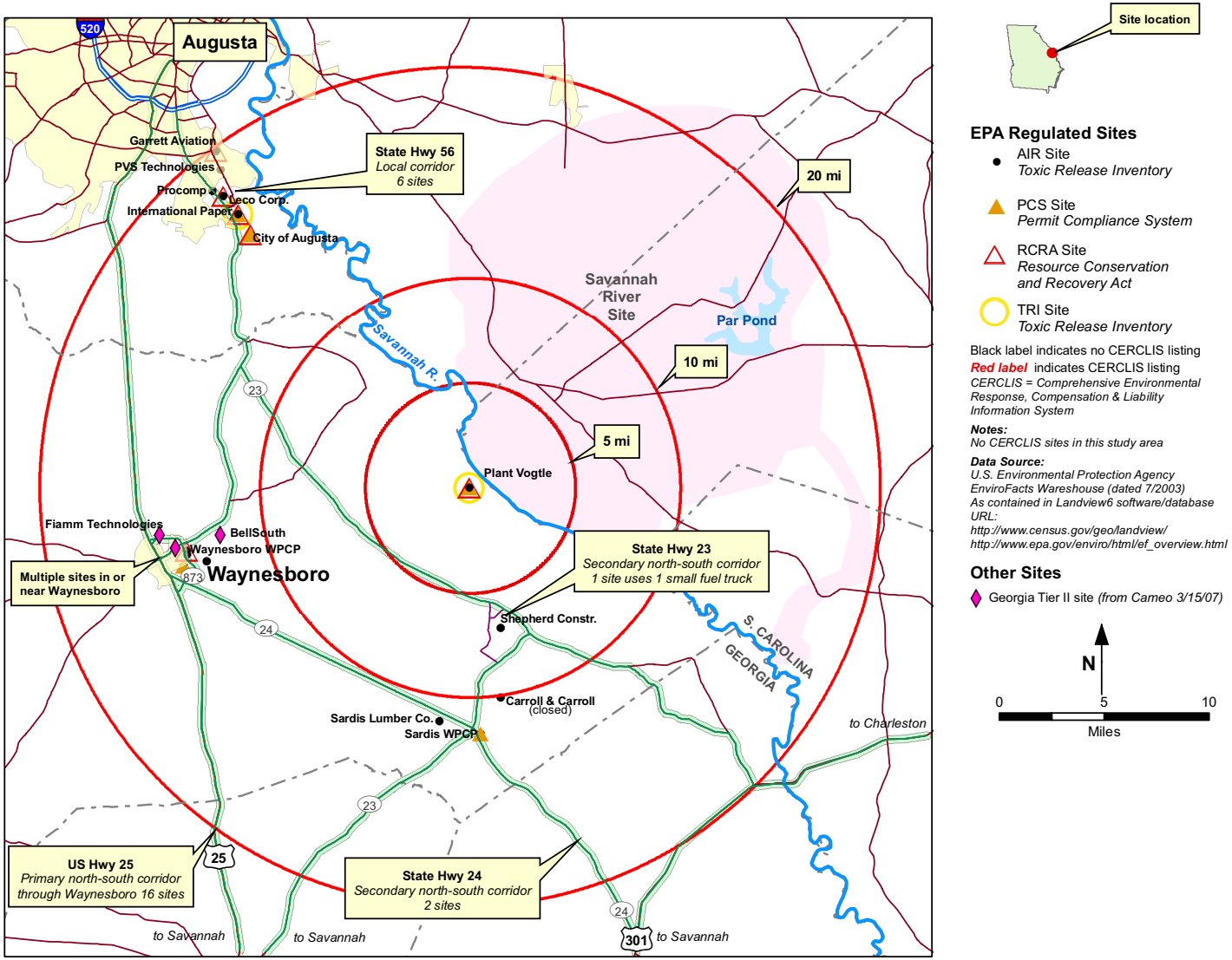

Figure 2.2-204
Corridor Analysis