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Evacuation Time Estimates for the Vogtle Electric Generating Plant

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Executive Summary

In order to ensure the safety of the public living in the vicinity of nuclear power plants in the nation, the U.S. Nuclear Regulatory Commission (NRC) requires the plants to update their evacuation times estimates (ETEs) within the 10-mile radius emergency planning zone (EPZ) as local conditions change (e.g., change in the type of effectiveness of public notification system).

Southern Nuclear Operating Company (SNC) contracted IEM to estimate ETEs for the projected 2006 and 2010 populations within the 10-mile emergency planning zone (EPZ) surrounding Vogtle Electric Generating Plant (VEGP). This document describes the methods used to obtain population data and to estimate the ETEs. It reports the estimated population figures, evacuation road network information, and ETEs.

The total permanent resident populations within the 10-mile EPZ for VEGP are estimated to be 3,017 for 2006 and 3,224 for 2010. This population is broken down by protective action zone (PAZ) and by sector and ring within the report. There is not a major change in the permanent population figures because the power station is located in a densely-wooded rural area, and no significant change in the land-use pattern is expected around the plant in the next four years. Transient population consists of workers employed within the area and recreational sportsmen on the Savannah River. Special facilities populations are composed of students, teachers, and other employees at the Lord's House of Praise Christian School and employees of the VEGP.

IEM used PTV Vision VISUM, a computer simulation model, to perform the ETE analyses. In order to represent the most realistic emergencies, ETEs have been prepared for several temporal, seasonal, and weather conditions. Evacuations for the nine geographic evacuation areas were modeled individually in each of three seasonal scenarios: Winter Weekday, Winter Weeknight, and Fall Weekend. The winter weekday and weeknight scenarios also represent summer weekday and weeknight scenarios because the population remain the same. The fall weekend scenarios are the same as the other weekends except for areas on and around the Savannah River, which include an increased population due to recreational sportsmen.

All these scenarios were considered under both fair and adverse weather conditions. ETEs for 2006 fair weather conditions ranged from 1 hour and 25 minutes to 1 hour and 45 minutes. ETEs for 2006 adverse weather conditions ranged from 1 hour 40 minutes to 1 hour 55 minutes. ETEs for 2010 fair weather conditions ranged from 1 hour 45 minutes to 1 hour 55 minutes. ETEs for 2010 adverse weather conditions ranged from 2 hours 5 minutes to 2 hours 45 minutes.

In conclusion, based on the data gathered and the results of the evacuation study conducted, IEM believes that the existing evacuation strategy is functional for

both 2006 and 2010 conditions, given the lack of severe congestion or very high ETEs.

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1.0 Introduction

The Vogtle Electric Generating Plant (VEGP) is a two-unit pressurized water reactor operated by Southern Nuclear Operating Company (SNC). In order to ensure the safety of the public living in the vicinity of the power plant, the U.S. Nuclear Regulatory Commission (NRC) requires nuclear power plants in the nation to conduct evacuation studies for the population within the 10-mile radius emergency planning zone (EPZ) at regular intervals. The population evacuation study fulfills regulatory requirements outlined in the NRC's and Federal Emergency Management Agency's (FEMA) *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants* (NUREG-0654), Appendix 4.[1]

SNC contracted IEM, Inc. to perform a population evacuation study for the 10-mile radius EPZ surrounding VEGP. This document presents the results of this study. It describes the assumptions and methodologies used by IEM to obtain population and evacuation network data and to perform evacuation time estimates (ETE) analyses. ETEs in this evacuation study incorporate the projected population numbers of years 2006 and 2010. The 2010 population numbers also include the projected construction workforce for the projected site expansion. This document reports the updated population figures, evacuation road network information, and ETEs.

The study is consistent with the requirements specified in Appendix 4 of NUREG-0654. If and wherever appropriate, the study uses guidance contained in NUREG/CR-6863 and NUREG/CR-6864, Volume 1.[2,3] The study is intended to provide information for State, local, and VEGP emergency management personnel to effectively plan for an event at the plant.

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[1] NRC and FEMA. *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*. NUREG-0654, FEMA-REP-1. November 1980. Online: http://www.nrc.gov.edgesuite.net/reading-rm/doc-collections/nuregs/staff/sr0654/sr0654r1.pdf (last accessed March 20, 2006).

[2] NRC. *Development of Evacuation Time Estimate Studies for Nuclear Power Plants*. NUREG/CR-6863. January 2005. Online: http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6863/cr6863.pdf (last accessed March 20, 2006).

[3] NRC. *Identification and Analysis of Factors Affecting Emergency Evacuations Emergency Evacuations*, Volume 1. NUREG/CR-6864. January 2005. Online: http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6864/v1/cr6864v1.pdf (last accessed March 20, 2006).

1.1. Site Location

VEGP is located on the southwestern bank of the Savannah River in Burke County, Georgia. The plant is approximately 15 miles east-northeast of the City of Waynesboro. The small town of Girard is approximately seven miles south of the plant. The closest population center is the town of Sardis, which is approximately 12 miles south of the plant. Figure 1 shows location of the VEGP site.

Figure 1: Vogtle Electric Generating Plant Site Location

1.2. Emergency Planning Zone

The plume exposure pathway EPZ includes the majority of the 10-mile geographic area surrounding VEGP. The VEGP EPZ covers areas in both Georgia and South Carolina. The land within the plume exposure pathway is divided almost equally by the Savannah River. The EPZ covers portions of the counties of Burke and Richmond, Georgia, and Barnwell, Allendale, and Aiken, South Carolina. Burke County has the largest resident population within the EPZ. This population is small and dispersed.

The major portion of the EPZ in South Carolina is within the United States Department of Energy's (DOE) Savannah River Site (SRS). DOE's Savannah River Operations Office (DOE-SR), pursuant to a memorandum of agreement between Georgia Power Company (GPC), as assigned to SNC, will be responsible for all emergency response actions on the SRS whenever an emergency occurs at VEGP[4]. For this reason, a portion of the VEGP EPZ located in Barnwell County in South Carolina contained by the DOE-SR facility is not included in the study.

The areas in South Carolina that are not Federally-owned or controlled are along the Savannah River lowlands in Aiken, Allendale, and Barnwell counties. The segment in Aiken County, approximately 8–10 miles north-northwest of VEGP, is part of the Cowden Plantation, which has no resident population. The segments in Barnwell and Allendale counties, approximately 9–10 miles east-southeast of VEGP, are largely comprised of portions of the Creek Plantation, a horse farm. Within the South Carolina portion of the EPZ, the only housing is located within the Creek Plantation in Barnwell County, where there are only a limited number of permanent residences.

[4] A copy of the memorandum of agreement is provided in Appendix A. It can also be found in Appendix 5 of the VEGP emergency plan.

NUREG-0654 recommends that the EPZ be subdivided into evacuation areas, for performing the evacuation time estimate analyses (see Table 1).[5]

Table 1: Evacuation Areas for ETE Analysis

Radius	Area
Approximately 2 miles	Four 90° sectors
Approximately 5 miles	Four 90° sectors
Approximately 10 miles (EPZ)	Four 90° sectors
Approximately 10 miles (EPZ)	Entire EPZ

Based on the geography and political boundaries in the EPZ, one 0–2 mile area, two 0–5 mile areas, and four 0–10 mile areas are defined for the VEGP EPZ. For evacuation and emergency response planning purposes, these areas have been further divided into 13 protective action zones (PAZ).[6] The PAZ descriptions were obtained and verified from Appendix 4 of the VEGP Emergency Plan[7], the 2006 public outreach calendar[8], and the State of Georgia Radiological Emergency Plan: Appendix D—Burke County Plan.[9] The zones were selected based on existing political boundaries and prominent physical features—either natural (e.g., rivers and lakes) or man-made (e.g., roads)—to enhance direction and coordination of the public in the affected area.

[5] NUREG-0654. p. 4-4.
[6] Protective Action Zone is also referred to as "Zone" in this document.
[7] VEGP. VEGP Emergency Plan, 46-49.
[8] Plant Vogtle Emergency Information Calendar 2006.
[9] Georgia Emergency Management Agency. State of Georgia Radiological Emergency Plan: Appendix D—Burke County Plan, Georgia Annex D and Burke RERP..46–47. May 2005.

Figure 2 is a map of the evacuation zones for VEGP. Appendix B contains boundary descriptions of the zones within the 10-mile EPZ for VEGP.

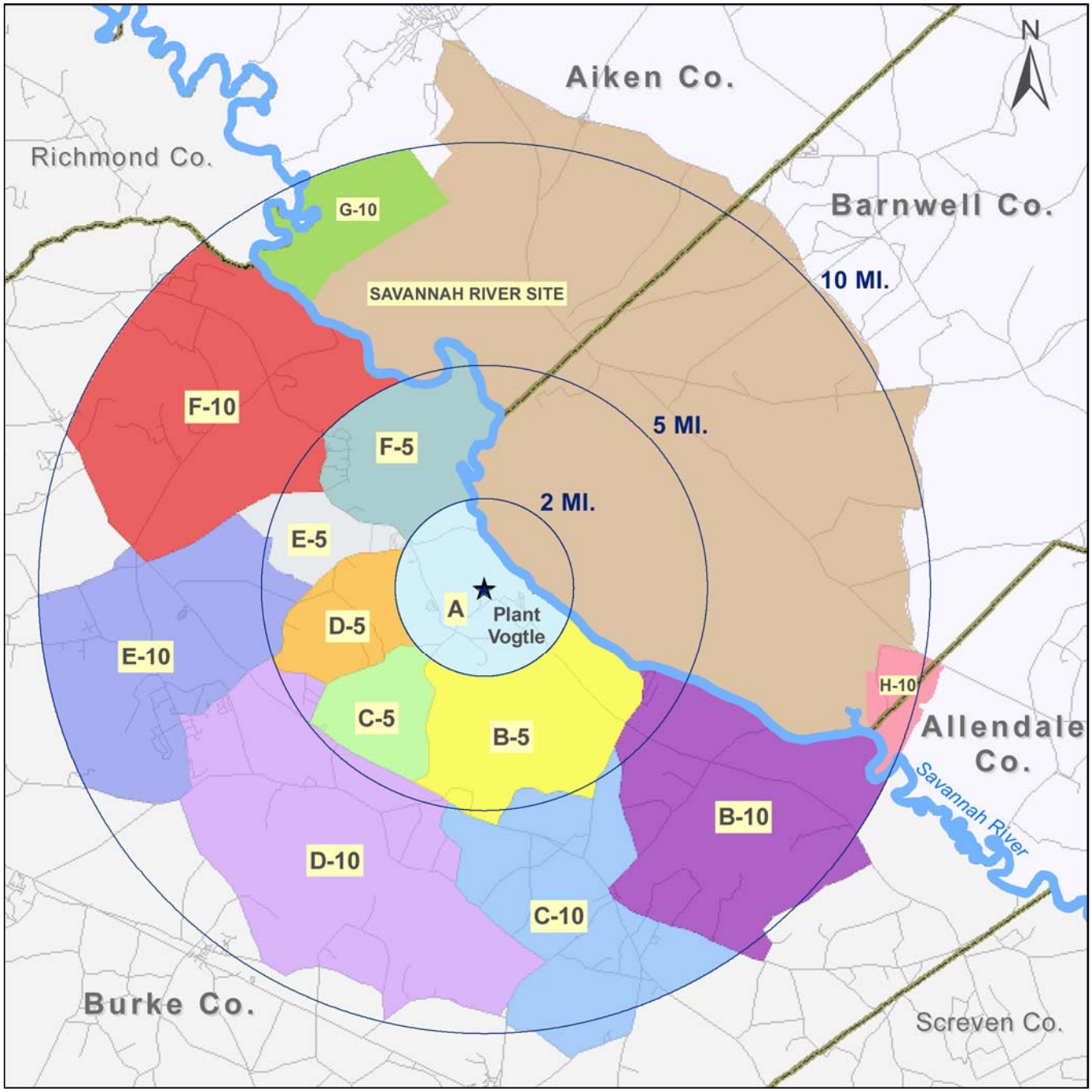

Figure 2: VEGP EPZ Boundary and Protective Action Zones

The relationship between the evacuation areas and evacuation zones is summarized in Table 2.

Table 2: Summary of Evacuation Areas and Protective Action Zones

Evacuation Area	Protective Action Zones
0-2 Miles	A
0–5 Miles, 90° S	A, B-5, and C-5
0–5 Miles, 90° NW	A, D-5, E-5, and F-5
0–5 Miles, (except SRS)	A, B-5, C-5, D-5, E-5, and F-5
0-10 Miles, 90° S	A, B-5, C-5, B-10, C-10, and D-10
0-10 Miles, 90° NW	A, D-5, E-5, F-5, E-10, and F-10
0-10 Miles, 90° N	G-10
0-10 Miles, 90° E	H-10
0-10 Miles, Full EPZ	All 13 evacuation zones

2.0 Assumptions and Methodology

2.1. General Assumptions

The general assumptions made to model the population evacuation study are outlined below:

- The ETEs include the times associated with warning diffusion, public mobilization, and travel time out of the EPZ.
- Following initial notification, all persons within the EPZ will evacuate. Evacuation of the EPZ will be considered complete after all evacuating vehicles are outside the EPZ.
- Existing lane utilization patterns will prevail during the course of the evacuation. There will be traffic control points in the network to allow efficient flow of traffic towards the reception centers.
- Reception centers are modeled as defined in the 2006 public outreach calendar[10].
- All households having more than one vehicle will use only use one automobile. This is consistent with empirical data, which indicates that family members, where possible, prefer to evacuate as a unit.[11]

[10] Plant Vogtle Emergency Information Calendar 2006.
[11] R.W. Perry, M.K. Lindell, M.R. Greene. *Evacuation Planning in Emergency Management*. 1981.

- Non-auto-owning households will evacuate with neighbors, friends, and relatives, or they will be evacuated through coordinated efforts by State and county emergency management officials. This is also consistent with the 2006 public outreach calendar.
- To model the population evacuation during adverse weather conditions, the speed limits are reduced by 40%, and the road capacities are reduced by 25%. This is consistent with research that concludes that during the adverse weather conditions, drivers may reduce their velocity by nearly 40%, which can result in a 25–30% reduction in capacity.[12] Weather-related capacity reductions of 20–25% are generally used in current evacuation studies for bad weather roadway conditions.[13]

2.2. Methodology

IEM used PTV Vision VISUM, a computer simulation model, to perform the ETEs for the VEGP site.[14] PTV Vision is the leading software suite for transportation planning and operations analyses used in more than 70 countries. Detailed information on the evacuation time analysis methodology using VISUM is provided in Section 5.2. PTV Vision quality assurance and industry acceptance information is provided in Appendix D.

2.3. Sources of Data

The most up-to-date data sources were reviewed and analyzed to prepare appropriate input data for running the traffic simulation and providing the best ETEs. These data sources are explained below:

- Population estimates were based on data obtained from Synergos Technologies, contact with individual facilities, and discussions with the SNC emergency planning staff.
- The peak estimated employment level at VEGP reflects office or operations personnel, as well as 2010 projections for construction workforce in that scenario.
- Roadway geometric data were obtained from PTV. PTV data is based on high-quality, regularly updated, NAVTEQ street network data. NAVTEQ networks are detailed, including neighborhood streets in every community in North America. This data was validated by IEM during a “ground truthing” field trip in February 2006.

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[12] National Research Council, Committee on Weather Research for Surface Transportation. *Where the Weather Meets the Road: A Research Agenda for Improving Road Weather Services;* Transportation Research Board (TRB), Board on Atmospheric Services. 2004.
[13] Urbanik, T. E. and J. D. Jamison, *State of the Art in Evacuation Time Estimate Studies for Nuclear Power Plants* (NUREG/CR-4831; PNL-7776). Richland, WA: Pacific Northwest Laboratory, 1992. Page 5.
[14] PTV Vision can be found online at http://www.ptvamerica.com.

- Roadway and intersection approach capacities were calculated using the concepts and procedures defined in the Highway Capacity Manual[15].
- Warning diffusion and mobilization times were based on the data presented in *Evaluating Protective Actions for Chemical Agent Emergencies*.[16] This data was collected during evacuations executed in response to large-scale chemical spills, and it explicitly incorporates the time required for communication of the warning (warning diffusion) and the time required for an individual to respond to the warning (mobilization). The data collected in this meta-study were based on transient, permanent, and special populations. Section 5.1.1 of this report provides more information on warning diffusion and mobilization time assumptions.
- Vehicle occupancy rates for the different population categories were derived based on average household size and discussions with the SNC emergency planning staff. Section 3.0 provides more information on population and vehicle demand assumptions.

2.4. Scenarios Modeled

As per NUREG-0654 guidelines, ETEs have been prepared for several temporal, seasonal, and weather conditions. Based on the discussion with the SNC emergency planning staff, estimates have been prepared for winter weekday fair and adverse weather conditions, winter weeknight fair and adverse weather conditions, and fall weekend fair and adverse weather conditions. Fair weather refers to conditions where roads are clear and dry and visibility is not impaired. Adverse weather refers to conditions where road capacities are reduced by 25% and speed limits are reduced by 40%. Evacuation conditions are modeled for the populations of the years 2006 and 2010. The 2010 population estimates also include the construction workforce for the planned two new units.[17] Table 3 presents the snapshot of the ETE scenarios that were modeled for the study.

Table 3: ETE Scenarios Modeled

2006		2010	
Fair Weather	**Adverse Weather**	**Fair Weather**	**Adverse Weather**
Winter Weekday	Winter Weekday	Winter Weekday	Winter Weekday
Winter Weeknight	Winter Weeknight	Winter Weeknight	Winter Weeknight
Fall Weekend	Fall Weekend	Fall Weekend	Fall Weekend

[15] Transportation Research Board, National Research Council. *Highway Capacity Manual*. Washington, D.C. 2000.
[16] Rogers, G. O., et al., *Evaluating Protective Actions for Chemical Agent Emergencies* (ORNL-6615). Oak Ridge, TN: Oak Ridge National Laboratory, 1990.
[17] The construction work force population figures are based on the projected construction plan for the two new units provided by the SNC emergency planning staff.

The various population components for different scenarios are summarized below:

- **Winter Weekday:** This situation represents a typical weekday period when the VEGP workforce is at a full, daytime level. Assumptions on the population levels for this condition include the following:
  - Permanent residents within the EPZ will evacuate from their place of residence.
  - The VEGP site employment is at an estimated peak daytime level.
  - For the 2010 scenarios only, one-fourth of the construction workforce is deployed at the VEGP site. Out of rest of the construction workers, the temporary construction workers are located within the 10-mile EPZ at a temporary housing site, and the permanent construction workers are located outside the 10-mile EPZ.
  - School is in session.
- **Winter Weeknight:** This situation reflects a typical nighttime period when the workforce is at a nighttime level. Assumptions on the population levels for this condition include the following:
  - Permanent residents within the EPZ will evacuate from their place of residence.
  - The VEGP site is staffed at an estimated peak nighttime level.
  - For the 2010 scenarios only, one-fourth of the construction workforce is deployed at the VEGP site. Out of rest of the construction workers, the temporary construction workers are located within the 10-mile EPZ at a temporary housing site, and the permanent construction workers are located outside the 10-mile EPZ.
- **Fall Weekend:** The fall weekend situation represents a daytime period when recreational activities are at peak levels. This condition would most likely occur during any weekend day during the hunting season (i.e., September 15 through January 6), when there would be a large number of hunters and fishermen at various points along the Savannah River. Assumptions on the population levels for this condition include the following:
  - Permanent residents within the EPZ will evacuate from their place of residence.
  - The VEGP site is at an estimated peak weekend level.
  - For the 2010 scenarios only, one-fourth of the construction workforce is deployed at the VEGP site. Out of rest of the construction workers, the temporary construction workers are located within the 10-mile EPZ at a temporary housing site, and the permanent construction workers are located outside the 10-mile EPZ.
  - Recreational activities are at a peak estimated level.

3.0 Population and Vehicle Demand Estimation

IEM identified three population categories within the EPZ surrounding VEGP, as specified in the NUREG-0654 guidelines. These populations include the permanent resident population, the transient population, and the special facility population. Because the VEGP power station is located in a densely-wooded area, there are no special facility populations within the 10-mile EPZ other than a private school (The Lord's House of Praise Christian School). The majority of the population consists of permanent residents and a varying number of recreational visitors mainly located on or around the Savannah River.

IEM derived the 2006 population estimates, as well as business location data, from 2005 fourth-quarter population estimates obtained from Synergos Technologies, Inc.[18] These population estimates formed the basis for determining the evacuee demand used in the analyses for any given evacuation scenario. Local school data were obtained from commercially available geographic information system (GIS) data and through contact with individual facilities. The recreational visitors' population figures were based on the discussion with the SNC emergency planning staff. The populations from these sources were assigned to each zone.

SNC also asked IEM to provide population projections for the year 2010. Synergos Technologies provided general estimates for 2010 population projections. The same calculations and assumptions used in calculating 2006 population figures were applied to derive the 2010 population figures. This ensures consistency in comparing ETEs for 2006 and 2010 populations for the area considered.

3.1. Permanent Residents

IEM obtained permanent resident population data from the Synergos Technologies January 2006 data release. IEM used GIS software to process the geographic data and associated population counts for census blocks in each of the counties surrounding the VEGP. IEM then aggregated these populations over each zone to generate a permanent resident population count, which is comprised of the nighttime population.

To calculate population by each zone and radial sector, census block population was aggregated within each of the sectors. Since boundaries of the sectors do not follow census block boundaries, many of the blocks had to be divided into sub-areas based on sector boundaries. To do this, IEM overlaid the census blocks with the EPZ zones and 10-mile radius sectors. The blocks were then split into sub-

[18] Synergos Technologies, Inc. http://www.synergos-tech.com.

areas and allocated the block population to the sub-areas based on an area ratio method. The populations of the block sub-areas within the sector boundaries were then aggregated for each radius sector.

The area ratio method assigns each sub-area a portion of the block population based on the ratio of the area of each block part to the area of the entire block. For example, if a particular sub-area contains one-fourth the area of the total block area, the sub-area receives one-fourth of the block's total population. Figure 3 illustrates this principle, in which one-fourth of the total area is located in the sub-area and it includes one-fourth of the population. The area ratio method assumes that the population within the block is evenly distributed, a reasonable assumption in most cases.

The populations of the block sub-areas within the sector boundaries were then aggregated for each sector. This method was also used in the few instances in which the PAZ boundaries did not follow block boundaries, making it necessary to split blocks along a particular zone boundary.

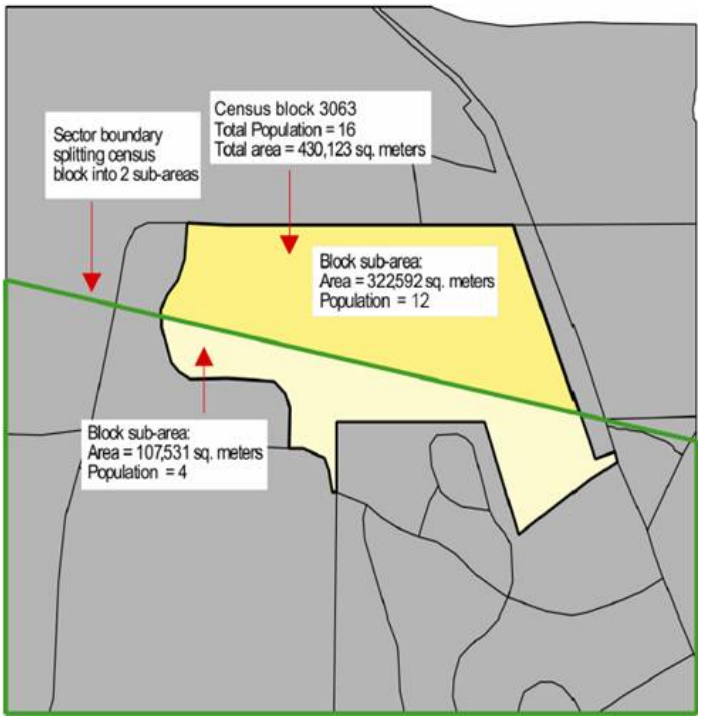


Figure 3: An Example of the Area Ratio Method Applied to a Census Block Divided into Sub-Areas

The permanent resident population is divided into auto-owning versus non-auto-owning populations.

3.1.1. Auto-Owning Population

It was assumed that one vehicle would evacuate from each permanent resident household. This assumption is consistent with the research indicating the

tendency of evacuees to evacuate, where possible, as a family unit.[19] The population projections and estimates indicate that 92% of the households within the EPZ have at least one vehicle-per-household. The data also indicates an average household size of 2.75 persons for the VEGP EPZ.

3.1.2. Non-Auto-Owning Population

The population projections and estimates indicate that 8% of the households within the EPZ do not own a vehicle. It is assumed that privately-owned vehicles of friends and/or relatives will be available to evacuate this population component (this is also recommended in the 2006 public outreach calendar).[20] This assumption is used since it provides the most realistic representation of evacuation traffic generated from the non-auto-owning households, which would account for vehicles within the network following internal routes to collect non-auto-owning passengers.

For an estimate of the vehicle demand associated with the permanent population (auto-owning and non-auto-owning), IEM used a vehicle occupancy rate of 3.0. This is based on the assumptions stated above that a family will evacuate in a vehicle and non-auto-owning households will evacuate with neighbors, friends, and relatives—or they will be evacuated through coordinated efforts by State and county emergency management officials.

Table 4 shows the distribution of the 2006 and 2010 total permanent resident population by sector and ring, while Figure 4 and Figure 5 present the same data graphically. Table 5 shows the distribution of the permanent resident population by zone, and Figure 6 and Figure 7 present this data graphically.

[19] R.W. Perry, M.K. Lindell, M.R. Greene. *Evacuation Planning in Emergency Management*. 1981.
[20] Plant Vogtle Emergency Information Calendar 2006. p 6.

Table 4: 2006 and 2010 Permanent Resident Population Distribution by Sector and Ring

Sector[21]	Ring[22]	Permanent Resident Population	
		2006	2010
N	2	3	3
N	5	18	16
N	10	3	0
NNW	2	13	14
NNW	5	47	46
NNW	10	13	14
NW	2	17	17
NW	5	122	193
NW	10	160	169
WNW	2	16	17
WNW	5	147	160
WNW	10	172	180
W	2	6	6
W	5	72	75
W	10	408	456
WSW	2	3	3
WSW	5	82	85
WSW	10	500	560
SW	2	2	2
SW	5	7	7
SW	10	121	125
SSW	2	0	0
SSW	5	6	6
SSW	10	57	59
S	2	0	0

[21] There are a total of 12 sectors, each measured 22.5°. Sectors of 22.5°are designated by compass direction going outward from the plant on the centerline of the sector (e.g., the sector from 348.75° to 11.25° is designated "N" for north). The remaining 11 sectors are designated NNW, NW, WNW, W, WSW, SW, SSW, S, etc.

[22] Rings are defined as the area between two circles of radius 0 and 2 miles, 2 and 5 miles, and 5 and 10 miles.

Sector[21]	Ring[22]	Permanent Resident Population	
		2006	2010
S	5	25	25
S	10	253	253
SSE	2	0	0
SSE	5	17	17
SSE	10	485	478
SE	2	0	0
SE	5	22	22
SE	10	184	180
ESE	2	0	0
ESE	5	5	5
ESE	10	31	31

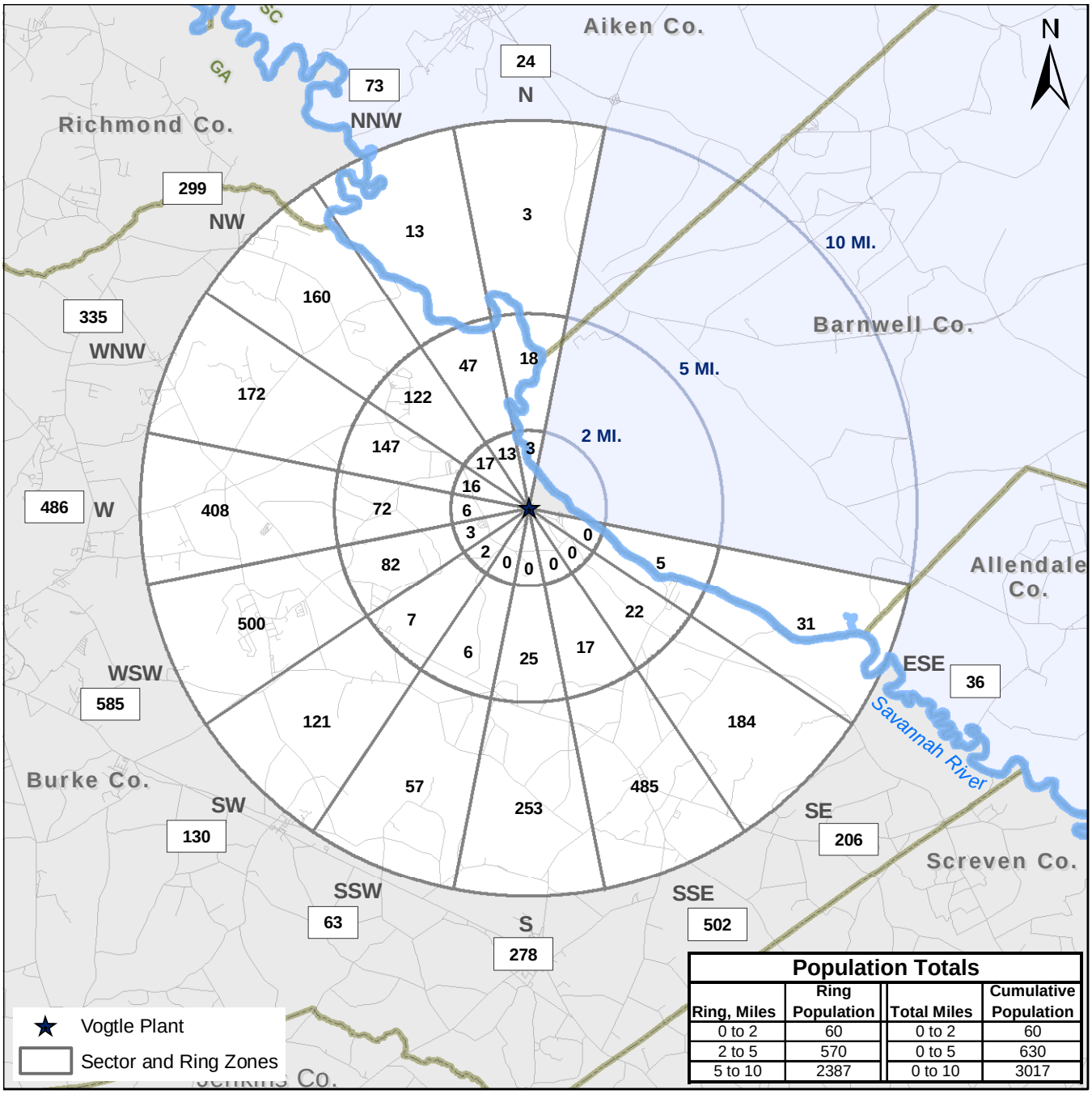
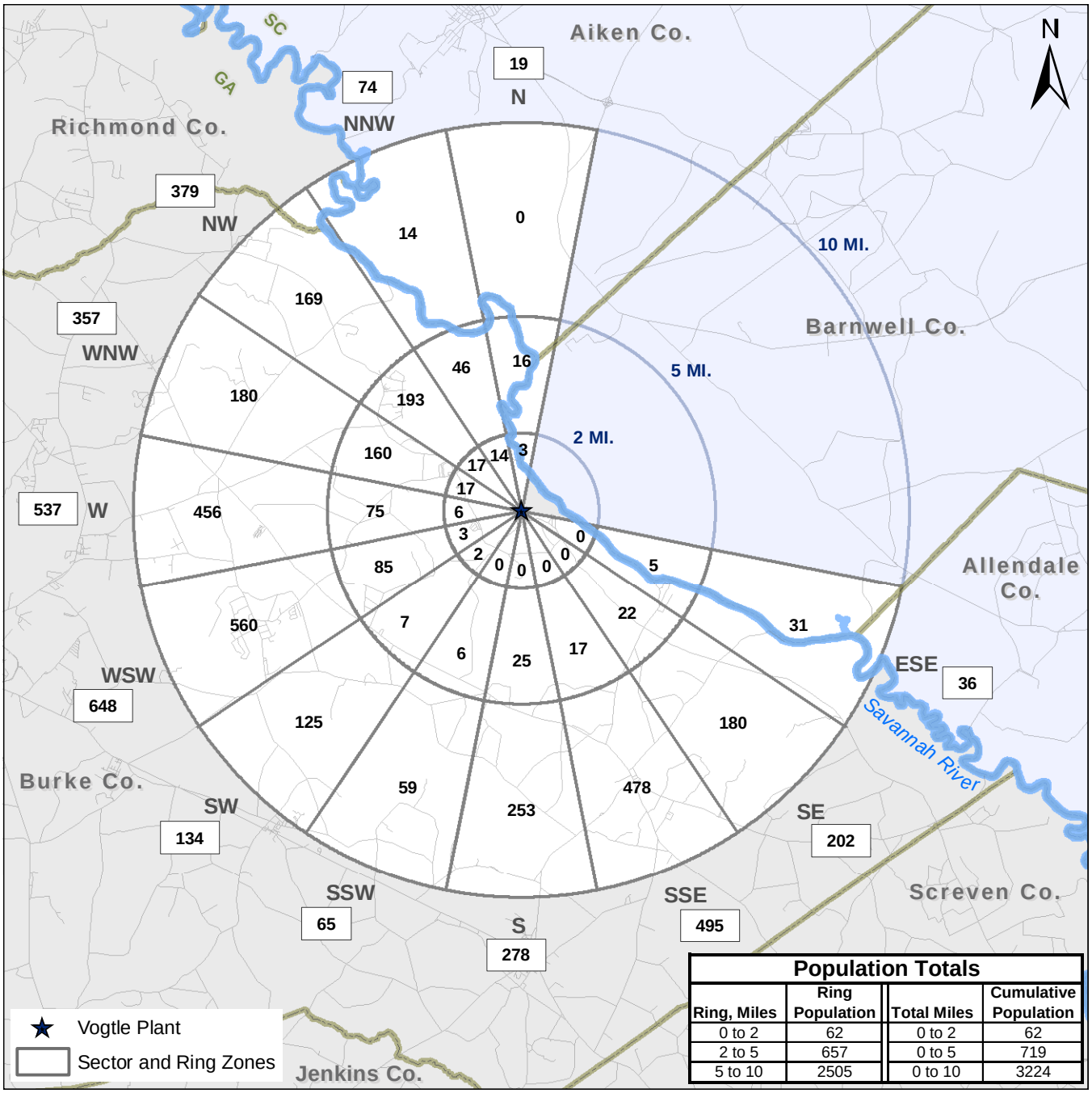


Figure 4: 2006 VEGP Sector and Ring Permanent Resident Population Map



Population Totals

Ring, Miles	Ring Population	Total Miles	Cumulative Population
0 to 2	62	0 to 2	62
2 to 5	657	0 to 5	719
5 to 10	2505	0 to 10	3224

Figure 5: 2010 VEGP Sector and Ring Permanent Resident Population Map

Table 5: 2006 and 2010 Permanent Resident Population Distribution by Zones

Zone	Permanent Resident Population	
	2006	2010
A	60	62
B-5	65	65
B-10	277	273
C-5	5	5
C-10	565	558
D-5	111	115
D-10	610	631
E-5	157	164
E-10	582	678
F-5	221	293
F-10	344	360
G-10	0	0
H-10	20	20

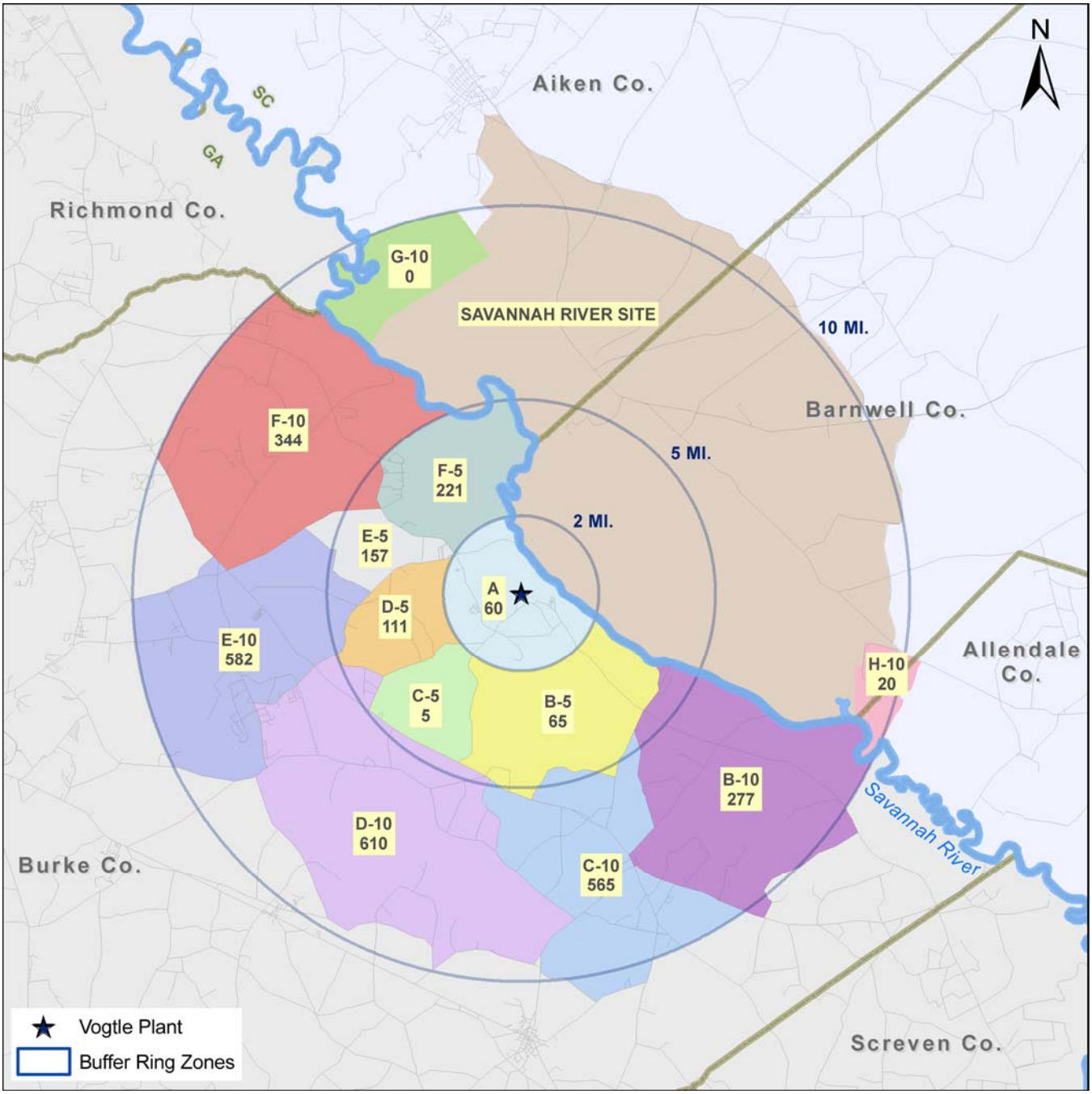


Figure 6: 2006 VEGP Zone Permanent Resident Populations Map

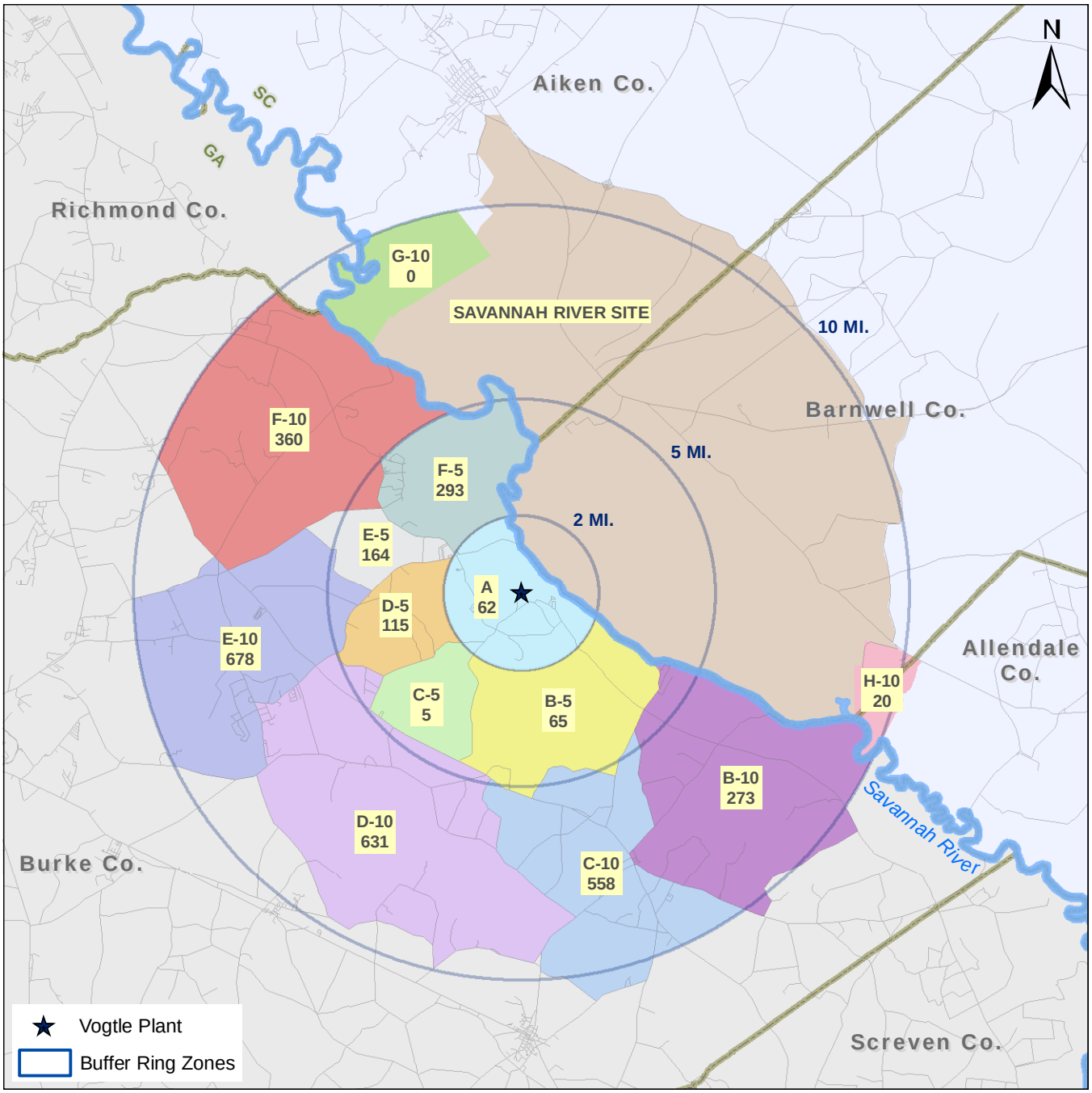


Figure 7: 2010 VEGP Zone Permanent Resident Populations Map

3.2. Transient Populations

The transient population for the VEGP EPZ area is derived from a combination of daytime populations, recreation populations, and employment data. These populations were combined with other contributors, such as the percentage of the population that is of working-age, to daytime population estimations and assigned to loading points in a manner similar to the permanent resident populations. The daytime populations incorporate employment and workforce information, such as county working-age population and unemployment statistics.

The recreational population shown for the VEGP area considers the use of private land and wildlife management areas by hunters and fisherman along the Savannah River. Through conversations with the SNC emergency planning staff, IEM was able to estimate recreational population approximates within the EPZ. There are three public boat landings in the VEGP EPZ. Two are in Burke County, Georgia—the Vogtle boat landing in zone B-5 and Brigham's Landing in zone B-10. The third boat landing is in Aiken County, South Carolina—Grays Landing located in zone G-10. It is estimated that there will be 200 hunters/fishermen in zones G-10 and H-10 during the hunting season.

A vehicle occupancy rate of 1.0 was used to estimate the number of vehicles to be evacuated by the transient population.

Table 6 shows the distribution of the 2006 and 2010 transient population by sector and ring, while Figure 8and Figure 9 present the same data graphically. Table 7 shows the distribution of the permanent resident population by zone, and Figure 10 and Figure 11 present this data graphically. There is no change between the 2006 and 2010 transient population figures, except for the sectors NW and WSW between 5 to 10-mile radius rings. This is because the power station is located in a densely-wooded rural area and no significant change in the land-use pattern is expected around the plant in next four years.

Table 6: 2006 and 2010 Transient Population Distribution by Sector and Ring

Sector	Ring	Transient Population	
		2006	2010
N	2	0	0
N	5	3	3
N	10	24	24
NNW	2	2	2
NNW	5	8	8
NNW	10	153	153
NW	2	2	2

Sector	Ring	Transient Population	
		2006	2010
NW	5	8	8
NW	10	51	52
WNW	2	1	1
WNW	5	9	9
WNW	10	28	28
W	2	1	1
W	5	7	7
W	10	21	21
WSW	2	1	1
WSW	5	7	7
WSW	10	82	83
SW	2	1	1
SW	5	2	2
SW	10	12	12
SSW	2	1	1
SSW	5	2	2
SSW	10	9	9
S	2	1	1
S	5	1	1
S	10	9	9
SSE	2	1	1
SSE	5	3	3
SSE	10	6	6
SE	2	0	0
SE	5	43	43
SE	10	13	13
ESE	2	0	0
ESE	5	16	16
ESE	10	223	223

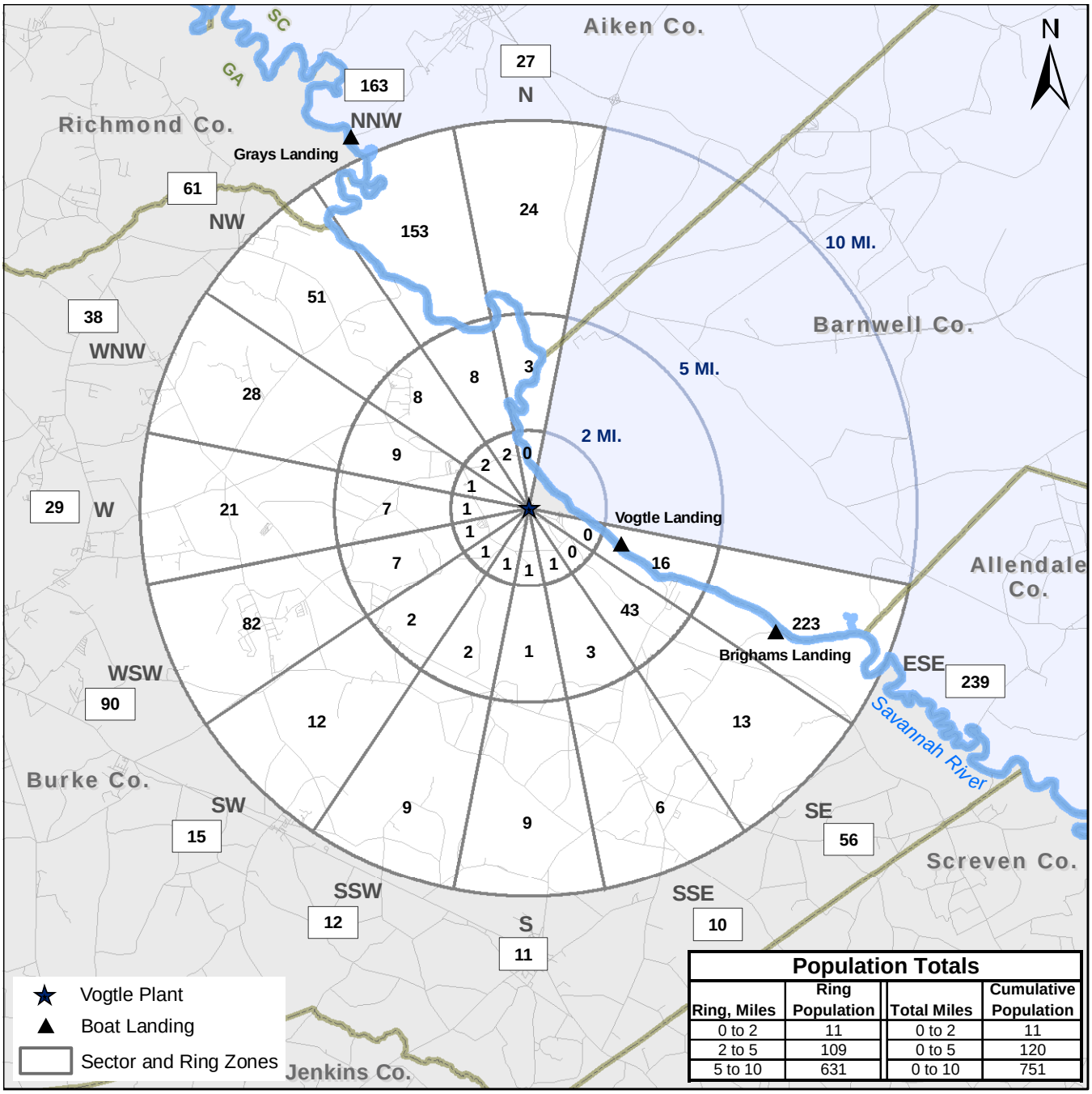


Figure 8: 2006 VEGP Sector and Ring Transient Populations Map

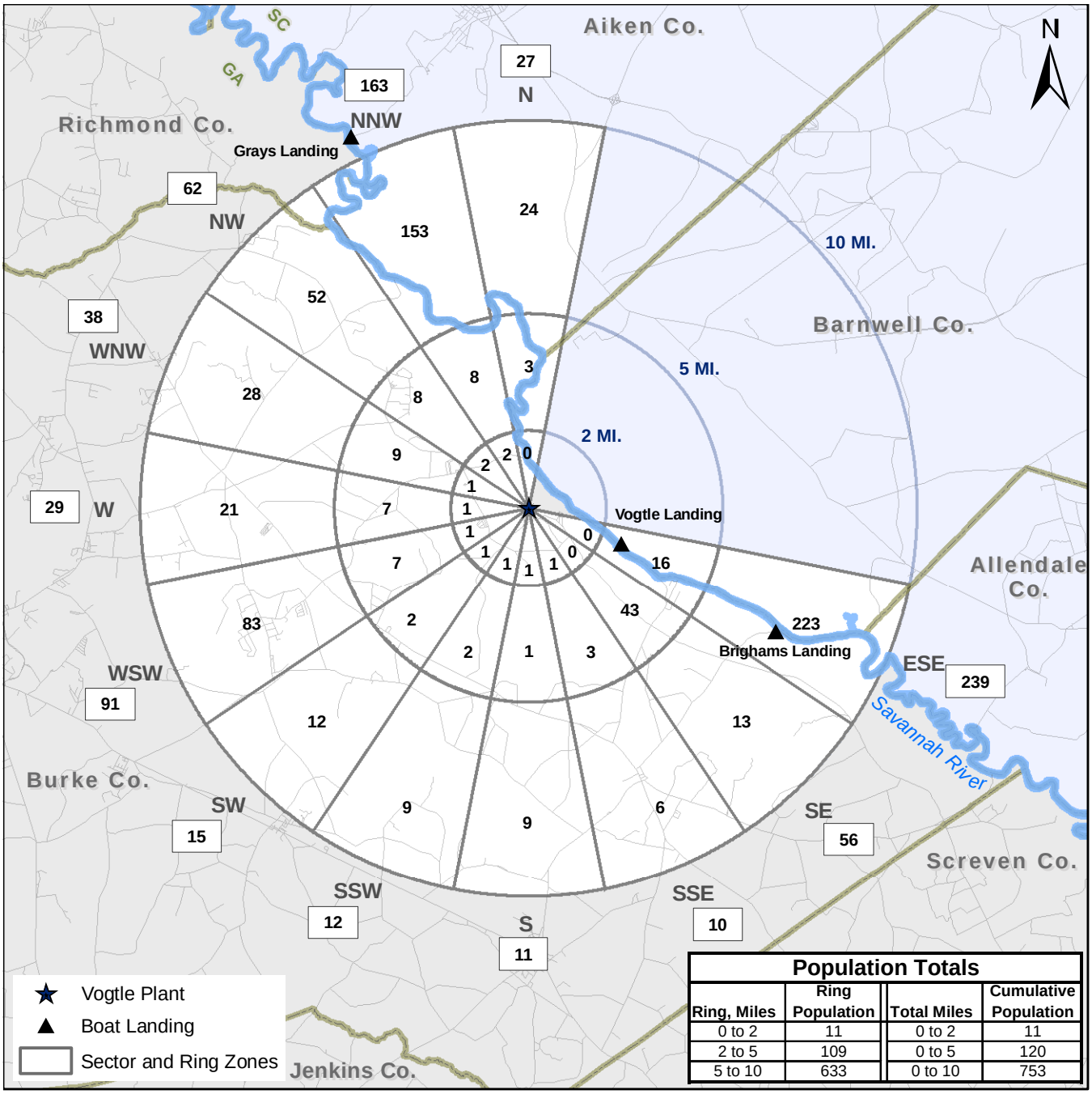


Figure 9: 2010 VEGP Sector and Ring Transient Populations Map

Table 7: 2006 and 2010 Transient Population Distribution by Zones

Zone	Transient Population	
	2006	**2010**
A	11	11
B-5	56	56
B-10	44	44
C-5	3	3
C-10	12	12
D-5	9	9
D-10	32	32
E-5	10	10
E-10	95	96
F-5	21	21
F-10	58	59
G-10	200	200
H-10	200	200

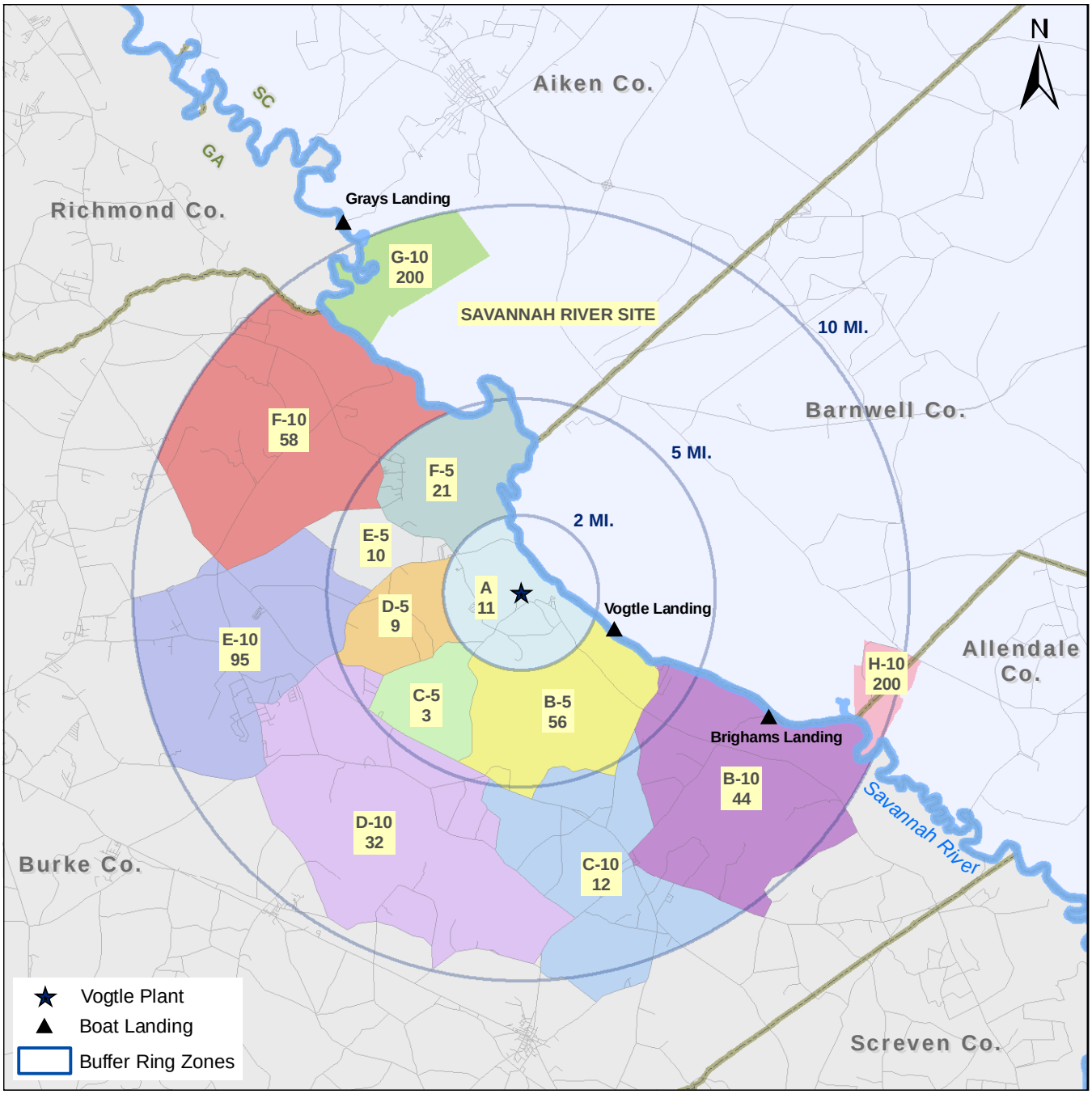


Figure 10: 2006 VEGP Zone Transient Populations Map

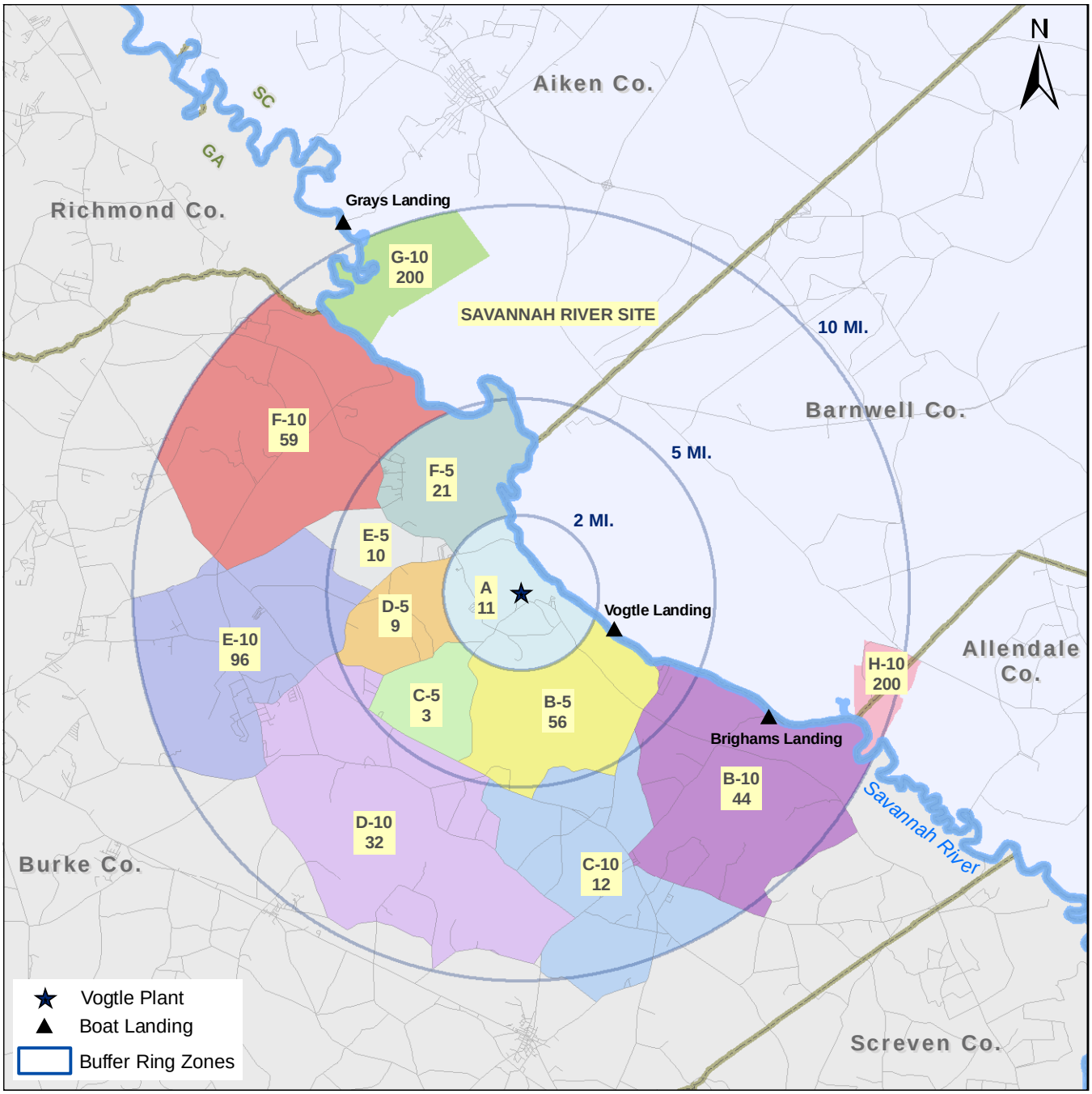


Figure 11: 2010 VEGP Zone Transient Populations Map

3.3. Special Facility and Other Special Consideration Populations

There are two facilities with in the VEGP EPZ that are classified as special facility (i.e., employers, schools, or other facilities with more than 50 employees or residents). The special facilities include the Vogtle Electric Generator Plant and

the Lord's House of Praise Christian School. Although there are only two large facilities, the modeled population for the ETE estimates were not limited to these large facilities only. It included employment from all businesses for which IEM had relevant information.

For the 2010 VEGP workplace estimates, IEM worked closely with the SNC emergency planners to get workforce and construction workers estimates. By 2010, the SNC emergency planning staff estimates that 3,045 construction workers will be onsite. The construction workforce is divided up into four crews. Two crews are assumed to work four shifts of 10 hours, and the remaining two crews are assumed to work three shifts of 12 hours. Therefore, only one-fourth of the construction workers are assumed to be deployed at any time at the VEGP site. Table 8 shows the special facility population within the EPZ.

The construction workforce is divided into two categories: permanent and temporary. The permanent construction workers would stay for a period of two years or longer and would bring families. The temporary construction workers would stay for less than two years and would not bring family. The permanent construction workers are assumed to be housed outside the VEGP EPZ, and the temporary construction workers are assumed to be housed inside the VEGP EPZ at a temporary housing location. SNC emergency planners estimate that a total of 94 temporary workers would be living at the temporary housing location in 2010. Figure 12 shows the distribution of special facility and temporary construction workers around VEGP in 2010.

A vehicle occupancy rate of 1.5 was used to estimate the number of vehicles to be evacuated by the VEGP onsite population, as was discussed with the SNC emergency planning staff. It was based on the assumption that one to two persons will use one vehicle. Therefore, an average value of 1.5 persons per vehicle is a reasonable assumption.

The population of Lord's House of Praise Christian School consists of approximately 50 students and 20 teachers and staff. After consultation with SNC emergency planners, the students were assumed to evacuate via two buses, with the remaining school population departing in their own cars (occupancy rate of 1.0).

Table 8: 2006 and 2010 Special Facility Population

Facility Name	Address	Zone	County	Special Facility Population	
				2006	2010
VEGP	PO Box 1600, Waynesboro, GA 30830	A	Burke	805	1,566
Lords House of Praise Christian School	162 Daybreak Road Waynesboro, GA 30830	E-10	Burke	70	70

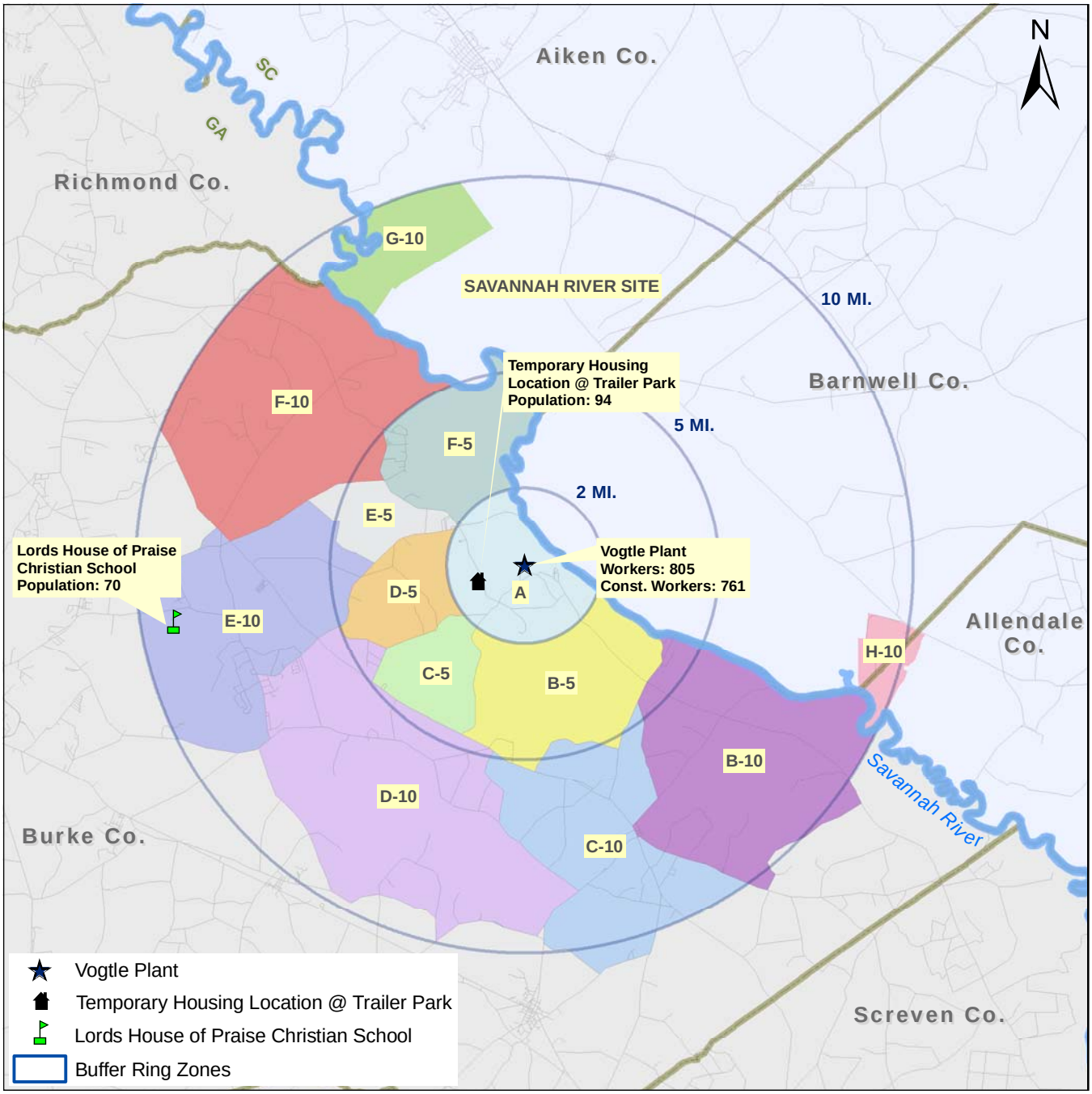


Figure 12: 2010 VEGP Special Facility Populations Map

4.0 The Evacuation Roadway Network

The evacuation routes were modeled based on the information provided in the 2006 VEGP Public Outreach Calendar. Additional information regarding the evacuation routes was obtained from Section 4, Appendix 6 of the VEGP Emergency Plan. The maps and descriptions in both documents were also used as the basis of network verification activity by IEM.

The public outreach calendar included a detailed description of the evacuation routes for each zone within the 10-mile radius. It provided descriptive information on recommended protective actions and the names and locations of reception centers for each zone. The map in the calendar clearly marked the evacuation routes and the direction of evacuation. The relocation centers are located well beyond the 10-mile EPZ.

IEM personnel drove along the designated evacuation routes in the direction of an evacuation, as marked on the public outreach calendar, to ensure complete and accurate information about the physical state of the roads. Any differences between information indicated in the calendar, NAVTEQ data, and existing field conditions were noted and, where necessary, were incorporated into the analyses. The differences that were noted are described later in this section. Figure 13 shows the entire evacuation network.

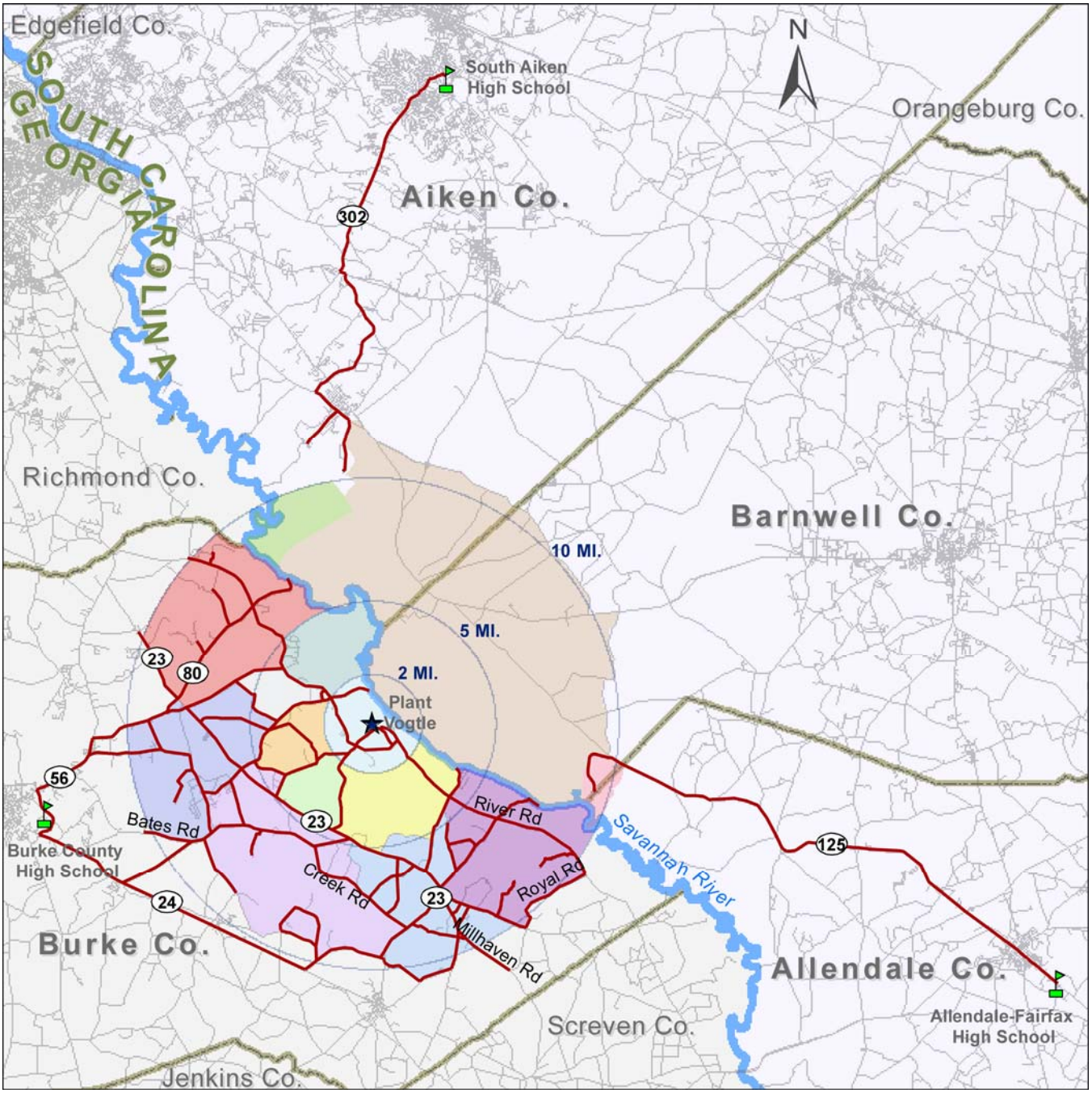


Figure 13: VEGP Evacuation Network

4.1. Network Definition

IEM performed a complete review of the evacuation roadway network. The evacuation network was developed using published evacuation routes and GIS road network data representing roads available from NAVTEQ and the U.S.

Census Bureau (USCB).[23,24] The high accuracy NAVTEQ street network GIS data, obtained for the PTV Vision simulation software, was used for field validation purposes and to build the digital evacuation network database. The USCB data is included in the Census Bureau's Topologically Integrated Geographic Encoding and Reference (TIGER) files, and was used to supplement the NAVTEQ data where required.[25] To ensure the accuracy of this data, the entire evacuation network, including those roads outside the 10-mile EPZ leading to the reception centers, was verified by traveling each route in the network in the direction of evacuation and collecting detailed information regarding the properties of each road section using a Global Positioning System (GPS)-enabled device. The GPS allowed locating—with a high degree of precision—any sections that had changed in channelization, curvature, speed limits, or other necessary network information.

The specific network attributes that were collected during the field trip included number of lanes, speed, turns, traffic controls, pavement type and width, shoulder width, and any other information required to model the traffic capacity of each link in the network.

4.2. Evacuation Route Descriptions

The evacuation network modeled for the ETE analyses covers Burke County in Georgia and Aiken, Barnwell, and Allendale Counties in South Carolina. The evacuation routes were originally developed to permit a general radial travel pattern away from the plant toward the designated reception center. Figure 14 shows the designated reception centers, and Table 9 provides the street address and evacuation route number information (as mentioned in the 2006 public outreach calendar) for the individual reception renters.

Table 9: Reception Centers

Reception Center	Address	Evacuation Routes
Burke County High School	1057 Perimeter Road Waynesboro, GA 30830	1, 2, 3, 4
South Aiken High School	232 E Pine Log Rd Aiken, SC 29803	5
Allendale-Fairfax High School	3581 Allendale-Fairfax Highway Fairfax, SC 29827	6

[23] PTV America, Inc. "NAVTEQ Data for PTV VISION." Online: http://www.ptvamerica.com/navteq_tiles/index.html (last accessed March 31, 2006).
[24] US Census Bureau. Online: http://www.census.gov.
[25] U.S. Census Bureau. "TIGER®, TIGER/Line® and TIGER-Related Products." Online: http://www.census.gov/geo/www/tiger/index.html (last accessed March 21, 2006).

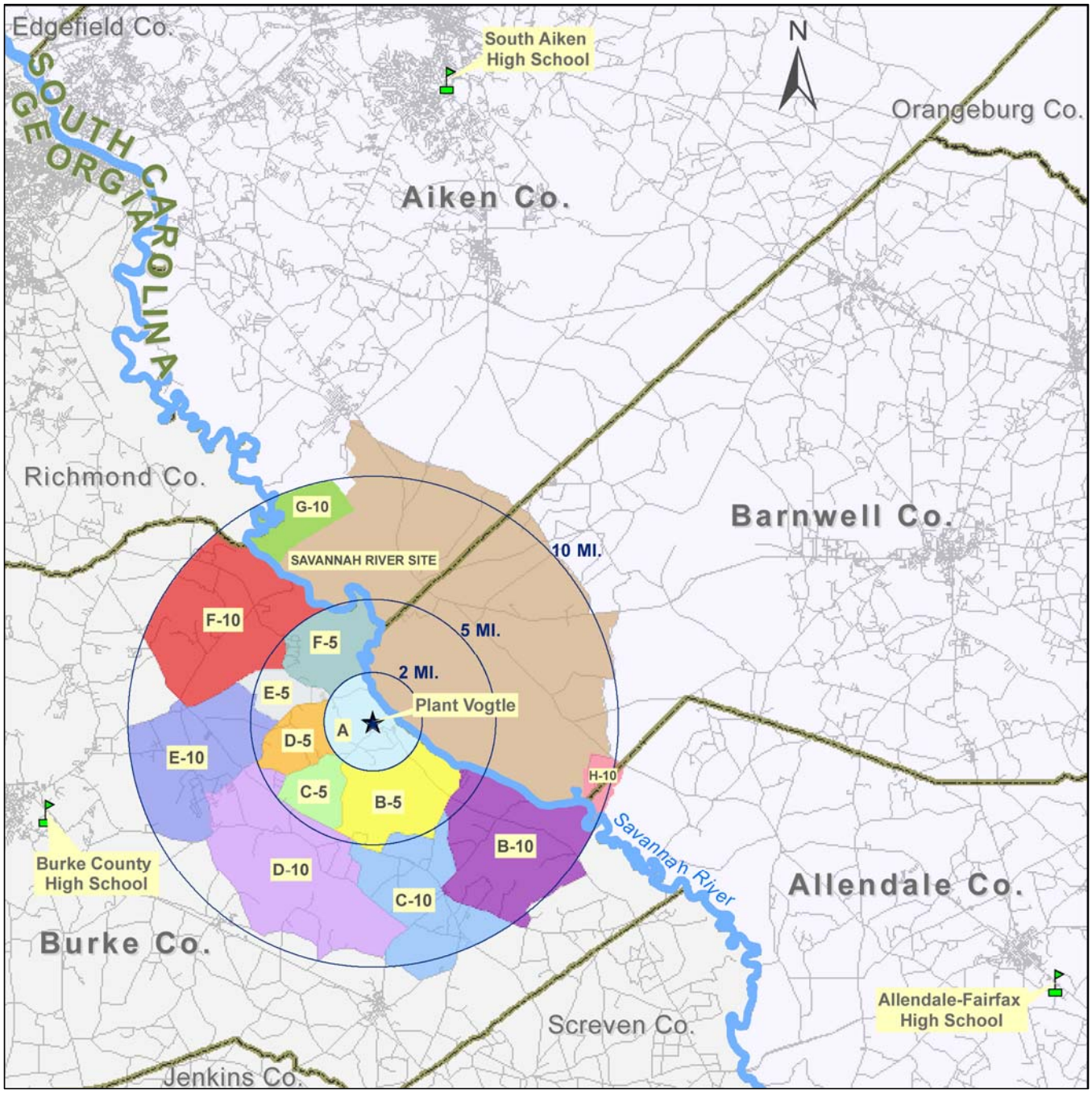


Figure 14: VEGP EPZ Boundary, Evacuation Zones, and Reception Centers

The evacuation route network is composed of three kinds of roads: highways, major arterial (roads connecting to highways), and minor arterial or connector roads (residential roads connecting to major arterial roads). Examples of highways are Georgia State Highways 23 and 80. Examples of major arterials are Ben Hatcher Road and Thompson Bridge Road. Examples of connector roads are Claxton-Lively Road and Thomas Road. The connector roads, although not part of the evacuation routes as described in the VEGP calendar, actually load the evacuee population (in cars) onto the evacuation routes composed of highways, major, and minor arterial roads. Following is a description of the evacuation routes as taken from the calendar (also see Figure 15, Figure 16, and Figure 17):

Evacuation Route 1

- Ben Hatcher Road to Shell Bluff Spur to Georgia Highway 80 to Georgia Highway 56 to Perimeter Rd. to Burke County High School.

Evacuation Route 2

- Hancock Landing Road to Botsford Church Road to Seven Oaks Road to Cates Mead Road to Highway 56 to Perimeter Rd. to Burke County High School.

Evacuation Route 3

- Ebenezer Church Road to Highway 23 to Thompson Bridge Road to Georgia Highway 24 to Perimeter Rd. to Burke County High School.

Evacuation Route 4

- Brigham's Landing Road to Georgia Highway 23 to Tom Bargeron Road to Georgia Highway 24 to Perimeter Rd. to Burke County High School.
- Royal Road to Stoney Bluff Road to Georgia Highway 23 to Tom Bargeron Road to Georgia Highway 24 to Perimeter Rd. to Burke County High School.

Evacuation Route 5 (Zone G-10, Cowden Plantation)

- West on County Road 5 to County Road 63 north to County Road 57 west to U.S. Highway 278 north to South Carolina Highway 302 north to South Aiken High School.

Evacuation Route 6 (Zone H-10, Creek Plantation)

- South on South Carolina Highway 125 to U.S. Highway 278 to Allendale-Fairfax High School.

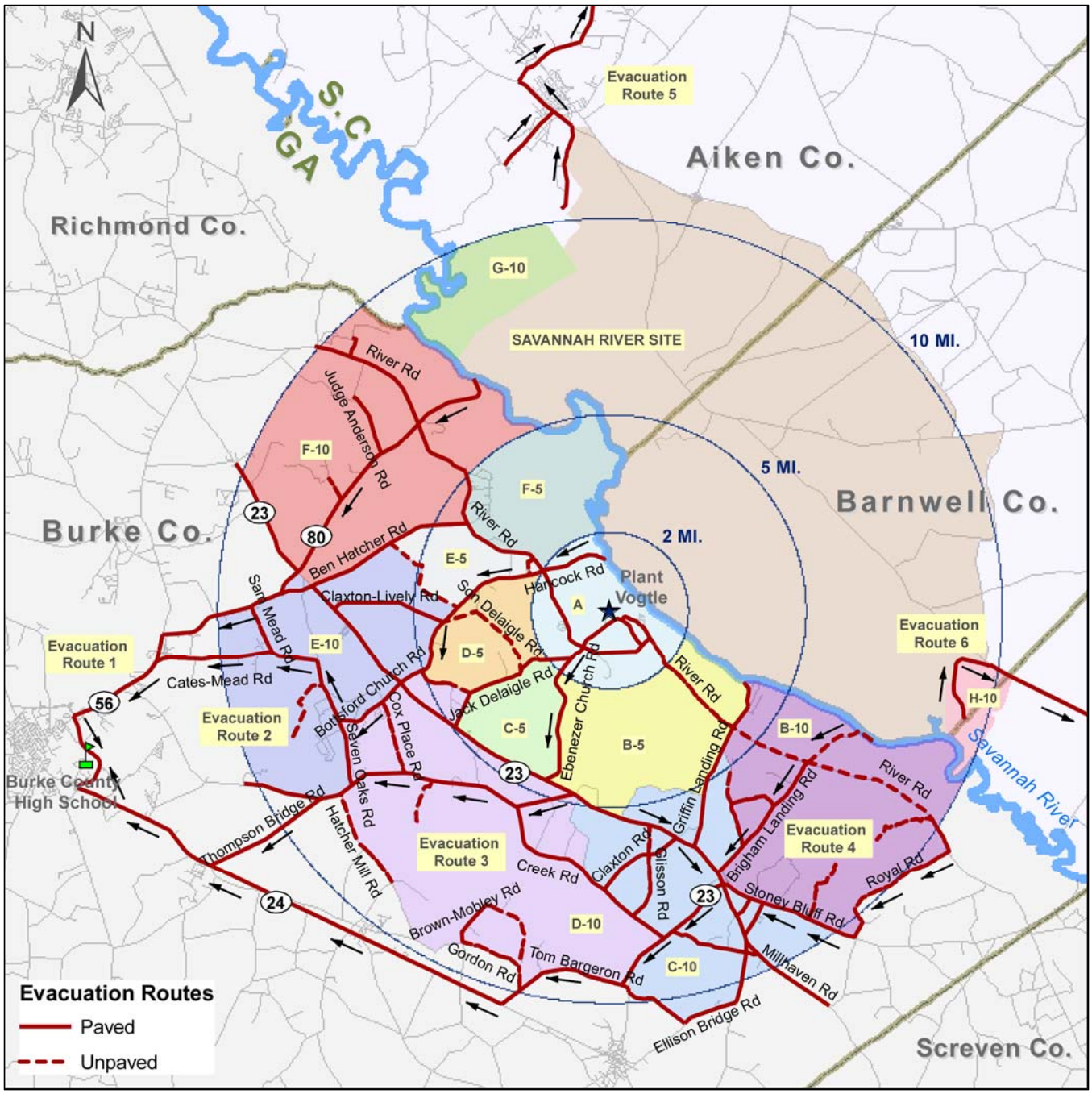


Figure 15: Burke County Evacuation Routes

Figure 16: Aiken County Evacuation Route

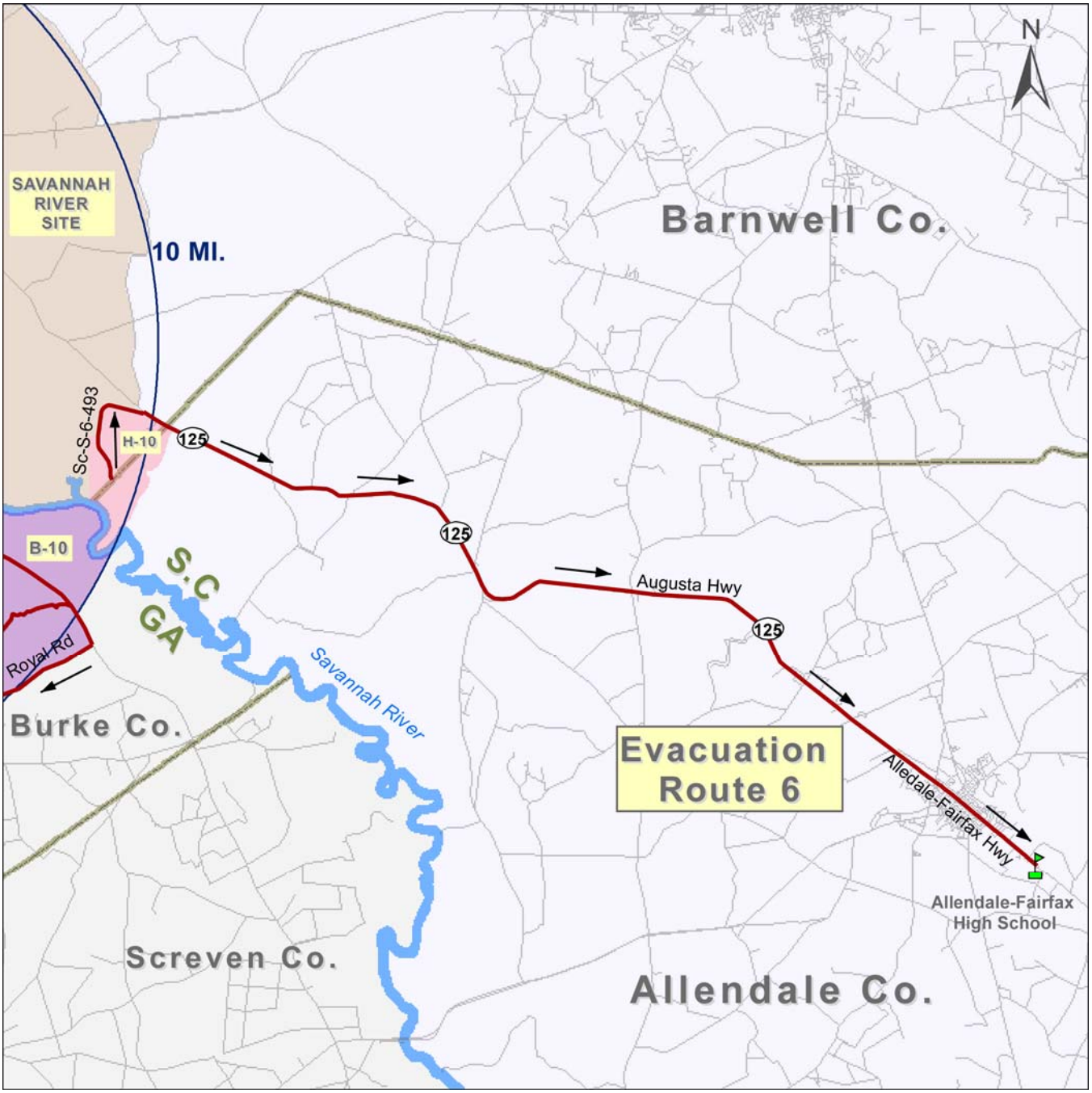


Figure 17: Barnwell County and Allendale County Evacuation Route

4.3. Evacuation Network Characteristics

The evacuation network, as modeled using the NAVTEQ street network data, contains a total of 578 links[26] and includes the connector roads. The total length of the network is about 241.5 miles. Detailed information regarding the roads that make up the evacuation network is provided in Appendix C.

The highways (e.g., GA 23, GA 24, GA 56, GA 80, SC 125, and SC 302) generally have a posted speed limit of 55 mph. The major and minor arterial or connector roads (e.g., Seven Oaks Road and Ben Hatcher Road) generally have a posted speed limit of 45 mph. On some of the roads, especially the highways, the posted speed limit decreases to 35 mph near city limit boundaries. Nearly all the links in the evacuation network (including highways) generally have one lane available in the direction of evacuation. Perimeter Road is the only road that has at least two lanes available in the direction of evacuation. Other roads that have network links with two lanes are River Road, SC 302 (Pine Log Road inside Aiken City limits), and SC 125 (Augusta Highway in Allendale City limits).

Traffic control along the evacuation routes is mostly managed using stop signs. Traffic lights were found at Perimeter Road, Pine Log Road, and Augusta Highway.

During the road network review, IEM personnel noted some differences between documented and field validated information, as summarized in Table 10 and shown in Figure 18.

Table 10: Differences between Documented and Field Data

Feature (Road) Name	Documented Information	Field Verified Information
Ben Hatcher Road	Unpaved Road	Paved (Asphalt) Road
Jack Delaigle Road	Unpaved Road	Paved (Asphalt) Road
Vogtle Boat Ramp Road	Unmapped	Dirt Road

[26] A link is defined as a road section where its characteristics (e.g. speed limit and number of lanes) are constant. An intersection starts a new link or end a link.

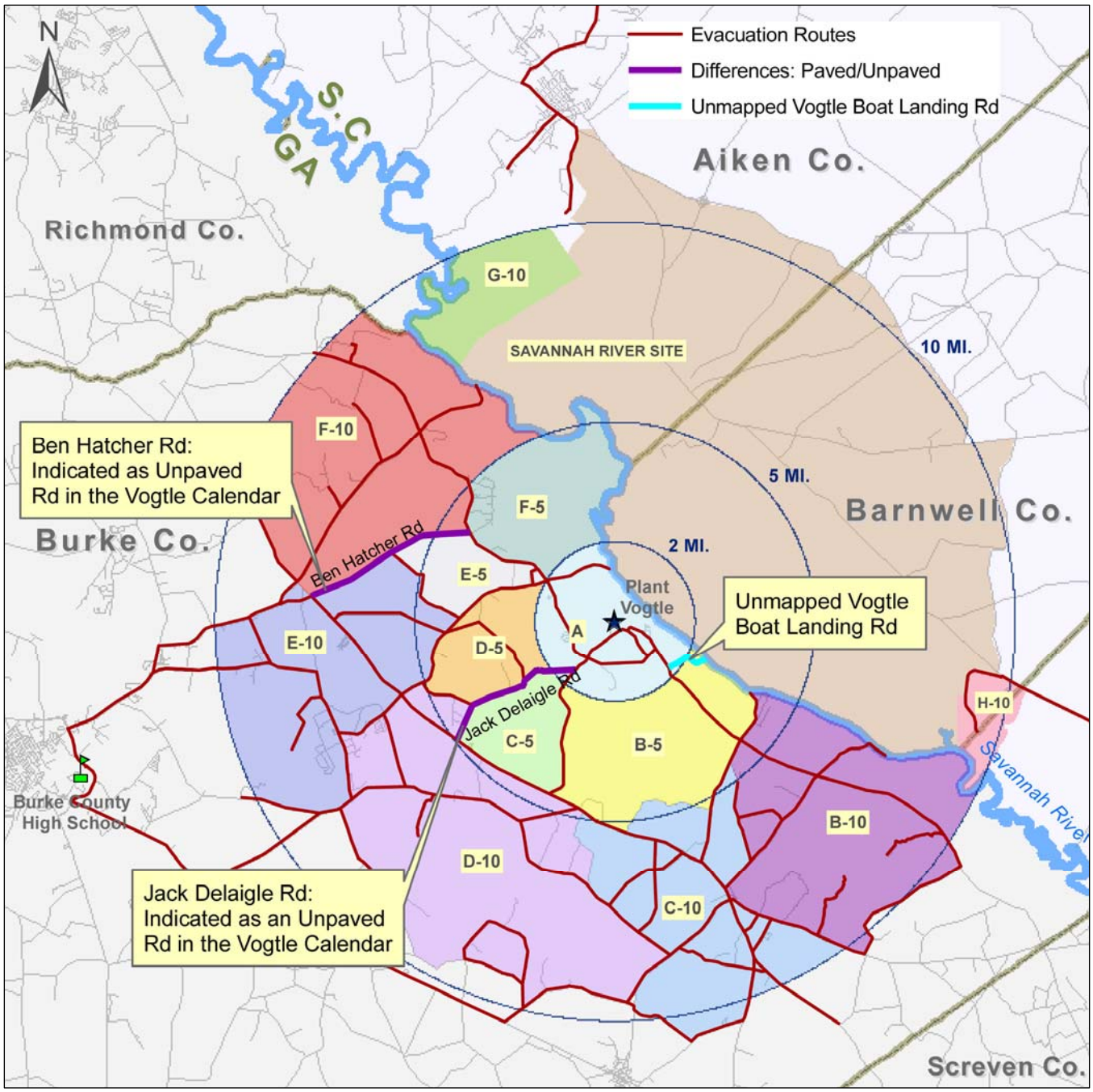


Figure 18: Evacuation Network: Differences between Documented and Field Validated Information

5.0 Evacuation Time Estimate Methodology

ETEs are developed using VISUM, one of the core components of the PTV Vision software suite. VISUM is used to estimate evacuation times for different scenarios (e.g., day vs. night or fair vs. adverse weather) for user-defined spatial networks. Information provided by VISUM includes evacuation or clearance times, operational characteristics (e.g., average evacuation speed, average distance traveled), points of congestion, and other data necessary to evaluate evacuation plans.

The evacuation network was defined based on the information provided in 2006 public outreach calendar. IEM subject matter experts drove the designated routes to ensure complete and accurate information about the state of the roads and to evaluate the appropriate selection of routes given the current conditions onsite.

Population (number of cars) loaded onto the network is based on the data and methods described above in the Section 3.0. Loading times for the evacuation network are described below. Additional details about the methodology are included in the following sections.

5.1. Assumptions

Key assumptions that have a substantial impact on the results of the analysis are detailed in the following sections. Any assumptions associated with the development of population estimates are included in Section 3.0.

5.1.1. Loading of the Evacuation Network

The timing of network loading[27] is derived from data presented in *Evaluating Protective Actions for Chemical Agent Emergencies*.[28] This data was collected during evacuations executed in response to large-scale chemical spills and explicitly incorporates the time required for communication of the warning (warning diffusion) and the time required for an individual to respond to the warning (mobilization). The data collected in this meta-study was based on transient, permanent, and special populations and is therefore appropriate to use as "general" warning diffusion and public mobilization curves for all three population types.

The underlying assumption regarding the applicability of Rogers' mobilization curves in the ETE study is that public perception of radiological emergencies differs from the actual characteristic of such an event. The familiarity of the hazard and the social assessment of the risks associated with the hazards are among the underlying forces that guide the decision-making process in an

[27] Loading is defined as the appearance of evacuating vehicles on the roads.
[28] Rogers, G. O., et al., *Evaluating Protective Actions for Chemical Agent Emergencies* (ORNL-6615), Oak Ridge, TN: Oak Ridge National Laboratory, 1990.

evacuation scenario. People are more likely to respond to calls for evacuation when the assessment of threat in the community is high and dangers to life and property are recognized. The reality may be different. The alarm associated with social response in a radiological emergency makes the use of Rogers' mobilization curves prudent for the ETE study.

It should also be noted that these curves were developed from the empirical data collected from real-life evacuations in response to actual events. No similar study developed specifically for radiological events is readily available. Therefore, the widely accepted Rogers' mobilization curves were used for this study. The implications of assuming public behavior in absence of real data are unknown. Actual data taken from a somewhat similar real-life scenario and similar public response is more applicable than some manufactured assumptions about how people will behave.

The specific timing used for warning diffusion is detailed in Figure 19. Since the distribution of times depends on the warning system employed, the alert and notification (A&N) systems around the site were evaluated based on the description in the emergency plans. The warning diffusion time distribution was chosen based on the availability of sirens, tone alert radios (TAR), and the emergency alert system (EAS) in the EPZ. Any deviations from this assumption will impact the evacuation times. For example, any loss of the capability of the A&N components will potentially increase the evacuation times. For example, Figure 19 shows that if only sirens and EAS are used, the evacuation times will be longer since it takes comparatively longer time for warning to diffuse.

The mobilization curve (Figure 20) is combined with the warning diffusion curve to form a composite loading curve that reflects the actual time distribution of cars loaded on the network. It is important to note that the starting point for this curve is the time at which public notification begins—not the start time of a hypothetical event.

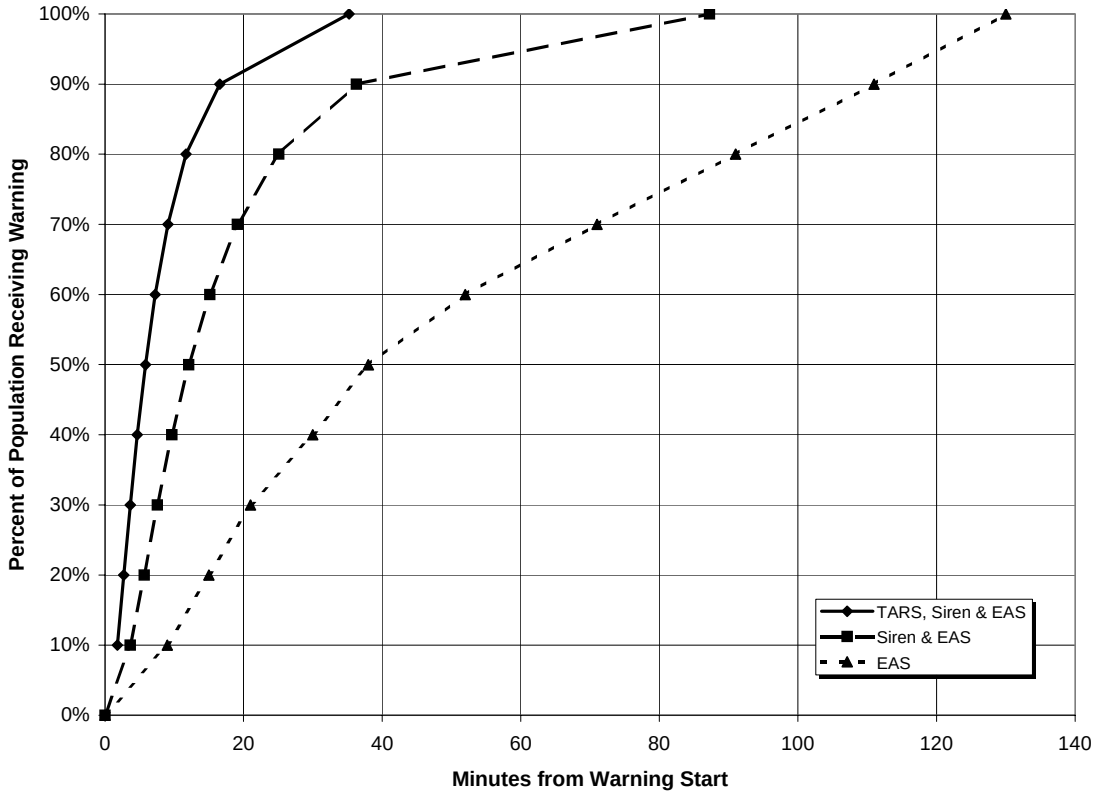


Figure 19: Warning Diffusion for Selected Notification Systems[29]

[29] *Ibid.*

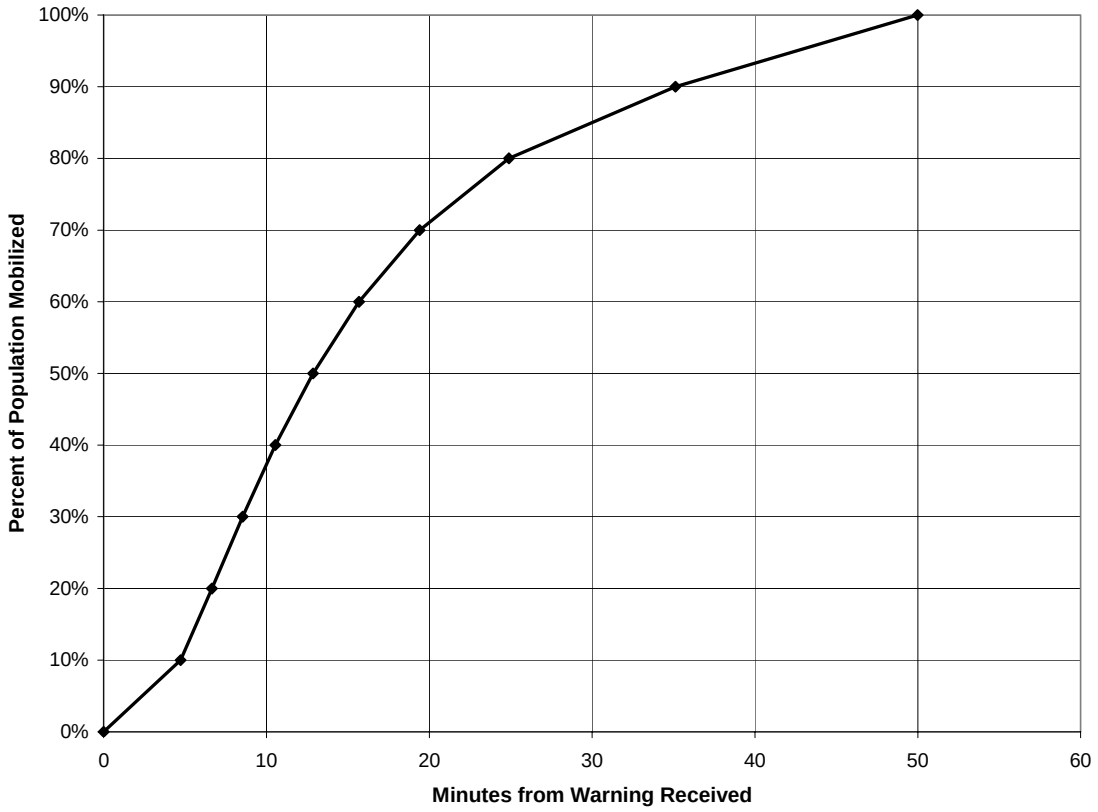


Figure 20: Population Mobilization Times[30]

Because the evacuation of students from Lord's House of Praise Christian School would require the arrival of buses from Burke County Emergency Management, their loading times were modeled differently. Conversations with the SNC emergency planners estimated that a total of 40 minutes would be necessary for the buses to arrive and be loaded, so the buses were assumed to depart at this time. Teachers and other staff were also assumed to depart at this time, as their presence would be necessary at the school for as long as students remained there. The school is located near the edge of the EPZ and has a small population; therefore, it would not have a significant impact on the ETEs.

[30] *Ibid.*

5.2. Evacuation Simulation

Evacuations were simulated using the population and vehicle demand data, evacuation network data, and loading distribution data discussed in the previous sections. VISUM was used to simulate evacuations. Figure 21 describes the framework of the analysis and three of its main features: the demand model, the network model, and the impact model.

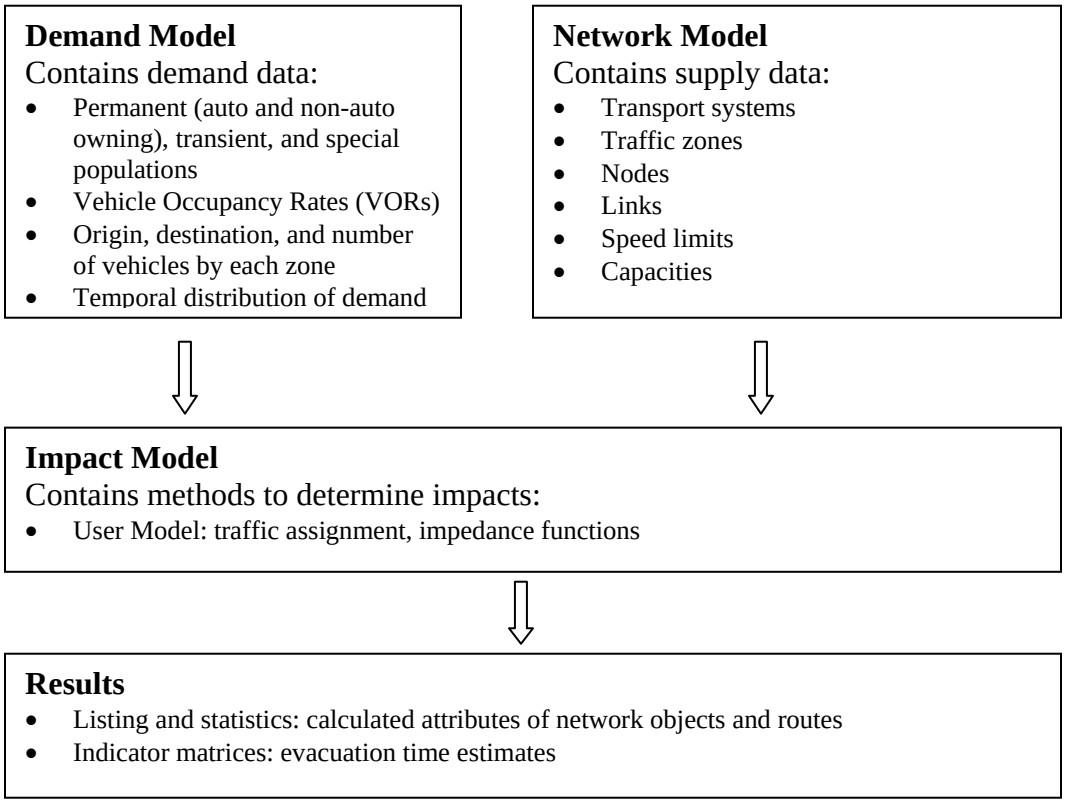


Figure 21: ETEs Analysis Framework using VISUM

5.2.1. The Demand Model

The demand model contains the travel demand data. The total number of vehicles originating from a zone is calculated by dividing a population with its expected vehicle occupancy rate. The total number of vehicles originating from a zone is then distributed to different time intervals based on the loading distribution curve for the zone. The loading distribution curve for the zone depends on the warning system available for that zone. The travel demand is described by an origin-destination (OD) matrix. The OD matrix refers to a time interval and the total number of vehicles departing in that time interval.

5.2.2. The Network Model

The network model describes the relevant supply data of an evacuation network. The supply data consists of traffic zones, nodes, links, speed limits, and capacities. Traffic zones describe areas with particular boundaries based on demography, topography, land characteristics, access routes, and local jurisdictions. They are origin and destination of trips within the evacuation network. Nodes define positions of intersections in the evacuation network. Links connect nodes and, therefore, describe the road infrastructure. Every network object is described by its attributes (e.g., speed limits and capacities for the links). Travel times of vehicles depend on the speed permitted on the links used and the capacity of the links used. The capacity of a transportation facility is the maximum hourly rate at which vehicles can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions. The capacity calculations in the analysis are based on the Transportation Research Board's Highway Capacity Manual[31].

5.2.3. The Impact Model

The impact model takes its input data from the demand model and the network model. VISUM provides different impact models to analyze and evaluate the evacuation network. A user model simulates the behavior of travelers. It calculates traffic volumes and service indicators, such as travel time. VISUM provides six traffic assignment procedures. Five procedures are static assignment procedures with no explicit time modeling, and the sixth procedures uses a time-dynamic model of the traffic flow. The dynamic stochastic assignment procedure was used for analyzing evacuation times. This procedure accounts for the inherent variability of travelers by not requiring them to take the optimal route but one of several of the shortest paths available to them. It also models how traffic flows change over the course of time and how the results affect the decisions of subsequent travelers entering the roadway network. This time-dynamic functionality allows for loading of the network via distributions, as when using a range of mobilization times.

The ETE is measured by noting when the last car passes the boundary of the EPZ. VISUM displays the calculated results in graphic and tabular forms and allows graphical analysis of results. In this way, for example, routes per OD pair, traffic flow, and isochrones can be displayed and analyzed.

[31] Transportation Research Board, National Research Council. *Highway Capacity Manual*. Washington, D.C. 2000.

6.0 Analysis of Evacuation Times

In accordance with guidelines in NUREG-0654, Rev. 1, the EPZ has been divided into 13 PAZs, which were then grouped into nine evacuation areas used to perform ETEs: one comprising 2-mile radius, two within the five-mile radius, the entire five-mile radius, four within the ten-mile radius, and the entire ten-mile EPZ. The PAZs and evacuation areas were defined in the Vogtle Emergency Plan and described in Section 1.0 of this document.

Evacuees inside the 10-mile EPZ are broken down into three segments: permanent residents, transients, and special facilities. The transient population consists of workers employed within the area and recreational sportsmen located near one of the boat ramps on the Savannah River. The population in special facilities is composed of students, teachers, and other employees at the Lord's House of Praise Christian School and employees of VEGP. In the 2010 scenario, construction employees are included among the VEGP employees. The population of the EPZ is described in more detail in Section 3.0

The South Carolina portion of the EPZ is covered almost entirely by the Savannah River Site, so only two of the PAZs, G-10 and H-10, are located on this side of the river. The population within G-10, which is covered by Cowden Plantation, is assumed to consist solely of sportsmen. PAZ H-10, which consists primarily of Creek Plantation, has a similar number of sportsmen, and has a small permanent population.

Five roads within the evacuation network cross the EPZ boundary: Georgia Highway 80, Cates Mead Road, Thompson Bridge Road, Tom Bargeron Road, and South Carolina Highway 125. Evacuees in PAZ G-10 are considered to exit the evacuation network via private roads within Cowden Plantation. All other vehicles exited the EPZ on one of these five roads.

6.1. Summary of ETE Results

Evacuations for the nine geographic evacuation areas were modeled individually in each of three seasonal scenarios: Winter Weekday, Winter Weeknight, and Fall Weekend. Sportsmen were considered to be at their peak in the Fall Weekend scenario and zero in the other cases. These scenarios were considered under both normal and adverse weather conditions. In the latter case, the speed limits and capacities of the evacuation routes were reduced by 40% and 25%, respectively. Each PAZ had been assigned a set of evacuation routes by VEGP planners, and these route restrictions were reflected in the models. Additionally, each of these 54 cases was modeled for 2006 and 2010. By the latter year, plant expansion was expected to have started, so construction workers were added to the model.

The evacuation time estimate results are displayed in Table 11. Evacuation times listed include warning diffusion, public mobilization, and travel time out of the EPZ. It is important to note that the evacuation time is the time from the moment at which public notification begins—not the start time of a hypothetical event. The seasonal scenarios are abbreviated, with "Day" representing Winter Weekday, "Night" corresponding to Winter Weeknight, and "Weekend" meaning Fall Weekend. No estimates were prepared for the 10-mile 90° N evacuation area in the Winter Weekday and Weeknight scenarios, as it had no population to evacuate in those cases.

Table 11 : ETEs in Minutes

		2006						2010					
		Fair Weather			Adverse Weather			Fair Weather			Adverse Weather		
Evacuation Area	**PAZs Impacted**	**Day**	**Night**	**Weekend**	**Day**	**Night**	**Weekend**	**Day**	**Night**	**Weekend**	**Day**	**Night**	**Weekend**
0–2 Miles	A	100	85	85	115	100	100	115	105	105	160	125	125
0–5 Miles, 90 S	A, B-5, C-5	100	85	90	115	100	105	115	105	105	160	125	125
0–5 Miles, 90 NW	A, D-5, E-5, F-5	105	90	90	115	105	115	115	105	105	160	125	125
0–5 Miles	A, B-5, C-5, D-5, E-5, F-5	105	100	100	115	105	115	115	105	105	160	125	125
0–10 Miles, 90 S	A, B-5, C-5, B-10, C-10, D-10	105	100	100	115	115	115	115	105	105	160	125	125
0–10 Miles, 90 NW	A, D-5, E-5, F-5, E-10, F-10	105	100	100	115	115	115	115	105	105	160	125	125
0–10 Miles, 90 N	G-10	**	**	75	**	**	80	**	**	75	**	**	80
0–10 Miles, 90 E	H-10	40	40	80	40	40	80	40	40	80	40	40	80
0–10 Miles	All 13 Evacuation Zones	105	100	100	115	115	115	115	105	105	165	125	125

Note:
1: ** : No estimates were prepared for G-10 in the Winter Weekday and Weeknight scenarios, as it had no population to evacuate in those cases.
2. The scenarios are each considered individually; if combinations of the geographic evacuation areas are to be evacuated together, the larger of the two numbers should be used as the evacuation time. For example, if PAZs A (2-mile scenario) and H-10 (10-mile 90° E scenario) were to be evacuated on a normal 2006 winter weekday, the ETE would be the greater of the two ETEs or 100 minutes.

6.2. Discussion of Scenario Results

6.2.1. Evacuation Area 1: 0–2 Miles

Year 2006

For 2006, this evacuation area contains small populations of residents and non-plant employees, but most of its evacuees are employees of VEGP. For winter weekdays, the Vogtle workforce is assumed to be at its maximum level. This results in the largest number of evacuees of the three seasonal scenarios, and, therefore, the longest evacuation time of 100 minutes in fair weather. In adverse weather conditions, where speed limits and capacities are reduced, the evacuation times increase by 15% to 115 minutes. In the Winter Weeknight and Fall Weekend scenarios, the Vogtle workforce is at a minimum, and residents are expected to be at home. The smaller number of evacuees is reflected in the shorter evacuation times (85 minutes in fair weather and 100 minutes in adverse weather conditions) compared to the Winter Weekday scenario. Congestion is not sufficient to cause traffic "jamming" in any of these cases, where speeds of travel drop sharply and road throughput is reduced to stop-and-go traffic.

Year 2010

In the 2010 simulations, large numbers of construction workers are expected to be working at the plant in all seasons and times of day. This additional population causes traffic congestion and queuing in the evacuation network for a limited time period. The effect on the evacuation time estimates is mild, for the most part. In normal weather, evacuation times increase by 5–25% from those in 2006 (from 85–100 minutes in 2006 to 105–115 minutes in 2010). Also, in the weeknight and weekend adverse weather scenarios, 2010 ETEs were found to be 20% greater than the corresponding 2006 values.

However, the congestion and queuing are increased when adverse weather conditions are applied to the Winter Weekday scenario when the Vogtle workforce is at its peak. In this case, evacuations are expected to take nearly 40% longer in 2010 (160 minutes) than in 2006 (115 minutes). The queuing is maximum on the VEGP evacuation route, with Ebenezer Church Road and Thompson Bridge Road each exhibiting volumes exceeding their capacities.

6.2.2. Evacuation Area 2: 0–5 Miles 90° S

In this scenario, PAZs B-5 and C-5 evacuate in addition to the population within the two-mile radius. These two zones add small residential and employment populations, as well as the sportsmen using the Vogtle Boat Ramp south of the plant.

The ETEs for this scenario (for both 2006 and 2010) are very similar to those for the 2-mile radius. This is because the people within the two-mile radius compose a large portion of the total population and have the farthest distance to travel to

exit the EPZ. As a result, they typically take the longest to reach the boundary, making their movement the limiting factor in any evacuation. As an example, consider the 2006 normal weekday evacuation times for different PAZs within the 0–5 mile 90° S evacuation area:

PAZ	Time to Exit EPZ
A (2-mile radius)	100
B-5	70
C-5	35

Evacuees originating in zones B-5 and C-5, which were not a part of the two-mile evacuation area, reach the EPZ boundary in significantly less time than those within the two-mile radius. However, because zone A requires the same time to evacuate, the total ETE remains the same.

This phenomenon is a general feature of the ETEs in that year, weather, and season tend to have more effect on the evacuation times than the geographic region being evacuated. The exceptions to this trend are the two evacuation areas that do not include the two-mile radius, 10-mile 90° E and 10-mile 90° N.

An additional and related result of the sparse population in the area is that congestion does not occur on roads outside of the Vogtle evacuation route.

6.2.3. Evacuation Area 3: 0–5 Miles 90° NW

This evacuation area is made up of the two-mile radius and D-5, E-5, and F-5, the three PAZs inside the five-mile radius to the north and west of the plant. Worker and residential population in these PAZs total approximately 200 in the Winter Weekday scenario and nearly 500 in the Winter Weeknight and Fall Weekend scenarios. As with the 0–5 Miles 90° S evacuation area, this extra population has less distance to travel than evacuees from VEGP and therefore have little effect on the ETEs compared to the 2-Miles evacuation area.

6.2.4. Evacuation Area 4: 0–5 Miles (except Savannah River Site)

All of the population inside the five-mile radius is contained in this evacuation area, making it a combination of the 0–5 Miles 90° S and 0–5 Miles 90° NW areas. As a result, the ETE results are similar to those for these two evacuation areas.

6.2.5. Evacuation Area 5: 0–10 Miles 90° S

This evacuation area consists of the 0–5 Miles 90° S evacuation area and three additional PAZs, B-10, C-10, and D-10. These PAZs contribute roughly 200 evacuating vehicles from residents and employees in the Winter Weekday scenario and approximately 500 vehicles in the Winter Weeknight and Fall

Weekend scenarios. Zone B-10 also contains a small population of sportsmen in the weekend scenario. As with other scenarios, however, these vehicles exit the EPZ before the last of the evacuees from PAZ A, so they have little effect on the ETEs.

6.2.6. Evacuation Area 6: 0–10 Miles 90° NW

This evacuation area consists of the 0–5 Miles 90° NW evacuation area and two additional PAZs, E-10 and F-10. These PAZs contribute roughly 300 evacuating vehicles from residents and employees in the Weekday, Weeknight, and Weekend scenarios. As with other scenarios, however, these vehicles exit the EPZ before the last of the evacuees from PAZ A, so they have little effect on the ETEs.

Also, Lord's House of Praise Christian School, the only special facility in the EPZ other than VEGP, is located in PAZ E-10 in this evacuation area. Its students are assumed to evacuate via two buses, with the teachers and other employees traveling via car. The school is located just inside the 10-mile boundary, so its evacuees reached the EPZ boundary before some of those from other areas, which had no impact on the ETEs.

6.2.7. Evacuation Area 7: 0–10 Miles 90° N

This evacuation area consists of one PAZ, G-10. This zone is covered entirely by Cowden Plantation and contains neither public road nor inhabited buildings. Evacuees are assumed to travel the short distance to the 10-mile boundary via private routes within the plantation. It has no population in the Winter Weekday and Weeknight scenarios, but it has a significant population of sportsmen in the Fall Weekend scenario. With little expectation for growth, the number of sportsmen is kept the same for the 2006 and 2010 scenarios, resulting in identical ETEs (75 minutes in normal weather and 80 minutes in bad weather) for the two years. The ETEs only increase by five minutes under adverse weather conditions, as the reduced speed limits and capacities have only minor effects given the small distance traveled to exit the EPZ.

6.2.8. Evacuation Area 8: 0–10 Miles 90° E

Only one PAZ, H-10, is included in this evacuation area. This zone bridges Barnwell and Allendale counties near the 10-mile radius in South Carolina and is covered largely by Creek Plantation. It has a small residential population and, in the Fall Weekend scenario, a somewhat larger population of sportsmen. The close proximity of evacuees to the EPZ boundary means that evacuation times for this zone are comprised largely of notification and mobilization time and very little travel time, resulting in the short ETEs for this evacuation area. Weekend results are somewhat higher due to the additional sportsmen in this scenario, while the effects of adverse weather conditions are muted by the short distance of travel. Even though all evacuees from this zone use the same road, South Carolina Highway 125, congestion is not an issue in any scenarios due to the small number of evacuees.

6.2.9. Evacuation Area 9: 0–10 Miles (whole EPZ)

This scenario requires evacuation of the entire population within the EPZ. In a more densely-populated area, this might have resulted in congestion and higher evacuation times than in the smaller evacuation areas. The population around VEGP, however, is small enough that the additional evacuees do not cause a significant slowing of vehicles on the road network. Congestion in the 2010 scenario is almost identical to that found for evacuation of the 0–2 Miles area.

6.2.10. Wind from 20°–55° Subset (VEGP South Route Evacuation)

The VEGP Document 91403-C[32], which details how an evacuation of the plant is to be carried out, documents two scenarios in which Vogtle employees are to evacuate via different routes. The West Route, which is modeled in all of the scenarios discussed above, is to be used if the wind is blowing in the 325° range between 55°–20°. The alternative South Route is only to be implemented if the wind blows from within the remaining 35° range from 20° to 55°. The latter case is discussed in this section.

The effects of evacuating Plant Vogtle via the South Route were investigated by testing a representative case, Winter Weekday 0–10 Miles 90° S, in each combination of year and weather condition. This scenario was chosen because it represented the largest population of evacuees among scenarios where the wind could blow from between 20° and 55°. These results were then compared to those found for evacuation via the West Route. The ETEs for these scenarios can be found in Table 12.

Table 12: South Route ETE vs. West Route ETE

Scenario	ETE with South Route Evacuation	ETE with West Route Evacuation
2006, Normal Weather	105	105
2006, Adverse Weather	120	115
2010, Normal Weather	130	115
2010, Adverse Weather	220	160

Altering the evacuation route for the plant employees increases evacuation times by 0–60 minutes. The change has little effect on the ETEs for the 2006 scenarios, as the South Route has sufficient capacity to handle the number of evacuees, which allows them to reach the boundary in the same amount of time.

[32] VEGP Site Dismissal, 12/15/2004.

This change for the 2010 scenarios (with the additional construction workers), proves enough to overload the route, creating more congestion than in the West Route scenarios and increasing the ETEs. The additional queuing stems from the South Route, including an unpaved three-mile section of River Road. The capacity on this section is lower than at any point along the West Route and creates queuing responsible for increasing the total travel times.

7.0 Supplemental Analysis

The analyses related to confirmation of evacuation and potential mitigating measures to effectively manage the traffic flow were performed and are provide in the following sections.

7.1. Confirmation of Evacuation

The confirmation of evacuation process determines if the evacuation has been completed. The time required for confirmation of evacuation is dependent upon the method employed. The most time-consuming method typically employed is to use ground vehicles. The time required involves the driving time for each route selected. Given the lack of congestion evident around VEGP in 2006, the evacuation confirmation process in this case would not need to wait for the bulk of the evacuation to complete. This indicates that the confirmation could be completed concurrently with the evacuation. Substantial congestion was, however, observed in 2010 scenarios, so confirmation in this case is recommended to be conducted after the evacuation had completed.

Informing people to leave some standard signs on their doors or windows when they leave their houses would help the authorities in the confirmation of evacuation. Presence of Traffic Control Points (TCPs) and Access Control Points (ACPs) at strategic locations within the evacuation network could provide real-time feedback regarding the progress of the evacuation process. All evacuees are recommended to sign in at the designated county reception centers as they arrive. This procedure helps the authorities to account for the population within the designated county. This can be accounted as one of the means of confirmation of evacuation, only under the assumption that all the evacuees would actually report to the reception centers and nowhere else. Telephoning people at their homes could also be considered as a possible means of ensuring completion of evacuation.

As noted in the VEGP Emergency Plan and Burke County Radiological Emergency Response Plan (RERP), “Evacuation confirmation will be accomplished by the Burke County Sheriffs Department and supporting law enforcement agency personnel that will traverse roadways throughout the affected area to ensure that the residential population has evacuated their homes. Personnel from Burke County EMA and Georgia Department of Natural Resources, Law Enforcement section, will move along the Savannah River and tributaries in boats to ensure that hunters and fishermen have evacuated the area. Additional

assistance is available from other state agencies, i.e., Georgia Forestry Commission and Department of Transportation."

The actual time associated with the confirmation process would depend on both the number of personnel and the amount of equipment available. These resources may change significantly under various emergency conditions.

7.2. Evacuation Traffic Management Locations and Other Potential Mitigating Measures

In order to efficiently promote smooth movement of traffic flow during an evacuation, several TCPs locations were developed and are listed in the Burke County RERP, Aiken County RERP, Allendale County RERP, and Barnwell County RERP. These TCPs are listed in Table 13 and Table 14 and shown in graphically Figure 22. The responsibility of supervising traffic controls during an evacuation will be shared between the State's and counties' emergency management and law enforcement agency personnel, as available. Each TCP will be manned and/or road blocks will be established to direct evacuees out of the EPZ and to deny access into the affected area. Also, route markers will be placed along the evacuation routes at critical intersections and road block locations to promote more efficient traffic flow out from the EPZ.

Table 13: Georgia Traffic Control Points for the VEGP EPZ

Location No.	Description
1	Georgia Highway 56 SP (River Road) at McBean Club Road
2	Georgia Highway 23 at Spring Branch Church Road
3	Georgia Highway 80 at Georgia Highway 23
4	Georgia Highway 23 at Hancock Landing Road
5	Botsford Church Road at Seven Oaks Road
6	Sam Mead Road at Seven Oaks Road
7	Georgia Highway 80 at Shell Bluff Spur
8	Georgia Highway 56 at Georgia Highway 80
9	Georgia Highway 56 at Cates Mead Road
10	Georgia Highway 56 at Perimeter Road
11	Entrance to Reception Center, Perimeter Road
12	Georgia Highway 24 at Perimeter Road
13	Thompson Bridge Road at Hatchers Mill Road
14	Georgia Highway 24 at Tom Bargeron Road
15	Georgia Highway 23 at Johnson Road
16	Ellison Bridge Road at Johnson Road

Location No.	Description
17	Ellison Bridge Road at Murray Hill Road
18	Millhaven Road, 1 mile south of Givens Church Road
19	Millhaven Road, Stony Bluff Road, Georgia Highway 23 Intersection in Girard
20	Stony Bluff Road at Intersection at Oak Grove Church
21	Royal Road at River Road
22	VEGP Main Access Road at River Road
23	River Road at Hancock Landing Road
24	Jack Delaigle Road at Ebenezer Church Road

Table 14: South Carolina Traffic Control Points for the VEGP EPZ

County	Location No.	Description
Aiken County	1	Route 437 (Browns Road) at Route 5 (direct traffice north on Route 5: restrict vehicles from traveling south on Route 437)
	2	Route 5 at Route 299 (direct traffice north on Route 5)
	3	Route 5 at Route 63 (direct traffic west on Route 63)
	4	Route 63 at Route 125 (allow traffic to flow on Route 63)
	5	Route 63 at Route 57 (direct traffic north on Route 57)
Barnwell County	6	Route 125 at Route 493 (direct traffic south on Route 125)
Allendale County	7	Route 125 at Route 12 (direct traffic south on Route 125)
	8	Route 125 at Route 17 (direct traffic south on Route 125)

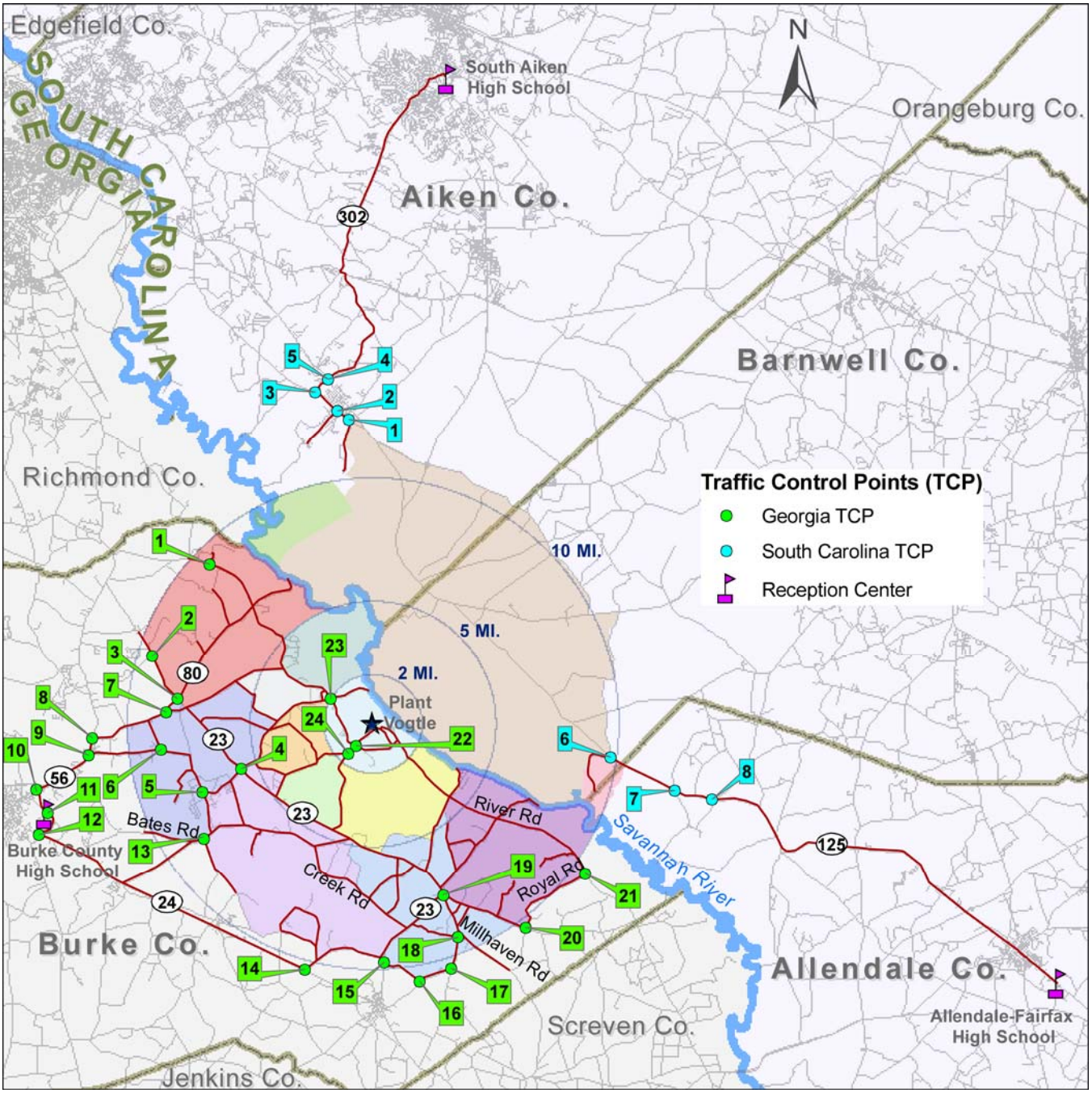


Figure 22: Traffic Control Points

8.0 Conclusion

Travel time is primarily affected by the conditions on the evacuation network, including any areas prone to congestion during times of large volume. As no areas of congestion were identified for the 2006 scenarios, improvement in this area is not necessary at this time. In 2010 scenarios, a large number of workers at the plant for the construction of new reactor units is expected to cause traffic congestion for a limited time period during the evacuation. In conclusion, based on the data gathered and the results of the evacuation study conducted, IEM believes that the existing evacuation strategy is functional for both 2006 and 2010 conditions, given the lack of severe congestion or very high ETEs.

Appendix A: MOA between DOE-SR and VEGP

The following pages contain Appendix 5, "Memorandum of Agreement with Department of Energy—Savannah River," of the *Vogtle Electric Generating Plant Emergency Plan*.

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

APR 12 1999

Mr. J. B. Beasley, Jr.
Vice President – Nuclear Vogtle Project
Southern Nuclear Operating Company
Birmingham, Alabama 35201

Dear Mr. Beasley:

SUBJECT: Vogtle Electric Generating Plant (VEGP) Memorandum of Agreement (MOA)

Enclosed is your copy of the executed MOA between the Department of Energy Savannah River Operations Office and the Southern Nuclear Operating Company (SNC) for planning and responding to emergencies originating at the Vogtle Electric Generating Plant (VEGP) and the Savannah River Site (SRS).

We appreciate the continued support of SNC and the staff at VEGP in promoting effective emergency preparedness and response activities for our respective facilities. Our staffs are working together to identify more effective ways that we can communicate with the states and demonstrate that we are hearing and addressing their concerns. In the near future I intend to submit to you a revised MOA which includes provisions for notifying the states and/or each other upon the impending release of tritiated water. Our goal would be to assure that government entities with interests in downstream Savannah River water quality will not be surprised by intentional releases of tritium in the water, and there will be no need for SRS to demonstrate when tritium detected in the water is not from SRS facilities. Again, I thank you for your support,

Please contact me or Len Sjostrom of my staff at (803) 725-5562, if you have any questions.

Sincerely,

Greg Rudy
Manager

VF-99-0033

Enclosure:
Memorandum of Agreement

cc w/encl:
Lawrence E. Mayo, SNC
Merrill Maddox, SNC

MEMORANDUM OF AGREEMENT
BETWEEN
UNITED STATES DEPARTMENT OF ENERGY
SAVANNAH RIVER OPERATIONS OFFICE
AND
SOUTHERN NUCLEAR OPERATING COMPANY

I. PURPOSE

This Memorandum of Agreement (MOA) is between the United States Department of Energy Savannah River Operations Office (DOE-SR) and the Southern Nuclear Operating Company (SNC) and provides for planning and responding to emergencies originating at the Vogtle Electric Generating Plant (VEGP), and the Savannah River Site (SRS).

II. RESPONSIBILITIES

DOE-SR is the responsible authority for SRS and as such, is responsible for the protection of all persons and for the direction and control of all emergency response actions on SRS for emergencies occurring at or affecting SRS, including emergencies originating at VEGP.

SNC is responsible for the protection of all persons and for the direction and control of all emergency response actions on the VEGP site for emergencies occurring at or affecting VEGP, including emergencies originating at SRS.

III. AGREEMENT

SNC and DOE-SR agree as follows:

A. In the event an emergency is declared at VEGP:

1. SNC will:

   a. notify the Savannah River Site Operations Center through the Emergency Notification Network within 15 minutes of an emergency declaration;

   b. utilize the Emergency Notification form to provide information concerning the emergency, including meteorological and radiological data and any protective action recommendations;

   c. provide periodic follow-up information to DOE-SR in accordance with the VEGP emergency plan;

   d. dispatch a technical liaison to the SRS Emergency Operations Center if requested by SRS.

2. DOE-SR will:

   a. provide for the prompt notification of all persons on SRS within VEGP's plume exposure pathway Emergency Planning Zone;

   b. assess the radiological hazard on SRS and decide upon and implement any protective actions necessary to protect the health and safety of affected persons on SRS, including access control;

   c. perform radiological monitoring on SRS as requested by SNC or the State of South Carolina and provide monitoring results to SNC and to the States of South Carolina and Georgia;

   d. provide resources and support as identified in the Federal Radiological Emergency Response Plan (FRERP) to address ingestion pathway concerns;

   e. provide meteorological data to SNC, as requested; and

   f. advise SNC and the States of South Carolina and Georgia of public information activities concerning the SRS to the maximum extent possible, and provide a spokesperson to the VEGP Emergency News Center when significant media/public interest in SRS activities is anticipated.

   g. as the Regional Coordinating Office for DOE Region 3, respond to requests for radiological assistance from SNC, the Nuclear Regulatory Commission (NRC), or the States of South Carolina or Georgia in the event of an incident involving the actual or potential release of radiological materials. This assistance will be provided under the Radiological Assistance Program (RAP) and will be limited to technical advice and resources for monitoring and assessment actions essential for the control of the immediate hazards to health and safety. DOE radiological assistance will be terminated when it is no longer needed or the necessary assistance is available from State, local, or commercial services.

   h. as the Regional Coordinating Office for DOE Region 3, advise SNC, the NRC, or the States of South Carolina or Georgia of additional DOE Emergency Response assets available to assist in the response.

B. In the event an emergency is declared at SRS:

   1. DOE-SR will:

      a. notify VEGP personnel through the Emergency Notification Network within 15 minutes of an emergency declaration;

      b. utilize the Emergency Notification form to provide information concerning the emergency, including meteorological and radiological data and any protective action recommendations;

c. dispatch a technical liaison to the VEGP Emergency Operations Facility, as requested by SNC;

d. provide periodic follow-up information to SNC in accordance with the SRS emergency plan;

e. provide resources and support as identified in the FRERP to address ingestion pathway concerns.

2. SNC will:

a. provide for the prompt notification of all persons on the VEGP site within the SRS plume exposure pathway Emergency Planning Zone;

b. assess the radiological hazard on the VEGP site, and decide upon and implement any protective actions necessary to protect the health and safety of affected persons on the VEGP site;

c. perform radiological monitoring as requested by DOE-SR or the States of Georgia and South Carolina and provide results to DOE-SR and to the States of Georgia and South Carolina; and

d. provide meteorological data to DOE-SR, as requested.

C. The parties will also:

1. provide a twenty-four hour point of contact at VEGP and SRS for notification purposes;

2. maintain effective lines of communication during an emergency;

3. participate in each other's emergency response exercises as requested and agreed upon.

IV. TERMS OF AGREEMENT

A. This MOA shall become effective upon the latter date of signature of the parties.

B. This MOA supersedes a previous MOA dated January 3, 1986, between the United States Department of Energy Savannah River Operations Office and the Georgia Power Company, as assigned.

C. This MOA may be amended by mutual consent of the parties concerned or terminated by either party upon giving at least thirty (30) days written notice to the other party.

Greg Rudy
Manager
Savannah River Operations Office
United States Department of Energy

4/12/99
Date

J. B. Beasley, Jr.
Southern Nuclear Operating Company
Vice President - Nuclear
Vogtle Project

12/11/98
Date

----------Nothing Follows----------

Appendix B: Geographical Boundaries of Evacuation Zones

Evacuation Zones	Geographical Boundaries
A	Northeast—Savannah River
	Southeast, South/Southwest and West Northwest—2-mile area
B-5	North—2-mile area
	West—Ebenezer Church Road
	Southwest—GA Highway 23
	South—Chance Road
	Southeast—Griffin's Landing Road
	Northeast—Savannah River
B-10	Northwest—Griffin's Landing Road
	West—Dixon Road and City of Girard eastern boundary
	Southwest—Stony Bluff Road
	Southeast—Royal Road and then 10-mile area
	Northeast—Savannah River
C-5	Northwest—Jack Delaigle Road
	Southwest—GA Highway 23
	East—Ebenezer Church Road
C-10	North—Chance Road and GA Highway 23
	West—Brier Creek Road, Buck Road, and GA Highway 23
	South—Johnson Road, Ellison Bridge Road, Murray Hill Road, and the 10-mile area
	Southeast—Stony Bluff Road
	East—City of Girard eastern boundary and Dixon Road
D-5	North—Hancock Landing Road
	West—Hancock Landing Road and Thomas Road
	Southwest—Hatchers Mill Road and Thompson Bridge Road
	South—Gordon Road and Tom Bargeron Road
	East—GA Highway 23, Brier Creek Road, and Buck Road
E-5	North—Ben Hatcher Road
	East—River Road
	South—Hancock Landing Road
	West—Nathaniel Howard Road

Evacuation Zones	Geographical Boundaries
E-10	Northeast—Nathaniel Howard Road
	North—GA Highway 80, GA Highway 23, and Ben Hatcher Road
	West—10-mile area and Bates Road
	South—Thompson Bridge, Seven Oaks Road, and Botsford Church Road
	East—Hancock Landing Road
F-5	North—Savannah River
	East—Savannah River
	West—5-mile radius and River Road
	South—2-mile area
F-10	Northeast—Savannah River
	West—10-mile radius and GA Highway 23
	South—Ben Hatcher Road
	East—River Road and the 5-mile area
G-10	North—Gray's Landing on the Savannah River to the CSX track and Cowden Plantation Road
	East—SRS boundary and the CSX line
	South—Savanna River and the SRS boundary
	West—Savannah River
	Northeast—CSX track
H-10	North—the SRS boundary and S125 extending into Allendale County's northern boundary
	East—Creek Plantation Road
	South—Savannah River
	West—SRS boundary

Appendix C: Evacuation Network Links (Detailed Information)

Road Name	Number of Links	Length (miles)	Number of Lanes	Speed Limit	Type
Academy Ave/Brigham Landing Rd	2	0.72	1	35	Evacuation
Alledale-Fairfax Hwy	21	2.04	1	55	Evacuation
Augusta Hwy	25	8.32	1	55	Evacuation
Baker St	4	0.76	1	30	Evacuation
Bates Rd	3	1.98	1	35	Connector
Ben Hatcher Rd	9	4.36	1	45	Evacuation
Bottsford Church Rd	8	1.32	1	45	Evacuation
Bottsford Church Rd/Hancock Landing Rd	2	0.65	1	45	Evacuation
Brigham Landing Rd	8	5.04	1	35	Evacuation
Brown Rd	5	2.23	1	45	Evacuation
Brown-Mobley Rd	5	3.93	1	35	Connector
Burke County High Sc	1	0.03	1	20	Evacuation
C C Rd	1	0.18	1	45	Evacuation
Cates-Mead Rd	11	3.82	1	45	Evacuation
Cates-Mead Rd/Cates Head Rd	1	0.34	1	45	Evacuation
Claxton Rd	6	1.98	1	45	Connector
Claxton-Lively Rd	11	3.83	1	45	Connector
Clayton Rd/Claxton Rd	1	0.38	1	45	Connector
Cox Place Rd	1	1.89	1	25	Connector
Creek Rd	13	5.39	1	45	Evacuation

Road Name	Number of Links	Length (miles)	Number of Lanes	Speed Limit	Type
Earl Dixon Rd	2	2.04	1	25	Connector
Ebenezer Church Rd	2	3.80	1	45	Evacuation
Ellison Bridge Rd	3	1.42	1	45	Connector
GA Highway 23	38	19.05	1	55	Connector
GA Highway 24	32	12.19	2	55	Evacuation
GA Highway 56	22	3.29	2	55	Evacuation
GA Highway 80	14	8.94	1	55	Evacuation
Givens Church Rd	6	2.30	1	45	Connector
Glisson Rd	3	2.53	1	25	Connector
Godbee Rd	1	0.62	1	25	Connector
Gordon Rd	4	1.60	1	25	Connector
Green Pond Rd	8	2.76	1	50	Evacuation
Griffin Landing Rd	11	4.60	1	45	Connector
Griffin Rd	2	1.77	1	25	Connector
Hancock Landing Rd	6	2.10	1	45	Evacuation
Hancock Rd	14	4.62	1	45	Evacuation
Hatcher Mill Rd	3	2.10	1	25	Connector
Hatchers Mill Rd	1	0.54	1	25	Connector
JCT SC 125/Atomic & Baker/McElMurray	1	0.01	1	30	Evacuation
Jack Delaigle Rd	6	2.88	1	40	Evacuation
Jackson Rd	5	1.02	1	45	Evacuation
Jackson St	4	0.85	1	45	Evacuation

Road Name	Number of Links	Length (miles)	Number of Lanes	Speed Limit	Type
Johnson Rd	4	1.71	1	45	Connector
Judge Anderson Rd	1	1.67	1	35	Connector
Long Rd	5	0.96	1	45	Connector
Main St	18	2.69	1	55	Evacuation
Mcbean Club Rd	1	0.58	1	35	Connector
Mcelmurray Farm Rd	7	2.90	1	45	Evacuation
Milhouse Rd	1	0.33	1	45	Evacuation
Millhaven Rd	9	4.27	1	45	Connector
Murray Hill Rd	2	1.60	1	45	Connector
Nathaniel Howard Rd	3	2.70	1	25	Connector
No Name (connected to Thompson Bridge)*	1	1.21	1	25	Connector
Perimeter Rd	9	2.38	2	55	Evacuation
Pine Log Rd	7	0.66	2	35	Evacuation
River Rd	36	23.11	1	55	Connector
Riverside Dr	2	0.52	1	25	Connector
Royal Rd	4	5.46	1	25	Connector
S Aiken Blvd	1	0.13	1	20	Evacuation
SC Highway 125	16	11.52	1	55	Evacuation
SC Highway 302	28	7.11	1	55	Evacuation
Sam Mead Rd	3	1.31	1	35	Connector

* This particular road has no name, and is located in zone D-10.

Road Name	Number of Links	Length (miles)	Number of Lanes	Speed Limit	Type
Sc-S-6-493	2	2.43	1	40	Evacuation
Seven Oaks Rd	1	0.24	1	45	Connector
Seven Oaks-Shell Bluff Rd	13	3.11	1	45	Connector
Shell Bluff Landing Rd	5	2.21	1	45	Evacuation
Shell Bluff Spur Rd	3	0.84	1	45	Evacuation
Silver Bluff Rd Sw	16	1.33	1	35	Evacuation
Silver Bluff Rd Sw/Pine Log Rd	4	0.50	1	35	Evacuation
Son Delaigle Rd	1	2.01	1	25	Connector
Stoney Bluff Rd	10	3.64	1	45	Evacuation
Sweet Water Rd	1	0.58	1	45	Connector
Thankful Church Rd	4	1.82	1	25	Connector
Thomas Rd	2	1.45	1	25	Evacuation
Thompson Bridge Rd	12	10.16	1	45	Evacuation
Tom Bargeron Rd	10	3.61	1	45	Connector
Vine Rd	1	1.23	1	25	Connector
Vogtle Main Plant Access Rd	3	1.30	3	35	Connector
Vogtle Plant Rd	4	0.97	1	45	Evacuation
Vogtle Visitor Center Access Rd	1	0.83	2	35	Connector
Williston Rd	1	0.28	1	55	Evacuation

Appendix D: PTV Vision Quality Assurance and Industry Acceptance Information

March 28, 2006

PTV America, Inc.
1300 N Market Street, Suite 603
Wilmington, DE 19801-1809

Phone: 302-654-4384
Fax: 302-691-4740
www.ptvamerica.com

Akhil Chauhan
Transportation Analyst/Modeler
IEM, Inc.
8555 United Plaza Blvd.
Baton Rouge, LA 70809

RE: PTV Vision® Quality Assurance and Industry Acceptance

Dear Mr. Chauhan:

Per your request, I am providing the following information concerning quality assurance and industry acceptance of the PTV Vision traffic simulation and transportation planning software.

PTV AG has performed extensive research and development of the PTV Vision software since 1992. The basis of the VISSIM simulation model is the car-following and lane-changing models developed at the University of Karlsruhe, Germany since 1974. The first commercial release of VISSIM was in 1993. The VISSIM simulation model components have been validated by PTV for accuracy and performance based on field data in Germany and the United States.

A comprehensive quality assurance procedure is conducted before each service pack and major software release by PTV, ensuring consistency of the results within acceptable stochastic variation. A summary of changes/improvements/fixes for each service pack are provided in the release_notes_..._e.txt file included with any service pack.

There are over 430 users of the VISSIM simulation software in North America and over 800 users worldwide. There are over 200 users of the VISUM planning software in North America and over 600 user worldwide. In total, there are over 850 VISSIM licenses and over 350 VISUM licenses within North America. PTV Vision is accepted and used by over 90 academic agencies in the United States and Canada, 18 State Department of Transportation agencies in United States, 3 Provincial Transport Ministries in Canada, and the Federal Highway Administration.

traffic mobility logistics.

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The following public agencies are currently using VISSIM:

- Arkansas State Highway Dept,
- CALTRANS,
- Colorado DOT,
- Florida DOT,
- Idaho DOT,
- Kansas DOT,
- Louisiana DOT,
- Michigan DOT,
- Missouri DOT,
- Nevada DOT,
- New Mexico DOT,
- NYSDOT.
- Ohio DOT,
- Oregon DOT,
- South Carolina DOT,
- UDOT,
- Washington DOT

The following public agencies are currently using VISUM:

- AGFTC, Fort Edward NY
- BMPO, Bend OR
- BMTS, Binghamton NY
- CAMPO, Corvallis OR
- CDTC, Albany NY
- El Paso MPO, El Paso TX
- Farmington MPO, Farmington NM
- KMPO, Coeur D'Alene ID
- Las Cruces MPO, Las Cruces NM
- LCOG, Eugene OR
- METRO, Portland OR
- MWVCOG, Salem OR
- NOCTC, Goshen NY
- PPACG, Colorado Springs CO
- RATS, Rockford IL
- Santa Fe MPO, Santa Fe NM
- Skagit COG, Mount Vernon WA
- Southwest WA RTC, Vancouver WA
- SRTC, Spokane WA
- WVTC, Wenatchee, WA
- YVCOG, Yakima WA

If you have any questions about the PTV Vision software, feel free to contact me at 302-654-4384.

Sincerely yours,

Kiel Ova, P.E., PTOE
Project Manager

traffic mobility logistics.

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