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Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL 14-092

June 5, 2014

10 CFR 50.4
10 CFR 50, Appendix E

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 1
Facility Operating License NPF-90
NRC Docket No. 50-390

Watts Bar Nuclear Plant, Unit 2
Construction Permit No. CPPR-92
NRC Docket No. 50-391

Subject: WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - UPDATED EVACUATION TIME ESTIMATES

References:
1. Tennessee Valley Authority letter to NRC, "Evacuation Time Estimates," dated December 18, 2012 (ML12362A464).
2. Tennessee Valley Authority letter to NRC, "Watts Bar Nuclear Plant (WBN) Unit 1 - Revised Evacuation Time Estimates," dated August 16, 2013 (ML13234A356).

In Reference 1, the Tennessee Valley Authority (TVA) provided an Evacuation Time Estimate (ETE) for Watts Bar Nuclear Plant (WBN) Unit 1. In reference 2, TVA submitted a revised ETE based on comments provided by the NRC in a June 6, 2013 teleconference on the Reference 1 submittal.

The purpose of this submittal is to provide an addendum to the ETE that addresses changes to the population in the evacuation zone, the impact of peak construction staffing for WBN Unit 2 in 2014, and the expected evacuation times during the first operating year of WBN Unit 2 in 2016. In no case has the longest ETE value for the 2-mile zone or 5-mile zone, including all affected Emergency Response Planning areas, or for the entire 10-mile Emergency Planning Zone (EPZ), increased by more than 25% or 30 minutes (10 CFR 50 Appendix E.IV.6).

By submitting this addendum, TVA is providing an ETE that supports construction of WBN Unit 2 and is applicable to the operation of both WBN Units 1 and 2. This addendum should be used in conjunction with Reference 2.

There are no new regulatory commitments contained in this letter.

If you have any questions or comments, please contact Gordon Arent at (423) 365-2004.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosure:

Evacuation Time Estimate Addendum for Watts Bar Nuclear Plant.

cc (Enclosure):

U. S. Nuclear Regulatory Commission - Region II
NRC Resident Inspector WBN Unit 1
NRC Resident Inspector WBN Unit 2
NRR Project Manager - Watts Bar Nuclear Plant

ENCLOSURE

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

EVACUATION TIME ESTIMATE ADDENDUM FOR WATTS BAR NUCLEAR PLANT

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Evacuation Time Estimate Addendum for Watts Bar Nuclear Plant

Peak Construction and Operational Years for WBN Unit 2

5 May 2014

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Evacuation Time Estimate Addendum for Watts Bar Nuclear Plant

Peak Construction and Operational Years for WBN Unit 2

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Date:
5 May 2014

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Summary

This report documents the methodology and findings of an updated Evacuation Time Estimate (ETE) study prepared by ARCADIS U.S., Inc. for the Watts Bar Nuclear Power Plant (Watts Bar or WBN) located in Rhea County, Tennessee, near the cities of Spring City and Decatur. This ETE study examines increases in evacuation time as a result of construction of a new reactor at WBN. This study is intended to be used in conjunction with the 2013 ETE study, and the methodologies and many of the data inputs of this study rely on the previous study. The 2013 ETE study included only the workforce for operating Unit 1.

Construction of both of the WBN units began in the 1970s. In 1985, construction at Watts Bar Unit 2 was deferred. Tennessee Valley Authority (TVA) completed construction of Watts Bar Unit 1 in 1996. Construction of Unit 2 resumed in late 2007 and is anticipated to be completed between March 2015 and June 2016. Evacuation times were estimated for both the construction-phase workforce and for conditions when operation of Unit 2 commences. The anticipated peak employment volumes during construction will occur in mid-2014, and commercial operation is expected by the end of 2016.

PTV Vision software was again utilized to perform evacuation modeling for various scenarios. The PTV Vision traffic simulation software package includes VISUM (macroscopic traffic simulation) and VISSIM (microscopic traffic simulation). VISUM is a comprehensive, flexible software system for transportation planning, travel demand modeling, and network data management. VISSIM is capable of performing detailed microscopic simulation of traffic and can model any type of traffic signal control and geometric configuration. The same road network used for the 2013 ETE study was used for this study with minor modifications made for the WBN plant access road.

Vehicle demand was modified only for the surrounding permanent population and transient workforce required at WBN. A significantly larger workforce was assumed during peak construction compared to the operational year. The permanent resident population in the Emergency Planning Zone (EPZ) was estimated using census data for 2010 and 2012, assuming that the growth rates between 2010 and 2012 would persist until 2016. Shadow evacuation traffic was also linearly increased, assuming populations in the 10- to 15-mile zone would exhibit the same population changes estimated for the 10-mile EPZ.

ETEs for vehicles departing from the 2-mile zone, 5-mile zone, and the full 10-mile EPZ during peak construction are summarized in Table S-1. Table S-2 shows ETEs during the

first operational year. In general, the ETEs are similar to the ETEs developed during the previous 2013 ETE study. A larger increase is noted for the 90 percent ETE of the 2-mile zone during the construction year due to the large increase in on-site traffic at WBN. This traffic mobilizes and evacuates more quickly than the surrounding residential population, and therefore only affects the 90 percent ETE and not the 100 percent ETE. The other increases noted during the operational year are a result of 10-mile EPZ population increases and not increases in WBN on-site traffic.

Table S-1 Peak Construction 2014: Evacuation Time Estimate Summary for Watts Bar EPZ

	Summer				Winter			
	Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Scenario:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
90 Percent Evacuation of Affected Areas (hours:minutes) *(increase over 2013 Study in minutes, if any*)								
2-Mile Zone	1:45 (*10*)	1:55 (*10*)	1:40 (*5*)	1:40 (*5*)	1:40 (*10*)	1:50 (*10*)	1:35 (*5*)	1:35 (*5*)
5-Mile Zone	2:30	2:40	2:25 (*5*)	2:25 (*5*)	2:30	2:45	2:25 (*5*)	2:25 (*5*)
10-Mile EPZ	3:00	3:10	2:35 (*5*)	2:35 (*5*)	3:00	3:25	2:30 (*5*)	2:30 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) *(increase over 2013 Study in minutes, if any*)								
2-Mile Zone	3:15	3:25	3:10	3:10	3:15	3:30	3:10	3:10
5-Mile Zone	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
10-Mile EPZ	4:20 (*5*)	4:30 (*5*)	4:15 (*5*)	4:15 (*5*)	4:25 (*10*)	5:05 (*10*)	4:20 (*10*)	4:20 (*10*)

Table S-2 First Operational Year 2016: Evacuation Time Estimate Summary for Watts Bar EPZ

	Summer				Winter			
	Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Scenario:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
90 Percent Evacuation of Affected Areas (hours:minutes) *(increase over 2013 Study in minutes, if any*)								
2-Mile Zone	1:35	1:45	1:35	1:35	1:30	1:40	1:30	1:30
5-Mile Zone	2:30	2:40	2:20	2:20	2:30	2:45	2:20	2:20
10-Mile EPZ	3:00	3:10	2:40 (*10*)	2:40 (*10*)	3:00	3:25	2:30 (*5*)	2:30 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) *(increase over 2013 Study in minutes, if any*)								
2-Mile Zone	3:15	3:25	3:10	3:10	3:15	3:30	3:10	3:10
5-Mile Zone	3:55	4:05	3:35 (*5*)	3:35 (*5*)	3:55	4:20	3:35 (*5*)	3:35 (*5*)
10-Mile EPZ	4:15	4:25	4:20 (*10*)	4:20 (*10*)	4:15	4:55	4:20 (*10*)	4:20 (*10*)

1. Introduction

1.1 General

Evacuation time studies analyze the manner in which the population within the Plume Exposure Pathway Emergency Planning Zone (EPZ) surrounding a nuclear power plant site would evacuate during a radiological emergency. Evacuation time studies provide licensees and state and local governments with site-specific information helpful for protective action decision-making. The studies estimate the time necessary to evacuate the EPZ for a range of evacuation scenarios. Analysis of the evacuation simulation results also identifies locations where traffic management and control measures can facilitate evacuations, and may identify unique evacuation constraints or conditions.

Estimates of the time required to evacuate areas around nuclear power plant sites are required for all operating plants in the United States. Federal guidance has been prepared to outline the format and content of these evacuation time estimates (ETEs) (NUREG-0654, Rev. 1,[1] NUREG/CR-4831,[2] and NUREG/CR-7002[3]).

This study was prompted by current construction of a reactor at the Watts Bar Nuclear Power Plant (Watts Bar or WBN) located in Rhea County, Tennessee. Nuclear Regulatory Commission (NRC) guidance (CR-7002) states:

> *The construction of new reactors may occur at sites with existing reactors where emergency response programs are established…the ETE analysis developed for the new reactor should be prepared to address any impacts that the new reactor may have on the evacuation time. Considerations include addressing the number of workers and suppliers at the site during the peak construction period. The addition of employees and support staff that may reside within the EPZ is also a*

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[1] *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, NUREG-0654, FEMA-REP-1, Rev. 1, U.S. Nuclear Regulatory Commission, Federal Emergency Management Agency, November 1980.

[2] *State of the Art in Evacuation Time Estimate Studies for Nuclear Power Plants*, NUREG/CR-4831, T. E. Urbanik and J. D. Jamison, Pacific Northwest Laboratory, U.S. Nuclear Regulatory Commission, March 1992.

[3] *Criteria for Development of Evacuation Time Estimate Studies*, NUREG/CR-7002, J. Jones and F. Walton, Sandia National Laboratories, and B. Wolshon, Louisiana State University, November 2011.

consideration as well as potential growth throughout the EPZ during the construction phase.

Therefore, updated projected populations and on-site personnel (both construction and operational staff) estimates as provided by Tennessee Valley Authority (TVA) were used for this study. PTV Vision traffic simulation software was again utilized to perform evacuation modeling for various scenarios. PTV Vision includes the VISSIM (microscopic traffic simulation) and VISUM (macroscopic traffic simulation) models. The evacuation times have been updated for various areas, times, and weather conditions, as outlined in CR-7002. The evacuation times represent the amount of time required for completing the following actions:

- Public notification
- Preparation and mobilization
- Actual movement out of the EPZ (i.e., on-road travel time, including delays associated with vehicle queuing)

1.2 Addendum Study Purpose

TVA's WBN includes two Westinghouse-designed pressurized water reactors. Watts Bar Unit 1 has been operating since early 1996, and TVA is currently working to complete Unit 2.

Construction of both of the Watts Bar units began in the 1970s. In 1985, construction at Watts Bar Unit 2 was deferred. TVA completed construction of Watts Bar Unit 1 in 1996, while reaffirming the deferral of Watts Bar Unit 2 as a valuable option for future generation. Construction of Unit 2 resumed in late 2007 and is anticipated to be completed between March 2015 and June 2016.

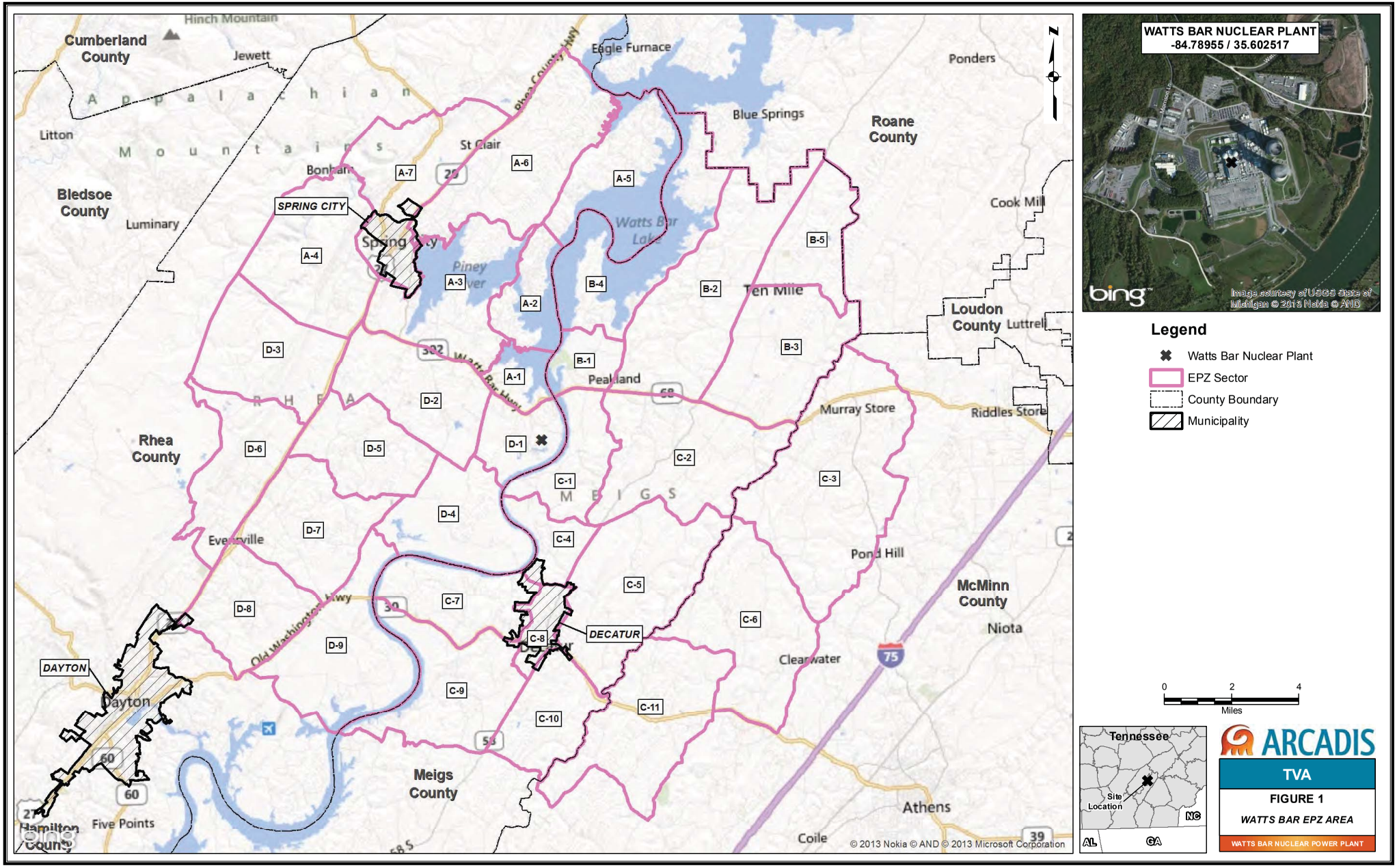
An ETE study for the 10-mile EPZ for Watts Bar was performed in 2013, following release of population data from the 2010 census. The 2013 ETE study included only the workforce for operating Unit 1. This addendum assesses the potential impact of the workforce associated with construction and operation of Watts Bar Unit 2 on ETEs.

Evacuation times were estimated for both the construction-phase workforce and for conditions when operation of Unit 2 commences. The anticipated peak employment volume during construction will occur in mid-2014, and commercial operation is expected by the end of 2016.

1.3 Overview of Changes from 2013 ETE Study

Changes in residential population within the EPZ are summarized in Table 1. The Watts Bar EPZ with county boundaries and municipalities in the vicinity of the EPZ is shown on Figure 1. Table 2 provides a comparison of the main features and assumptions of the current study to the 2013 ETE study. Much of the same data from the 2013 ETE study were retained for this study. The ETE methodology and assumptions for the current study are discussed in greater detail in subsequent sections of this report.

The increase in EPZ population and in the number of construction workers and operations staff at the Watts Bar plant is expected to have the greatest impact on estimated evacuation times. The “shadow evacuation” area 5 miles outside the EPZ was also increased at the same rate as the EPZ population, adding more vehicles to the evacuation model. The emergency response evacuation plan for the previous study was retained for this addendum. The designated reception centers for Emergency Response Planning Areas (ERPAs) within the Watts Bar EPZ are Central High School, Roane State Community College, Cumberland County High School, and Soddy-Daisy High School. The preferred reception center for each ERPA is listed in Table 3. (Some ERPAs may evacuate differently, depending upon the prevailing wind direction.) However, one modification to this plan was made to the model for the Watts Bar plant during the construction phase. Due to the number of workers present on site, it was assumed that during an evacuation, construction workers would proceed to Roane State Community College and Central High School in addition to the designated reception center for the plant, Soddy-Daisy High School.


Cumberland County
Hinch Mountain
Jewett
Eagle Furnace
Ponders
Litton
Blue Springs
Roane County
St Clair
Bledsoe County
SPRING CITY
Luminary
Cook Mill
Watts Bar Lake
Piney River
Ten Mile
Loudon County
Luttrell
Peakland
Murray Store
Riddles Store
Rhea County
Evensville
Pond Hill
McMinn County
DECATUR
DAYTON
Dayton
Niota
Clearwater
Meigs County
Athens
Five Points
Coile
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A-1
A-2
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C-1
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WATTS BAR NUCLEAR PLANT
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Image courtesy of USGS State of Michigan © 2013 Nokia © AND
Legend
Watts Bar Nuclear Plant
EPZ Sector
County Boundary
Municipality
0
2
4
Miles
Tennessee
Site Location
NC
AL
GA
ARCADIS
TVA
FIGURE 1
WATTS BAR EPZ AREA
WATTS BAR NUCLEAR POWER PLANT

Table 1 Population Estimates for Watts Bar EPZ

	2010	2014	2016	Percent Change 2010–2014	Percent Change 2010–2016	County	Municipality
0 to 2 miles							
A-1	2	2	2	2.60	3.82	Rhea	unincorporated
B-1	235	241	244	2.60	3.82	Rhea	unincorporated
C-1	153	152	151	-0.88	-1.30	Meigs	unincorporated
D-1	104	107	108	2.60	3.82	Rhea	unincorporated
2 to 5 miles							
A-2	407	418	423	2.60	3.82	Rhea	unincorporated
A-3	1,221	1,253	1,268	2.60	3.82	Rhea	unincorporated
B-2	1,153	1,183	1,197	2.60	3.82	Rhea	unincorporated
B-4	640	657	664	2.60	3.82	Rhea	unincorporated
C-2	827	820	816	-0.88	-1.30	Meigs	unincorporated
C-4	172	168	166	-2.48	-3.65	Meigs	Decatur
C-5	790	783	780	-0.88	-1.30	Meigs	unincorporated
C-7	535	522	515	-2.48	-3.65	Meigs	Decatur
C-8	1,294	1,262	1,247	-2.48	-3.65	Meigs	Decatur
D-2	999	1,025	1,037	2.60	3.82	Rhea	unincorporated
D-4	134	137	139	2.60	3.82	Rhea	unincorporated
D-5	641	658	666	2.60	3.82	Rhea	unincorporated
5 to 10 miles							
A-4	222	228	230	2.60	3.82	Rhea	unincorporated
A-5	707	725	734	2.60	3.82	Rhea	unincorporated
A-6	1,465	1,485	1,494	1.33	1.96	Rhea	Spring City
A-7	2,245	2,275	2,289	1.33	1.96	Rhea	Spring City
B-3	275	282	286	2.60	3.82	Rhea	unincorporated
B-5	48	49	50	2.60	3.82	Rhea	unincorporated
C-3	1,233	1,240	1,243	0.54	0.80	McMinn	unincorporated
C-6	881	886	888	0.54	0.80	McMinn	unincorporated
C-9	793	786	783	-0.88	-1.30	Meigs	unincorporated
C-10	406	402	401	-0.88	-1.30	Meigs	unincorporated
C-11	944	949	952	0.54	0.80	McMinn	unincorporated
D-3	27	28	28	2.60	3.82	Rhea	unincorporated
D-6	744	763	772	2.60	3.82	Rhea	unincorporated
D-7	1,270	1,303	1,319	2.60	3.82	Rhea	unincorporated
D-8	1,448	1,494	1,516	3.20	4.71	Rhea	Dayton
D-9	554	568	575	2.60	3.82	Rhea	unincorporated
EPZ total	**22,569**	**22,851**	**22,983**	**1.24**	**1.83**		

Note: Estimated population change for each ERPA is based on county/municipal level growth rate provided by the most recent US Census release. Population values are rounded to the nearest integer.

Table 2 ETE Comparison

ETE Element	2013 ETE Study	Current Study
Permanent residents – Total population – Vehicle occupancy (persons per vehicle)	 – 22,569 (Census 2010) – 2.04	 – 22,851 (Projected 2014) 22,983 (Projected 2016) – 2.04 (2014 and 2016)
Transit dependent – Population estimate – Number of vehicles	 – 340 persons, 14 disabled, 8 bed-ridden – 12 bus – 5 wheelchair bus/van – 4 ambulances	No Change
Transient facilities – Estimated population – Vehicle demand – Adjust for double-count	 – 2,697 – 1,956 – Adjust for retail facilities	No Change except for WBN (see Table 6)
Special facilities – Estimated population – Number of buses, vans – Ambulance, other	(Winter Weekday) – 545 (schools and daycare not included) – 20 buses – 5 ambulances – 8 wheelchair bus	No Change
Schools – Student population – Number of buses	(Winter Weekday) – 4,682 (daycare included) – 72 buses/vans	No Change
Background traffic	Average traffic by time of day	No Change
Shadow evacuation (assumed basis)	20 percent of resident population outside designated zones	No Change
Special event(s)	Meigs County Fair	No Change
Scenarios	– Weekday (winter, summer) – Weeknight (winter, summer) – Weekend (winter, summer) – Adverse weather weekday only – Staged evacuation (weekday)	No Change
Adverse weather	Snow for winter, rain for summer	No Change
Evacuation model name and version	PTV Vision VISUM 11.5, VISSIM 5.3	No Change

Table 2 ETE Comparison

ETE Element	2013 ETE Study	Current Study
Departure times	– Warning based on literature – Residential based on survey – Transient based on survey – Specials notified with public	No Change
Evacuation times	Estimates provided for 90 and 100 percent	No Change

Table 3 Designated Reception Centers for Evacuation

ERPAs	Receiving Community
A1, A2, A3, A5, A6, B1, B2, B3, B4, B5, WBN*	Roane State Community College
A4, A7	Cumberland County High School
C1, C2, C3,C4, C5, C6, C7, C8, C9, C10, C11, WBN*	Central High School
D1, D2, D3, D4, D5, D6, D7, D8, D9, WBN	Soddy-Daisy High School

*During Construction Phase Only

2. Methodology and Assumptions

Most of the general assumptions and data sources used for the 2013 ETE study were also used for this addendum study. The following sections detail the assumptions and methodologies utilized to develop the ETEs.

2.1 General Assumptions

The following assumptions were made for this addendum study for both the construction-phase and operating-phase scenarios:

- The permanent resident population in the EPZ was estimated using census data for 2010 and for 2012, assuming that the growth rates between 2010 and 2012 would persist until 2016.
- It was assumed that the vehicle demand per household estimated from 2010 census data would not significantly change and was therefore applied for 2014 and 2016.
- Shadow evacuation traffic amount of 20 percent of the public was assumed to be present during the model runs for areas outside of the EPZ up to 15 miles outside of WBN. The shadow population was also linearly increased, assuming populations in the 10- to 15-mile zone would exhibit the same changes estimated for the 10-mile EPZ.
- The population and vehicle demand for transient and special facilities did not change, except for the addition of the workforce associated with Watts Bar Unit 2.
- The roadway network for traffic simulations did not change, except that more detailed roadways were added to WBN. This change was necessary due to the large increase in traffic projected to originate from the plant site in the event of an emergency.

2.2 Permanent Resident Population Estimate Methodology

The permanent resident population in the EPZ was estimated using the same methodology as for annual population updates. This method combines data from both the “block-level” decennial federal census and yearly population increases provided by the Census Bureau at county and municipal levels.

The comprehensive, decennial federal census provides population counts with detailed spatial resolution ("census block level"). EPZ population estimates for the Watts Bar EPZ were developed using block-level data. Between the 10-year counts, U.S. Census Bureau publishes annual population estimates at the "county subdivision" level. The most recent data from the Census Bureau provides population estimates as of July 2012. The release of 2013 population estimates for incorporated municipalities and "minor civil divisions" is scheduled for May 2014.

The population change in the Watts Bar EPZ was estimated based on the rate of population change between 2010 and 2012 reported by the Census Bureau for each county or county subdivision. The rate of population change between 2010 and 2012 was assumed to exhibit a linear growth pattern and was projected for 2014 and 2016 for use in this addendum study.

This procedure assumes that the rate of population change for an entire county or municipality is representative of the rate of change in each subdivision of that larger geographic unit. For an ERPA that contains an incorporated municipality, this approach provides a representative "local" measure of population change. For Tennessee, however, large areas in most counties are not assigned to individual municipalities, and instead are categorized as "unincorporated." For ERPAs located in unincorporated areas, the county average rate of population change represents the best available information.

Table 1 provides a summary of the estimated population change for each ERPA in the Watts Bar EPZ, and identifies the county or county subdivision that was used to determine the rate of population change for each ERPA. Six of the 32 ERPAs in the Watts Bar EPZ are associated with incorporated municipalities: in Rhea County, A-6 and A-7 are associated with Spring City and D-8 with Dayton; and in Meigs County, C-4, C-7, and C-8 are associated with Decatur. These six ERPAs account for 31.7 percent of the EPZ population. Population change for the remaining 26 ERPAs is based on county-level population estimates. Figure 1 shows the municipal boundaries and ERPA boundaries for the EPZ.

2.3 Other Assumptions for 2013 ETE Study

- Population estimates for major employers were developed from the ESRI business database and the facility list from the former ETE study report for WBN (dated 2001). ARCADIS conducted internet searches and obtained information from TVA, Tennessee Emergency Management Agency (TEMA), and counties to estimate

facility employment and staffing levels for various scenarios. Only facilities with potential staffing level of at least 50 persons per work shift were pursued.

- Information relating to hotels, motels, and recreational facilities was obtained from tourism websites and the 2001 study report. For parks, visitation information was obtained from counties.

- Current population estimates for schools were obtained primarily from county emergency response agencies.

- Lists of hospitals, rest homes, and incarceration facilities were obtained from each county emergency management agency.

- The staffing levels at WBN reflect estimated peak personnel on site and were provided by TVA.

- Initial estimates of roadway characteristics were obtained from the NAVTEQ™ database. Roadway geometric and operational data were compiled based on field surveys performed by ARCADIS in 2012. The intersection saturation flow rate and capacities utilized by the model were estimated using 2010 Highway Capacity Manual methodology.

- Average traffic volumes by time of day for weekdays and weekends for designated evacuation routes were obtained from state and county transportation agencies. These data were used to assign background traffic volumes for the roadway network. It was assumed that access control would be established within two hours following public notice to evacuate.

- Preparation and mobilization times for the permanent resident population were developed based on the results of a telephone survey (see Appendix E of 2013 ETE study), combined with published time estimates for warning diffusion. The survey results provide estimates of the time to depart from home following notification, and commuting times for household members who would return from work before departing.

- Departure times for transient facilities were estimated assuming relatively prompt evacuation of most workplaces and recreational facilities after notification is received. The distribution of departure times also reflects information gathered from the telephone survey of EPZ residents, as discussed in Section 3.

- It is assumed that schools and special facilities receive initial notification at the same time as the rest of the EPZ.

- The ETEs represent the time required to evacuate the Watts Bar EPZ and designated analysis areas and include the time required for initial notification.

- ETEs are presented for 90 percent and 100 percent of evacuating vehicles. It is assumed that all persons within the EPZ area will evacuate. For the 100 percent evacuation time, evacuation of the EPZ will be considered complete after all evacuating vehicles are outside of the EPZ or analysis area.

- The general public will evacuate using designated evacuation routes and will proceed to the reception centers listed in Table 3 after leaving the EPZ. When schools are in session, children attending school will be transported directly to designated host schools.

- It is assumed that existing lane utilization will prevail during the course of the evacuation. Traffic control signals will be overridden or converted to flashing mode, as necessary, to give preference to flow on all major outbound roadways. It is also assumed that state and municipal personnel will restrict unauthorized access into the EPZ, consistent with existing traffic management plans.

- The evacuation analysis cases are described in Section 5 and represent a range of conditions, in accordance with guidance presented in CR-7002. These cases have been chosen to provide information for an appropriate range of conditions (i.e., low, typical, and high population; fair and adverse weather) to guide the protective action decision-making process.

- Vehicle occupancy rates used for the various population categories are as follows:

  - Permanent residents: 2.04 persons per vehicle, based on telephone survey results
  - Major places of employment: 1 vehicle per employee
  - Motels: 1 vehicle (1 to 2 persons) per occupied room
  - Recreational areas: 1 vehicle (3 persons) per campsite; 1.5 persons per vehicle at shopping malls, visitor centers, and museums
  - Schools: 55 students and 3 staff per bus; 1 vehicle per additional staff person

  - Hospitals/nursing homes/correctional facilities: 2 persons per ambulance/medical van for non-ambulatory patients and 20 persons per bus or van for ambulatory residents
  - Transit-dependent general population: 28 persons per bus for ambulatory residents (50 percent of the 55 persons assumed for schools), and 2 per ambulance or 3 per wheelchair bus/van for non-ambulatory

- The transit-dependent population will be evacuated by bus, wheelchair bus, van, or ambulance through efforts coordinated by state and municipal emergency preparedness officials.

- Adverse weather refers to moderate to heavy rainstorms for summer conditions, and a moderate snowstorm for winter conditions.

3. Population and Vehicle Demand Evaluation

The development of vehicle demand estimates for this addendum study consisted of combining the estimates utilized for the 2013 ETE study and adding the increased traffic volume from both permanent population increases and increases at the Watts Bar plant. It is important to note, that while population and vehicle demand estimates incorporate some adjustments for double-counting, the estimates are considered to be conservative (i.e., they overestimate actual population and vehicle levels that may be in the area at any given time). Population and vehicle demand estimates for each of the population categories are summarized below.

3.1 Permanent Residents

Permanent residents are those persons identified by the census as having a permanent residence within the EPZ. As previously explained, the change between the 2010 and 2012 census population was used to project the permanent resident population within the EPZ for 2014 and 2016. The allocation of the resident population to entry nodes on the roadway network was based on detailed census block maps.

The estimated number of persons residing permanently within the Watts Bar EPZ was previously 22,569. The updated values for this addendum study are 22,851 for peak construction (2014) and 22,983 for the operational year (2016). Tables 4 and 5 present the resident population and vehicle demand for the 2014 and 2016 scenarios, respectively.

The estimated vehicle occupancy factor of 2.04 persons per vehicle was retained from the 2013 study. This factor corresponds to 1.46 vehicles per household. The total vehicle demand for EPZ residents for winter scenarios is 11,197 for peak construction (2014) and 11,260 for operational (2016) conditions, compared to 11,065 for both conditions for the 2013 ETE study. In addition, the 789 seasonal housing units and 1,151 associated vehicles identified in the 2013 ETE study were retained for this addendum study.

Emergency response plans specify that the transit-dependent population will receive transportation assistance. The amount of transit-dependent population and number of vehicles required to assist these individuals were retained from the 2013 ETE study.

3.2 Transient Population

The transient population segment includes persons in the workforce, hotels/motels, and recreational areas. The same transient population utilized for the 2013 ETE study

was retained for this addendum study. However, additional transient population was added to account for construction workers during the peak construction period (2014) and the additional operational staff required once the Unit 2 reactor becomes operational (2016). Table 6 presents the original amount of population assumed for the 2013 study and the additional workers for this addendum study. The number of workers required for construction and operations was estimated based on information provided by TVA.

3.3 Special Facilities Population

The special facilities population segment includes persons in schools, hospitals, nursing homes, and correctional facilities who will require transportation assistance during an evacuation. The special facilities population shown in Table 3-3 of the 2013 ETE study was retained for this addendum study.

3.4 Emergency Response Planning Area Population Totals

Population and vehicle demand totals for each ERPA are summarized in Table 7 for the peak construction year (2014) and Table 8 for the first operational year (2016). The totals listed in the tables represent the peak number of people to be evacuated for each analysis case, which is discussed in Section 6 of this report.

Vehicle demand is highest for the summer weekday scenario. During peak construction, vehicle demand for the highest scenario is 30 percent higher than the lowest (winter weeknight) scenario. During the first operational year, this difference will decrease to 13 percent, similar to the 14 percent reported in the 2013 ETE study.

The vehicle demand listed in Tables 4 through 8 reflects the data used as input for the ETE traffic simulations.

3.5 Transportation Resources

The estimated inventory of transportation resources available to support evacuation of special facilities and residents for the Watts Bar EPZ was determined from information provided by county agencies, as well as data developed by surveyed school systems, transportation companies, and emergency medical service (EMS) providers in the surrounding region. The transportation resources estimated in Table 3-5 of the 2013 ETE study were retained in this addendum study (Table 9).

Table 4 Peak Construction Year 2014: Resident Population and Vehicle Demand by EPZ Subarea

ERPA	Distance	Permanent Resident Population	Vehicle Demand (winter)	Seasonal (summer) Resident Population	Vehicle Demand (summer)
A-1	0 to 2 miles	2	1	2	1
B-1	0 to 2 miles	241	118	272	140
C-1	0 to 2 miles	152	75	156	78
D-1	0 to 2 miles	107	51	109	54
A-2	2 to 5 miles	418	205	554	300
A-3	2 to 5 miles	1,253	614	1,394	713
B-2	2 to 5 miles	1,183	579	1,207	597
B-4	2 to 5 miles	657	322	1,146	664
C-2	2 to 5 miles	820	401	830	408
C-5	2 to 5 miles	168	82	174	86
C-4	2 to 5 miles	783	384	787	387
C-7	2 to 5 miles	522	256	524	257
C-8	2 to 5 miles	1,262	620	1,267	623
D-2	2 to 5 miles	1,025	502	1,069	533
D-4	2 to 5 miles	137	67	137	67
D-5	2 to 5 miles	658	322	660	323
A-4	5 to 10 miles	228	112	230	113
A-5	5 to 10 miles	725	355	1,088	608
A-6	5 to 10 miles	1,485	727	1,680	864
A-7	5 to 10 miles	2,275	1,116	2,323	1,150
B-3	5 to 10 miles	282	138	286	141
B-5	5 to 10 miles	49	24	50	24
C-3	5 to 10 miles	1,240	607	1,248	613
C-6	5 to 10 miles	886	434	889	437
C-9	5 to 10 miles	786	385	866	440
C-10	5 to 10 miles	402	197	408	201
C-11	5 to 10 miles	949	465	953	468
D-3	5 to 10 miles	28	13	28	13
D-6	5 to10 miles	763	375	765	376
D-7	5 to 10 miles	1,303	638	1,305	639
D-8	5 to 10 miles	1,494	733	1,499	736
D-9	5 to 10 miles	568	279	589	294
EPZ total		**22,851**	**11,197**	**24,495**	**12,348**
2013 ETE Study Total		***22,569***	***11,065***	***24,214***	***12,216***

Table 5 First Operational Year 2016: Resident Population and Vehicle Demand by EPZ Subarea

ERPA	Distance	Permanent Resident Population	Vehicle Demand (winter)	Seasonal (summer) Resident Population	Vehicle Demand (summer)
A-1	0 to 2 miles	2	1	2	1
B-1	0 to 2 miles	244	119	275	141
C-1	0 to 2 miles	151	74	155	77
D-1	0 to 2 miles	108	52	112	55
A-2	2 to 5 miles	423	207	558	302
A-3	2 to 5 miles	1,268	622	1,410	721
B-2	2 to 5 miles	1,197	587	1,221	605
B-4	2 to 5 miles	664	325	1,154	667
C-2	2 to 5 miles	816	399	826	406
C-4	2 to 5 miles	166	81	172	85
C-5	2 to 5 miles	780	381	784	384
C-7	2 to 5 miles	515	253	518	254
C-8	2 to 5 miles	1,247	611	1,251	614
D-2	2 to 5 miles	1,037	508	1,081	539
D-4	2 to 5 miles	139	69	140	69
D-5	2 to 5 miles	666	326	667	327
A-4	5 to 10 miles	230	113	232	114
A-5	5 to 10 miles	734	360	1,096	613
A-6	5 to 10 miles	1,494	732	1,690	869
A-7	5 to 10 miles	2,289	1,122	2,337	1,156
B-3	5 to 10 miles	286	140	289	143
B-5	5 to 10 miles	50	24	50	24
C-3	5 to 10 miles	1,243	608	1,250	614
C-6	5 to 10 miles	888	435	892	438
C-9	5 to 10 miles	783	384	863	439
C-10	5 to 10 miles	401	197	407	201
C-11	5 to 10 miles	952	466	954	469
D-3	5 to 10 miles	28	13	28	13
D-6	5 to10 miles	772	379	775	380
D-7	5 to 10 miles	1,319	646	1,321	647
D-8	5 to 10 miles	1,516	744	1,521	747
D-9	5 to 10 miles	575	282	596	297
EPZ total		**22,983**	**11,260**	**24,627**	**12,411**
2013 ETE Study Total		***22,569***	***11,065***	***24,214***	***12,216***

Table 6 Transient Population and Vehicle Demand in the Watts Bar EPZ

Zone	Population						Vehicles					
	Winter			Summer			Winter			Summer		
	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend
2013 ETE Study												
WBN[1]	685	230	215	685	230	215	685	230	215	685	230	215
Other[2]	2,012	588	1,317	2,012	588	1,317	1,271	291	576	1,271	291	576
Total	2,697	818	1,532	2,697	818	1,532	1,956	521	791	1,956	521	791
Peak Construction (2014)												
WBN[1]	3,485	580	1,015	3,485	580	1,015	3,485	580	1,015	3,485	580	1,015
Other[2]	2,012	588	1,317	2,012	588	1,317	1,271	291	576	1,271	291	576
Total	5,497	1,168	2,332	5,497	1,168	2,332	4,756	871	1,591	4,756	871	1,591
First Operational Year (2016)												
WBN[1]	1,100	250	250	1,100	250	250	1,100	250	250	1,100	250	250
Other[2]	2,012	588	1,317	2,012	588	1,317	1,271	291	576	1,271	291	576
Total	3,112	838	1,567	3,112	838	1,567	2,371	541	826	2,371	541	826

[1]WBN = Watts Bar Nuclear Plant, ERPA D-1

[2]Other = Total from all other ERPAs within the Watts Bar EPZ

Table 7 Peak Construction Year 2014: Summary of Population and Vehicle Demand in the Watts Bar EPZ

Subarea County	Population						Vehicles					
	Winter			Summer			Winter			Summer		
	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend
A-1	2	2	2	2	2	2	1	1	1	1	1	1
A-2	418	418	418	554	554	554	184	205	205	279	300	300
A-3	1,597	1,297	1,597	1,739	1,439	1,739	689	632	752	788	731	851
A-4	871	228	228	230	230	230	144	112	112	101	113	113
A-5	1,067	766	1,067	1,429	1,128	1,429	455	372	492	708	625	745
A-6	1,554	1,519	1,519	1,744	1,715	1,715	670	736	736	806	873	873
A-7	2,998	2,468	2,468	2,648	2,516	2,516	1,168	1,155	1,155	1,173	1,189	1,189
B-1	241	241	241	272	272	272	106	118	118	128	140	140
B-2	1,229	1,182	1,182	1,245	1,207	1,207	525	579	579	541	597	597
B-3	282	282	282	286	286	286	124	138	138	127	141	141
B-4	1,113	1,000	1,113	1,602	1,489	1,602	471	459	504	813	801	846
B-5	50	50	50	50	50	50	22	25	25	22	25	25
C-1	152	152	152	156	156	156	67	75	75	70	78	78
C-2	1,316	820	820	849	830	830	398	402	402	371	409	409
C-3	1,240	1,240	1,240	1,248	1,248	1,248	545	608	608	551	614	614
C-4	168	168	168	174	174	174	74	82	82	78	86	86
C-5	783	783	783	787	787	787	344	384	384	347	387	387
C-6	1,291	885	885	889	889	889	418	434	434	392	437	437
C-7	710	682	682	712	684	684	268	266	266	269	267	267
C-8	2,537	1,283	1,288	1,447	1,287	1,292	813	639	644	739	642	647
C-9	1,262	887	887	1,341	966	966	776	456	441	831	511	496
C-10	527	402	412	533	408	418	302	197	207	306	201	211
C-11	949	949	949	953	953	953	417	465	465	420	468	468

Table 7 Peak Construction Year 2014: Summary of Population and Vehicle Demand in the Watts Bar EPZ

Subarea County	Population						Vehicles					
	Winter			Summer			Winter			Summer		
	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend
D-1*	105	105	105	109	109	109	46	51	51	49	54	54
D-2	1,025	1,025	1,025	1,069	1,069	1,069	451	502	502	482	533	533
D-3	28	28	28	28	28	28	12	14	14	12	14	14
D-4	137	137	137	137	137	137	60	67	67	60	67	67
D-5	658	658	658	660	660	660	289	323	323	290	324	324
D-6	2,293	763	763	819	765	765	447	374	374	343	375	375
D-7	1,303	1,303	1,303	1,305	1,305	1,305	573	639	639	574	640	640
D-8	1,495	1,495	1,495	1,499	1,499	1,499	658	733	733	661	736	736
D-9	568	568	568	589	589	589	250	278	278	265	293	293
WBN	3,485	580	1,015	3,485	580	1,015	3,485	580	1,015	3,485	580	1,015
EPZ total	33,454	24,366	25,530	30,590	26,011	27,175	15,252	12,101	12,821	16,082	13,252	13,972
2013 ETE Study Total	*30,493*	*23,805*	*24,519*	*27,629*	*25,450*	*26,164*	*12,422*	*11,636*	*11,936*	*13,252*	*12,787*	*13,087*

*Except for WBN Site

Note: Population numbers reflect some double-counting between categories (e.g., residents, workforce, schools).

Table 8 First Operational Year 2016: Summary of Population and Vehicle Demand in the Watts Bar EPZ

Subarea County	Population						Vehicles					
	Winter			Summer			Winter			Summer		
	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend
A-1	2	2	2	2	2	2	1	1	1	1	1	1
A-2	422	422	422	558	558	558	186	207	207	281	302	302
A-3	1,613	1,313	1,613	1,755	1,455	1,755	696	640	760	795	739	859
A-4	873	230	230	232	232	232	145	113	113	102	114	114
A-5	1,075	774	1,075	1,437	1,136	1,437	459	376	496	712	629	749
A-6	1,564	1,529	1,529	1,754	1,725	1,725	674	741	741	810	878	878
A-7	3,012	2,482	2,482	2,662	2,530	2,530	1,174	1,162	1,162	1,179	1,196	1,196
B-1	244	244	244	275	275	275	107	120	120	129	142	142
B-2	1,243	1,196	1,196	1,259	1,221	1,221	531	586	586	547	604	604
B-3	285	285	285	289	289	289	125	140	140	128	143	143
B-4	1,121	1,008	1,121	1,610	1,497	1,610	474	463	508	816	805	850
B-5	50	50	50	50	50	50	22	25	25	22	25	25
C-1	151	151	151	155	155	155	66	74	74	69	77	77
C-2	1,312	816	816	845	826	826	396	400	400	369	407	407
C-3	1,242	1,242	1,242	1,250	1,250	1,250	546	609	609	552	615	615
C-4	166	166	166	172	172	172	73	81	81	77	85	85
C-5	780	780	780	784	784	784	343	382	382	346	385	385
C-6	1,294	888	888	892	892	892	420	435	435	394	438	438
C-7	704	676	676	706	678	678	265	263	263	266	264	264
C-8	2,521	1,267	1,272	1,431	1,271	1,276	805	631	636	731	634	639
C-9	1,259	884	884	1,338	963	963	775	454	439	830	509	494
C-10	526	401	411	532	407	417	301	197	207	305	201	211
C-11	950	950	950	954	954	954	418	466	466	421	469	469

Table 8 First Operational Year 2016: Summary of Population and Vehicle Demand in the Watts Bar EPZ

Subarea County	Population						Vehicles					
	Winter			Summer			Winter			Summer		
	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend	Day	Night	Weekend
D-1*	108	108	108	112	112	112	48	53	53	51	56	56
D-2	1,037	1,037	1,037	1,081	1,081	1,081	456	508	508	487	539	539
D-3	28	28	28	28	28	28	12	14	14	12	14	14
D-4	140	140	140	140	140	140	62	69	69	62	69	69
D-5	665	665	665	667	667	667	292	326	326	293	327	327
D-6	2,303	773	773	829	775	775	451	379	379	347	380	380
D-7	1,319	1,319	1,319	1,321	1,321	1,321	580	647	647	581	648	648
D-8	1,517	1,517	1,517	1,521	1,521	1,521	667	744	744	670	747	747
D-9	575	575	575	596	596	596	253	282	282	268	297	297
WBN	1,100	250	250	1,100	250	250	1,100	250	250	1,100	250	250
EPZ total	31,201	24,168	24,897	28,337	25,813	26,542	12,923	11,838	12,123	13,753	12,989	13,274
2013 ETE Study Total	*30,493*	*23,805*	*24,519*	*27,629*	*25,450*	*26,164*	*12,422*	*11,636*	*11,936*	*13,252*	*12,787*	*13,087*

*Except for WBN Site

Note: Population numbers reflect some double-counting between categories (e.g., residents, workforce, schools).

Table 9 Summary of Transportation Resources

County	Bus	Van	Wheelchair Bus	Wheelchair Van	Ambulance
Rhea	42	0	6	0	10
Meigs	28	0	2	1	2
McMinn	65	6	9	2	11
Total Available	**135**	**6**	**17**	**3**	**23**
Identified Vehicle Need					
Schools and Daycare	69	3	0	0	0
Special Facilities	20	0	8	0	5
Transit-Dependent Public	12	0	3	2	4
Total Identified Need	**101**	**3**	**11**	**2**	**9**

4. Evacuation Roadway Network

The same roadway network developed for the 2013 ETE study was retained for this addendum study. However, modifications were made for the Watts Bar plant to more realistically represent the travel patterns on site during the construction phase. The primary evacuation routes used in the modeling are indicated on Figure 2.

4.1 Evacuation Network Characteristics

Roadway characteristics, such as roadway class, number of lanes, lane and shoulder width, speed limit, lane configuration near intersections, and traffic control, are key factors in determining the time in which an evacuation can be completed. These roadway attributes control roadway capacity, which in turn governs operating traffic conditions measured in terms of level of service (LOS). LOS is measured from A to F for roadway segments and intersections. LOS A represents free-flow conditions, and LOS F represents force or breakdown flow conditions.

ARCADIS used NAVTEQ™ roadway data with detailed information, including local street data, to build the evacuation roadway network for the study. NAVTEQ data were imported into geographic information system (GIS) software (ESRI ArcGIS™) for use in conducting field surveys to verify evacuation roadway segment attributes. The information provided in the public outreach calendar for WBN was used to highlight evacuation routes in GIS. ARCADIS has developed an integrated GIS-global positioning system tool that allows field personnel to record observations in an efficient and effective manner. The evacuation network, including traffic controls, was verified to a 15-mile radius from the plant and along designated routes to the reception centers. After the NAVTEQ data were verified through the field survey, the evacuation roadway network was transferred to the traffic simulation software VISUM for modeling various evacuation scenarios.

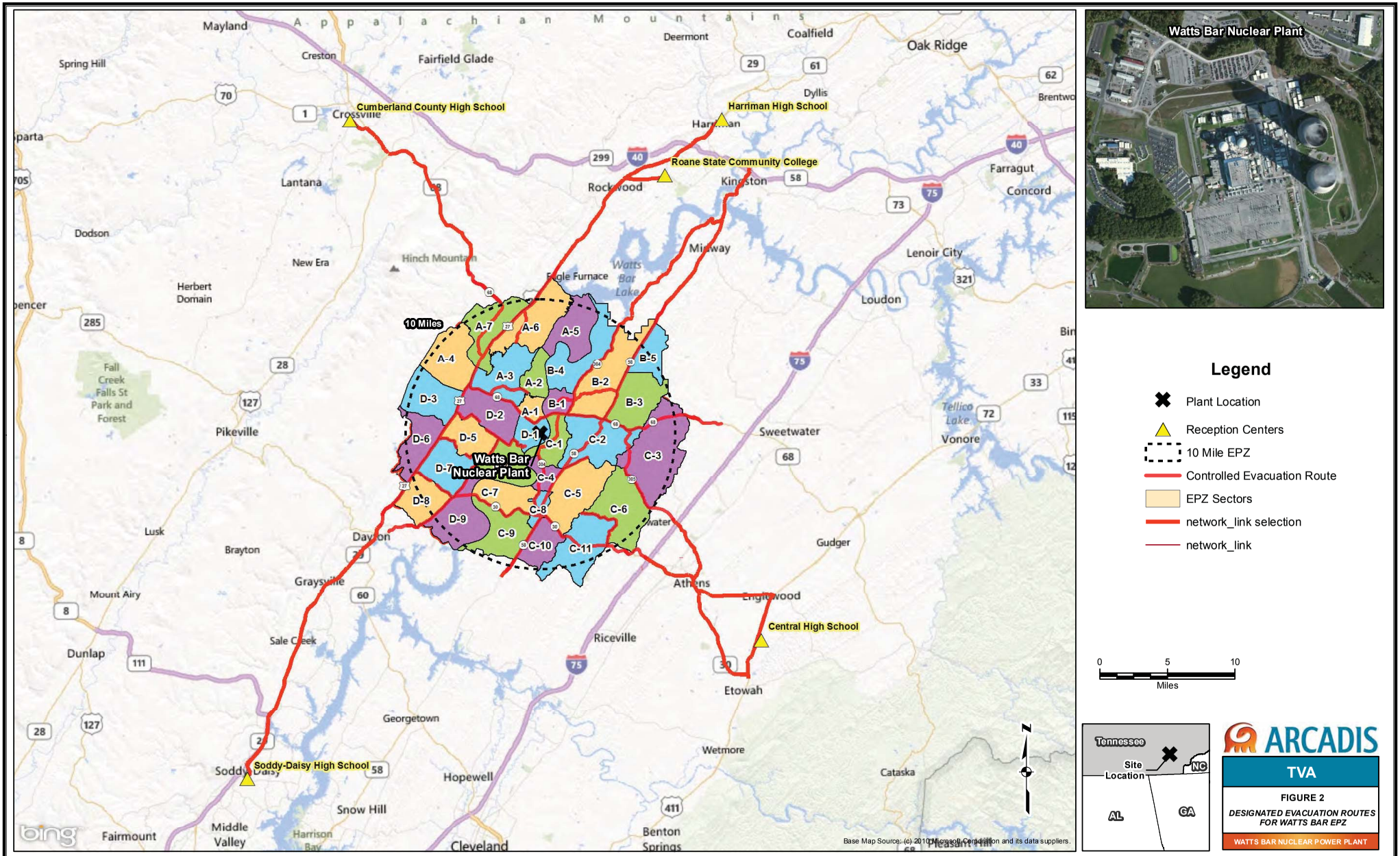
The verified geometric attributes of each roadway were used to develop capacities in accordance with 2010 Highway Capacity Manual (HCM) methodology. The HCM requires lane width, shoulder width, grade, intersection spacing, etc., to estimate roadway capacity. The HCM contains different equations to estimate capacity based on roadway use type (freeway, multilane highway, and urban/rural two-lane highway). ARCADIS estimated the capacity based on each roadway's classification and the field-verified geometric attributes that are required by HCM empirical methods. The HCM estimated hourly capacity was tabulated for each roadway and transferred to VISUM software.

Because intersections have the potential to create bottleneck points, accurate traffic control information is important to effectively estimate evacuation times. During an evacuation scenario, intersections might be manually controlled by officials, operated with existing traffic signal timing plans, or adjusted according to changing vehicular demand. In general, the emergency response plans for Watts Bar call for signal override (i.e., signals set to flashing to give priority to outbound travel on designated evacuation routes). Traffic control information is coded as part of the evacuation network database.

Background and pass-through traffic in the EPZ could account for a significant number of vehicles and could influence evacuation depending on the direction of travel. As recommended in CR-7002, average daily traffic (ADT) volumes, representative of typical background levels, were obtained from state and county transportation agencies. During simulations, background traffic is included during the initial two hours of the evacuation scenario, up to the time when access control is established to prevent vehicles from entering the EPZ.

4.2 Network Modifications

Modifications to the original network were made for the Watts Bar plant site. Information provided by Watts Bar staff indicated that construction workers and plant staff currently park in different areas of the plant. Also, the construction workers and staff exit the plant each day under contraflow conditions. Given this information and the increase in on-site workers modeled for this study, the decision was made to modify the network links representing the plant site. Figure 3 depicts the links added to the model construction and operational sides of the plant. Figure 4 shows the WBN access network link during an evacuation, with contraflow of traffic out of the plant. The access road currently ends at Tennessee State Route (TN) 68. At this point, existing traffic may proceed east toward TN 58 and Interstate 75 (I-75) or west toward TN 29/US 27.



ARCADIS

TVA

FIGURE 2

DESIGNATED EVACUATION ROUTES FOR WATTS BAR EPZ

WATTS BAR NUCLEAR POWER PLANT

Path: G:\TRA\Projects\LA003219 Pete's Hwy\2-Data\GIS_CADD\ArcMap\WattsBar_Figure_2.mxd

U:\projects\TVA_ETE\Output

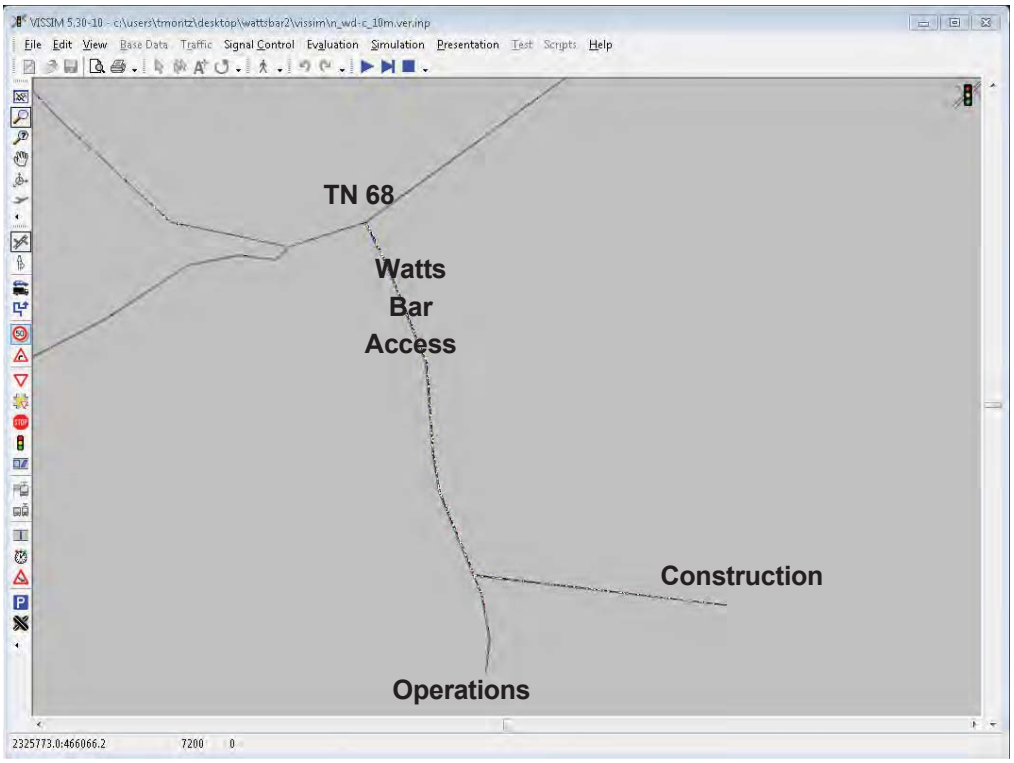


Figure 3 Construction Worker and Operation Staff Entry Links Added to Network

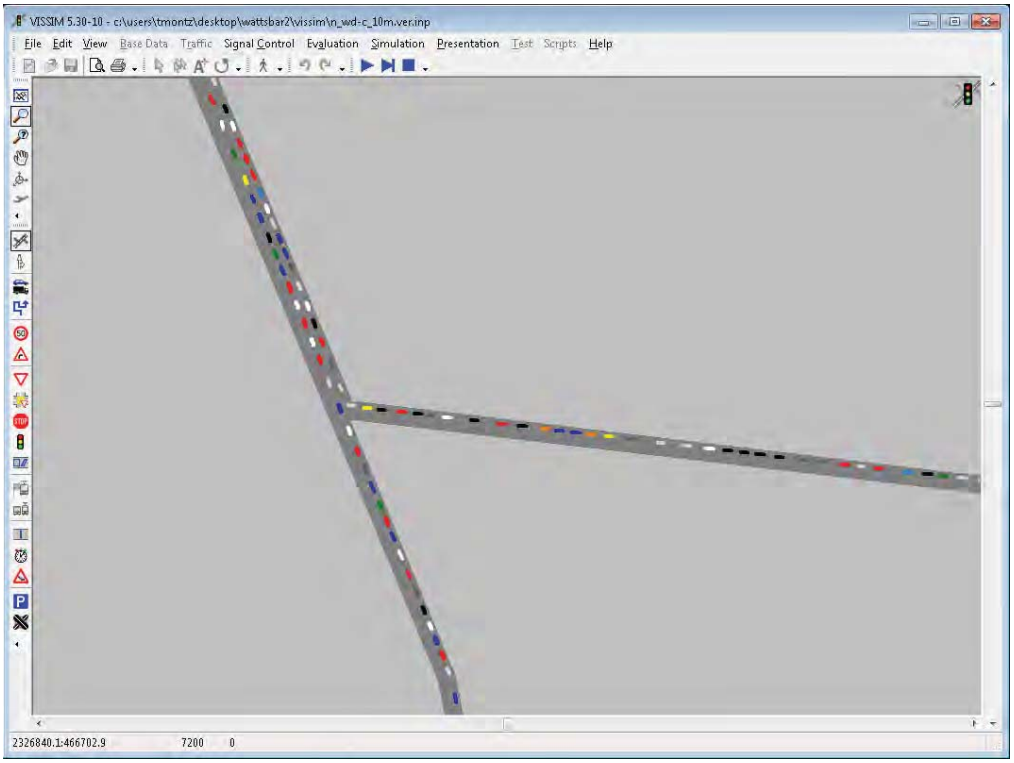


Figure 4 Contraflow Modeled on Access Road During Emergency Evacuation

5. Evacuation Time Estimate Methodology

The same methodology utilized for the 2013 ETE study was retained for the addendum study. Time estimates have been prepared for a general evacuation scenario for each of the following analysis cases:

- Winter Weekday, Fair Weather, and Adverse Weather Conditions
- Winter Weeknight, Fair Weather Conditions
- Winter Weekend, Fair Weather Conditions
- Summer Weekday, Fair Weather, and Adverse Weather Conditions
- Summer Weeknight, Fair Weather Conditions
- Summer Weekend, Fair Weather Conditions

Areas for evacuation are selected based on the “keyhole” configuration (0- to 2-mile zone plus 2 to 5 miles or 0 to 5 miles plus 5- to 10-mile downwind zone). The partial EPZ evacuation areas for WBN are listed in Table 10, based on the Protective Action Response (PAR) chart.

For partial EPZ evacuation cases, “shadow” vehicle demand (20 percent of residents) is assigned to all ERPAs that are not officially included in the evacuation region, as well as the region outside of the EPZ to a total distance of 15 miles from WBN.

5.1 Initial Notification

The EPZ surrounding WBN has an outdoor siren notification system consistent with the requirements of NUREG-0654, Rev. 1/FEMA-REP-1 Appendix 3. This system will be used by state and local officials in the event of an emergency to alert the population to turn on radios and television sets. Pursuant to NUREG 0654, Rev. 1 guidance, notification messages will commence on the designated EAS television and radio stations concurrently with sounding of the sirens and tone alert radios. Within 15 minutes of alert notification, essentially all of the population within the EPZ will begin to receive an informational or instructional message. If evacuation is deemed necessary, the timing of the order to evacuate and notification measures will be controlled by the state and local emergency preparedness officials. Those officials may choose to alert

Table 10 Potential Evacuation Areas for Watts Bar EPZ

Wind Direction (from)	EPZ Subareas/ERPAs
2-mile radius and 5 miles downwind	
N	A-1, B-1, C-1, C-4, C-5, C-7, C-8, D-1, D-4
NNE	A-1, B-1, C-1, C-4, C-7, C-8, D-1, D-4
NE	A-1, B-1, C-1, C-4, C-7, D-1, D-4, D-5
ENE	A-1, B-1, C-1, C-7, D-1, D-2, D-4, D-5
E	A-1, B-1, C-1, D-1, D-2, D-4, D-5
ESE	A-1, A-3, B-1, C-1, D-1, D-2, D-5
SE	A-1, A-2, A-3, B-1, C-1, D-1, D-2
SSE	A-1, A-2, A-3, B-1, B-4, C-1, D-1, D-2
S	A-1, A-2, A-3, B-1, B-4, C-1, D-1
SSW	A-1, A-2, B-1, B-2, B-4, C-1, D-1
SW-WSW	A-1, B-1, B-2, B-4, C-1, C-2, D-1
W	A-1, B-1, B-2, C-1, C-2, D-1
WNW	A-1, B-1, C-1, C-2, C-5, D-1
NW	A-1, B-1, C-1, C-2, C-4, C-5, D-1
NNW	A-1, B-1, C-1, C-2, C-4, C-5, C-7, C-8, D-1
2-mile radius and 10 miles downwind	
N	A-1, B-1, C-1, C-4, C-5, C-7, C-8, C-9, C-10, C-11, D-1, D-4
NNE	A-1, B-1, C-1, C-4, C-7, C-8, C-9, C-10, C-11, D-1, D-4, D-9
NE	A-1, B-1, C-1, C-4, C-7, C-9, D-1, D-4, D-5, D-6, D-7, D-8, D-9
ENE	A-1, B-1, C-1, C-7, C-9, D-1, D-2, D-4, D-5, D-6, D-7, D-8, D-9
E	A-1, A-4, B-1, C-1, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8
ESE	A-1, A-3, A-4, A-7, B-1, C-1, D-1, D-2, D-3, D-5, D-6, D-7
SE	A-1, A-2, A-3, A-4, A-6, A-7, B-1, C-1, D-1, D-2, D-3
SSE	A-1, A-2, A-3, A-4, A-5, A-6, A-7, B-1, C-1, D-1, D-2
S	A-1, A-2, A-3, A-5, A-6, A-7, B-1, B-4, C-1, D-1
SSW	A-1, A-2, A-3, A-5, A-6, B-1, B-2, B-4, B-5, C-1, D-1
SW	A-1, A-5, B-1, B-2, B-3, B-4, B-5, C-1, C-2, D-1
WSW	A-1, B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, D-1
W	A-1, B-1, B-2, B-3, B-5, C-1, C-2, C-3, C-5, C-6, D-1
WNW	A-1, B-1, B-3, C-1, C-2, C-3, C-5, C-6, C-11, D-1
NW	A-1, B-1, C-1, C-2, C-3, C-4, C-5, C-6, C-11, D-1
NNW	A-1, B-1, C-1, C-2, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-11,D-1
Entire EPZ	**All**

and mobilize an emergency response workforce to control and expedite evacuation prior to the evacuation order.

5.2 Transportation-Dependent Population

The transportation-dependent population includes individuals without access to transportation, as well as those requiring special transportation assistance. Transportation-dependent persons will be notified of a protective action recommendation in the same manner as the general public. If evacuation is recommended, persons needing transportation assistance will be informed through the EAS to contact the appropriate officials for assistance. Evacuees who do not have access to transportation and confined persons who require special transportation assistance will be provided transportation by the appropriate agency.

5.3 Evacuation Preparation Times and Departure Distributions

It is assumed that no vehicles will begin to evacuate during the 15-minute initial notification period. Accordingly, in the model simulations, vehicles begin to evacuate at 15 minutes following the initial notification. After the initial 15-minute time period, vehicles are loaded at a linear rate over each 5-minute time interval, in accordance with the network loading distributions for each population type. For example, if 2 percent of 2,500 vehicles (50 vehicles) are to be loaded at a specific location over a 5-minute period, VISUM will load 10 vehicles per minute at that location during the specified interval. Network loading distribution assumptions for the permanent population, transient population, and special facilities are based on the anticipated response of different population sectors to an evacuation order. Mobilization times for residents and workers reflect the data acquired by the telephone survey of EPZ residents, and are consistent with published data from actual historical events. Loading distributions are explained below and summarized on Figure 5.

Permanent, seasonal, and shadow populations with access to automobiles will take varying amounts of time to begin evacuating. Some persons will leave as quickly as possible; most will take some time to prepare, pack valuables and clothes, and then depart; some will take added time to secure property before departing; and some may require transportation assistance. In addition, actual departure and preparation times may vary according to the perceived severity of a particular evacuation order. Based on these factors, it was assumed that there would be a period of up to 3 hours over which the permanent, seasonal, and shadow populations would begin to evacuate (“resident day/night” profile on Figure 5).

It was assumed that the workforce would be subject to the same warning diffusion as the general public. Based on estimated warning diffusion and survey results from EPZ residents, it was estimated that 50 percent of the workforce would evacuate within 40 minutes following the decision to evacuate, 90 percent within 65 minutes, and 99 percent within 105 minutes ("worker" profile on Figure 5). For a few facilities, it may be necessary for a limited number of workers to remain on the job in order to safely shut down processes, secure the facility, or maintain essential operations. The ETEs do not address those workers who remain behind, because there is no reliable basis for predicting whether or how soon they will evacuate.

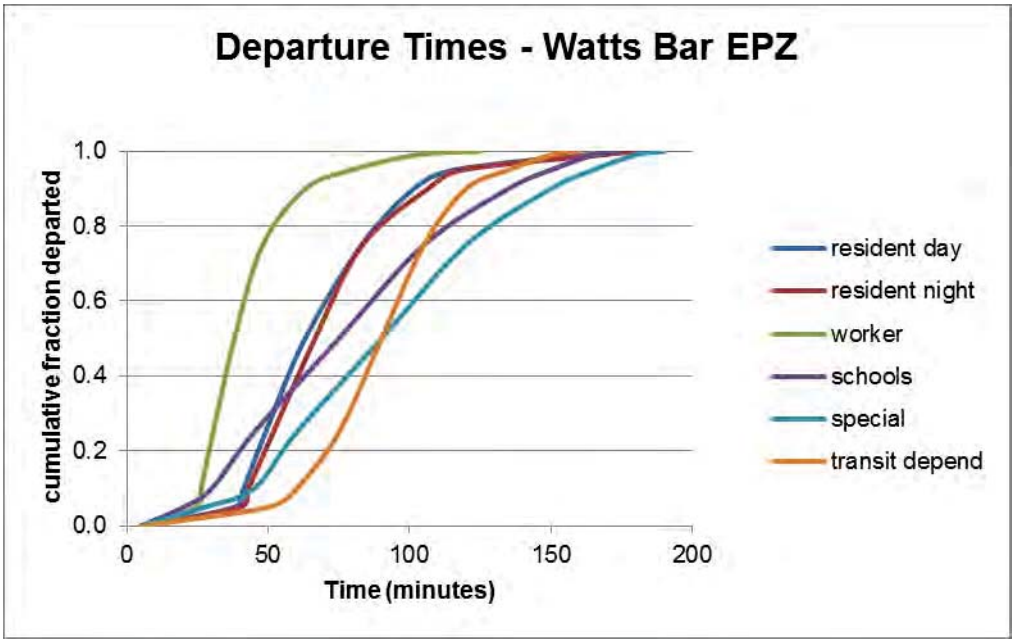


Figure 5 Departure Time Distributions for the Watts Bar EPZ

It was assumed that special facilities (i.e., schools, nursing homes) within the EPZ would also receive initial notification promptly. Based on data obtained from previous studies, vehicle departure times were developed that reflect a distribution of notification, preparation, and mobilization times.

Consistent with the current off-site emergency response plans, it was assumed that schools will be evacuated via bus to the designated host schools. For school facilities, it was assumed that up to 1 hour may be required to assemble buses, transport vehicles to schools, and load students onto buses. Vehicles stationed at the facilities at

the time of the ordered evacuation could be loaded in as little as 15 minutes following notification. Accordingly, 50 percent of school buses depart onto the evacuation network during the period between 15 and 75 minutes, 90 percent by 135 minutes, and 99 percent by 165 minutes. The school profile was also applied for daycare facilities.

Evacuation of nursing home facilities would also require additional time associated with preparation and transport of vehicles to the respective facilities. Based on previous studies, it was assumed that these facilities would begin to evacuate between 30 minutes and 3 hours following notification. The first 50 percent will depart within 90 minutes, 90 percent within 150 minutes, and 99 percent within 180 minutes.

5.4 Evacuation Simulation

ARCADIS used PTV Vision to perform evacuation modeling for different scenarios. The PTV Vision traffic simulation software package includes VISSIM (microscopic traffic simulation) and VISUM (macroscopic traffic simulation). VISUM is a comprehensive, flexible software system for transportation planning, travel demand modeling, and network data management. VISSIM is capable of performing detailed microscopic simulation of traffic, public transport, and pedestrian simulations, and can model any type of traffic control and geometric configuration.

VISUM was used to develop the evacuation network, population entry nodes (centroids), as well as calculate an initial evacuation routing solution for each scenario. The field-verified evacuation network data and population data developed in ArcGIS were imported directly into VISUM. Origin-destination trip tables were then developed for each evacuation scenario. VISUM software was then used to route the origin-destination information on the network using a dynamic equilibrium algorithm. This algorithm ensured that traffic levels on the network were realistic given the capacities available on individual links. Once an initial solution was found in VISUM, the information was exported into VISSIM for microsimulation. A microsimulation was deemed a necessary step in order to obtain detailed and realistic results on queuing and average travel times. VISSIM can model an intersection with different types of traffic control, such as yield signs, stop signs, and signals. VISSIM also provides a better understating of critical and congested parts of the network.

5.4.1 Simulation Process

The ETE results include the time to evacuate 90 percent and 100 percent of the total permanent and transient population. Based on the current guidance, ETEs for special

facilities, schools, and the transit-dependent population are developed separately; only time to evacuate 100 percent of these population groups was needed.

Consistent with current guidance, vehicle demand for each scenario was based on 100 percent of the population residing in areas designated for evacuation, plus 20 percent of the population residing in ERPAs outside the designated evacuation area, and 20 percent of the population residing outside of the EPZ, out to a distance of 15 miles. Vehicle demand outside of the designated evacuation area is intended to account for the impact of “shadow evacuees.”

The simulation process can be summarized as follows:

VISUM

1. Create every scenario based on:
    a. Background traffic
    b. Time of day
    c. Day of week
    d. Weather condition
    e. Season
    f. Wind direction
    g. Shadow traffic
2. Run Dynamic Traffic Assignment to calculate permanent and transient, shadow, special need/school volumes.
3. Assignment process will last until suitable convergence is reached. VISUM provides output on the goodness of convergence after assignment. The convergence fit is not as critical because this is an evacuation model of a no-notice event; therefore, full user equilibrium cannot be expected.
4. Export to VISSIM.

VISSIM

1. Warm-up time built into background/pass-through traffic generation.

2. Check for any local calibration parameters.

3. Run the final multimodal Dynamic Traffic Assignment in VISSIM to consider queues and intersection delays.

4. Sensitivity analysis and count evacuees at 2, 5, and 10 miles.

5. Prepare ETE times.

6. Analysis of Evacuation Times

6.1 Evacuation Time Estimate Summary

ETEs for the general population in the Watts Bar EPZ are summarized by scenario and distance in Table 11 for the peak construction year and Table 12 for the operational year. The pattern of evacuation times is consistent with the differences in vehicle demand and travel time for various scenarios. The increases (if any) over the original 2013 ETE study are also provided in the tables.

The ETEs during the peak construction year (2014) are slightly higher than the original 2013 ETE study. The largest difference is seen in the 90 percent ETE of the 2-mile zone due to the large increase in traffic originating at the WBN plant. Workers are assumed to exit the plant faster (due to their more rapid departure time curve) than the surrounding general public; therefore, the on-site traffic only affects the 90 percent ETE rather than the 100 percent ETE of the 2-mile zone.

The ETEs during the first operational year of the new reactor (2016) are generally consistent with the ETEs developed during the 2013 ETE study. There are slight increases in the weekend and evening scenarios due to the increase in general population and shadow evacuation traffic. These scenarios experience increases over the daytime scenario because during weekends and evenings, more of the permanent population would originate from their homes, in which case they are assumed to evacuate at a slower rate than if they evacuate directly from work. However, the increases are minor and are expected over this time period (see Section 6.6 of the 2013 ETE study).

6.2 Keyhole Evacuation Scenarios

ETEs for scenarios that reflect the current range of PAR scenarios to evacuate the near-field population and selected downwind zones are summarized in Tables 13, 14, and 15 for the construction year and Tables 16, 17, and 18 for the operational year. The keyhole scenarios are consistent with the results for the full 2-mile, 5-mile, and 10-mile zones.

A series of staged evacuation scenarios were evaluated based on NRC guidance (CR-7002). In a staged evacuation, the 2-mile zone evacuates first, while surrounding zones shelter in place; after the population has evacuated the 2-mile zone, the outer zones would be instructed to evacuate. The “Stage 1” time is

determined by simulating evacuation of the 2-mile zone for the Winter Weekday, Normal Weather scenario, with only background and shadow traffic in other parts of the EPZ. Once the Stage 1 time (1:30) was determined, a revised set of departure curves was developed for the outer (Stage 2) zones. The results for staged evacuation of the 5-mile zone after the 2-mile zone are provided in Tables 15 and 18.

During the peak construction year (2014), the keyhole scenarios (staged and unstaged) experience increased ETEs due to increased traffic at WBN. As previously explained, this increase is only found for 90 percent ETEs rather than 100 percent ETEs. The 10-mile downwind keyhole scenarios were the only increases for 100 percent ETEs, consistent with the evacuation increases found for the evacuation of the full 10-mile EPZ.

For the first operational year (2016), the only increases identified were during weekend and evening times, consistent with the increases found for the full 5-mile and 10-mile EPZs. The increase in permanent population in the EPZ and shadow evacuation area resulted in slight increases for the 10-mile downwind keyhole scenarios for both the 90 percent and the 100 percent ETEs.

6.3 TEMA Sector Evacuation Scenarios

Tables 19 and 20 summarize the ETEs for each TEMA sector for the peak construction and operational years, respectively. The results are similar to the keyhole scenarios presented in Tables 13 through 18.

During peak construction, the evacuation time of WBN controls to the 90 percent ETE for sectors A, B, and D (i.e., extends the total evacuation time). Sector C incorporates the City of Decatur, which controls the ETE more so than WBN; therefore, the ETE for this sector is longer than the ETE for the other sectors.

For the operational year, the ETE trend is the same as found in other scenarios. Evening and weekend time periods were identified to show an increase, which again is due to population increases within the EPZ.

Table 11 Evacuation Time Estimate Summary for Watts Bar EPZ during Peak Construction Year 2014

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, D-1	**2-Mile Zone**	1:45 (*10*)	1:55 (*10*)	1:40 (*5*)	1:40 (*5*)	1:40 (*10*)	1:50 (*10*)	1:35 (*5*)	1:35 (*5*)
A-1, B-1, C-1, D-1, A-2, A-3, B-2, B-4, C-2, C-4, C-5, C-7, C-8, D-2, D-4, D-5	**5-Mile Zone**	2:30	2:40	2:25 (*5*)	2:25 (*5*)	2:30	2:45	2:25 (*5*)	2:25 (*5*)
ALL	**10-Mile EPZ**	3:00	3:10	2:35 (*5*)	2:35 (*5*)	3:00	3:25	2:30 (*5*)	2:30 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, D-1	**2-Mile Zone**	3:15	3:25	3:10	3:10	3:15	3:30	3:10	3:10
A-1, B-1, C-1, D-1, A-2, A-3, B-2, B-4, C-2, C-4, C-5, C-7, C-8, D-2, D-4, D-5	**5-Mile Zone**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
ALL	**10-Mile EPZ**	4:20 (*5*)	4:30 (*5*)	4:15 (*5*)	4:15 (*5*)	4:25 (*10*)	5:05 (*10*)	4:20 (*10*)	4:20 (*10*)

Table 12 Evacuation Time Estimate Summary for Watts Bar EPZ during First Operational Year 2016

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	**Scenario:**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, D-1	**2-Mile Zone**	1:35	1:45	1:35	1:35	1:30	1:40	1:30	1:30
A-1, B-1, C-1, D-1, A-2, A-3, B-2, B-4, C-2, C-4, C-5, C-7, C-8, D-2, D-4, D-5	**5-Mile Zone**	2:30	2:40	2:20	2:20	2:30	2:45	2:20	2:20
ALL	**10-Mile EPZ**	3:00	3:10	2:40 (*10*)	2:40 (*10*)	3:00	3:25	2:35 (*5*)	2:35 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, D-1	**2-Mile Zone**	3:15	3:25	3:10	3:10	3:15	3:30	3:10	3:10
A-1, B-1, C-1, D-1, A-2, A-3, B-2, B-4, C-2, C-4, C-5, C-7, C-8, D-2, D-4, D-5	**5-Mile Zone**	3:55	4:05	3:35 (*5*)	3:35 (*5*)	3:55	4:20	3:35 (*5*)	3:35 (*5*)
ALL	**10-Mile EPZ**	4:15	4:25	4:20 (*10*)	4:20 (*10*)	4:15	4:55	4:20 (*10*)	4:20 (*10*)

Table 13 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, D-1, D-4	N	2:40 (*10*)	2:50 (*10*)	2:25 (*5*)	2:25 (*5*)	2:40 (*10*)	2:55 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, B-1, C-1, C-4, C-7, C-8, D-1, D-4	NNE	2:40 (*10*)	2:50 (*10*)	2:25 (*5*)	2:25 (*5*)	2:40 (*10*)	2:55 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, B-1, C-1, C-4, C-7, D-1, D-4, D-5	NE	2:15 (*10*)	2:25 (*10*)	2:00 (*5*)	2:00 (*5*)	2:15 (*10*)	2:30 (*10*)	2:00 (*5*)	2:00 (*5*)
A-1, B-1, C-1, C-7, D-1, D-2, D-4, D-5	ENE	2:15 (*10*)	2:25 (*10*)	2:00 (*5*)	2:00 (*5*)	2:15 (*10*)	2:30 (*10*)	2:00 (*5*)	2:00 (*5*)
A-1, B-1, C-1, D-1, D-2, D-4, D-5	E	2:15 (*10*)	2:25 (*10*)	2:00 (*5*)	2:00 (*5*)	2:15 (*10*)	2:30 (*10*)	2:00 (*5*)	2:00 (*5*)
A-1, A-3, B-1, C-1, D-1, D-2, D-5	ESE	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, A-2, A-3, B-1, C-1, D-1, D-2	SE	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, A-2, A-3, B-1, B-4, C-1, D-1, D-2	SSE	2:15 (*10*)	2:25 (*10*)	2:00 (*5*)	2:00 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, A-2, A-3, B-1, B-4, C-1, D-1	S	2:15 (*10*)	2:25 (*10*)	2:00 (*5*)	2:00 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, A-2, B-1, B-2, B-4, C-1, D-1	SSW	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)

Table 13 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, B-1, B-2, B-4, C-1, C-2, D-1	SW-WSW	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, B-1, B-2, C-1, C-2, D-1	W	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, B-1, C-1, C-2, C-5, D-1	WNW	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, B-1, C-1, C-2, C-4, C-5, D-1	NW	2:10 (*10*)	2:20 (*10*)	1:55 (*5*)	1:55 (*5*)	2:10 (*10*)	2:25 (*10*)	1:55 (*5*)	1:55 (*5*)
A-1, B-1, C-1, C-2, C-4, C-5, C-7, C-8, D-1	NNW	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, D-1, D-4	N	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-4, C-7, C-8, D-1, D-4	NNE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-4, C-7, D-1, D-4, D-5	NE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-7, D-1, D-2, D-4, D-5	ENE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, D-1, D-2, D-4, D-5	E	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, A-3, B-1, C-1, D-1, D-2, D-5	ESE	3:35	3:45	3:10	3:10	3:35	4:00	3:10	3:10

Table 13 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, A-2, A-3, B-1, C-1, D-1, D-2	SE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, A-2, A-3, B-1, B-4, C-1, D-1, D-2	SSE	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, A-2, A-3, B-1, B-4, C-1, D-1	S	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, A-2, B-1, B-2, B-4, C-1, D-1	SSW	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, B-2, B-4, C-1, C-2, D-1	SW-WSW	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, B-2, C-1, C-2, D-1	W	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-5, D-1	WNW	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-4, C-5, D-1	NW	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-4, C-5, C-7, C-8, D-1	NNW	3:40	3:50	3:15	3:15	3:40	4:05	3:15	3:15

Table 14 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, C-9, C-10, C-11, D-1, D-4	**N**	3:05 (*10*)	3:15 (*10*)	2:50 (*5*)	2:50 (*5*)	3:05 (*10*)	3:30 (*10*)	2:50 (*5*)	2:50 (*5*)
A-1, B-1, C-1, C-4, C-7, C-8, C-9, C-10, C-11, D-1, D-4, D-9	**NNE**	3:05 (*10*)	3:15 (*10*)	2:50 (*5*)	2:50 (*5*)	3:05 (*10*)	3:30 (*10*)	2:50 (*5*)	2:50 (*5*)
A-1, B-1, C-1, C-4, C-7, C-9, D-1, D-4, D-5, D-6, D-7, D-8, D-9	**NE**	2:40 (*10*)	2:50 (*10*)	2:25 (*5*)	2:25 (*5*)	2:40 (*10*)	3:05 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, B-1, C-1, C-7, C-9, D-1, D-2, D-4, D-5, D-6, D-7, D-8, D-9	**ENE**	2:40 (*10*)	2:50 (*10*)	2:25 (*5*)	2:25 (*5*)	2:40 (*10*)	3:05 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, A-4, B-1, C-1, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8	**E**	2:35 (*10*)	2:45 (*10*)	2:20 (*5*)	2:20 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, A-3, A-4, A-7, B-1, C-1, D-1, D-2, D-3, D-5, D-6, D-7	**ESE**	2:35 (*10*)	2:45 (*10*)	2:20 (*5*)	2:20 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, A-2, A-3, A-4, A-6, A-7, B-1, C-1, D-1, D-2, D-3	**SE**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:40 (*10*)	3:05 (*10*)	2:25 (*5*)	2:25 (*5*)

Table 14 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, A-2, A-3, A-4, A-5, A-6, A-7, B-1, C-1, D-1, D-2	**SSE**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:40 (*10*)	3:05 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, A-2, A-3, A-5, A-6, A-7, B-1, B-4, C-1, D-1	**S**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:40 (*10*)	3:05 (*10*)	2:25 (*5*)	2:25 (*5*)
A-1, A-2 ,A-3, A-5, A-6, B-1, B-2, B-4, B-5, C-1, D-1	**SSW**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, A-5, B-1, B-2, B-3, B-4, B-5, C-1, C-2, D-1	**SW**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, D-1	**WSW**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, B-1, B-2, B-3, B-5, C-1, C-2, C-3, C-5, C-6, D-1	**W**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:35 (*10*)	3:00 (*10*)	2:20 (*5*)	2:20 (*5*)
A-1, B-1, B-3, C-1, C-2, C-3, C-5, C-6, C-11, D-1	**WNW**	2:55 (*10*)	3:05 (*10*)	2:40 (*5*)	2:40 (*5*)	2:55 (*10*)	3:20 (*10*)	2:40 (*5*)	2:40 (*5*)
A-1, B-1, C-1, C-2, C-3, C-4, C-5, C-6, C-11, D-1	**NW**	2:55 (*10*)	3:05 (*10*)	2:40 (*5*)	2:40 (*5*)	2:55 (*10*)	3:20 (*10*)	2:40 (*5*)	2:40 (*5*)

Table 14 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, C-9, C-10, C-11, D-1, D-4	**N**	4:05 (*5*)	4:15 (*5*)	3:55 (*5*)	3:55 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, B-1, C-1, C-4, C-7, C-8, C-9, C-10, C-11, D-1, D-4, D-9	**NNE**	4:05 (*5*)	4:15 (*5*)	3:55 (*5*)	3:55 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, B-1, C-1, C-4, C-7, C-9, D-1, D-4, D-5, D-6, D-7, D-8, D-9	**NE**	4:10 (*5*)	4:20 (*5*)	4:00 (*5*)	4:00 (*5*)	4:10 (*5*)	4:50 (*5*)	4:00 (*5*)	4:00 (*5*)
A-1, B-1, C-1, C-7, C-9, D-1, D-2, D-4, D-5, D-6, D-7, D-8, D-9	**ENE**	4:10 (*5*)	4:20 (*5*)	4:00 (*5*)	4:00 (*5*)	4:10 (*5*)	4:50 (*5*)	4:00 (*5*)	4:00 (*5*)
A-1, A-4, B-1, C-1, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8	**E**	4:15 (*5*)	4:25 (*5*)	4:05 (*5*)	4:05 (*5*)	4:15 (*5*)	4:55 (*5*)	4:05 (*5*)	4:05 (*5*)
A-1, A-3, A-4, A-7, B-1, C-1, D-1, D-2, D-3, D-5, D-6, D-7	**ESE**	4:15 (*5*)	4:25 (*5*)	4:05 (*5*)	4:05 (*5*)	4:15 (*5*)	4:55 (*5*)	4:05 (*5*)	4:05 (*5*)
A-1, A-2, A-3, A-4, A-6, A-7, B-1, C-1, D-1, D-2, D-3	**SE**	4:20 (*5*)	4:30 (*5*)	4:10 (*5*)	4:10 (*5*)	4:20 (*5*)	5:00 (*5*)	4:10 (*5*)	4:10 (*5*)

Table 14 Peak Construction Year 2014:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, A-2, A-3, A-4, A-5, A-6, A-7, B-1, C-1, D-1, D-2	SSE	4:20 (*5*)	4:30 (*5*)	4:10 (*5*)	4:10 (*5*)	4:20 (*5*)	5:00 (*5*)	4:10 (*5*)	4:10 (*5*)
A-1, A-2, A-3, A-5, A-6, A-7, B-1, B-4, C-1, D-1	S	4:20 (*5*)	4:30 (*5*)	4:10 (*5*)	4:10 (*5*)	4:20 (*5*)	5:00 (*5*)	4:10 (*5*)	4:10 (*5*)
A-1, A-2, A-3, A-5, A-6, B-1, B-2, B-4, B-5, C-1, D-1	SSW	4:00 (*5*)	4:10 (*5*)	3:50 (*5*)	3:50 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, A-5, B-1, B-2, B-3, B-4, B-5, C-1, C-2, D-1	SW	4:00 (*5*)	4:10 (*5*)	3:50 (*5*)	3:50 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, D-1	WSW	4:00 (*5*)	4:10 (*5*)	3:50 (*5*)	3:50 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, B-1, B-2, B-3, B-5, C-1, C-2, C-3, C-5, C-6, D-1	W	4:00 (*5*)	4:10 (*5*)	3:50 (*5*)	3:50 (*5*)	4:05 (*5*)	4:45 (*5*)	3:55 (*5*)	3:55 (*5*)
A-1, B-1, B-3, C-1, C-2, C-3, C-5, C-6, C-11, D-1	WNW	4:15 (*5*)	4:25 (*5*)	4:05 (*5*)	4:05 (*5*)	4:15 (*5*)	4:55 (*5*)	4:05 (*5*)	4:05 (*5*)
A-1, B-1, C-1, C-2, C-3, C-4, C-5, C-6, C-11, D-1	NW	4:10 (*5*)	4:20 (*5*)	4:00 (*5*)	4:00 (*5*)	4:10 (*5*)	4:50 (*5*)	4:00 (*5*)	4:00 (*5*)

Table 15 Peak Construction Year 2014:
Evacuation Time Estimates for Staged EPZ Scenarios (2-Mile Zone, then 5 Miles Downwind)

		Summer				Winter			
Affected ERPAs		**Midweek Daytime**		**Weekend Daytime**	**Evening**	**Midweek Daytime**		**Weekend Daytime**	**Evening**
2-mile Zone (A-1, B-1, C-1, D-1) then:	**Scenario:**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
C-4, C-5, C-7, C-8, D-1, D-4	**N**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:50 (*10*)	3:05 (*10*)	2:35 (*5*)	2:35 (*5*)
C-4, C-7, C-8, D-1, D-4	**NNE**	2:50 (*10*)	3:00 (*10*)	2:35 (*5*)	2:35 (*5*)	2:55 (*10*)	3:10 (*10*)	2:40 (*5*)	2:40 (*5*)
C-4, C-7, D-1, D-4, D-5	**NE**	2:25 (*10*)	2:35 (*10*)	2:10 (*5*)	2:10 (*5*)	2:30 (*10*)	2:45 (*10*)	2:15 (*5*)	2:15 (*5*)
C-7, D-2, D-4, D-5	**ENE**	2:25 (*10*)	2:35 (*10*)	2:10 (*5*)	2:10 (*5*)	2:30 (*10*)	2:45 (*10*)	2:15 (*5*)	2:15 (*5*)
D-2, D-4, D-5	**E**	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)
A-3, D-2, D-5	**ESE**	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)
A-2, A-3, D-2	**SE**	2:35 (*10*)	2:45 (*10*)	2:20 (*5*)	2:20 (*5*)	2:40 (*10*)	2:55 (*10*)	2:25 (*5*)	2:25 (*5*)
A-2, A-3, B-4, D-2	**SSE**	2:35 (*10*)	2:45 (*10*)	2:20 (*5*)	2:20 (*5*)	2:40 (*10*)	2:55 (*10*)	2:25 (*5*)	2:25 (*5*)
A-2, A-3, B-4	**S**	2:35 (*10*)	2:45 (*10*)	2:20 (*5*)	2:20 (*5*)	2:40 (*10*)	2:55 (*10*)	2:25 (*5*)	2:25 (*5*)
A-2, B-2, B-4	**SSW**	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)
B-2, B-4, C-2	**SW-WSW**	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)
B-2, C-2	**W**	2:25 (*10*)	2:35 (*10*)	2:10 (*5*)	2:10 (*5*)	2:30 (*10*)	2:45 (*10*)	2:15 (*5*)	2:15 (*5*)
C-2, C-5	**WNW**	2:25 (*10*)	2:35 (*10*)	2:10 (*5*)	2:10 (*5*)	2:30 (*10*)	2:45 (*10*)	2:15 (*5*)	2:15 (*5*)
C-2, C-4, C-5	**NW**	2:30 (*10*)	2:40 (*10*)	2:15 (*5*)	2:15 (*5*)	2:35 (*10*)	2:50 (*10*)	2:20 (*5*)	2:20 (*5*)

Table 15 Peak Construction Year 2014:
Evacuation Time Estimates for Staged EPZ Scenarios (2-Mile Zone, then 5 Miles Downwind)

		Summer				Winter			
Affected ERPAs		**Midweek Daytime**		**Weekend Daytime**	**Evening**	**Midweek Daytime**		**Weekend Daytime**	**Evening**
2-mile Zone (A-1, B-1, C-1, D-1) then:	**Scenario:**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
C-2, C-4, C-5, C-7, C-8	**NNW**	2:40 (*10*)	2:50 (*10*)	2:25 (*5*)	2:25 (*5*)	2:45 (*10*)	3:00 (*10*)	2:30 (*5*)	2:30 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
C-4, C-5, C-7, C-8, D-1, D-4	**N**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-4, C-7, C-8, D-1, D-4	**NNE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-4, C-7, D-1, D-4, D-5	**NE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-7, D-2, D-4, D-5	**ENE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
D-2, D-4, D-5	**E**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
A-3, D-2, D-5	**ESE**	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-2, A-3, D-2	**SE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
A-2, A-3, B-4, D-2	**SSE**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-2, A-3, B-4	**S**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-2, B-2, B-4	**SSW**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
B-2, B-4, C-2	**SW-WSW**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
B-2, C-2	**W**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-5	**WNW**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-4, C-5	**NW**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-4, C-5, C-7, C-8	**NNW**	3:50	4:00	3:25	3:25	3:50	4:15	3:25	3:25

Table 16 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, D-1, D-4	N	2:30	2:40	2:20	2:20	2:30	2:45	2:20	2:20
A-1, B-1, C-1, C-4, C-7, C-8, D-1, D-4	NNE	2:30	2:40	2:20	2:20	2:30	2:45	2:20	2:20
A-1, B-1, C-1, C-4, C-7, D-1, D-4, D-5	NE	2:05	2:15	1:55	1:55	2:05	2:20	1:55	1:55
A-1, B-1, C-1, C-7, D-1, D-2, D-4, D-5	ENE	2:05	2:15	1:55	1:55	2:05	2:20	1:55	1:55
A-1, B-1, C-1, D-1, D-2, D-4, D-5	E	2:05	2:15	1:55	1:55	2:05	2:20	1:55	1:55
A-1, A-3, B-1, C-1, D-1, D-2, D-5	ESE	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, A-2, A-3, B-1, C-1, D-1, D-2	SE	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, A-2, A-3, B-1, B-4, C-1, D-1, D-2	SSE	2:05	2:15	1:55	1:55	2:00	2:15	1:50	1:50
A-1, A-2, A-3, B-1, B-4, C-1, D-1	S	2:05	2:15	1:55	1:55	2:00	2:15	1:50	1:50
A-1, A-2, B-1, B-2, B-4, C-1, D-1	SSW	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50

Table 16 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, B-1, B-2, B-4, C-1, C-2, D-1	SW-WSW	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, B-1, B-2, C-1, C-2, D-1	W	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, B-1, C-1, C-2, C-5, D-1	WNW	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, B-1, C-1, C-2, C-4, C-5, D-1	NW	2:00	2:10	1:50	1:50	2:00	2:15	1:50	1:50
A-1, B-1, C-1, C-2, C-4, C-5, C-7, C-8, D-1	NNW	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, D-1, D-4	N	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-4, C-7, C-8, D-1, D-4	NNE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-4, C-7, D-1, D-4, D-5	NE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, C-7, D-1, D-2, D-4, D-5	ENE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, C-1, D-1, D-2, D-4, D-5	E	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30

Table 16 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 5-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, A-3, B-1, C-1, D-1, D-2, D-5	ESE	3:35	3:45	3:10	3:10	3:35	4:00	3:10	3:10
A-1, A-2, A-3, B-1, C-1, D-1, D-2	SE	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, A-2, A-3, B-1, B-4, C-1, D-1, D-2	SSE	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, A-2, A-3, B-1, B-4, C-1, D-1	S	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, A-2, B-1, B-2, B-4, C-1, D-1	SSW	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, B-2, B-4, C-1, C-2, D-1	SW-WSW	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-1, B-1, B-2, C-1, C-2, D-1	W	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-5, D-1	WNW	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-4, C-5, D-1	NW	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-1, B-1, C-1, C-2, C-4, C-5, C-7, C-8, D-1	NNW	3:40	3:50	3:15	3:15	3:40	4:05	3:15	3:15

Table 17 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, C-9, C-10, C-11, D-1, D-4	**N**	2:55	3:05	2:55 (*10*)	2:55 (*10*)	2:55	3:20	2:55 (*10*)	2:55 (*10*)
A-1, B-1, C-1, C-4, C-7, C-8, C-9, C-10, C-11, D-1, D-4, D-9	**NNE**	2:55	3:05	2:55 (*10*)	2:55 (*10*)	2:55	3:20	2:55 (*10*)	2:55 (*10*)
A-1, B-1, C-1, C-4, C-7, C-9, D-1, D-4, D-5, D-6, D-7, D-8, D-9	**NE**	2:30	2:40	2:30 (*10*)	2:30 (*10*)	2:30	2:55	2:30 (*10*)	2:30 (*10*)
A-1, B-1, C-1, C-7, C-9, D-1, D-2, D-4, D-5, D-6, D-7, D-8, D-9	**ENE**	2:30	2:40	2:30 (*10*)	2:30 (*10*)	2:30	2:55	2:30 (*10*)	2:30 (*10*)
A-1, A-4, B-1, C-1, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8	**E**	2:25	2:35	2:25 (*10*)	2:25 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, A-3, A-4, A-7, B-1, C-1, D-1, D-2, D-3, D-5, D-6, D-7	**ESE**	2:25	2:35	2:25 (*10*)	2:25 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, A-2, A-3, A-4, A-6, A-7, B-1, C-1, D-1, D-2, D-3	**SE**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:30	2:55	2:30 (*10*)	2:30 (*10*)
A-1, A-2, A-3, A-4, A-5, A-6, A-7, B-1, C-1, D-1, D-2	**SSE**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:30	2:55	2:30 (*10*)	2:30 (*10*)

Table 17 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, A-2, A-3, A-5, A-6, A-7, B-1, B-4, C-1, D-1	**S**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:30	2:55	2:30 (*10*)	2:30 (*10*)
A-1, A-2, A-3, A-5, A-6, B-1, B-2, B-4, B-5, C-1, D-1	**SSW**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, A-5, B-1, B-2, B-3, B-4, B-5, C-1, C-2, D-1	**SW**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, D-1	**WSW**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, B-1, B-2, B-3, B-5, C-1, C-2, C-3, C-5, C-6, D-1	**W**	2:35	2:45	2:35 (*10*)	2:35 (*10*)	2:25	2:50	2:25 (*10*)	2:25 (*10*)
A-1, B-1, B-3, C-1, C-2, C-3, C-5, C-6, C-11, D-1	**WNW**	2:45	2:55	2:45 (*10*)	2:45 (*10*)	2:45	3:10	2:45 (*10*)	2:45 (*10*)
A-1, B-1, C-1, C-2, C-3, C-4, C-5, C-6, C-11, D-1	**NW**	2:45	2:55	2:45 (*10*)	2:45 (*10*)	2:45	3:10	2:45 (*10*)	2:45 (*10*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, B-1, C-1, C-4, C-5, C-7, C-8, C-9, C-10, C-11, D-1, D-4	**N**	4:00	4:10	3:50 (*10*)	3:50 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)
A-1, B-1, C-1, C-4, C-7, C-8, C-9, C-10, C-11, D-1, D-4, D-9	**NNE**	4:00	4:10	3:50 (*10*)	3:50 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)

Table 17 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, B-1, C-1, C-4, C-7, C-9, D-1, D-4, D-5, D-6, D-7, D-8, D-9	**NE**	4:05	4:15	3:55 (*10*)	3:55 (*10*)	4:05	4:45	3:55 (*10*)	3:55 (*10*)
A-1, B-1, C-1, C-7, C-9, D-1, D-2, D-4, D-5, D-6, D-7, D-8, D-9	**ENE**	4:05	4:15	3:55 (*10*)	3:55 (*10*)	4:05	4:45	3:55 (*10*)	3:55 (*10*)
A-1, A-4, B-1, C-1, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8	**E**	4:10	4:20	4:00 (*10*)	4:00 (*10*)	4:10	4:50	4:00 (*10*)	4:00 (*10*)
A-1, A-3, A-4, A-7, B-1, C-1, D-1, D-2, D-3, D-5, D-6, D-7	**ESE**	4:10	4:20	4:00 (*10*)	4:00 (*10*)	4:10	4:50	4:00 (*10*)	4:00 (*10*)
A-1 ,A-2, A-3, A-4, A-6, A-7, B-1, C-1, D-1, D-2, D-3	**SE**	4:15	4:25	4:05 (*10*)	4:05 (*10*)	4:15	4:55	4:05 (*10*)	4:05 (*10*)
A-1, A-2, A-3, A-4, A-5, A-6, A-7, B-1, C-1, D-1, D-2	**SSE**	4:15	4:25	4:05 (*10*)	4:05 (*10*)	4:15	4:55	4:05 (*10*)	4:05 (*10*)
A-1, A-2, A-3, A-5, A-6, A-7, B-1, B-4, C-1, D-1	**S**	4:15	4:25	4:05 (*10*)	4:05 (*10*)	4:15	4:55	4:05 (*10*)	4:05 (*10*)
A-1, A-2, A-3, A-5, A-6, B-1, B-2, B-4, B-5, C-1, D-1	**SSW**	3:55	4:05	3:45 (*10*)	3:45 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)
A-1, A-5, B-1, B-2, B-3, B-4, B-5, C-1, C-2, D-1	**SW**	3:55	4:05	3:45 (*10*)	3:45 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)

Table 17 First Operational Year 2016:
Evacuation Time Estimates for Partial EPZ Scenarios (2-Mile Zone Plus 10-Mile Downwind, Unstaged)

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
A-1, B-1, B-2, B-3, B-4, B-5, C-1, C-2, C-3, D-1	WSW	3:55	4:05	3:45 (*10*)	3:45 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)
A-1, B-1, B-2, B-3, B-5, C-1, C-2, C-3, C-5, C-6, D-1	W	3:55	4:05	3:45 (*10*)	3:45 (*10*)	4:00	4:40	3:50 (*10*)	3:50 (*10*)
A-1, B-1, B-3, C-1, C-2, C-3, C-5, C-6, C-11, D-1	WNW	4:10	4:20	4:00 (*10*)	4:00 (*10*)	4:10	4:50	4:00 (*10*)	4:00 (*10*)
A-1, B-1, C-1, C-2, C-3, C-4, C-5, C-6, C-11, D-1	NW	4:10	4:20	4:00 (*10*)	4:00 (*10*)	4:10	4:50	4:00 (*10*)	4:00 (*10*)

Table 18 First Operational Year 2016:
Evacuation Time Estimates for Staged EPZ Scenarios (2-Mile Zone, then 5 Miles Downwind)

		Summer				Winter			
Affected ERPAs		**Midweek Daytime**		**Weekend Daytime**	**Evening**	**Midweek Daytime**		**Weekend Daytime**	**Evening**
2-mile Zone (A-1, B-1, C-1, D-1) then:	**Scenario:**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
C-4, C-5, C-7, C-8, D-1, D-4	**N**	2:35	2:45	2:25	2:25	2:40	2:55	2:30	2:30
C-4, C-7, C-8, D-1, D-4	**NNE**	2:40	2:50	2:30	2:30	2:45	3:00	2:35	2:35
C-4, C-7, D-1, D-4, D-5	**NE**	2:15	2:25	2:05	2:05	2:20	2:35	2:10	2:10
C-7, D-2, D-4, D-5	**ENE**	2:15	2:25	2:05	2:05	2:20	2:35	2:10	2:10
D-2, D-4, D-5	**E**	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
A-3, D-2, D-5	**ESE**	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
A-2, A-3, D-2	**SE**	2:25	2:35	2:15	2:15	2:30	2:45	2:20	2:20
A-2, A-3, B-4, D-2	**SSE**	2:25	2:35	2:15	2:15	2:30	2:45	2:20	2:20
A-2, A-3, B-4	**S**	2:25	2:35	2:15	2:15	2:30	2:45	2:20	2:20
A-2, B-2, B-4	**SSW**	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
B-2, B-4, C-2	**SW-WSW**	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
B-2, C-2	**W**	2:15	2:25	2:05	2:05	2:20	2:35	2:10	2:10
C-2, C-5	**WNW**	2:15	2:25	2:05	2:05	2:20	2:35	2:10	2:10
C-2, C-4, C-5	**NW**	2:20	2:30	2:10	2:10	2:25	2:40	2:15	2:15
C-2, C-4, C-5, C-7, C-8	**NNW**	2:30	2:40	2:20	2:20	2:35	2:50	2:25	2:25

Table 18 First Operational Year 2016: Evacuation Time Estimates for Staged EPZ Scenarios (2-Mile Zone, then 5 Miles Downwind)

		Summer				Winter			
Affected ERPAs		**Midweek Daytime**		**Weekend Daytime**	**Evening**	**Midweek Daytime**		**Weekend Daytime**	**Evening**
2-mile Zone (A-1, B-1, C-1, D-1) then:	**Scenario:**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Weather:	**Normal**	**Adverse**	**Normal**	**Normal**	**Normal**	**Adverse**	**Normal**	**Normal**
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
C-4, C-5, C-7, C-8, D-1, D-4	**N**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-4, C-7, C-8, D-1, D-4	**NNE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-4, C-7, D-1, D-4, D-5	**NE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
C-7, D-2, D-4, D-5	**ENE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
D-2, D-4, D-5	**E**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
A-3, D-2, D-5	**ESE**	3:45	3:55	3:20	3:20	3:45	4:10	3:20	3:20
A-2, A-3, D-2	**SE**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
A-2, A-3, B-4, D-2	**SSE**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-2, A-3, B-4	**S**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
A-2, B-2, B-4	**SSW**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
B-2, B-4, C-2	**SW-WSW**	4:05	4:15	3:40	3:40	4:05	4:30	3:40	3:40
B-2, C-2	**W**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-5	**WNW**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-4, C-5	**NW**	3:55	4:05	3:30	3:30	3:55	4:20	3:30	3:30
C-2, C-4, C-5, C-7, C-8	**NNW**	3:50	4:00	3:25	3:25	3:50	4:15	3:25	3:25

Table 19 Peak Construction Year 2014: Evacuation Time Estimates for TEMA Sectors

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, A-2, A-3, A-4, A-5, A-6, A-7	**Sector A**	2:50 (*15*)	3:00 (*15*)	2:35 (*10*)	2:35 (*10*)	2:40 (*5*)	3:05 (*5*)	2:30 (*5*)	2:30 (*5*)
B-1, B-2, B-3, B-4, B-5	**Sector B**	2:45 (*10*)	2:55 (*10*)	2:30 (*5*)	2:30 (*5*)	2:40 (*5*)	3:05 (*5*)	2:30 (*5*)	2:30 (*5*)
C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-11	**Sector C**	2:55	3:05	2:45	2:45	2:55	3:20	2:45	2:45
D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9	**Sector D**	2:45 (*15*)	2:55 (*15*)	2:30 (*10*)	2:30 (*10*)	2:40 (*10*)	3:05 (*10*)	2:30 (*10*)	2:30 (*10*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, A-2, A-3, A-4, A-5, A-6, A-7	**Sector A**	4:15	4:25	4:05	4:05	4:15	4:55	4:05	4:05
B-1, B-2, B-3, B-4, B-5	**Sector B**	3:55	4:05	3:45	3:45	4:00	4:40	3:50	3:50
C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-11	**Sector C**	4:10	4:20	4:00	4:00	4:10	4:50	4:00	4:00
D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9	**Sector D**	4:10	4:20	4:00	4:00	4:10	4:50	4:00	4:00

Table 20 First Operational Year 2016: Evacuation Time Estimates for TEMA Sectors

		Summer				Winter			
		Midweek Daytime		Weekend Daytime	Evening	Midweek Daytime		Weekend Daytime	Evening
Affected ERPAs	Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weather:	Normal	Adverse	Normal	Normal	Normal	Adverse	Normal	Normal
90 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, A-2, A-3, A-4, A-5, A-6, A-7	**Sector A**	2:40 (*5*)	2:50 (*5*)	2:30 (*5*)	2:30 (*5*)	2:40 (*5*)	3:05 (*5*)	2:30 (*5*)	2:30 (*5*)
B-1, B-2, B-3, B-4, B-5	**Sector B**	2:35	2:45	2:30 (*5*)	2:30 (*5*)	2:35	3:00	2:30 (*5*)	2:30 (*5*)
C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-11	**Sector C**	2:55	3:05	2:50 (*5*)	2:50 (*5*)	2:55	3:20	2:50 (*5*)	2:50 (*5*)
D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9	**Sector D**	2:35 (*5*)	2:45 (*5*)	2:25 (*5*)	2:25 (*5*)	2:35 (*5*)	3:00 (*5*)	2:25 (*5*)	2:25 (*5*)
100 Percent Evacuation of Affected Areas (hours:minutes) (*increase over 2013 Study in minutes, if any*)									
A-1, A-2, A-3, A-4, A-5, A-6, A-7	**Sector A**	4:15	4:25	4:10 (*5*)	4:10 (*5*)	4:15	4:55	4:10 (*5*)	4:10 (*5*)
B-1, B-2, B-3, B-4, B-5	**Sector B**	3:55	4:05	3:50 (*5*)	3:50 (*5*)	4:00	4:40	3:55 (*5*)	3:55 (*5*)
C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-11	**Sector C**	4:10	4:20	4:05 (*5*)	4:05 (*5*)	4:10	4:50	4:05 (*5*)	4:05 (*5*)
D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9	**Sector D**	4:10	4:20	4:05 (*5*)	4:05 (*5*)	4:10	4:50	4:05 (*5*)	4:05 (*5*)

6.4 Performance Metrics for Simulation Model

The performance of VISSIM is assessed using standard metrics, consistent with the guidance provided in CR-7002. Tables 21 and 22 provide a summary of simulation parameters for the Winter Weekday Normal Weather scenario for the full EPZ under both the 2014 peak construction year and the 2016 operational year. Note that the average travel times reported reflect travel to the designated reception centers, rather than the travel time to exit the EPZ. The tables reflect higher number of total trips and lower average speed during the construction scenario due to the increase in on-site personnel.

Table 21 Summary of Network Performance for Peak Construction Year 2014 (Full 10-Mile EPZ, Winter Weekday, Normal Weather)

	All Vehicles	Background/Shadow	Evacuation
Average Delay (s)	1,537	848	2,098
Average Stop Delay (s)	379	263	473
Average No. of Stops	171	89	238
Average Speed (mph)	34.9	35.4	34.7
Average Travel Time (hr)	2.2	1.7	2.7
Vehicle Hours Traveled	55,256	18,610	36,646
Vehicle Miles Traveled	1,929,005	659,403	1,269,602
No. of Completed Trips	26,263	11,011	15,252

Table 22 Summary of Network Performance for First Operational Year 2016 (Full 10-Mile EPZ, Winter Weekday, Normal Weather)

	All Vehicles	Background/Shadow	Evacuation
Average Delay (s)	1,319	851	1,718
Average Stop Delay (s)	325	260	380
Average No. of Stops	143	90	187
Average Speed (mph)	35.7	35.4	35.8
Average Travel Time (hr)	2.2	1.7	2.6
Vehicle Hours Traveled	52,087	18,710	33,377
Vehicle Miles Traveled	1,858,559	662,201	1,196,357
No. of Completed Trips	24,012	11,089	12,923

7. Traffic Control Recommendations

Table 23 lists control type and average queue lengths for the top 10 high-volume intersections in the model network. These volumes are based on the normal winter-day scenario for the evacuation of the full 10-mile EPZ. While no new or specialized traffic control plans were suggested by the modeling effort, this table shows intersections with the potential for congestion. The traffic simulation results for Watts Bar indicate that traffic flow will not encounter significant congestion inside the EPZ. However, Table 23 reveals locations where additional traffic management could be best deployed to achieve a reduction in ETEs.

Because of the large increase in on-site traffic at WBN during the peak construction year, it is recommended that law enforcement personnel be present to allow traffic to exit WBN onto TN 68. TVA personnel at WBN have confirmed that this traffic routinely enters and exits the site with local law enforcement assistance during normal daily operations. However, under emergency conditions, it is anticipated that TVA's security force will provide traffic control for the evacuation of the plant site.

Table 23 Predicted Queuing at Major Intersections (Full 10-mile EPZ, Winter Weekday, Normal Weather)

Intersection Name	City/Town/Area	Control Type	Average Queue (feet)	Volume
S White St (TN 30) at New Englewood Rd (TN 39)	Athens, TN	Signalized	60	7,024
Green St (TN 30) at E Madison Ave	Athens, TN	Signalized	<20	6,592
Green St (TN 30) at Ingleside Ave	Athens, TN	Signalized	<20	5,488
Rhea County Hwy (TN 29) at Hiwassee Hwy	Dayton, TN	Signalized	620	4,820
U.S. 27 SB off-ramp at Co Hwy 2158	Soddy Daisy, TN	Signalized	180	3,540
N Gateway Ave at Roane State Hwy	Rockwood, TN	Signalized	<20	3,358
Decatur Pike (TN 30) at N Jackson St	Athens, TN	Signalized	<20	3,248
Rhea County Hwy (TN 29) at Old Washington Hwy (TN 30)	Dayton, TN	Signalized	<20	2,972
David W Lillard Memorial Hwy at Co Rd 100	Decatur, TN*	Two-way Stop	<20	2,030
TN 30 at TN 58	Decatur, TN*	Signalized	280	1,374

*Inside EPZ Boundary

Table B-1 ETE Review Criteria Checklist ***Watts Bar***

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
1.0 Introduction		
a. The emergency planning zone (EPZ) and surrounding area should be described.	yes	Sect 1.2 of 2013 ETE study (2013)
b. A map should be included that identifies primary features of the site, including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ.	yes	Figures 1-1, 1-2, and 1-3 of 2013 ETE study. Figures 1 and 2 of Addendum study.
c. A comparison of the current and previous ETE should be provided and includes similar information as identified in Table 1-1, "ETE Comparison," of NUREG/CR-7002.	yes	Table 1-3 of 2013 ETE study / Table 2 Addendum
1.1 Approach		
a. A discussion of the approach and level of detail obtained during the field survey of the roadway network should be provided.	yes	Section 4.3 and Appendix D of 2013 ETE study
b. Sources of demographic data for schools, special facilities, large employers, and special events should be identified.	yes	Sect. 2.1, Sect. 3 of 2013 ETE study
c. Discussion should be presented on use of traffic control plans in the analysis.	yes	Sect 2.1 (2013) / Sec 4.1 Addendum
d. Traffic simulation models used for the analyses should be identified by name and version.	yes	Sect 5.5.2 and Table 1-3 (2013) / Section 1.1
e. Methods used to address data uncertainties should be described.	yes	Sect 2.1, 6.6, 6.7 of 2013 ETE study
1.2 Assumptions		
a. The planning basis for the ETE includes the assumption that the evacuation is ordered promptly and no early protective actions have been implemented.	yes	Sect 2.1, 3, 5.4 of 2013 ETE study
b. Assumptions consistent with Table 1-2, "General Assumptions," of NUREG/CR-7002 should be provided and include the basis to support their use.	yes	Sect 2.1 of 2013 and Addendum studies
1.3 Scenario Development		
a. The ten scenarios in Table 1-3, Evacuation Scenarios, should be developed for the ETE analysis, or a reason should be provided for use of other scenarios.	yes	All scenarios updated except special event

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
1.3.1 Staged Evacuation		
a. A discussion should be provided on the approach used in development of a staged evacuation.	yes	Sect 6.4 of 2013 ETE study / Section 6.2 Addendum
1.4 Evacuation Planning Areas		
a. A map of the EPZ with emergency response planning areas (ERPAs) should be included.	yes	Figure 1-2 (2013) / Figure 1 Addendum
b. A table should be provided identifying the ERPAs considered for each ETE calculation by downwind direction in each sector.	yes	Table 5-1 of 2013 ETE study / Table 10 Addendum
c. A table similar to Table 1-4, "Evacuation Areas for a Staged Evacuation Keyhole," of NUREG/CR-7002 should be provided and includes the complete evacuation of the 2, 5, and 10 mile areas and for the 2 mile area/5 mile keyhole evacuations.	yes	Table 5-1 of 2013 ETE study / Table 10 Addendum
2.0 Demand Estimation		
a. Demand estimation should be developed for the four population groups, including permanent residents of the EPZ, transients, special facilities, and schools.	yes	Table 3-1 thru 3-4 (2013) / Table 8 Addendum
2.1 Permanent Residents and Transient Population		
a. The US Census should be the source of the population values, or another credible source should be provided.	yes	Sect 2.1 in both the 2013 and Addendum studies
b. Population values should be adjusted as necessary for growth to reflect population estimates to the year of the ETE.	yes	Table 1 and Sect 2.1 of Addendum
c. A sector diagram should be included, similar to Figure 2-1, "Population by Sector," of NUREG/CR-7002, showing the population distribution for permanent residents.	yes	Appendix C of 2013 ETE study
2.1.1 Permanent Residents with Vehicles		
a. The persons per vehicle value should be between 1 and 2 or justification should be provided for other values.	yes	Sect 3.1.1 of 2013 ETE study / Sect 2.3 Addendum
b. Major employers should be listed.	yes	Table B-1 of 2013 ETE study
2.1.2 Transient Population		
a. A list of facilities which attract transient populations should be included, and peak and average attendance for these facilities should be listed. The source of information used to develop attendance values should be provided.	yes	Table B-2 of 2013 ETE study
b. The average population during the season should be used,	yes	Sect 3.2 of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
itemized and totaled for each scenario.		
c. The percent of permanent residents assumed to be at facilities should be estimated.	yes	Sect 3.3 of 2013 ETE study
d. The number of people per vehicle should be provided. Numbers may vary by scenario, and if so, discussion on why values vary should be provided.	yes	Sect 2.1, 3.3, Tables B-1, B-2 of 2013 ETE study
e. A sector diagram should be included, similar to Figure 2-1 of NUREG/CR-7002, showing the population distribution for the transient population.	yes	Table 3-2 of 2013 ETE study
2.2 Transit Dependent Permanent Residents		
a. The methodology used to determine the number of transit dependent residents should be discussed.	yes	Sect 3.1.2 of 2013 ETE study
b. Transportation resources needed to evacuate this group should be quantified.	yes	Sect 3.1.2 and Table 3-5 of 2013 ETE study
c. The county/local evacuation plans for transit dependent residents should be used in the analysis.	yes	Sect 3.1.2 of 2013 ETE study
d. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities should be provided. Data from local/county registration programs should be used in the estimate, but should not be the only set of data.	yes	Sect 3.1.2 of 2013 ETE study
e. Capacities should be provided for all types of transportation resources. Bus seating capacity of 50% should be used or justification should be provided for higher values.	yes	Sect 2.1 of 2013 ETE study
f. An estimate of this population should be provided and information should be provided that the existing registration programs were used in developing the estimate.	yes	Sect 3.1.2 of 2013 ETE study
g. A summary table of the total number of buses, ambulances, or other transport needed to support evacuation should be provided and the quantification of resources should be detailed enough to assure double counting has not occurred.	yes	Table 3-5 of 2013 ETE study
2.3 Special Facility Residents		
a. A list of special facilities, including the type of facility, location, and average population should be provided. Special facility staff should be included in the total special	yes	Table B-4 of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
facility population.		
b. A discussion should be provided on how special facility data was obtained.	yes	Sect 3.4 of 2013 ETE study / Sect 2.3 Addendum
c. The number of wheelchair and bed-bound individuals should be provided.	yes	Table B-4 of 2013 ETE study
d. An estimate of the number and capacity of vehicles needed to support the evacuation of the facility should be provided.	yes	Table B-4 of 2013 ETE study
e. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) should be discussed when appropriate.	N/A	Part of 2013 ETE study
2.4 Schools		
a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, should be provided. The source of this information should be provided.	yes	Sect 3.4.2, Table 3-3 & Table B-3 of 2013 ETE study
b. Transportation resources for elementary and middle schools are based on 100% of the school capacity.	yes	Sect 3.4.2, Table B-3 of 2013 ETE study
c. The estimate of high school students who will use their personal vehicle to evacuate should be provided and a basis for the values used should be provided.	yes	Sect 3 of 2013 ETE study
d. The need for return trips should be identified if necessary.	yes	Sect 6.8 of 2013 ETE study
2.5.1 Special Events		
a. A complete list of special events should be provided and includes information on the population, estimated duration, and season of the event.	yes	Sect 6.9 of 2013 ETE study
b. The special event that encompasses the peak transient population should be analyzed in the ETE.	yes	Sect 6.9 of 2013 ETE study
c. The percent of permanent residents attending the event should be estimated.	yes	Sect 6.9 of 2013 ETE study
2.5.2 Shadow Evacuation		
a. A shadow evacuation of 20 percent should be included for areas outside the evacuation area extending to 15 miles from the NPP.	yes	Sect 1.2, 1.4, 6.4 (2013) / Sect 2.1 Addendum
b. Population estimates for the shadow evacuation in the 10 to 15 mile area beyond the EPZ are provided by sector.	yes	Appendix C of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
c. The loading of the shadow evacuation onto the roadway network should be consistent with the trip generation time generated for the permanent resident population.	yes	Sect 5 of 2013 ETE and Addendum studies
2.5.3 Background and Pass Through Traffic		
a. The volume of background traffic and pass-through traffic should be based on the average daytime traffic. Values may be reduced for nighttime scenarios.	yes	Sect 2.1, 4.3 of 2013 ETE study
b. Pass-through traffic should be assumed to have stopped entering the EPZ about two hours after the initial notification.	yes	Sect 2.1, 4.3 of 2013 ETE study
2.6 Summary of Demand Estimation		
a. A summary table should be provided that identifies the total populations and total vehicles used in the analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand used in each scenario.	yes	Table 3-1 thru 3-4 of 2013 ETE study And Table 8 of Addendum
3.0 Roadway Capacity		
a. The method(s) used to assess roadway capacity should be discussed.	yes	Sect 4 of 2013 ETE and Addendum studies
3.1 Roadway Characteristics		
a. A field survey of key routes within the EPZ has been conducted.	yes	Sect 4.1 of 2013 ETE and Addendum studies
b. Information should be provided describing the extent of the survey, and types of information gathered and used in the analysis.	yes	Sect 4.3 of 2013 ETE study / Sect 4.1 Addendum
c. A table similar to that in Appendix A, "Roadway Characteristics," of NUREG/CR-7002 should be provided.	yes	Appendix D of 2013 ETE study
d. Calculations for a representative roadway segment should be provided.	yes	Appendix D of 2013 ETE study
e. A legible map of the roadway system that identifies node numbers and segments used to develop the ETE should be provided and should be similar to Figure 3-1, "Roadway Network Identifying Nodes and Segments," of NUREG/CR-7002.	yes	Figure 4-1 plus map in Appendix D of 2013 ETE study Figure 2 Addendum
3.2 Capacity Analysis		
a. The approach used to calculate the roadway capacity for the transportation network should be described in detail and	yes	Sect 4.3 of 2013 ETE study / Sect 4.1 Addendum

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
identifies factors that are expressly used in the modeling.		
b. The capacity analysis identifies where field information should be used in the ETE calculation.	yes	Sect 4.3 of 2013 ETE study / Sect 4.1 Addendum
3.3 Intersection Control		
a. A list of intersections should be provided that includes the total numbers of intersections modeled that are unsignalized, signalized, or manned by response personnel.	yes	Sect 7 of 2013 and Addendum studies
b. Characteristics for the 10 highest volume intersections within the EPZ are provided including the location, signal cycle length, and turn lane queue capacity.	yes	Table 7-1 of 2013 ETE study / Table 23 Addendum
c. Discussion should be provided on how time signal cycle is used in the calculations.	yes	Sect 4.3 of 2013 ETE study
3.4 Adverse Weather		
a. The adverse weather condition should be identified and the effect of adverse weather on mobilization should be considered.	yes	Sect 2.4 of 2013 ETE study / Updated ETE provided
b. The speed and capacity reduction factors identified in Table 3-1, "Weather Capacity Factors," of NUREG/CR-7002 should be used or a basis should be provided for other values.	yes	Sect 2.4 of 2013 ETE study
c. The study identifies assumptions for snow removal on streets and driveways, when applicable.	N/A	Moderate conditions assumed; no snow removal req'd
4.0 Development of Evacuation Times		
4.1 Trip Generation Time		
a. The process used to develop trip generation times should be identified.	yes	Sect 5 of 2013 ETE and Addendum studies
b. When telephone surveys are used, the scope of the survey, area of the survey, number of participants, and statistical relevance should be provided.	yes	Appendix E of 2013 ETE study
c. Data obtained from telephone surveys should be summarized.	yes	Appendix E of 2013 ETE study
d. The trip generation time for each population group should be developed from site specific information.	yes	Sect 5 of 2013 ETE and Addendum studies
4.1.1 Permanent Residents and Transient Population		
a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip	yes	Sect 5 of 2013 ETE and Addendum studies

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
generation time includes the assumption that a percentage of residents will need to return home prior to evacuating.		
b. Discussion should be provided on the time and method used to notify transients. The trip generation time discusses any difficulties notifying persons in hard to reach areas such as on lakes or in campgrounds.	yes	Sect 5 of 2013 ETE and Addendum studies
c. The trip generation time accounts for transients potentially returning to hotels prior to evacuating.	yes	Sect 5 of 2013 ETE and Addendum studies
d. Effect of public transportation resources used during special events where a large number of transients are expected should be considered.	N/A	No public transportation planned for event
e. The trip generation time for the transient population should be integrated and loaded onto the transportation network with the general public.	yes	Sect 5 of 2013 ETE and Addendum studies
4.1.2 Transit Dependent Residents		
a. If available, existing plans and bus routes are used in the ETE analysis. If new plans are developed with the ETE, they should have been agreed upon by the responsible authorities.	N/A	Bus routes for transit dependent not developed. Assumed buses take shortest path out of EPZ at average evacuation travel speed
b. Discussion should be included on the means of evacuating ambulatory and non-ambulatory residents.	yes	Sect 5.3 of 2013 ETE study
c. The number, location and availability of buses, and other resources needed to support the demand estimation are provided.	N/A	Table 3-5 of 2013 ETE study
d. Logistical details, such as the time to obtain buses, brief drivers and initiate the bus route are provided.	yes	Sect 5.4.3, 6.8 of 2013 ETE study
e. Discussion should identify the time estimated for transit dependent residents to prepare and then travel to a bus pickup point, and describes the expected means of travel to the pickup point.	yes	Sect 6.8 of 2013 ETE study
f. The number of bus stops and time needed to load passengers should be discussed.	yes	Sect 6.8 of 2013 ETE study
g. A map of bus routes should be included.	N/A	Bus routes not developed; see 4.1.2a
h. The trip generation time for non-ambulatory persons includes the time to mobilize ambulances or special vehicles, time to drive to the home of residents, loading time,	yes	Section 6.8 of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
and time to drive out of the EPZ should be provided.		
i. Information should be provided to support analysis of return trips, if necessary.	yes	Sect 6.8 of 2013 ETE study
4.1.3 Special Facilities		
a. Information on evacuation logistics and mobilization times should be provided.	yes	Sect 6.8 of 2013 ETE study
b. Discussion should be provided on the inbound and outbound speeds.	yes	Sect 6.8 of 2013 ETE study
c. The number of wheelchair and bed-bound individuals should be provided, and the logistics of evacuating these residents should be discussed.	yes	Table B-4 of 2013 ETE study
d. Time for loading of residents should be provided.	yes	Sect 6.8 of 2013 ETE study
e. Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	yes	Table 6-7 of 2013 ETE study
f. If return trips are needed, the destination of vehicles should be provided.	N/A	Return trips are not anticipated.
g. Discussion should be provided on whether special facility residents are expected to pass through the reception center prior to being evacuated to their final destination.	yes	Sect 5.4.3 of 2013 ETE study
h. Supporting information should be provided to quantify the time elements for the return trips.	yes	Sect 6.8 of 2013 ETE study
4.1.4 Schools		
a. Information on evacuation logistics and mobilization times should be provided.	yes	Sect 6.8 of 2013 ETE study
b. Discussion should be provided on the inbound and outbound speeds.	yes	Sect 6.8 of 2013 ETE study
c. Time for loading of students should be provided.	yes	Sect 6.8 of 2013 ETE study
d. Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	yes	Table 6-8 of 2013 ETE study
e. If return trips are needed, the destination of school buses should be provided.	N/A	Return trips are not anticipated.
f. If used, reception centers should be identified. Discussion should be provided on whether students are expected to pass through the reception center prior to being evacuated	yes	Sect 5.4.3 of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
to their final destination.		
g. Supporting information should be provided to quantify the time elements for the return trips.	N/A	Return trips are not anticipated.
4.2 ETE Modeling		
a. General information about the model should be provided and demonstrates its use in ETE studies.	yes	Sect 5.5 of 2013 ETE and Addendum Studies
b. If a traffic simulation model is not used to conduct the ETE calculation, sufficient detail should be provided to validate the analytical approach used. All criteria elements should have been met, as appropriate.	N/A	Traffic simulation model was used for this study
4.2.1 Traffic Simulation Model Input		
a. Traffic simulation model assumptions and a representative set of model inputs should be provided.	yes	Sect 5.5 of 2013 ETE and Addendum studies
b. A glossary of terms should be provided for the key performance measures and parameters used in the analysis.	yes	Sect 5.5, 6.7 of 2013 ETE and Addendum studies
4.2.2 Traffic Simulation Model Output		
a. A discussion regarding whether the traffic simulation model used must be in equilibration prior to calculating the ETE should be provided.	yes	Sect 5.5 of 2013 ETE and Addendum studies
b. The minimum following model outputs should be provided to support review: 1. Total volume and percent by hour at each EPZ exit mode. 2. Network wide average travel time. 3. Longest Queue length for the 10 intersections with the highest traffic volume. 4. Total vehicles exiting the network. 5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the EPZ. 6. Average speed for each major evacuation route that exits the EPZ.	yes	Sect 6 and Appendix F of 2013 ETE study Sect 6 of Addendum
c. Color coded roadway maps should be provided for various times (i.e., at 2, 4, 6 hrs., etc.) during a full EPZ evacuation scenario, identifying areas where long queues exist including level of service (LOS) "E" and LOS "F" conditions,	yes	Appendix F of 2013 ETE study

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
if they occur.		
4.3 Evacuation Time Estimates for the General Public		
a. The ETE should include the time to evacuate 90% and 100% of the total permanent resident and transient population.	yes	Table 6-1 (2013) / Table 11 & 12 Addendum
b. The ETE for 100% of the general public should include all members of the general public. Any reductions or truncated data should be explained.	yes	Table 6-1 (2013) / Table 11 & 12 Addendum
c. Tables should be provided for the 90 and 100 percent ETEs similar to Table 4-3, "ETEs for Staged Evacuation Keyhole," of NUREG/CR-7002.	yes	Table 6-4 (2013) / Tables 13-18 Addendum
d. ETEs should be provided for the 100 percent evacuation of special facilities, transit dependent, and school populations.	yes	Sect 6 of 2013 Study
5.0 Other Considerations		
5.1 Development of Traffic Control Plans		
a. Information that responsible authorities have approved the traffic control plan used in the analysis should be provided.	yes	Sect 7 of both 2013 and Addendum studies
b. A discussion of adjustments or additions to the traffic control plan that affect the ETE should be provided.	yes	Sect 7 of both 2013 and Addendum studies
5.2 Enhancements in Evacuation Time		
a. The results of assessments for improvement of evacuation time should be provided.	yes	Sect 7 (2013 & Addendum) / Sect 4.1 Addendum
b. A statement or discussion regarding presentation of enhancements to local authorities should be provided.	yes	Sect 7 (2013 & Addendum) / Sect 4.1 Addendum
5.3 State and Local Review		
a. A list of agencies contacted and the extent of interaction with these agencies should be discussed.	yes	Sect 2 of 2013 Study
b. Information should be provided on any unresolved issues that may affect the ETE.	N/A	No unresolved issues were identified
5.4 Reviews and Updates		
a. A discussion of when an updated ETE analysis is required to be performed and submitted to the NRC.	yes	Sect 6.6 of 2013 Study
5.5 Reception Centers and Congregate Care Center		
a. A map of congregate care centers and reception centers should be provided.	yes	Figure 4-1 of 2013 Study / Figure 2 Addendum
b. If return trips are required, assumptions used to estimate	N/A	Return trips not required

	Criterion Addressed in ETE Analysis (Yes/No)	Comments
return times for buses should be provided.		
c. It should be clearly stated if it is assumed that passengers are left at the reception center and are taken by separate buses to the congregate care center.	yes	Sect 3.1.2 of 2013 Study

Technical Reviewer Thomas Montz Date 5/5/14

Supervisory Review Akhil Chauhan Date 5/5/14