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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

December 22, 2008

UN#08-096

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

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Submittal of Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3
RAI No. 36, Revision 0 – Emergency Planning

Reference: John Rycyna (NRC) to George Wrobel (UniStar), "RAI No 36 ORLT 1194.doc (P)," email dated November 20, 2008

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear, dated November 20, 2008 (Reference). This RAI addresses Emergency Planning, as submitted in Part 5 of the CCNPP Unit 3 Combined License Application (COLA).

Enclosure 1 provides the response to RAI No. 36. Enclosures 2 and 3 provide copies of the "Calvert Cliffs Nuclear Power Plant, Development of Evacuation Time Estimates," and the "Addendum to Calvert Cliffs Nuclear Power Plant, Development of Evacuation Time Estimates." Enclosure 4 provides a large scale traffic map of the Calvert Cliffs region. Enclosure 5 provides page markups for the "Calvert Cliffs Nuclear Power Plant Unit 3, Emergency Response Plan" and "CCNPP Unit 3 Impact to CCNPP Units 1 & 2 Emergency Preparedness Program Evaluation."

The enclosure provides our response to RAI 36, which includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA. There are no new regulatory commitments in this correspondence.

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NRO

If there are any questions regarding this transmittal, please contact me at (410) 470-4205 or Mr. George Wrobel at (585) 771-3535.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 22, 2008

Greg Gibson

Enclosures:
1) Response to RAI No. 36, Revision 0, Emergency Planning
2) Calvert Cliffs Nuclear Power Plant, Development of Evacuation Time Estimates
3) Addendum to Calvert Cliffs Nuclear Power Plant, Development of Evacuation Time Estimates
4) Large Scale Traffic Map of the Calvert Cliffs Site Region
5) Page Markups for the "Calvert Cliffs Nuclear Power Plant Unit 3, Emergency Response Plan" and "CCNPP Unit 3 Impact to CCNPP Units 1 & 2 Emergency Preparedness Program Evaluation"

cc: U.S. NRC Region I
U.S. NRC Resident Inspector, Calvert Cliffs Nuclear Power Plant, Units 1 and 2
NRC Environmental Project Manager, U.S. EPR Combined License Application
NRC Project Manager, U.S. EPR Combined License Application
NRC Project Manager, U.S. EPR Design Certification Application (w/o enclosure)

Enclosure 1

Response to RAI No. 36, Revision 0

Emergency Planning

RAI Response Introduction

The CCNPP Evacuation Time Estimate (ETE) has been updated to consider the population projected to 2008, the addition of CCNPP Unit 3 and the effect of the construction activities on evacuation time. A copy of the final updated ETE report, dated April, 2008, is provided as Enclosure 2. Subsequent sensitivity studies and ETE cases were deemed necessary and an addendum to the ETE report was issued in August, 2008. This addendum is provided as Enclosure 3.

In our response to Request for Additional Information No. 36 Revision 0, the issues are addressed with respect to the above referenced Evacuation Time Estimate reports.

COLA Impact

The updated ETE Report and ETE Report Addendum will be provided in a future revision of the CCNPP Unit 3 COLA. Additionally, the "Calvert Cliffs Nuclear Power Plant Unit 3, Emergency Response Plan" and "CCNPP Unit 3 Impact to CCNPP Units 1 & 2 Emergency Preparedness Program Evaluation" will be updated as shown on the page markups provided with Enclosure 5.

NRC RAI 13.03-1

ETE-1: **Subject:** Preparation of an Evacuation Time Estimate
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Section 1.1, "Purpose," (page 1-1) of the Calvert Cliffs Nuclear Power Plant (CCNPP) Evacuation Time Estimate (ETE) states that the results of the study reflects changes in population and the road network which occurred since the last revision in 1998. Data for this revision was collected until December 21, 2001. The ETE does not mention the addition of Unit 3 at the CCNPP site or evaluate the affect it would have on the evacuation time estimate. Explain why the ETE does not mention the addition of Unit 3 and the effect the activities surrounding its construction and operation will have on evacuation.

Response

An update to the CCNPP ETE was contracted in 2007. This effort considered the population projected to 2008, the addition of CCNPP Unit 3 and the effect of the construction activities on evacuation time. The final ETE report was provided in April, 2008 (Enclosure 2). Subsequent sensitivity studies and ETE cases were deemed necessary and an addendum to the ETE report was issued in August, 2008 (Enclosure 3).

Detailed road surveys were conducted in July 2007 to document the existing roadway network within the EPZ and within the Shadow Region (see Section 7.1 and Figure 7-2 in the ETE report). The response to RAI 13.03-8 describes the road survey in detail. The observations from the road survey were used to create a link-node analysis network (see Figure 1-2 in the ETE report). Census data for Year 2000 were used to estimate the permanent resident population within the EPZ and the Shadow Region. The population was extrapolated to 2008 using county-specific growth rates provided by the State of Maryland – Department of Planning. The results of the telephone survey, which are documented in Appendix F of the ETE report, were used to estimate the vehicle demand and the pre-trip mobilization time distributions used to load the network with evacuating vehicles to compute ETE. A data gathering effort was conducted in 2007 to estimate the transient population within the EPZ and the number of employees commuting into the EPZ to work (see Section 3 of the ETE report). Therefore, a 2008 base year was assumed in the new ETE study.

Section 3 of the ETE report (see page 3-2) discusses a "special event" scenario (Scenario 11) which represents a typical summer, midweek, midday with construction workers on site at CCNPP Unit 3 when an evacuation is advised due to an incident at one of the operational units (Units 1 and 2). As stated, the peak construction year is estimated to be in 2013 with a workforce of 3,940 workers. A traffic impact analysis (TIA) study was performed to determine mitigation measures needed during the construction years to alleviate any traffic congestion problems caused by the influx of construction traffic. The construction shift schedule assumptions and the average vehicle occupancy of 1.3 construction workers per vehicle used in the TIA were also used in the ETE study for Scenario 11. This scenario also assumes that an outage at one of the operational units is coincident with construction of CCNPP Unit 3. As discussed on page 3-2, these assumptions result in 2,821 additional vehicles present at the CCNPP site under Scenario 11 conditions. The existing roadways were modeled for Scenario 11, with a signal added at the intersection of Nursery Road and Maryland Route 2/4 to service

construction traffic. No roadway improvements were considered for Scenario 11 in the ETE study as the TIA study is still ongoing (see the response to RAI 13.03-11E).

Table 6-2 of the ETE report identifies the scenarios considered in the ETE study. As detailed in the footnote to Table 6-4, permanent resident and shadow populations were extrapolated to 2013 for Scenario 11, when construction activities will be at their peak. The extrapolation of population an additional 5 years plus the additional vehicles present for construction activities results in 5,800 additional vehicles evacuating for Scenario 11 when compared to Scenario 1. Comparison of the ETE for Scenarios 1 and 11 in Tables 7-1B, C and D indicates that the additional vehicle demand results in a 40 minute increase in ETE at the 90th percentile, and a 20 minute increase in ETE at the 95th and 100th percentiles of the population for an evacuation of the entire EPZ (Region R03).

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-2

ETE-2: **Subject:** Population Projections
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, RG 1.206
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 2, "Study Area Description," (page 2-6) states that the population increased 10% from 1997 to 2000. Population estimates for the counties in the Plume Exposure Pathway Emergency Planning Zone (EPZ) are listed as: Calvert County 34,345; St. Mary's County 100,378; and Dorchester County 31,846. These values do not agree with those in the Environmental Report. The following information needs to be provided and addressed in a revision to the Evacuation Time Estimate:

1. A current estimate of the population in the EPZ which includes Calvert County, St. Mary's County, and Dorchester County. If it is assumed that the population is unchanged, provide the basis for the assumption.
2. A projection of the population though the construction period which is scheduled through 2015;
3. Updated maps, figures, and tables should be provided along with any updates to population data;
4. An explanation for differences between the estimates in the Environmental Report and the Evacuation Time Estimate.

B. Section 3.2.3, "Assumptions Used in Developing the Evacuation Time Estimates," (page 3-4) states that the 2000 Census was used as interpreted by the Maryland Department of Planning. Discuss what is meant by "as interpreted by the Maryland Department of Planning." Provide additional Information to explain whether the actual Census values were used or if those values were adjusted. If they were adjusted, an explanation of this process should also be provided.

Response

A.1. Section 3 of the 2008 ETE report (Enclosure 2) documents the permanent resident population estimates for the CCNPP EPZ. Table 3-1 indicates the EPZ population has grown from 45,133 in 2000 to 55,205 in 2008, or 22.3%. The permanent resident population was estimated by overlaying the EPZ boundary and 2000 Census data using Geographical Information Systems (GIS) software. These population data were then extrapolated to 2008 using county-specific growth rates obtained from the Maryland Department of Planning website – 23.5%, 19.5% and 5.3% for Calvert, St. Mary's and Dorchester Counties, respectively. The following table summarizes the population by county:

COUNTY	2000 Population	2008 Population
Calvert	32,822	40,536
St. Mary's	12,016	14,358
Dorchester	295	311
TOTAL	**45,133**	**55,205**

A.2. As discussed on page 3-2 of the 2008 ETE report, the peak construction year is estimated as 2013. Scenario 11 is a "special event" scenario which includes additional vehicles present for both the construction of CCNPP Unit 3 and for a refueling outage of one of the operational units. The permanent resident and shadow populations were extrapolated to 2013 for this scenario. Table 6-4 indicates a total of 30,959 resident vehicles (sum of columns 2 and 3) and 10,714 shadow vehicles for Scenario 11. Based on the telephone survey results of 2.80 persons per household (see Figure F-1) and 1.46 evacuating vehicles per household (see Figure F-8), the 2013 permanent resident and shadow populations evacuation for Scenario 11 are 59,373 (30,959 ÷ 1.46 x 2.80) and 20,547 (10,714 ÷ 1.46 x 2.80), respectively. Note, however, that only 31% of the shadow population is evacuating for Scenario 11 (see Table 6-3), which accounts for the assumption that 30% of permanent residents in the Shadow Region plus a proportional number of employees in the Shadow Region, will voluntarily evacuate (see "Shadow" footnote to Table 6-3). The population of the Shadow Region in year 2013 is therefore 20,547 ÷ 31% = 66,281, compared with a year 2000 estimate of 60,188 (see final sentence on page I-2).

As stated in Appendix 4 of NUREG-0654, Rev. 1, "...evacuation time estimates should be updated as local conditions change." The base year for this ETE analysis is 2008. As a result, follow-up ETE studies will be provided when population or other local conditions change.

A.3. Permanent resident population and vehicle estimates for 2008 are presented in Table 3-2. Figures 3-2 and 3-3 present the permanent resident population and permanent resident vehicle estimates by sector and distance from the CCNPP.

Table 3-3 summarizes the transient population and vehicle estimates for 2008, while Figures 3-4 and 3-5 present the transient population and transient vehicle estimates by sector and distance from the CCNPP.

Table 3-4 summarizes the employee (those who live outside the EPZ and commute into the EPZ to work) population and vehicle estimates for 2008, while Figures 3-6 and 3-7 present the transient population and transient vehicle estimates by sector and distance from the CCNPP.

A.4. Table 2.5-6 of the Environmental Report (ER) presents a year 2000 population estimate of 48,755 people (40,745 permanent residents plus 8,010 transients). Note, however, that the ER only estimates population out to 10 miles. The ETE, on the other hand, estimates population within the EPZ, which extends beyond the 10 mile radius in several areas (see Figure 3-1 of the 2008 ETE report). Table 3-1 of the ETE report estimates the year 2000 permanent population within the EPZ as 45,133 people. Based on the GIS analysis for estimating population used in the ETE, there are 3,869 people residing between the 10-mile radius and the EPZ boundary. Therefore, the ETE estimate of year 2000 permanent resident population estimate within 10 miles is 41,264 people (45,133 – 3,869), 1.3% more than the ER estimate of 40,745. The estimate of 5,954 transients (4,640 + 1,314) for ETE purposes is about 25% lower than that of the ER. See discussion in the responses to RAI 13.03-6 and RAI 13.03-9.

The ER does not provide a 2008 population estimates; however, Table 2.5-9 presents a 2010 population (residents + transients) within 10 miles of CCNPP of 57,937 people. The 2008 EPZ population estimate presented in the ETE is 61,159 people [55,205 residents (see Table 3-1) + 4,640 transients (see Table 3-3) + 1,314 commuter-employees (see Table 3-4)].

B. As stated in the response to part A.1 above, the permanent resident population was estimated using 2000 Census data in a GIS environment. The population estimates were then

extrapolated to 2008 using county-specific growth rates obtained from the Maryland Department of Planning website.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-3

ETE-3: Subject: Site Location and Emergency Planning Zone
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section I.A
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Figure 2-1, "Site Vicinity Protective Action Zones and Reception Centers Plume Exposure Pathway EPZ, "(Page 2-12) provides a vicinity map of the Plume Exposure Pathway Emergency Planning Zone (EPZ) as of August 2002. Surrounding communities, political boundaries, and the location of the new unit are not identified. Provide a map that includes any information that may update the 2002 map in the ETE. This map should clearly define surrounding communities, political boundaries, and the location of the new unit.

Response

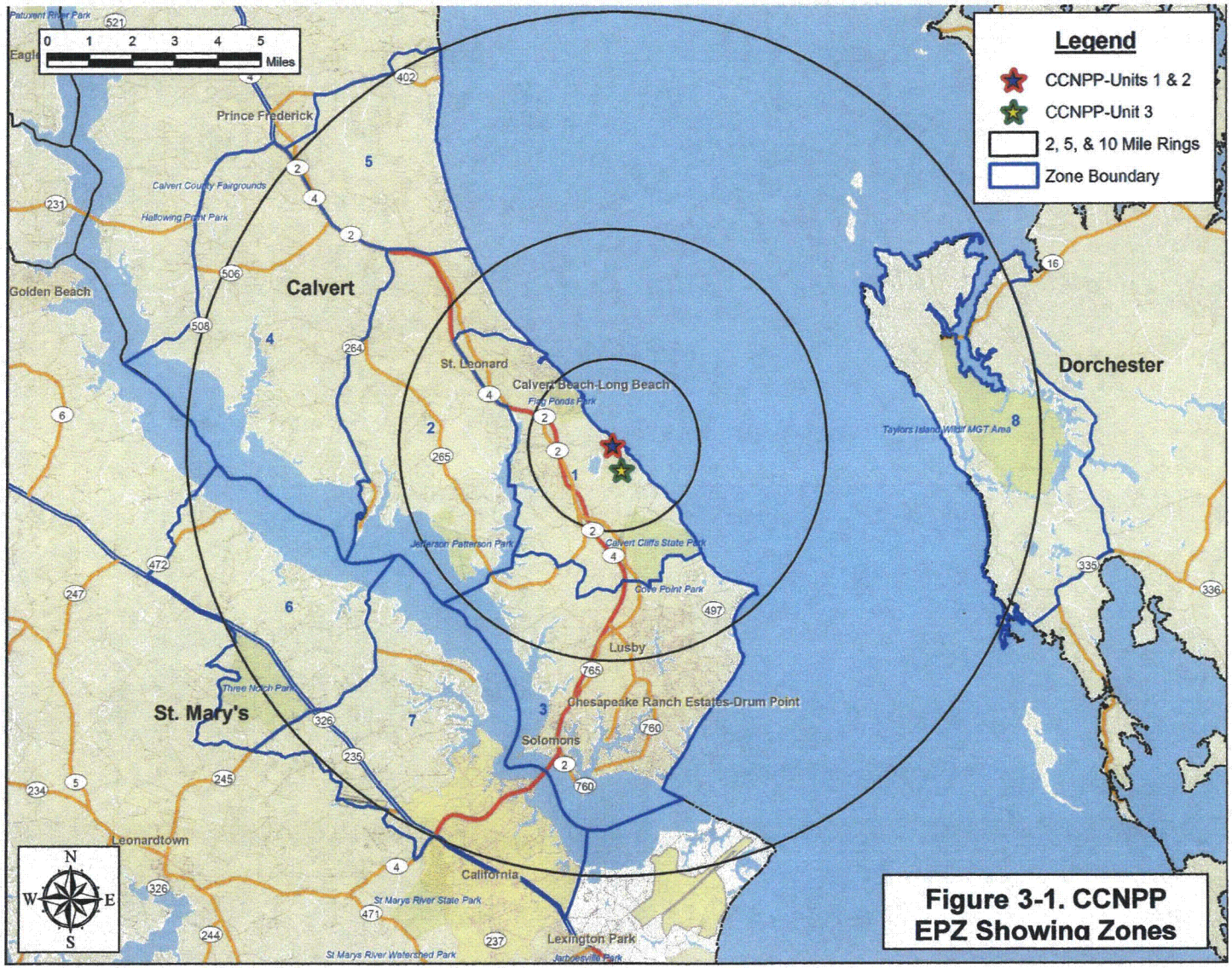
The 2008 ETE report contains several detailed, high resolution Geographical Information Systems (GIS) maps:

- Figure 1-1: The location of the CCNPP EPZ relative to Washington D.C. and Baltimore. The map also identifies major communities in the area and neighboring counties.
- Figure 1-2: The link-node analysis network used to compute ETE. A large scale version of the map (4 feet by 3 feet) with the nodes, major communities, and zones annotated is provided electronically in PDF format with these RAI responses (Enclosure 4).
- Figure 3-1: The eight Protective Action Zones that in aggregate form the CCNPP EPZ. The CCNPP symbol identified on the map in the report is the midpoint of the coordinates for CCNPP Units 1 and 2. The attached map also identifies the proposed coordinates of CCNPP Unit 3; this map will replace Figure 3-1 in a future revision of the ETE report. County boundaries and major communities are identified in the map.
- Figure 7-2: The Shadow Region considered in the ETE study, which extends radially from the EPZ boundary to a distance of 15 miles from the midpoint of CCNPP Units 1 and 2.
- Figure 8-2: The proposed bus routes designed to service transit-dependent population residing in the high population areas in the EPZ. The reception centers are also shown in the map as buses will be dropping off transit-dependents at these facilities.
- Figure 8-3: The schools within the CCNPP EPZ and the host schools which they will evacuate to.
- Figure 10-1: The designated reception centers servicing the CCNPP general population.
- Figure 10-2: The major evacuation routes for the Calvert County portion of the EPZ.
- Figure 10-3: The major evacuation routes for the St. Mary's County portion of the EPZ.
- Figure 10-4: The major evacuation routes for the Dorchester County portion of the EPZ.
- Figure E-1: Major employers within the CCNPP EPZ.
- Figure E-2: Recreational areas within the CCNPP EPZ.

- Figure E-3: Lodging facilities within the CCNPP EPZ.
- Figure E-4: Marinas within the CCNPP EPZ.
- Figure G-1: Recommended traffic control points.
- Figure G-2: Recommended access control points.
- Appendix H: Region maps – shades those Zones which are issued an advisory to evacuate for a given region. The maps include sector boundaries.

COLA Impact

Figure 3-1 of the ETE report (Enclosure 2) will be replaced with the attached figure in a future COLA revision.


Legend
CCNPP-Units 1 & 2
CCNPP-Unit 3
2, 5, & 10 Mile Rings
Zone Boundary
0 1 2 3 4 5
Miles
Prince Frederick
Calvert County Fairgrounds
Hallowing Point Park
Golden Beach
Calvert
St. Leonard
Calvert Beach-Long Beach
Fleg Ponds Park
Jefferson Patterson Park
Calvert Cliffs State Park
Cove Point Park
Lusby
Chesapeake Ranch Estates-Drum Point
Solomons
Three Notch Park
St. Mary's
Leonardtown
California
St Marys River State Park
St Marys River Watershed Park
Lexington Park
Jarboesville Park
Dorchester
Taylors Island Wildlife MGT Area
N
S
E
W
Figure 3-1. CCNPP
EPZ Showing Zones

NRC RAI 13.03-4

ETE-4: Subject: General Assumptions
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section I.B, IV.B.1, IV.B.2, IV.B.3
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 3.1, "The NETVAC2 Computer Model," (page 3-1) states that the NETVAC2 computer model that is used to calculate evacuation time estimates uses the 1985 Highway Capacity Manual as its prime reference to calculate capacity and vehicle flow on the roadway network. The following information needs to be provided and addressed in a revision to the Evacuation Time Estimate:

1. An explanation for the effect of using a more current version of the Highway Capacity Manual would have on evacuation estimates presented in this study.

B. The NETVAC2 Computer Model assumes that there is no cross traffic and all roads are open. This does not take into account that some people from outside the area may be passing through during the evacuation and add to loading on the network. It also does not account for the possibility of accidents which have a higher probability of occurrence as the traffic density increases. Provide a basis for these assumptions and an explanation for the effect that eliminating them would have on evacuation estimates.

C. Section 3.2.1, "Assumptions for Vehicle Demand Estimation," (page 3-2/3) states that the vehicle demand estimations were based on population average occupancy data obtained from 2000 census data and subsequent updated information. Provide clarification for what is considered to be "subsequent updated information."

D. For the assumptions made in Section 3.2.1, "Assumptions for Vehicle Demand Estimation," (page 3-2/3) for average household size and vehicle occupancy factors for the general population and other population sub-groups, provide the following information:

1. Population numbers used to determine vehicle demand estimation need to be adjusted to include current values or an explanation needs to be provided to clarify why the values used are accurate. For those values that are used, the basis for using them should be provided.
2. Provide information to explain the effect that adjusting the vehicle demand estimation would have on evacuation times.
3. The vehicle occupancy factor does not account for those households that may evacuate before a commuter returns home. The commuter may then evacuate from work and not return home. Clarify whether households that may evacuate before a commuter returns home were considered. If not, provide information on this population group and an analysis of the effect this would have on evacuation times.
4. The estimation does not consider weekends which could produce varying results due to the fact that children are not in school and a majority of people will not be at work. This also does not include increases in the transient population and permanent residences performing outdoor activities that normally do not occur during a work week. Clarify whether weekend activities were considered. If not, provide an analysis of the effect weekend activities would have on evacuation times.

E. Section 3.2.2, "Public Response Times and Network Loading Rates," (page 3-3) provides assumptions for individual response activities. Nighttime response only includes notification and evacuation. Section 2.4, "Evacuation Scenarios," (page 2-10) states that the nighttime scenarios include nighttime employees. Based on this statement, it would appear that the mobilization activities for nighttime employees were not included in the estimation of response times in Section 3.2.2. Clarify whether or not nighttime workers have been considered in the ETE.

F. Section 3.2.3, "Assumptions Used in Developing the Evacuation Time Estimates," Page 3-4) states the time to notify the population inside the Plume Exposure Pathway Emergency Planning Zone (EPZ) is 15 minutes and no vehicles will evacuate until 30 minutes following initial notification. Everyone that is notified and only those notified are assumed to evacuate.

1. Provide the basis for this 30 minute period where no one is evacuating.
2. Provide justification for the assumption that only those instructed to evacuate will evacuate.

G. The Evacuation Time Estimate (ETE) assumes that all traffic control points will be manned by police and that traffic lights will be overridden. This information is in the County Radiological Emergency Plan and Standard Operating Procedures but is not included in the ETE.

1. Provide a summary of this information in the evacuation time estimate.
2. Provided information on the timeframe used to establish traffic control points.
3. Provide information to determine that sufficient staffing is available for all traffic control points. If staffing is not sufficient, how will it affect the evacuation estimates?

H. Section 3.2.3, "Assumptions Used in Developing Evacuation Time Estimates," (page 3-5) states that traffic control personnel will prevent vehicles from entering the EPZ. Section 3.2.2, "Public Response Times and Network loading Rates," (page 3-3) states employees will be returning home from work before evacuating. Explain whether or not employees working outside the EPZ will be returning home prior to evacuating.

Response

A. As discussed in the response to RAI 13.03-8, the I-DYNEV system was used to compute ETE in the 2008 ETE report (Enclosure 2). Section 4 of the 2008 ETE Report references the latest edition (year 2000) of the Highway Capacity Manual (HCM). This section identifies the chapters in the HCM which were referenced for estimating highway capacity within the CCNPP EPZ and Shadow Region.

B. Figure 1-2 displays the link-node representation of the analysis network used to calculate ETE. As documented in Table 1-1, this network contains about 3½ times the number of nodes and about 3 times the number of links used in the network of the prior ETE study. The cross traffic along the links intersecting the evacuation routes are explicitly modeled. The allocation of GREEN time to service the competing traffic demands at these intersections is determined during the course of the ETE analysis – see discussions in Appendices C and D. Also, see the response to RAI 13.03-8.

As detailed in Section 3, the "Pass-Through Demand" is explicitly considered as part of the evacuating traffic demand.

Accidents are not considered for the following reasons:

- The evacuating traffic environment is characterized by low-speed travel. Any accidents that do occur at these low speeds would likely be "Property Damage Only" (PDO) with low probability of vehicle disablement.
- In an emergency situation, it is likely that the most skilled, mature driver in a household will be behind the wheel.
- If a PDO accident were to disable a vehicle, it could be pushed to the shoulder with little delay and with immaterial impact on ETE.
- As reported in the report of an extensive survey of 54 "incidents", each requiring an evacuation, as compiled by Hans and Sell[1], observers reported "that there were no deaths or injuries and the [evacuation traffic] accident rate was lower than normal."

C. Section 3 of the ETE report details the U.S. Census-based demand estimation. Appendix F details the results of the telephone survey which were used to estimate the vehicle demand corresponding with the projected population in 2008. See the response to RAI 13.03-13A and RAI 13.03-14 for additional information on the telephone survey.

D. 1,2. Population estimates have been projected to 2008 using Maryland Department of Planning county growth rates. See Section 3 of the ETE report for further information.

3. As documented in Appendix F, 42 percent of the households would await the return of commuters before evacuating. This information was utilized in computing trip generation distributions (column 4 in Table 5-1) and for vehicle estimates (column 3, Table 6-4).

4. Weekend activities were expressly considered as shown in Table 6-2: Scenarios 3, 4, 5, 8, 9, 10 and 12.

E. Scenarios 5 and 10 (Table 6-2) address evening evacuations. Nighttime employees are considered for these scenarios as shown in Table 6-4, column 4.

F. 1. In the 2008 ETE report, only those households who await the return of commuters are delayed 30 minutes. Table 5-1, which lists the mobilization time distribution statistics for 4 population groups, shows that a relatively few trips are generated within 15 minutes after the advisory to evacuate. The distributions presented in Table 5-1 are based on the results of the telephone survey documented in Appendix F of the ETE report and the summing of activity distributions discussed in Section 5 of the ETE report. Only those households who await the return of commuters are delayed 30 minutes.

2. The voluntarily evacuation of some members of the population who are not advised to evacuate, is discussed in Section 2.2. These voluntary evacuation trips are modeled as they mix on the highways with those evacuees who are advised to evacuate.

G. 1. Appendix G details the traffic management plan, showing Traffic Control Points (TCPs) and Access Control Points (ACPs).

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[1] Hans, Jr. H and Sell, T, "Evacuation Risks – An Evaluation", U.S. Environmental Protection Agency, EPA-520/6-74-002, June 1974.

2,3. As discussed in item 4 on page 9-2 of the ETE report and shown in Appendix G, all these control points are assigned a "priority" to guide the assignment of personnel. The timeframe of such a manning schedule depends on circumstances (scenario) and upon available personnel resources. See the response to RAI 13.03-16A for additional discussion of the traffic management plan and its impact on ETE.

H. As discussed in Section 5 of the ETE report, separate trip generation distributions apply for those households that do, and do not await the return of commuters before evacuating – Distributions C and D in Table 5-1. Thus, many workers will certainly return home. As stated in Assumption 5, Section 2.3, ACPs will not be manned for 90 minutes after the advisory to evacuate to avoid delaying returning commuters. Therefore, workers will not be prevented from returning home during that time.

Figure 5-2 of the ETE report indicates that approximately 95% of workers have returned home by 90 minutes after the advisory to evacuate. The second to last paragraph on page 9-1 of the ETE report indicates that there may be legitimate reasons for people to travel in directions counter to those indicated by traffic control guides. It is assumed that those relatively few workers (5%) wishing to travel back into the EPZ after 90 minutes will be permitted to do so. As stated on page 9-1, "the implementation of a plan must also be flexible enough for the application of sound judgment by the traffic guide."

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-5

ETE-5: Subject: The Transit Dependent Population
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section II.A, IV.B.1, IV.B.2, IV.B.4, IV.B.5, IV.B.6
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. In Section 3.2.3, "Assumptions Used in Developing the Evacuation Time Estimates," (page 3-4) the assumption is made that households without vehicles will receive rides from neighbors based on the sufficient number of vehicles in the Plume Exposure Pathway Emergency Planning Zone (EPZ). The availability of vehicles in the EPZ does not necessarily mean they will be available to those that need them. The section does state that local emergency plans include information on the evacuation of those without transportation which is a contradiction of the ridesharing assumption. The following information needs to be provided:

1. An assessment of the number of residents without vehicles that will require transportation assistance.
2. Information regarding how this assistance will be provided should be included to verify that the assumption is correct.
3. Locations of pickup points and an explanation regarding how passengers are expected to get there.
4. Clarify whether the transportation used is available and sufficient to evacuate all transit dependent people in one wave. If not, will a second wave be used?
5. An evacuation estimate that includes the second wave, if necessary.

A-1. Section 2.5.2.10.2, "Public Transportation (Bus)," (page 2.5-26/27) of the Calvert Cliffs Nuclear Power Plant Environmental Report states that a commuter bus service is operated by Calvert County as an alternative mode of transportation for those individuals living in the county, but working in the Washington D.C. area. The same service is provided in St. Mary's County. Calvert County has 17 passenger buses on 7 service routes that carried approximately 113,354 passengers for FY 2005. St. Mary's Transit System operates daily, including evenings and on the weekends. Ridership has increased from approximately 54,395 passengers annually in fiscal year (FY) 2000 to over 300,000 passengers annually in FY 2006.

1. Clarify whether these people have been factored into the evacuation estimates.
2. Clarify whether the evacuation plans include the use of these buses that may be unavailable due to the distance they travel.
3. The staff understands that Calvert County does not operate "commuter" buses.

A-2. Provide information regarding how information received from special needs resident registration cards has been used in supporting the assumptions for this population group.

Response

A.1. Section 8.1 of the ETE report (Enclosure 2) presents an analysis based on the projected population and on the results of the telephone survey (Appendix F), which yields an estimated 1,960 persons who will require transportation. It is assumed that half of them will ride-share, as

stated on page 2-6 of the ETE report. Figure 8 and page 34 of NUREG/CR-6953, Volume 2[2] indicates that the majority of evacuees would assist individuals in need of transportation.

A.2. Section 8.4 presents the analysis which yields the bus routes for the transit dependent persons who do not ride-share, and their associated ETE.

A.3. The bus routes for transit-dependent evacuees are shown in Figure 8-2. In addition to the buses traveling along the "loop" route shown and picking up passengers along the way at ad hoc "flag" stops, other buses will also circulate within residential areas. Pickup points within these areas shown in Figure 8-2 will be established by local government. All ambulatory passengers are expected to walk to the loop route or to those pickup points.

A.4,5. Communications with the county officials have confirmed that resources are available for a single-wave evacuation of all schools. Since there is some uncertainty in this respect for special facilities and for the transit dependent, ETE are provided for both first and second wave transit evacuations. See discussion on page 8-8 and Tables 8-7A and 8-7B.

A-1. The 2008 ETE analysis tacitly and conservatively assumes that commuter buses operated by private vendors will play no role in the evacuation.

A-2. Communication with the counties has yielded the following data concerning special transportation for people at home:

Within EPZ	Calvert	St. Mary's	Dorchester
Need ambulances	12	0	1
Wheelchair bound	25	0	0
Registered special needs	417	8	1
Ambulances available	15	26	12

The counties have mutual aid agreements with neighboring counties for resources in the event of an emergency. Therefore, it is reasonable to expect that the requisite number of vans accommodating wheelchair bound persons, or additional ambulances (15+26+12 ambulances available are more than needed) would be available within a 90 minute mobilization time. Note that most special needs persons living at home have their transport needs provided by other members of the household.

To calculate ETE for the homebound special needs population, assume that the 37 persons in Calvert County are serviced in 19 ambulances (assume 2 persons per ambulance), with 4 ambulances provided by St. Mary's County. Then, allowing 15 minutes to load each patient, 15 minutes to travel to the second home, then 15 minutes to travel out of the EPZ yields:

ETE: 90 + 15 +15 +15 + 15 = 2:30 (hr:min)

[2] Jones, J.A, et al, "Review of NUREG-0654, Supplement 3, 'Criteria for Protective Action Recommendations for Severe Accidents': Focus Groups and Telephone Survey", NUREG/CR-6953, Vol.2, 2008.

COLA Impact

A new subsection heading titled, "Evacuation of Homebound Special Needs Population," will be added to page 8-8 of the revised ETE report which will incorporate the information provided in this response. The updated ETE report will be provided in a future revision of the CCNPP Unit 3 COLA.

NRC RAI 13.03-6

ETE-6: Subject: The Transient Population
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section II.B, IV.B.1, IV.B.2, IV.B.6
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 2.3, "Evacuation Areas," (page 2-9) states that even though a large majority of the Plume Exposure Pathway Emergency Planning Zone (EPZ) consists of the Chesapeake Bay, the evacuation time estimate is not modeled for boaters. This portion of the population is to be warned by the Maryland Marine Police and the Coast Guard to return to port prior to evacuation. Early notification is said to give the boaters adequate time to return, and they will be among the first to evacuate. Section 3.2.3, "Assumptions Used in Developing Evacuation Time Estimates" (page 3-4) states vehicles will begin evacuating 30 minutes after notification is given. If these 30 minutes are the time frame used for boater's notification to evacuate, it seems unlikely that the police and Coast Guard could be mobilized and notify all boaters within this timeframe. Provide information to address the following questions:

1. What is the timeframe being used for notification and evacuation of boaters?
2. What is the process for notification of boaters and estimated time needed to notify all boaters on the water?
3. What is the basis for the statement that boaters should be the first to evacuate?

B. Section 3.4, "Special Event Evacuation Time Estimate Methodology and Assumptions," (page 3-6/7) lists six events that occur within the Plume Exposure Pathway Emergency Planning Zone (EPZ) that result in an influx of transient people. Although the special events are for short periods, peak tourist volumes do need to be assessed. Provide the following information:

1. An explanation of the capability to evacuate transient populations for these events.
2. An updated estimate of peak tourist populations.
3. An analysis of their affect on evacuation times.

C. The Calvert Cliffs Nuclear Power Plant Environmental Report states that Calvert County, St. Mary's County, and Charles County, had 541,791 visitors in 2004. Major parks within the 10-mile radius include Calvert Cliffs State Park and Flag Ponds Park. Calvert Cliffs State Park had 17,113 day visitors from July 2005 to June 2006 and 2,175 overnight visitors. The peak month for day users was October with 5,650 people and the peak month for overnight users was July with 875 people. October had the most overall visitors with 6,035. Flag Ponds Park receives approximately 20,000 annual visitors during the summer months. Provide an explanation of how these estimates compare to the transient population estimates in the Evacuation Time Estimate.

D. Table 2.5-6, "Resident and Transient Populations, by Sector and Distance from the {Calvert Cliffs Nuclear Power Plant} CCNPP Site," of the CCNPP Environmental Report contains different estimations of the transient population by sector than the ones in the Evacuation Time Estimate. Provide an explanation for these differences.

E. Table 4-1, "Population and Vehicle Demand by Protective Action Zone," (page 4-3) lists the summer daytime population as 59,621 and the winter daytime population as 63,893. Discuss why the winter daytime population is higher given summer is the tourist season.

F. Section 3-4, "Special Event Evacuation Time Estimate Methodology and Assumptions," (page 3-7) states that the special event that will be considered is the closure of the Governor Thomas Johnson Bridge. Discuss why one of the six peak tourist events discussed in Section 3.4, "Special Event Evacuation Time Estimate Methodology and Assumptions," was not used as a special evacuation event.

G. Table 4-4, "Transient Population Facilities – Major Employers within the {Plume Exposure Pathway Emergency Planning Zone} EPZ," (page 4-6) does not include Calvert Cliffs Nuclear Power Plant (CCNPP) or Dominion Cove Point Power Plant. The listings in the table do not agree with those in Table 2.5.2-5 of the CCNPP Environmental Report. The population estimates need to be updated to include current and projected values, which includes construction workers and vehicles.

H. Figures B-3, "Winter Day Time Special/Transient Facility Population Distribution by Compass Sector," (page B-3) through B-10, "Summer Night Time Special/Transient Facility Vehicle Distribution by Compass Sector," (page B-10) states that special and transient facilities are depicted, but the numbers do not correlate with Tables 4-2, "Special Facilities - Schools Within the Emergency Planning Zone," (page 4-4) through 4-7,"Transient Population Facilities – Marinas Within the Emergency Planning Zone" (page 4-10). Provide information to clarify which population groups were used in these figures.

Response

A.1, 2. Boaters within the EPZ will hear the siren alert. It is reasonable to expect them to become informed of the advisory to evacuate via radio communication or word-of-mouth. They would then return to the marinas and prepare to evacuate in their vehicles.

The maximum number of persons at marinas within the EPZ is estimated at 2,195 in the Table on page E-12, which is about half the number of transients estimated in Table 3-3. It is therefore reasonable to assume that all boaters are either residents or transients that have already been accounted for. (The footnote on page E-12 will be modified accordingly.)

A review of Distributions A (transients) and D (residents without commuters) in Table 5-1 reveals that they both extend to 2 hours. Boaters from marinas located within the EPZ, who are within the EPZ and hear the sirens would be a short distance away. It is certainly reasonable to expect that they can complete their mobilization times within 2 hours. Those boaters outside the EPZ would likely be directed to marinas outside the EPZ by the Maryland Marine Police or by the Coast Guard.

As a result, boaters will evacuate as members of the general population; no separate treatment is necessary.

A.3. The 2008 ETE report (Enclosure 2) does not make this assumption. As discussed in the response to parts 1 and 2 above, boaters will be notified over the same timeframe as all other people in the EPZ and will begin their evacuation trips according to the distributions provided in Table 5-1.

B.1, 2, 3. The semi-annual Air Show at the Naval Air Base (page 3-3) overshadows all other special events within the EPZ, and is assigned a separate Scenario 12. This scenario produces the longest ETE, by far, relative to the other scenarios: 11:20, 12:10 and 13:00 for the 90th, 95th and 100th population percentiles, respectively. The vehicle population estimates for Scenario 12 are presented in Table 6-4.

C. The Table on page E-8 presents estimates of evacuees (persons and vehicles) at recreational areas. As a preamble, it must be recognized that these estimates represent the number of occupants at the advisory to evacuate, which is a point in time. It is therefore necessary to reconcile the number of total visitors over a span of time, as stated in the comment, with those estimates on page E-8. The following discussion compares these estimates with those cited in the comment.

Flag Ponds Park

A total of 20,000 visitors during the summer months translate to an average of about 330 visitors per day:

- If all these visitors remained on-site 24 hours, then the number at any point in time must be 330. But if visitors come and go over the course of a day, then at any point in time there are likely to be fewer than 330 occupants.
- If some of these daily visitors are residents of the EPZ, which is certainly a reasonable expectation, this number must be subtracted from the total daily visitors
- If some of these daily visitors are lodging within the EPZ, which is a reasonable expectation, this number must be subtracted.

The Table on page E-8 presents an estimate of 263 persons, 20 percent fewer than 330. The arguments presented above suggest that this estimate is reasonable, particularly since the daily figure of 330 applies for only 2 months out of the year.

Calvert Cliffs State Park

The peak month of October averaged about 185 daily visitors, which compares with 217 estimated in the ETE report.

D. See responses to RAI 13.03-2 and RAI 13.03-9. Double counting must be avoided. Figure 3-2 of the 2008 ETE report presents the permanent resident population by sector and distance from the CCNPP. The 2008 ETE report treats transients and employees commuting into the EPZ separately. Figures 3-4 and 3-6 present the transient and commuter-employee populations, respectively, by sector and distance from the CCNPP.

E. Comparison of Scenarios 1 through 4 (Summer, midday scenarios) with Scenarios 6 through 9 (Winter, midday scenarios) in Table 6-4 of the 2008 ETE report indicates that there are more vehicles (and therefore more people) in the EPZ during the summer daytime than during the winter daytime. The number of vehicles for transients is highest for the summer weekends, Scenarios 3 and 4.

F. See response to B, above. Two special events are considered as Scenarios 11 and 12; see Table 6-2. Closure of the Governor Thomas Johnson (TJ) Bridge was analyzed and

documented in an Addendum to the 2008 ETE report (Enclosure 3). It was found that closure of the TJ Bridge increased the ETE for Region R03 (entire EPZ) by 10 min., 70 min., 80 min. and 30 min. at the 50th, 90th, 95th and 100th percentiles, respectively.

G. The Table on page E-6 lists the major employers within the EPZ, including those at CCNPP. The number of employees at the Dominion Cove Point Power Plant was not available at that time and this employer was omitted. Since then, the county has provided the following information:

- The facility is a LNG shipping terminal – not a power plant
- Day shift has 68 employees; night shift, 30
- The facility is being expanded. Over the next year, contractor employees will number 60 during the day, 30 at night
- Subsequently, employment will revert to present levels: 68/30.

Based on 2000 Census Journey-to-Work data, it is estimated that 25% of employees in the Calvert County portion of the EPZ commute from outside the EPZ (see the response to RAI 13.03-9); this yields 17/8 day/night employees with 16/8 vehicles, plus 14/8 vehicles for contractors over the next year. This major employer will be included in a future revision of the ETE report and employee figures will be updated accordingly.

H. In the 2008 ETE, all special facilities are documented in Appendix E. These facilities include: (1) schools; (2) day care; (3) nursing/senior; (4) medical (none); (5) correctional (none); (6) major employers; (7) recreational areas; (8) lodging; and (9) marinas. These data are compiled and documented in Section 3 and are referenced in Section 6 (Table 6-4) and in Section 8 (Tables 8-2, 8-4).

COLA Impact

The following ETE updates will be provided in a future revision of the CCNPP Unit 3 COLA: 1) the footnote on page E-12 will be revised as described in the response to items A.1 and A.2, 2) the Cove Point LNG shipping terminal will be added to the list of major employers on page E-6, and 3) the employee estimates in Section 3 will be updated as described in the response to item G.

NRC RAI 13.03-7

ETE-7: Subject: The Special Facility Population
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section II.C, IV.B.1, IV.B.2, IV.B.5, IV.B.6
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 3.3,"Special Facility Evacuation Time Estimates Methodology and Assumptions," (page 3-5) states evacuation times for school buses is 40 minutes for normal weather and 70 minutes in adverse weather at maximum speeds of 45 and 30 miles per hour respectively. Evacuation times for nursing facilities are 2 hours for normal conditions and 2 hours and 30 minutes in adverse conditions at 45 and 30 miles per hour respectively.

1. Provide current population data for special facilities with an analysis of the effect the updated numbers will have on evacuation times.
2. Provide justification for mobilization times for schools and nursing homes.

A-1. The last column in Table 4-2, "Special Facilities - Schools within the Emergency Planning Zone," (page 4-4) lists the transportation resources available for each school. Footnote "2" on page 4-4 states that local emergency plans provide buses for schools without sufficient means to evacuate their facilities. To verify the assumptions are correct, provide answers to the following questions.

1. Are the buses listed for each school those that will be required or those that will be available for evacuation. Is the number of buses sufficient to evacuate the schools?
2. Which facilities do not have sufficient means to evacuate?
3. How will those schools with insufficient means to evacuate acquire assistance?
4. Can all the schools be evacuated in one wave?

B. Table 4-3, "Special Facilities – Nursing Homes within the Emergency Planning Zone," (page 4-5) lists Solomon Pines as a special facility, which is an independent living center for seniors. It appears there are additional such facilities within the Plume Exposure Pathway Emergency Planning Zone (EPZ). Explain why other facilities within the EPZ such as Oyster Bay, Chapline Place, Calvert Pines, and Prince Frederick Senior Center were not considered in the Special Facilities totals. If they should be, the Evacuation Time Estimate should be adjusted accordingly.

B-1. In Table 4-3, "Special Facilities – Nursing Homes Within the Emergency Planning Zone," (page 4-5) Solomon Pines is identified as a senior living facility with 100 residents and 100 vehicles (Table 4-3, Special Facilities – Nursing Homes). Therefore, it can be assumed that most residents will have their own vehicles to evacuate. The other nursing facilities identified in Table 4-3 have more dependent residents and/or more non-ambulatory patients, all of which will likely require more time to evacuate. Clarify why Solomon Pines has a longer evacuation estimate than other facilities. Table 6-4, "Special Facility – Nursing Facilities Evacuation Times Estimates," (page 6-6) will need to be updated to include any changes.

C. Table 4-3, "Special Facilities – Nursing Homes within the Emergency Planning Zone," (page 4-5) footnote (3) indicates that 193 residents are transportation dependent. However, only 2

buses are identified in the transportation resources column as needed to support the evacuation.

1. Clarify whether special vehicles are required for evacuation of any transit dependent residents.
2. Provide details on the number and types of vehicles required, as well as the mobilization times for these vehicles.

C-1. If residents are evacuated via cars as indicated in the transportation resources column in Table 4-3, "Special Facilities – Nursing Homes within the Emergency Planning Zone," (page 4-5) provide additional detail on the loading time assumptions including the queuing vehicles at each facility. For instance, 446 cars are identified in Table 4-3, as needed to evacuate the Asbury at Solomon's Island facility. Discuss the time required to queue and load these vehicles.

Response

A.1. The most up to date special facility data were obtained during the information gathering efforts described in the response to RAI 13.03-1 and in Section 3 of the 2008 ETE report (Enclosure 2). The primary source of the school enrollment data was the website, www.schoolmatters.com. The data obtained are documented in Table 8-2 and repeated in the table on page E-2 of the 2008 ETE report. Figure 8-3 maps the schools within the EPZ and the host schools outside the EPZ to which they evacuate to.

Detailed data for day care centers were not available; enrollment can vary widely over time. As indicated by the footnote on page E-3, it was assumed that children at day care centers are picked up by their parents and that this activity is accounted for in the mobilization times discussed in Section 5 of the ETE report.

Data for nursing homes and senior centers were obtained from phone calls to the facilities. The data are summarized in Table 8-4 and repeated in the table on page E-4.

A.2. The estimated school bus mobilization times for each school in the EPZ were provided via e-mail by the emergency management offices for Calvert and St. Mary's Counties in November 2007. There are no schools in the Dorchester County portion of the EPZ. The data provided indicate that mobilization time is 60 minutes for schools in St. Mary's County and ranges from 60 to 90 minutes for those in Calvert County, as listed in Table 8-5A of the ETE report. It is assumed that mobilization times are 10 minutes longer in rain to account for slower travel times; this assumption is documented on page 8-5 of the report. The school ETE are estimated using network-wide average speeds output by the PC-DYNEV model at the time buses are ready to leave the schools, to calculate travel times within the EPZ as indicated at the bottom of page 8-5. Tables 8-5A and 8-5B present the ETE for schools in good weather and rain, respectively. The ETE range from 1:05 (hr:min) to 2:05 in good weather, depending on the school and from 1:20 to 2:25 in rain.

It is estimated that the mobilization time for buses to arrive at nursing homes/senior centers average 90 minutes, as stated on page 8-8 of the ETE report. In the event there are not sufficient buses to evacuate the schools and the nursing homes/senior centers in a single wave, the buses would be assigned to schools as their first priority. School children would be evacuated to host schools and then the buses will return to the EPZ to perform a "second-wave" evacuation of the nursing homes/senior centers. The mobilization of buses for nursing

homes/senior centers under these circumstances would be 2 hours and 35 minutes (155 minutes) as discussed in the second paragraph on page 8-8 of the report. ETE for these facilities are also estimated using network wide average speeds output by PC-DYNEV as discussed on page 8-8 of the report.

A-1. School bus resources were provided by representatives from the offices of emergency management for Calvert and St. Mary's Counties. The data provided are summarized in the table below.

Bus Data Provided by County Offices of Emergency Management		
Name of Facility	Transportation Resources (Buses)	Mobilization Time
CALVERT COUNTY		
Mutual Elementary School	10	1-1/2 hours
St. Leonard Elementary School	11	1 hour
Dowell Elementary School	11	1-1/2 hours
Patuxent High School	20	1-1/2 hours
Our Lady Star of the Sea	2	1 hour
Appeal Elementary School	9	1-1/2 hours
Southern Middle School	13	1 hour
Patuxent Elementary School	9	1-1/2 hours
Mill Creek Middle School	12	1-1/2 hours
TOTAL:	**97**	
ST MARY'S COUNTY		
Esperanza Middle School	14	1 hour
Town Creek Elementary School	5	1 hour
St. John's Creek Elementary School	5	1 hour
Green Holly Elementary School	13	1 hour
Hollywood Elementary School	10	1 hour
TOTAL:	**47**	

Comparison of the information provided by the counties with the estimated bus needs provided in Table 8-2 of the ETE report indicates good agreement. The estimate of buses needed for ETE purposes are overstated as discussed in Section 8.2 of the ETE report. Note that the county indicates 20 buses are needed to evacuate Patuxent High School, while Table 8-2 of the ETE indicates 28 buses are needed. The ETE report estimate is overstated in that no allowance is made for those high school students who drive to school on a daily basis. Representatives from St. Mary's County and Calvert County have confirmed that available bus resources can evacuate the schools in a single wave.

B. Oyster Bay is a condominium complex located at Solomon's Island. This community is within the CCNPP EPZ. The residents of this community have been included as part of the permanent resident population documented in Section 3 of the 2008 ETE report.

Internet searches did not return any information for a "Chapline Place" senior center; however, a "Chapline House" senior living center exists at 125 Allnutt Court in Prince Frederick, Maryland. This facility was mapped using GIS software and it is located outside of the CCNPP EPZ.

The Calvert Pines Senior Center is located at 450 West Dares Beach Rd in Prince Frederick, Maryland. This facility was mapped using GIS software and it is located outside of the CCNPP EPZ.

Internet searches did not return any information for a "Prince Frederick Senior Center". Additional searches were conduced for "senior centers in Prince Frederick, Maryland"; the only results in the vicinity of the CCNPP EPZ are the Calvert Pines Senior Center which is outside the EPZ and the Southern Pines Senior Center which is already included in the 2008 ETE report.

B-1. The section titled "Evacuation of Ambulatory Patients from Special Facilities" on pages 8-7 and 8-8 of the 2008 ETE report documents the ETE for nursing homes and senior centers within the CCNPP EPZ. See the response to part C below.

C. Table 8-4 of the 2008 ETE report summarizes the nursing home/senior center population and the number and types of vehicles required to evacuate these facilities. As indicated in the response to part A.1 above, the data provided in Table 8-4 was obtained through phone calls to the facilities. The data indicate that there were 103 people residing in these facilities at the time of the data gathering, 96 of which are ambulatory and 7 of which are wheel-chair bound. Section 8.3 of the ETE report indicates capacities of 30 ambulatory persons per bus and 4 wheel-chair bound persons per wheel-chair van. As indicated in Table 8-4, 2 wheel-chair vans are needed and 5 buses. It is likely that one of the buses servicing those people at Solomon's Nursing Center could be sent to evacuate the 5 people from Asbury at Solomon's Island, thereby reducing the buses needed to 4. It is estimated that the mobilization time for these vehicles is 90 minutes as discussed in the first paragraph of page 8-8. The section titled "Evacuation of Ambulatory Patients from Special Facilities" on pages 8-7 and 8-8 documents the ETE for the nursing homes and senior centers within the CCNPP EPZ.

C-1. The 2008 ETE report assumes that all persons at the nursing homes and senior centers within the EPZ are transit-dependent, as stated in Section 8.3 of the report. Therefore, all people at these facilities are evacuated in either buses or wheelchair vans as indicated in Table 8-4.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-8

ETE-8: Subject: NETVAC2 Traffic Simulation Model
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section I.C, II.D, III.A, III.B, IV.B.1, IV.B.3
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Section 3.1, "The NETVAC2 Computer Model," (page 3-1) states that specific data on the network and vehicle loading rates are required to develop the evacuation estimates. This information is utilized in the Highway Capacity Manual equations to determine evacuation times for different population groups. The equations themselves, other supporting algorithms, standard parameters, or default parameters are not provided or described in the Evacuation Time Estimate. Provide the following information:

1. The equations and supporting algorithms used to calculate evacuation times.
2. The standard parameters or default parameters used in the equations.

Response

The I-DYNEV system was used to prepare the 2008 ETE report (Enclosure 2). The I-DYNEV system is described in Section 1.3 of the ETE report under the "Analytical Tools" heading. Additional information about the TRAD – Traffic Assignment and Distribution model; PC-DYNEV – Dynamic Network Evacuation model; and the procedure used to compute ETE is provided in Appendices B through D of the ETE report. Further detail of the PC-DYNEV simulation model is found in NUREG/CR-4873, "Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code", and NUREG/CR-4874, "The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code". These two reports document studies undertaken to assess the validity of the DYNEV model for use in calculating ETEs. The discussions in the two cited references are at a level of technical detail and complexity which we believe lies outside the needs of an ETE document. Additional references to papers describing other algorithms are provided as a footnote on page 4-2.

Section 4 of the ETE report discusses the estimation of highway capacity. The values of the variables in the intersection algorithm in Section 4 were derived by applying the I-DYNEV system as an analysis tool rather than as a single "pass-through" calculation of an ETE. This tool was used to identify points of congestion and locations where traffic control points (TCPs) could be helpful to the evacuating public. Detailed results of the simulation were analyzed to identify locations where the green time was specified to realistically service the competing traffic volumes under evacuation conditions. The model was executed iteratively to provide assurance that the allocation of "effective green time" appropriately represents the operating conditions of an evacuation. The "Mean Duration of Green Time", G_m as shown in Section 4, is the amount of time per signal cycle, C, that the signal indication is "green" and services vehicles entering the intersection to perform movement, m, from an approach to the intersection. Yellow and all-red times were considered for each phase of each traffic signal; yellow time ranged from 2 to 3 seconds and all red time ranged from 1 to 2 seconds.

The variables F1 and F2 discussed on page 4-2 of the ETE report formally represent the factors that influence the turn movement specific flow rates through an intersection. These factors are detailed in Chapters 16 and 17 of the 2000 Highway Capacity Manual (HCM); Exhibit 16-17

summarizes the factors influencing saturation flow rate. A further (overlapping) list of factors is presented and identified in Equation 16-4 on page 16-9. These two chapters contain detailed technical discussions which extend over more than 250 pages.

"Mean queue discharge headway" ("h_m" in equation on page 4-2) as defined on page 7-8 of the Highway Capacity Manual 2000 (HCM2000), is "the time between the passage of the front axle of one vehicle and of the front axle of the next vehicle over a given cross-section of the roadway" (e.g. at a stop-bar). The mean queue discharge headway ranged from 1.9 seconds (multi-lane highways) to 2.1 seconds (two-lane rural roads). The mean "lost time" ("L" in equation on page 4-2) is defined on page 10-12 of HCM 2000 as "the time during which an intersection is not used effectively by any movement; it is the sum of clearance lost time plus start-up lost time." Clearance lost time is "the time between signal phases during which an intersection is not used by any traffic," and start-up lost time is "the additional time consumed by the first few vehicles in a queue at a signalized intersection above and beyond the saturation headway, because of the need to react to the initiation of the green phase and to accelerate." The mean lost time per signal phase is 2.0 seconds for each intersection in the analysis network.

The headway, h, is definitionally related to the saturation flow rate, s, by equation (7-9) of HCM2000: $s = 3600 \div h$, where h is in seconds per vehicle and s is in vehicles per hour. The values of s were estimated (see Appendix K) from the field survey (see Section 1.3 of the ETE report), and h was computed using equation (7-9). The saturation flow rate ("capacity") ranged from 1700 vehicles per hour per lane to 1900 vehicles per hour per lane for the at-grade highways in the analysis network.

The equation on page 4-1 of the ETE report applies to signalized and to manually-controlled intersections. The green times for each approach and for each intersection are input to DYNEV to represent the reasonable service provided to evacuees on the competing approaches. These green times are adjusted during the iterative procedure described above until the queues on the competing approaches dissipate at comparable times; no attempt is made to "optimize" these inputs. The establishment of a TCP at an intersection could well provide greater operational performance than is represented by the calibrated DYNEV model. Thus, if all TCPs are manned in a timely manner by experienced personnel, it is possible that the ETEs predicted by the model might be somewhat longer than achievable in the real world under these ideal circumstances. The ETE represents reasonable, but not optimal expectations; therefore, no allowance is made for TCP operations.

When there are competing traffic movements at an intersection or juncture, the real estate within the intersection must be time shared by these competing movements in order to afford safe passage. This is the situation during normal conditions as well. This process is implemented in the simulation model by the analyst determining the allocation of effective green time as described above. Thus, depending upon circumstances, one or more of the competing traffic flows may be delayed at the intersection as it would be in the real world, thereby influencing the travel time of evacuees. Figures 7-3 through 7-6 illustrate the resulting queuing that can take place as a result of this time sharing process when the traffic demand exceeds the intersection capacity at the indicated locations and times.

Personnel drove the entire highway system within the EPZ and for some distance outside. A tablet personal computer equipped with Geographical Information Systems (GIS) software was used during the road survey to acquire and record data. The characteristics of each section of

highway were recorded. These characteristics include: number and estimated width of lanes, shoulder type and estimated width, intersection configuration, lane channelization, roadway geometrics, posted speed, actual free speed, abutting land use, traffic control devices, street parking and signage.

In addition, video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 20-5 in the Highway Capacity Manual (HCM) indicates that a reduction in lane width from 12 feet (the "base" value) to 10 feet at any shoulder width can reduce free flow speed (FFS) by 1.1 mph – not a material difference – for two lane highways. Exhibit 12-15 shows no sensitivity for the estimates of service volumes at LOS E (near capacity), with respect to FFS. The terrain of the highway (level, rolling, mountainous) is a far more important factor than lane and shoulder width when estimating capacity.

The data from the audio and video recordings were used to create detailed GIS shapefiles and databases of the roadway characteristics and of the traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the I-DYNEV system. All of the information obtained during the road survey was input for the links and nodes shown in Figure 1-2 in order to ensure that the link-node analysis network replicates the actual roadway network surrounding the plant. Nodes generally represent intersections and ramp junctures. Links represent highway segments that exhibit reasonably consistent geometries and abutting land use characteristics. A large scale (4 feet by 3 feet) electronic version (PDF format) of ETE Figure 1-2 is provided with the RAI responses (Enclosure 4).

As documented on page 20-3 of the HCM2000, the capacity of a two-lane highway is 1700 passenger cars per hour for each direction of travel. For a multi-lane highway, a value of 1900 vehicles per hour per lane is assigned. Link capacity is an input to I-DYNEV which calculates the ETE. A general listing of simulation model inputs is presented in Exhibit 31-4 of the HCM.

Chapter 31 of the HCM provides further discussion of simulation models and their relationship with the HCM. Note that models such as PC-DYNEV are described as "operational simulation models" in the sense that they do not replicate the procedures of the HCM, but describe the operational performance of traffic in a manner that is consistent with the HCM analysis. Thus, there is no facility-specific Level of Service (LOS) calculation embodied within such simulation models; instead, these models describe the flow process throughout the analysis network over time and compute flow statistics known as "measures of effectiveness." It is the calibration of these operational models (and of PC-DYNEV, in particular) that relates to the procedures of the HCM. As stated on page 31-2 of the HCM, traffic simulation models use numerical techniques on a digital computer to create a description of how traffic behaves over extended periods of time for a given transportation facility or system.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-9

ETE-9: Subject: Resident Population
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E NUREG-0654/FEMA-REP-1; Appendix 4 Section II.A, IV.B.1, IV.B.2, IV.B.6
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Because a resident in the Plume Exposure Pathway Emergency Planning Zone (EPZ) may also work in the EPZ, the possibility exists for the resident to be counted twice. Explain how double counting was avoided or if it was considered. If not, the effect of double counting on evacuation times should be analyzed.

Response

The possibility of double counting has been considered and is discussed on page 3-1 of the 2008 ETE report (Enclosure 2). The EPZ general population consists of three distinct groups:

1. Permanent residents - people who are year-round residents of the EPZ.
2. Transients - people who reside outside of the EPZ, who enter the area for one day, or for a few days, for a specific purpose (e.g., boating, camping) and then leave the area.
3. Commuter-Employees - people who reside outside the EPZ and commute to businesses within the EPZ on a daily basis.

Permanent resident population was estimated using 2000 Census data overlaid on a map of the EPZ using Geographical Information Systems (GIS) software. The population was then extrapolated to 2008 using county-specific growth rates.

Transient population was estimated using data from the 2002 ETE Study Report, from county websites, and from websites for specific recreational facilities. The recreational areas in the CCNPP EPZ include marinas, parks, museums, recreation centers, campgrounds, a sports complex and a historical site. It is assumed that all people visiting the marinas are EPZ residents as stated in the footnote on page E-12 of the ETE report. All visitors to other recreation areas and all people staying overnight at lodging facilities are assumed to be transients.

Data for major employers (more than 50 total employees) in the EPZ were provided by the county offices of emergency management, by county websites, and by individual employer websites. In order to avoid double counting those people who live and work in the EPZ, Census Journey to Work data was accessed. The Journey to Work database provides the origin county for all employees working in a given county. These data indicate that there are 19,710 people working in Calvert County – 14,795 of which live in Calvert County. Therefore, 25% [100% - (14795 ÷ 19710)] of the employees in Calvert County commute into the county from outside the county. There are 40,179 people working in St. Mary's County – 32,134 of which live in St. Mary's County. Therefore, 20% [100% - (32134 ÷ 40179)] of the employees in St. Mary's County commute into the county from outside the county. This analysis was not done for Dorchester County as there are no major employers in the Dorchester County portion of the EPZ. The 25% and 20% estimates were applied to the number of employees at the major employers in Calvert and St. Mary's Counties, respectively, to estimate the number of employees commuting into the EPZ and avoid double counting EPZ residents.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-10

ETE-10: Subject: Protective Action Zones
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E NUREG-0654/FEMA-REP-1; Appendix 4 Section II.D
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Section 2.2, "Protective Action Zone," (page 2-7/9) states that eight protective action zones (PAZs) have been considered that approximate 90 degree sectors for 0, 2, 5, and 10 mile radii. PAZ boundaries are defined by roads and rivers and are agreed upon by county officials. Clarify whether PAZ boundaries bisect densely populated areas.

Response

PAZ (also called Zones in the 2008 ETE report [Enclosure 2]) boundaries do not bisect densely populated areas. Figure 3-1 is a detailed GIS map showing the Zone boundaries. Appendix L provides a detailed description of each Zone; Zones 1 through 5 are in Calvert County, Zones 6 and 7 are in St. Mary's County and Zone 8 is in Dorchester County. Zone 1 approximates the 2-mile radius, Zones 1 through 3 approximate the 5-mile radius, and Zones 1 through 7 approximate the 10-mile radius/entire EPZ. The Zone boundaries are defined by roads, bodies of water and political boundaries as the descriptions in Appendix L illustrate.

The major population center within the EPZ is the Chesapeake Ranch Estates, which is entirely within Zone 3, along with Drum Point, Cove Point, Dowell and Solomons. Calvert Beach, Long Beach and Lusby are all entirely within Zone 1. Broomes Island and Wallville are entirely within Zone 2. The community of California, in St. Mary's County is bisected by the Zone 7 boundary along Route 235 because this community extends well beyond the 10-mile radius, south of Route 235.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-11

ETE-11: Subject: Transportation Network
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E NUREG-0654/FEMA-REP-1; Appendix 4 Section II.D, III.A, III.B
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. The routes used for evacuation are described in Section 5.2, "Primary Evacuation Routes" (page 5-1). The primary routes are mapped with sectors and boundaries in Figure 5-1 "Evacuation Road Network" (page 5-3). Provide a version of Figure 5-1 that is more legible.

B. Section 3.2.3, "Assumption Used in Developing the Evacuation time Estimates," (page 3-4) states that the roadway capacity for the network is assumed to be 1800 vehicles per lane per hour based on the Highway Capacity Manual dated 1985. Provide any information regarding how using an updated version of the manual would affect the estimated value.

C. Section 5.3, "Roadway Capacities, Classification, and Vehicle Routing," (page 5-1) states that two rural divided highways, Routes 2/4 and Route 235, are located within the Plume Exposure Pathway Emergency Planning Zone. The rest of the roadways are identified as rural undivided highways. In the Appendix D, "Key to NETVAC2 Computer Printout" Roadway Type (6) is specified for rural divided highways. However, in the Roadway Link and Node Characteristics table (pages D-3/11), the column "Roadway Type" does not indicate any type (6) roadways.

1. Clarify if any type (6) roadways are present.
2. Explain if the omission of these roadways effects the evacuation times.

D. Figure 7-1, "Recommended Traffic control," (page 7-3) points out an area of congestion on the Thomas Johnson Bridge at the South of the plant. According to the MD 4 - Thomas Johnson Memorial Bridge Planning Study[1]," (pages 1-7) congestion on Thomas Johnson Memorial Bridge is problematic. All intersections have a failing Level of Service (LOS) in both the AM and PM peak hours. This information agrees with the findings in, "St. Mary's County Transportation Plan[2]," which identifies a need to widen Maryland Route 4 and add an additional span to the Thomas Johnson Bridge to accommodate existing conditions and anticipated growth. The current situation with traffic congestion on Maryland Route 4 and the Thomas Johnson Bridge is not addressed in the ETE. Provide additional information on potential traffic congestion associated with the Thomas Johnson Bridge and Maryland Route 4 during evacuation scenarios.

E. A Traffic Impact Analysis (TIA)[3] was conducted by KLD Associates, Inc in 2007. Explain how the TIA was used to develop the Evacuation Time Estimate (ETE). Specifically explain the apparent incongruity of the ETE dated 2002 and the TIA dated 2007.

Response

A. Section 10 of the 2008 ETE report (Enclosure 2) provides high resolution detailed GIS maps of the major evacuation routes within the Calvert Cliffs EPZ. Figures 10-2 through 10-4 depict the major evacuation routes servicing Calvert, St. Mary's and Dorchester Counties, respectively. The figures are annotated with the State Route designation of each evacuation route.

B. Section 4 of the 2008 ETE report describes the estimation of highway capacity used in preparing the evacuation time estimates for the Calvert Cliffs EPZ. As indicated in the opening paragraph of the section, the 2000 Highway Capacity Manual (HCM 2000) was used. A detailed survey of the roadways within the EPZ and the Shadow Region was conducted in July 2007; the survey is briefly described on page 1-5 of the ETE report. See the response to RAI 13.03-8 for additional information on the road survey. Appendix K of the ETE report documents the roadway characteristics input to the I-DYNEV system. As indicated in Appendix K, capacity ranged from 1700 to 1900 vehicles per hour per lane. As stated in the response to RAI 13.03-8, the HCM 2000 indicates a capacity of 1700 passenger cars per hour for each direction of travel for a two-lane rural road and a capacity of 1900 passenger cars per hour for a multi-lane highway. A large scale (4 feet by 3 feet) electronic version (PDF format) of Figure 1-2 is provided with this response (Enclosure 4).

C. As stated on page 4-5 of the 2008 ETE report, the roads within the EPZ consist primarily of two-lane local roads and multi-lane highways. Route 2/4 and Route 235 would be classified as multi-lane highways whereas all other roads in the analysis network are two-lane local roads. The number of lanes on each link in the analysis network is provided in Appendix K.

D. Section 7.2 of the 2008 ETE report discusses the patterns of traffic congestion during evacuation. The text indicates that there is pronounced congestion southbound on Maryland Route 2/4, especially in the area of the Thomas Johnson Bridge. Figures 7-3 through 7-6 provide screen captures from EVAN (Evacuation Animator) which show the level of service (LOS) on all links in the analysis network at that time. The links are color coded according to LOS, with those links experiencing LOS F (congested) colored red and those experiencing LOS A (free-flow) colored white. As Figure 7-5 indicates, congestion on the Thomas Johnson Bridge persists until 4½ hours after the advisory to evacuate, while congestion on Rousby Hall Road extends to almost 6 hours.

Based on guidance provided in NUREG-0654, revised versions of Figure 7-3 through 7-6 (attached to this response) were created, which identify the major roads in the analysis network and the major congestion points. The attached table summarizes the delay (minutes/vehicle) at each of the congestion points over the 10-minute period preceding the indicated elapsed time from the advisory to evacuate. This table and the revised Figure 7-3 will be included in Section 7 of a future revision of the ETE report.

As stated in Section 1.3 of the ETE report (page 1-8) and shown in Appendix D, the ETE provided in Section 7 are the result of an iterative design-analysis-redesign sequence of activities. During this iterative procedure, impediments to the evacuation process are identified. As discussed under Step 10 on page D-2 of the ETE report, there are many "treatments" available to remedy impediments to the evacuation process. One such treatment was identified when preparing the Calvert Cliffs ETE. Zone 3 is the most populous Zone in the EPZ (see Table 3-1) with more than twice the population of any other Zone. There is only one evacuation route servicing evacuating traffic generated in this Zone in an outbound direction relative to the location of CCNPP – Maryland Route 2/4 southbound. In addition, there is only one access point to Route 2/4 southbound from Zone 3, which is at Rousby Hall Rd. The approach from Rousby Hall Rd to Maryland Route 2/4 has a left turn lane and a right turn pocket. As shown in Figure 7-6, traffic evacuating northbound along Rousby Hall Rd to access Maryland Route 2/4 southbound is the last to clear in the EPZ; therefore, the ETE is dictated by the congestion at this intersection. At first, the ETE was calculated by restricting this traffic to travel southbound on Maryland Route 2/4 away from CCNPP. A sensitivity study was performed to explore the

effect on ETE of allowing traffic to evacuate northbound and southbound along Maryland Route 2/4 from its intersection with Rousby Hall Rd. It was found that the ETE is reduced by 4 hours and 40 minutes when Zone 3 evacuees use Route 2/4 northbound and southbound; Page I-3 of the ETE report documents this study. As a result, the ETE in Section 7 were computed assuming that Zone 3 evacuees could use Route 2/4 in both directions. The third paragraph of Section 7 states this assumption. The Southern Lusby Connector Road which recently opened and provides an additional access point to Route 2/4 southbound in Zone 3 will reduce this congestion and potentially reduce the ETE. This is discussed further in the response to RAI 13.03-16, Part A.3, and will be included in a future update to the ETE.

Two sensitivity studies involving the Thomas Johnson Bridge were considered. The first considered contra-flow southbound use of both lanes on the bridge and is documented on page I-5 of the ETE report. The ETE is unaffected by the contra-flow as shown in Table I-5; the ETE is dictated by the limited capacity servicing traffic from Rousby Hall Road and the additional capacity on the bridge is not utilized. The second study considered the closing of the bridge and is documented on page 9 of the August 2008 ETE addendum (Enclosure 3). The ETE increases by 30 minutes under these conditions.

E. The traffic impact analysis (TIA) work is still in progress as potential mitigation measures are being discussed by the stakeholders. A new ETE study was conducted; and the final report was provided on April 2008 with a subsequent addendum provided in August 2008. Page 3-2 of the ETE report discusses the Construction Special Event scenario considered. The peak construction assumptions used in the ETE study match those used in the TIA study; however, no roadway improvements were considered as mitigation measures are still in the process of being finalized.

COLA Impact

The following updates will be provided in a future revision of the CCNPP Unit 3 COLA: 1) the attached table "Average Delay for Selected Roadways in the CCNPP EPZ" will be inserted on page 7-3 of the ETE report, before the beginning of Section 7.3, 2) ETE Report Figures 7-3 through 7-6 will be replaced with the attached versions of these figures, and 3) the ETE report will incorporate the information cited in the response to item D of this question.

Average Delay for Selected Roadways in the CCNPP EPZ							
Congestion Point Number[1]	Link		Description	Average Delay (min/veh) at Indicated Time (hour:min) after Advisory to Evacuate			
	From Node	To Node		1:30	3:00	4:30	5:30
1	142	22	MD 264 Broomes Island Road Northbound	8.8	8.9	8.2	0.0
2	21	22	MD 2/4 Northbound in Port Republic	3.0	3.2	0.0	0.0
3	184	176	MD 760 Rousby Hall Road Westbound	7.5	7.6	7.9	3.1
4	12	13	TJ Bridge Southbound	3.0	2.9	0.3	0.0
5	293	66	MD 471 St. Andrews Church Road Southbound	0.0	8.4	0.0	0.0
6	74	328	MD 247 Loveville Road Southbound	5.7	9.2	3.8	0.0
7	45	16	MD 235 Three Notch Road Northbound in California	9.6	9.6	9.6	0.0
8	24	26	MD 2/4 Northbound in Prince Frederick	0.0	2.5	0.0	0.0

Note 1: See Figures 7-3 through 7-6

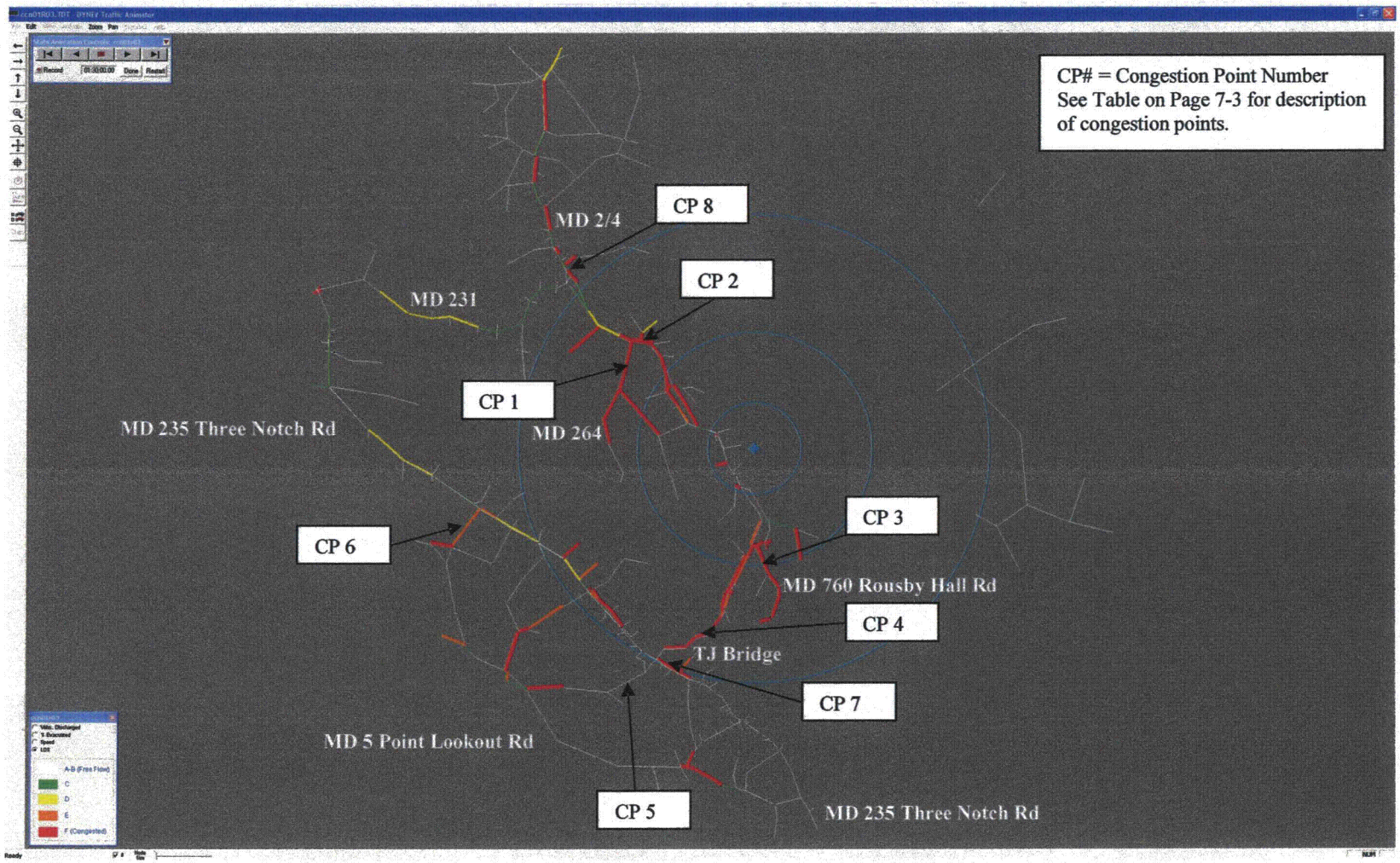

Figure 7-3. Congestion Patterns at 1½ Hours after the Evacuation Advisory – Scenario 1, Full EPZ

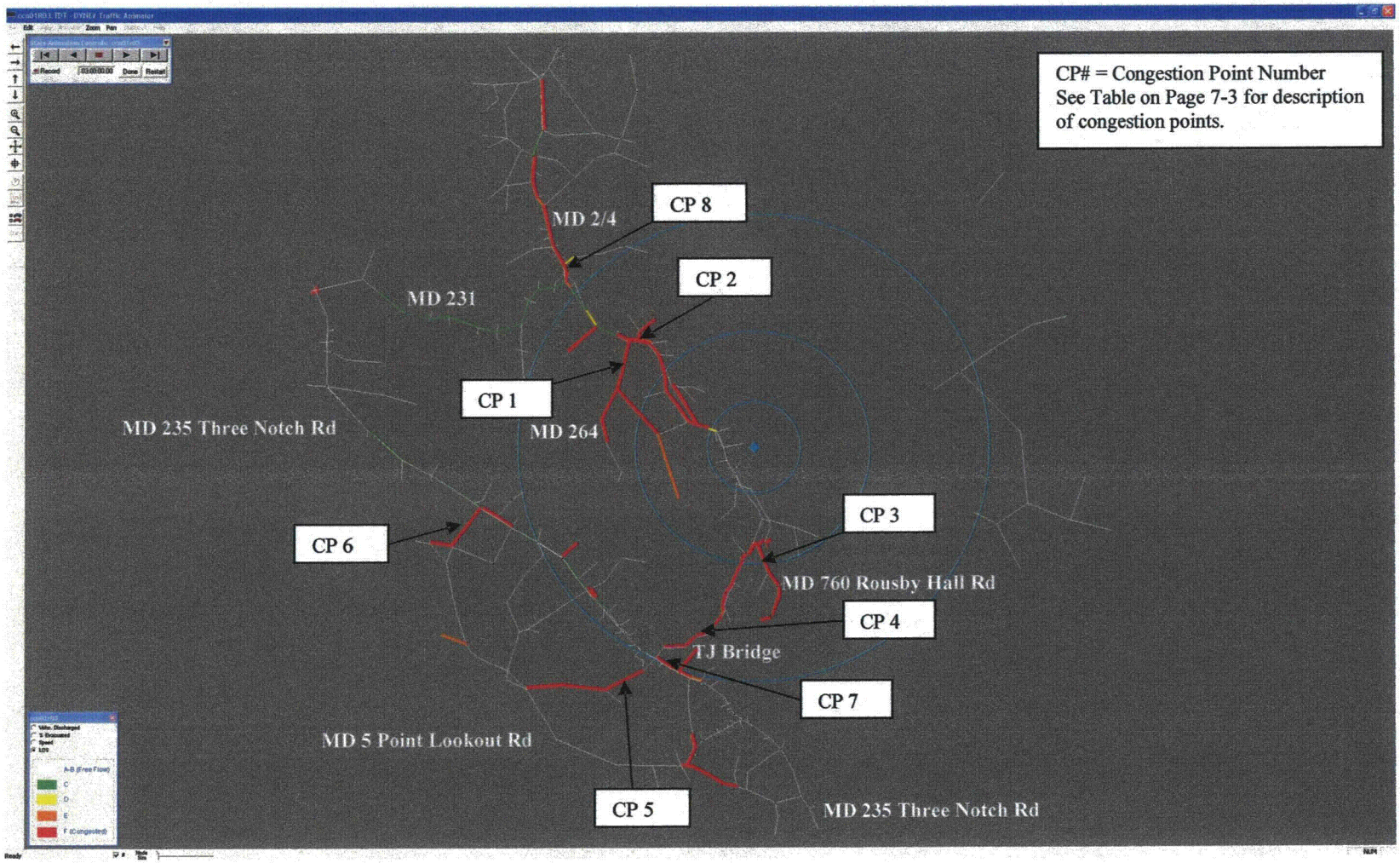

Figure 7-4 Congestion Patterns at 3 Hours after the Evacuation Advisory – Scenario 1, Full EPZ

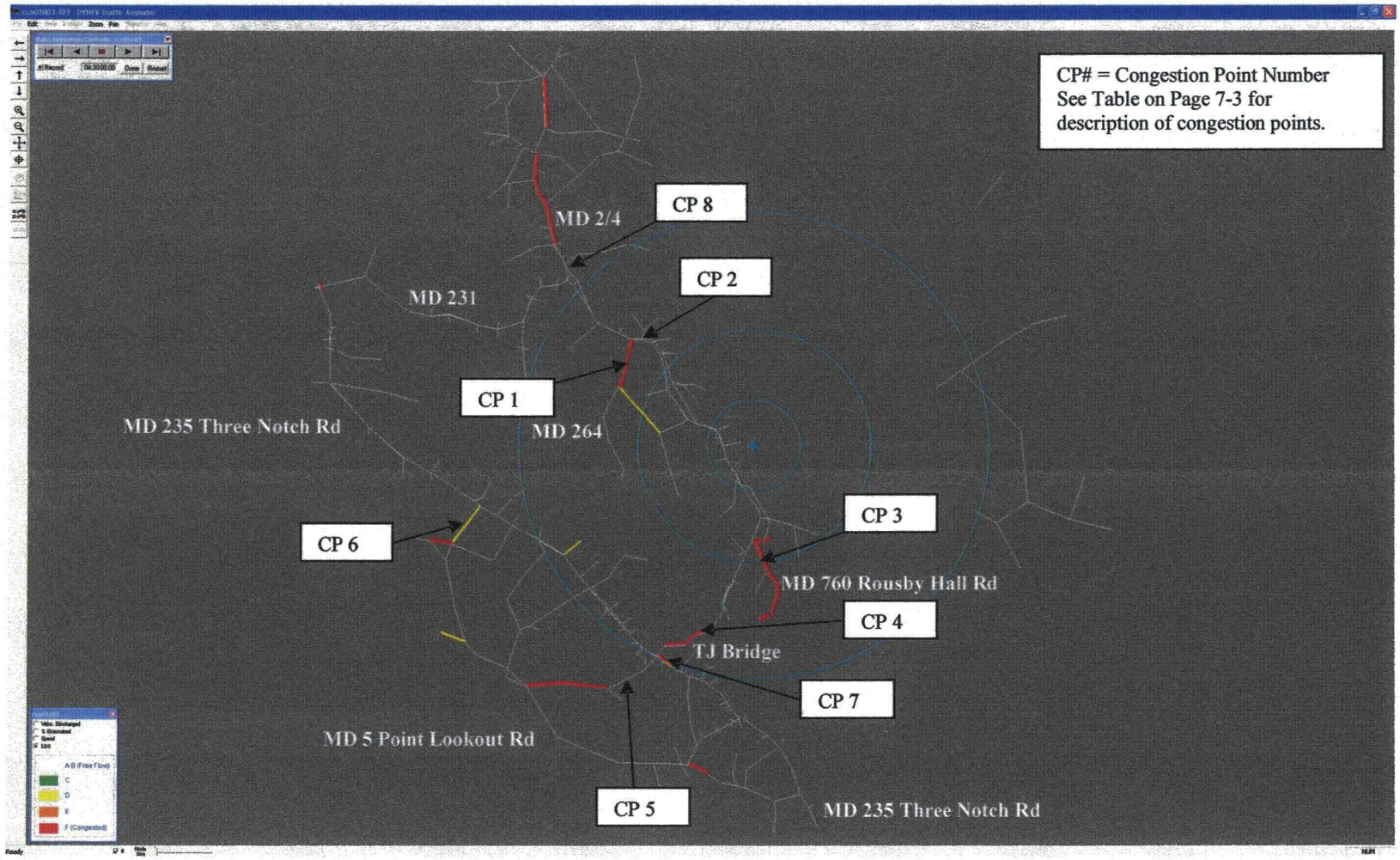

Figure 7-5 Congestion Patterns at 4½ Hours after the Evacuation Advisory– Scenario 1, Full EPZ

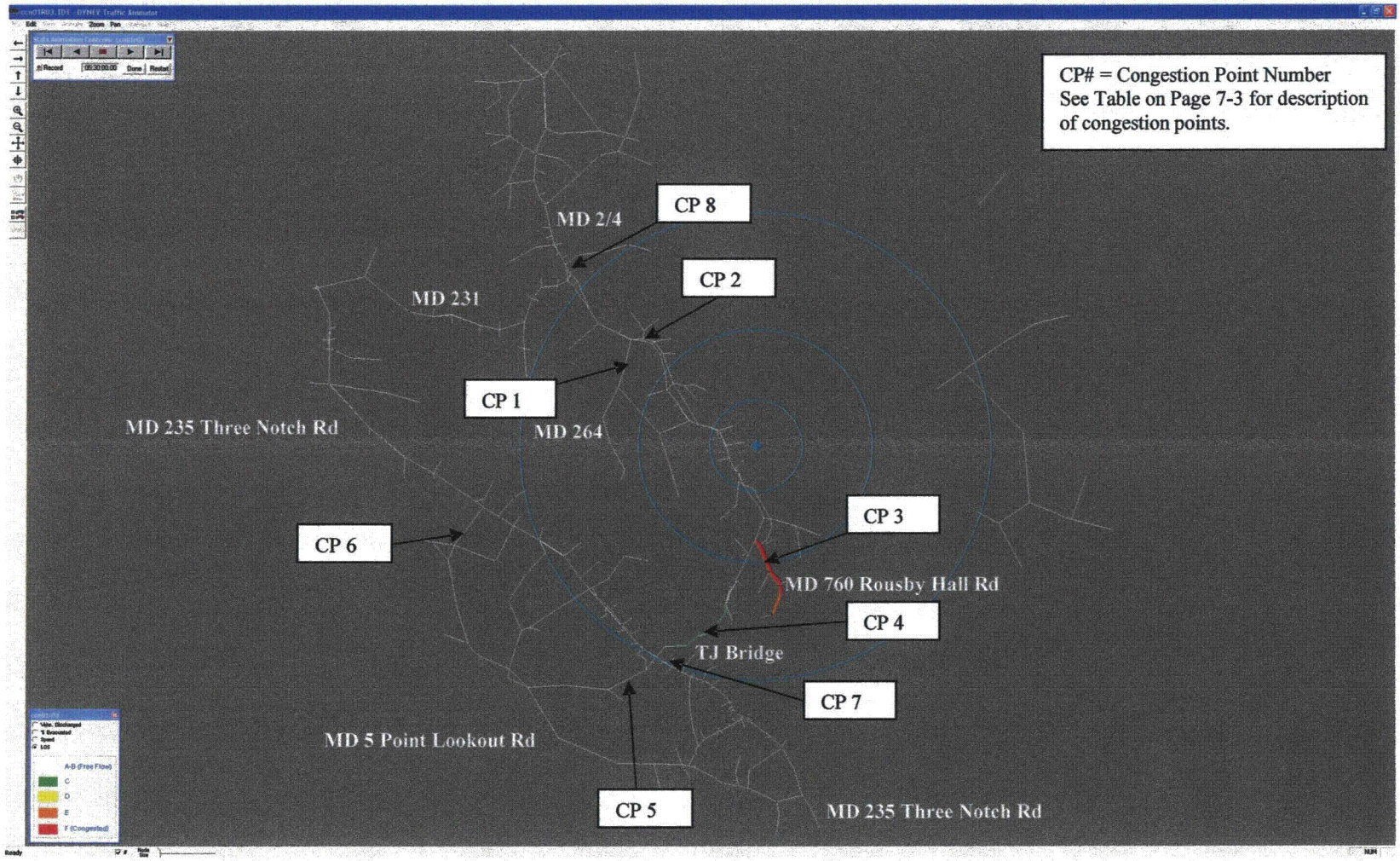

Figure 7-6 Congestion Patterns at 5½ Hours after the Evacuation Advisory – Scenario 1, Full EPZ

NRC RAI 13.03-12

ETE-12: Subject: Adverse Weather Conditions
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section IV.A.1.
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 2.3, "Evacuation Areas," (page 2-10) states that adverse conditions for the area includes snow, rain, fog, ice or high winds. Discuss the amount and severity of snow, ice or fog. Discuss which of these conditions is being analyzed in the scenarios, or whether they are all grouped together.

B. In Tables 1-1, "Summary of General Population Evacuation Time Estimates-Summer," (page 1-4) and Table 1-2, "Summary of General Population Evacuation Time Estimates-winter," (page 1-5) the "Preparation Time for Adverse Weather and Total Public Response Time for Adverse Weather" (columns 10 thru 13) are the same between summer and winter scenarios. Explain why there is not a difference between summer and winter preparation times or total response times for adverse weather. Also, discuss the basis for the 30 minute travel time.

Response

A. Assumption 9 of Section 2.3 of the 2008 ETE report (Enclosure 2) identifies one adverse weather condition – rain. It is assumed that the rain begins prior to, or at about the same time as the evacuation advisory is issued. Therefore, no weather-related reduction in the number of transients who may be present in the EPZ is assumed. The capacity and free-flow speed on all links in the analysis network was reduced by 10% for rain scenarios, based on research performed by Agarwal, et al.[3]

Table 6-4 presents the scenarios considered for the 2008 ETE study; rain is considered in Scenarios 2, 4, 7 and 9. The number of evacuation scenarios considered for ETE purposes balances the need to represent all conditions encountered throughout a typical year, with the need to avoid an excessive number of scenarios. An excessive number of scenarios could be confusing to the protective action decision maker; as it would introduce a higher potential for choosing the wrong scenario at the time of the accident, thereby potentially referencing an incorrect value of ETE. On the other hand, if the number of scenarios considered were too low, then the range of circumstances that could occur over a period of a typical year would not be adequately represented and that could lead to an inappropriate selection of ETE for PAR purposes.

With that as background, it was explored whether to consider snow scenarios for CCNPP. In discussion with utility personnel and other local representatives, the general consensus was that snow was infrequent and of small impact on traffic. We then accessed the data compiled by the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA) to confirm these impressions. We compiled the following data over the last 5 years.

[3] Agarwal, M. et. Al. Impacts of Weather on Urban Freeway Traffic Flow Characteristics and Facility Capacity, Proceedings of the 2005 Mid-Continent Transportation Research Symposium, August, 2005.

Table 1. Maximum Depth of Snow, inches					
Month	Year				
	2003	2004	2005	2006	2007
January	3	3	2	0	1
February	6	0	2	4	1
March	0	0	0	0	0
December	0	0	3	0	1

Table 2. Days with Snow Depth >= 1 inch					
Month	Year				
	2003	2004	2005	2006	2007
January	3	6	4	0	1
February	13	0	1	3	1
March	0	0	0	0	0
December	0	0	1	0	1

As indicated by Table 1, there have been only two instances in the last 5 years where the maximum depth of snow equaled or exceeded 4 inches. The value of 4 inches is a threshold since snowplowing is generally only authorized and practical when the depth of snow approximates 4 inches. The spreading of salt, of course, often takes place at lower depths of snow when icing conditions occur. Table 2 indicates that there were 3 days in 2006 and 3 days in 2007 where at least 1 inch of snow coverage was present, with 4 inches being the maximum depth. Given the infrequency of snow in this area over the past 5 years and the fact that the maximum depth of snow exceeded 4 inches only twice in that time, led us to the conclusion that it was not necessary to develop separate scenarios for snow.

Given global warming trends, it is believed that going back farther into the past would not be appropriate, even though looking farther back more storms of greater magnitude could be found. The global warming trend is evident in Table 2; in 2003 there were 16 days of at least 1 inch of snowfall, 6 days in 2004 and in 2005, and 3 days in 2006 and in 2007.

Nonetheless, two snow scenarios will be added to a future revision of the ETE report to address the unlikely event that significant snowfall is coincident with an advisory to evacuate the CCNPP EPZ. The capacity and free flow speed on all links in the analysis network was reduced by 20% for these new snow scenarios, also based on the research of Agarwal, et al referenced on page 1 of this response. In addition, the snow removal mobilization time distribution recently obtained from the telephone survey results of the Susquehanna Steam Electric Station (SSES) EPZ was adapted. The telephone survey question asks, "How long would it take you to clear 6-8" of snow to move the car from the driveway or curb to begin the evacuation trip? Assume the roads are passable." Table 5-1 of the 2008 ETE report will be replaced in a future revision of the ETE report with the attached revised table, which includes distributions for snow. The attached

table shows the results of these runs, which will be added to Table 7-1 and J-1 in the future revision of the ETE.

Liang, et al studied the effect of environmental factors on driver speed (including fog and high winds) on a 160-km corridor of Interstate 84 in southeast Idaho and northwest Utah[4]. Traffic speed data was provided by automatic traffic counters, while weather data was recorded by visibility and weather sensors from December 1995 through April 1996. Multiple regression analysis was used to determine the relationship between environmental factors and driver speed. It was found that fog reduces mean speed from the base of 105.9 km/h to 97.9 km/h, an 8% decrease. Thus, the speed reduction is comparable to that of rain used in the 2008 ETE report. It was also found that drivers reduce their speeds on the average by 1.1 km/h for every kilometer per hour that the wind speed exceeds 40 km/h. Therefore, for a wind speed of 60 km/h, there would be a reduction of 22 km/h or 21% when compared to the mean speed of 105.9 km/hr for base conditions. This is comparable to the speed reduction used for snow in the 2008 ETE report. It is important to note that if weather conditions are so severe, the suggested protective action could be to shelter, rather than to evacuate. The adverse weather conditions considered in the 2008 ETE report as amended with the two snow scenarios are reasonable weather conditions which should provide decision makers with data useful for making protective action recommendations in adverse weather conditions.

B. As discussed in the response to part A above, it is assumed that under heavy snow conditions, it is necessary to allow for some snow to be removed from the driveways of residents before they can move their car from the driveway and begin their evacuation trip. Comparison of Distributions C and D with Distributions E and F in the attached revised Table 5-1 indicates that the preparation time for residents will be longer in winter adverse weather. It is assumed that the preparation time for employees and transients is unaffected by snow as commercial property is usually kept passable, and they will not have to shovel a driveway before beginning their evacuation trip.

COLA Impact

The following ETE report updates will be provided in a future revision of the CCNPP Unit 3 COLA:

- snow scenarios will be added to the table on page 2-3 of the ETE report.
- snow will be added as assumption 9 of Section 2.3 of the ETE report.
- a reference to the research of Agarwal, et al and Liang, et al will be added to assumption 9 of Section 2.3 of the report.
- Section 5 of the ETE report will be modified to include the snow removal distribution.
- Table 5-1 of the ETE report will be replaced with the attached version of Table 5-1.
- Sections 6 and 7, Appendix J – references to "12 Scenarios" will be replaced with "14 Scenarios".
- snow scenarios will be added to Tables 6-2 through 6-4.
- Tables 7-1A, B, C and D – incorporate ETE results of snow scenarios.

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[4] Liang, W. et. Al. Effect of Environmental Factors on Driver Speed: A Case Study, Transportation Research Record 1635, January, 1998, pp. 155-161.

- Tables J-1A, B, C and D – incorporate ETE results of snow scenarios.
- attached figures J-13 and J-14 will be added to Appendix J

Table 5-1: Trip Generation Time Histograms for the EPZ Population

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period					
		Employees (Distribution A)	Transients (Distribution B)	Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents With Commuters Snow (Distribution E)	Residents Without Commuters Snow (Distribution F)
1	15	6	6	0	2	0	0
2	15	28	28	0	14	0	1
3	15	31	31	2	27	0	6
4	15	16	16	8	23	1	15
5	30	14	14	27	23	11	35
6	30	5	5	26	5	22	21
7	30	0	0	17	3	22	9
8	30	0	0	10	3	18	6
9	60	0	0	10	0	18	7
10	60	0	0	0	0	8	0
11	600	0	0	0	0	0	0

Supplement to Tables 7-1A, J-1A. Time to Clear the Indicated Area of 50 Percent of the Affected Population

Season		Winter	Winter
Day of Week		Midweek	Weekend
Scenario:			
Time of Day		Midday	Midday
Zone	Region Wind Direction Towards	Snow	Snow
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	R01 2-mile ring	2:05	1:50
1,2,3	R02 5-mile ring	3:15	3:05
1,2,3,4,5, 6,7,8	R03 Entire EPZ	3:05	2:55
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	N, NNE, NE, ENE, E	Refer Region 1	
1,3	R04 ESE, SE, SSE, S	2:50	2:45
1,2,3	SSW, SW, WSW	Refer Region 2	
1,2	R05 W, WNW, NW, NNW	2:25	2:20
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1,2,3	NNE	Refer Region 2	
1,2,3,8	R06 NE, ENE, E, ESE, SE	3:10	3:05
1,2,3,7	R07 SSE, S	3:00	2:55
1,2,3,6,7	R08 SSW, SW	3:05	3:00
1,2,3,4,6, 7	R09 WSW	3:05	3:00
1,2,3,4,6	R10 W	3:05	2:55
1,2,3,4,5, 6	R11 WNW	3:05	2:55
1,2,3,4,5	R12 NW, NNW	3:15	3:05
1,2,3,5	R13 N	3:15	3:05
1,8	R14	2:05	1:50

Supplement to Tables 7-1B, J-1B. Time to Clear the Indicated Area of 90 Percent of the Affected Population

Season		Winter	Winter
Day of Week		Midweek	Weekend
Scenario:			
Time of Day		Midday	Midday
Zone	Region Wind Direction Towards	Snow	Snow
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	R01 2-mile ring	3:40	3:10
1,2,3	R02 5-mile ring	5:30	5:20
1,2,3,4,5, 6,7,8	R03 Entire EPZ	5:40	5:30
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	N, NNE, NE, ENE, E	Refer Region 1	
1,3	R04 ESE, SE, SSE, S	5:50	5:40
1,2,3	SSW, SW, WSW	Refer Region 2	
1,2	R05 W, WNW, NW, NNW	4:00	3:50
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1,2,3	NNE	Refer Region 2	
1,2,3,8	R06 NE, ENE, E, ESE, SE	5:30	5:10
1,2,3,7	R07 SSE, S	5:30	5:20
1,2,3,6,7	R08 SSW, SW	5:30	5:20
1,2,3,4,6, 7	R09 WSW	5:35	5:30
1,2,3,4,6	R10 W	5:40	5:30
1,2,3,4,5, 6	R11 WNW	5:40	5:30
1,2,3,4,5	R12 NW, NNW	5:35	5:25
1,2,3,5	R13 N	5:40	5:25
1,8	R14	3:40	3:15

Supplement to Tables 7-1C, J-1C. Time to Clear the Indicated Area of 95 Percent of the Affected Population

Season		Winter	Winter
Day of Week		Midweek	Weekend
Scenario:			
Time of Day		Midday	Midday
Zone	Region Wind Direction Towards	Snow	Snow
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	R01 2-mile ring	4:00	3:40
1,2,3	R02 5-mile ring	6:30	6:20
1,2,3,4,5, 6,7,8	R03 Entire EPZ	6:30	6:20
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	N, NNE, NE, ENE, E	Refer Region 1	
1,3	R04 ESE, SE, SSE, S	6:30	6:20
1,2,3	SSW, SW, WSW	Refer Region 2	
1,2	R05 W, WNW, NW, NNW	4:15	4:05
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1,2,3	NNE	Refer Region 2	
1,2,3,8	R06 NE, ENE, E, ESE, SE	6:30	6:20
1,2,3,7	R07 SSE, S	6:10	6:10
1,2,3,6,7	R08 SSW, SW	6:10	6:10
1,2,3,4,6, 7	R09 WSW	6:10	6:05
1,2,3,4,6	R10 W	6:30	6:20
1,2,3,4,5, 6	R11 WNW	6:30	6:20
1,2,3,4,5	R12 NW, NNW	6:20	6:10
1,2,3,5	R13 N	6:30	6:20
1,8	R14	4:00	3:40

Supplement to Tables 7-1D, J-1D. Time to Clear the Indicated Area of 100 Percent of the Affected Population

Season		Winter	Winter
Day of Week		Midweek	Weekend
Scenario:			
Time of Day		Midday	Midday
Zone	Region Wind Direction Towards	Snow	Snow
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	R01 2-mile ring	5:10	5:00
1,2,3	R02 5-mile ring	7:40	7:20
1,2,3,4,5, 6,7,8	R03 Entire EPZ	7:50	7:40
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1	N, NNE, NE, ENE, E	Refer Region 1	
1,3	R04 ESE, SE, SSE, S	7:30	7:20
1,2,3	SSW, SW, WSW	Refer Region 2	
1,2	R05 W, WNW, NW, NNW	5:20	5:00
Entire 2-Mile Region, 5-Mile Region, and EPZ			
1,2,3	NNE	Refer Region 2	
1,2,3,8	R06 NE, ENE, E, ESE, SE	7:40	7:20
1,2,3,7	R07 SSE, S	7:40	7:40
1,2,3,6,7	R08 SSW, SW	7:50	7:40
1,2,3,4,6, 7	R09 WSW	7:50	7:40
1,2,3,4,6	R10 W	7:50	7:40
1,2,3,4,5, 6	R11 WNW	7:50	7:40
1,2,3,4,5	R12 NW, NNW	7:50	7:30
1,2,3,5	R13 N	7:40	7:30
1,8	R14	5:10	5:00

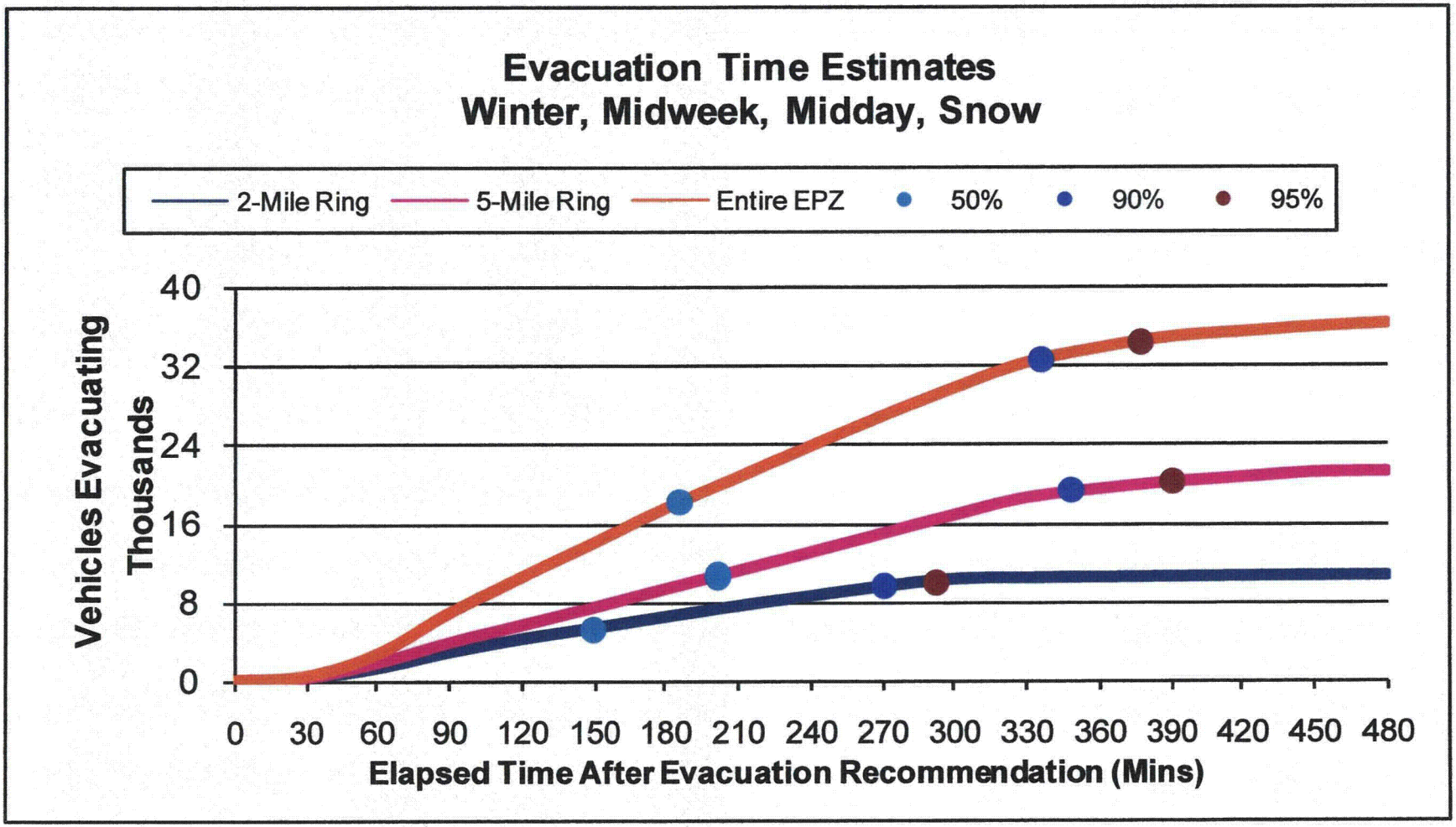

Figure J-13. Evacuation Time Estimates – Scenario 13 for Region R03 (Entire EPZ)

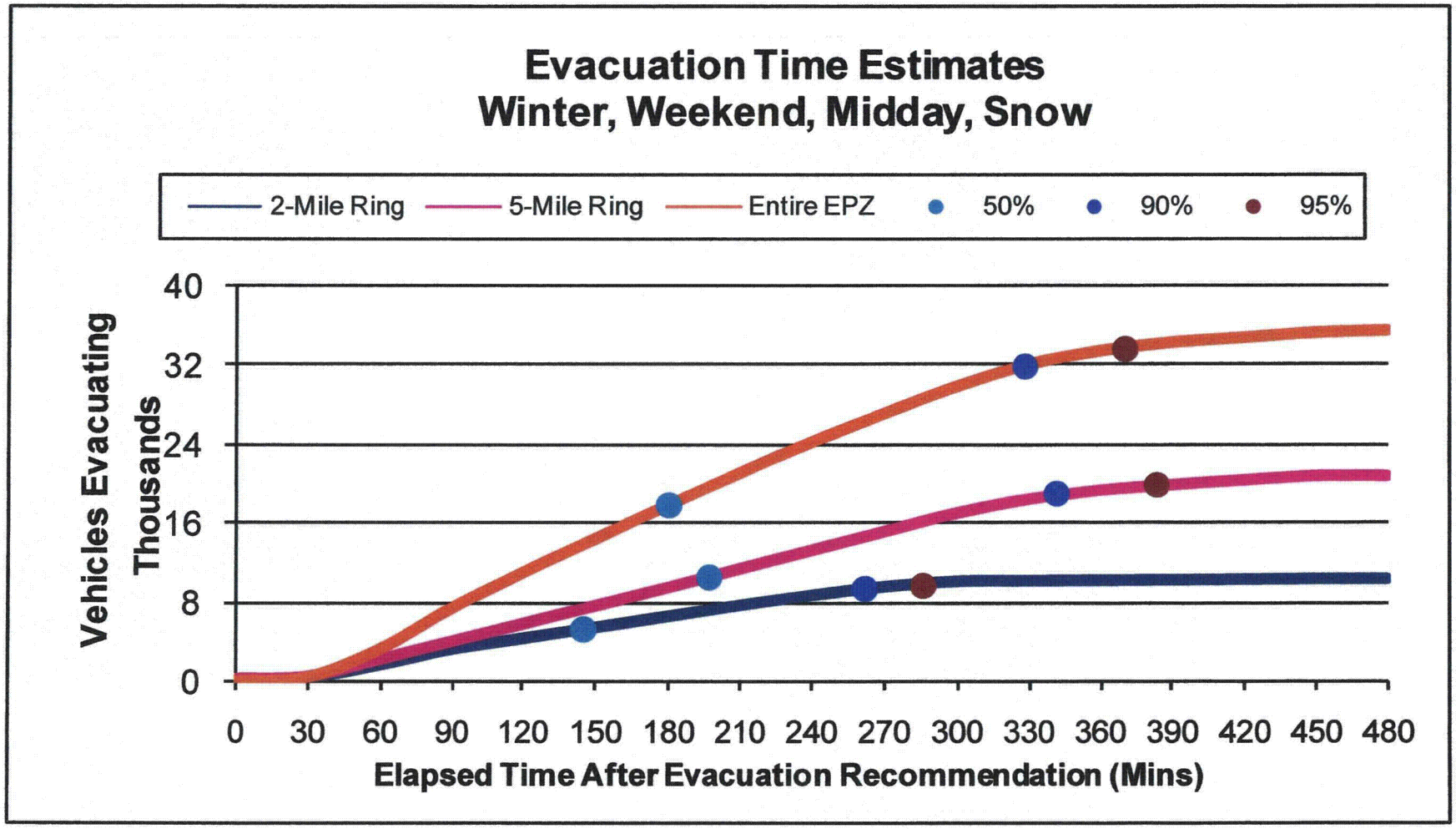

Figure J-14. Evacuation Time Estimates – Scenario 14 for Region R03 (Entire EPZ)

NRC RAI 13.03-13

ETE-13: Subject: Text Supporting Tables
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section IV.A.2.
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. The text on page 3-3 states that the distribution curves are represented by a bar graph in Figure 3-1, "Public Response Curves" (page 3-9). Figure 3-1 on page 3-9 is titled "Public Response Time Estimates." The text should be modified to include the correct figure title.

B. The text on page 6-2 states: "Evacuation confirmation time estimates for each "*Emergency Action Zone*" are presented in Table 6-5." The table and other supporting text refer to them as "*Protective Action Zones.*" Provide an explanation regarding the use of the differing terminology.

C. The difference between daytime and nighttime populations at 0-10 miles for all Protective Action Zones in Table 1-2, "Summary of General Population Evacuation Time Estimates-Winter," (page 1-5) is large when compared to Table 1-1, "Summary of General Population Evacuation Time Estimates-Summer," (page 1-4) values. Discuss why transient populations are not higher in the summer.

Response

A. A random sample telephone survey (see the response to RAI 13.03-14 for additional information) was undertaken of the EPZ population as part of the 2008 ETE report. Appendix F of the ETE report presents the telephone survey data obtained as well as the sampling plan and the survey instrument. Section 5 of the ETE report presents the estimation of trip generation time based on the data obtained from the telephone survey. Figure 5-2 plots the time distributions for the various mobilization activities performed by the EPZ population prior to evacuating, while Figure 5-3 plots the trip generation curves (S-curves) for the various population groups within the EPZ.

B. The terms Protective Action Zone (PAZ) and Zone have been used interchangeably in the 2008 ETE report. Page 30 of the public information calendar

(http://www.constellation.com/vcmfiles/Constellation/Files/ConstellationEnergy_CCNPP.pdf) uses the terms PAZ and Zone interchangeably; therefore, the public and the local emergency planners should be familiar with either term.

C. Table 6-2 of the 2008 ETE report summarizes the scenarios considered in the ETE study. Table 6-3 presents the percent of population groups evacuating for each scenario. As indicated in the table, transients are at their peak (100%) under Scenario 3 and 4 conditions – summer, weekend scenarios. The number of transients is significantly reduced (40%) under Scenario 8 and 9 conditions – winter, weekend scenarios. Table 6-4 presents the vehicle estimates by scenario; as shown, there are 1,918 transient vehicles evacuating during the summer, weekend scenarios versus 767 transient vehicles during the winter, weekend. Therefore, transient populations are higher in the summer than in the winter.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-14

ETE-14: Subject: Methodology for Total Evacuation Times
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section IV.B.
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

For clarification of the assumptions, explain what action items or steps are included in the estimation of "Total Public Response Time" in Tables 1-1 and 1-2, "Summary of General Evacuation Times Estimates – Summer/ Winter," on pages I-4 and I-5 respectively. For example, does preparation time include time to travel home from work, as well as time to prepare one's home for evacuation? Also, discuss whether the column titled, "General Public Evacuation Times," is a summation of previous travel (from work) and preparation activities, or is it solely the time to evacuate?

Response

A detailed telephone survey of the EPZ population was conducted to gather demographic data and data about mobilization activities specific to the EPZ population. Appendix F of the ETE report documents the telephone survey, including the sample size, the survey instrument and the results obtained. The questions posed in the telephone survey relate to everyday activities of the population – e.g., How long does it take you to travel to work? No mention was made of evacuation or of the nuclear plant, so as to avoid bias towards faster response times.

Section 5 of the ETE report describes the estimates of trip generation time obtained from the results of the telephone survey. As discussed on page 5-3 and shown graphically in Figure 5-1, the trip generation distributions, which include the times of all mobilization activities, vary from one population group to the next and consists of several activities. For example, an employee who commutes into the EPZ to work each day must receive notification, prepare to leave work, and then begin his evacuation trip. Someone who works in the EPZ, on the other hand, would have to receive notification, prepare to leave work, travel home from work, prepare to leave for the evacuation trip (pack supplies, load the car, etc.) and then begin his evacuation trip. Figure 5-3 presents the trip generation curves graphically, while Table 5-1 provides the trip generation statistics for the EPZ population. The values presented in Table 5-1 were input to the PC-DYNEV simulation model to generate the appropriate number of vehicles on each source link for each time period considered (See Appendices B and C for more information). The general population ETE provided in Tables 7-1A through D were computed using the trip generation curves presented in Section 5.

Proposed COLA Revisions

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-15

ETE-15: Subject: Evacuation Confirmation
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section V.A
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Section 6.5, "Evacuation Confirmation Time Estimates," (page 6-2) states that the county emergency management agency officials and law enforcement personnel estimate confirmation times based upon the number of vehicles available and the number of miles to be driven in each evacuation area. Discuss how these estimates may fluctuate depending on vehicle availability and miles to be driven.

Response

Resources and manpower needs for vehicular-based confirmation of evacuation are likely to be limited during an evacuation of the CCNPP EPZ, as discussed on page G-1 of the 2008 ETE report. Section 12 of the 2008 ETE report suggests a telephone survey of EPZ households be undertaken during the last hours of the evacuation to determine if the advisory to evacuate is being adhered to. The benefits of this suggested procedure are:

- Law enforcement personnel and patrol vehicles are not needed at that time.
- The telephone survey can be conducted by clerical personnel at a location outside the EPZ (e.g., at the Emergency Operations Center – EOC).

The confirmation times presented in Table 6-5 of the previous ETE report range from 30 to 90 minutes depending on the Protective Action Zone. The discussion on page 12-1 of the 2008 ETE report indicates that the use of 6 telephone operators working in parallel to call EPZ households would require about 75 minutes to confirm that the advisory to evacuate has been adhered to. The use of modern automated dialing equipment could likely reduce this time further. Nonetheless, the confirmation time presented in the 2008 ETE report is comparable to that of the previous ETE report.

If this method is used by the EPZ counties, it is recommended that a list of telephone numbers within the EPZ be available in the EOC at all times. Such a list could be purchased from vendors and should be periodically updated. As indicated in the third paragraph on Page 12-1, the confirmation process should not begin until 3 hours after the Advisory to Evacuate, to ensure that households have had enough time to mobilize. This 3-hour timeframe will enable telephone operators to arrive at their workplace, access the call list and prepare to make the necessary phone calls.

This proposed method does not preclude the counties from conducting route-based confirmation procedures when personnel become available.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-16

ETE-16: Subject: Recommendations
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E NUREG-0654/FEMA-REP-1; Appendix 4 Section V.B
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

A. Section 7.2, "Recommendations," (page 7-2) states that adding additional traffic control points could reduce the evacuation time estimates. Eight intersections in Calvert County and 16 additional intersections in St. Mary's County are listed.

1. Provide information regarding what is done with these recommendations.
2. Provide information regarding the cost associated with these recommendations.
3. Explain whether any additional changes could be instituted that could affect the current state of the transportation network.

B. The St. Mary's County Transportation Plan, dated August 2006, identifies a need to widen Maryland Route 4 to support current traffic volume and anticipated growth. This project is estimated to cost 41 million dollars. The plan also identifies a need for a second span on the Thomas Johnson Bridge estimated to cost 131 million dollars. Explain why potential widening of Maryland Route 4 and construction of a new span for the Thomas Johnson Bridge, which would improve evacuation times, were not discussed in the ETE.

Response

A.1,2 Section 9 and Appendix G of the ETE report document the traffic management plan to be implemented and the objective of that plan. Fifteen traffic control points (TCPs) are identified to help facilitate the flow of evacuating traffic. Five access control point (ACPs) are identified to discourage vehicles originating outside the EPZ from entering the EPZ.

Conservatively, the ETE calculations do not rely upon any of the traffic control measures in Appendix G. The estimates of capacity, which are used by the I-DYNEV system (see page 1-6 of the ETE report) and are documented in Appendix K, are based upon the factors described in Section 4 of the ETE report and upon the observations made during the road survey. It is assumed that these capacity estimates are not enhanced nor compromised by the establishment of a TCP at an intersection. As detailed in Section 9, the functions to be performed in the field at TCPs are to (1) facilitate evacuating traffic movements; and (2) discourage those movements that would move travelers closer to the Power Station. The personnel manning these TCPs will also serve a surveillance function to inform the EOC of any problems that occur in the vicinity or are reported to them by evacuees.

The values of the variables in the intersection algorithm in Section 4 were derived by applying the I-DYNEV system as an analysis tool rather than as a single "pass-through" calculation of an ETE. This tool was used to identify points of congestion and locations where TCPs could be helpful to the evacuating public. Detailed results of the simulation were analyzed to identify locations where the green time was specified to realistically service the competing traffic volumes under evacuation conditions. The model was executed iteratively to provide assurance that the allocation of "effective green time" appropriately represents the operating conditions of an evacuation.

The equation on page 4-1 of the ETE report applies to signalized and to manually-controlled intersections. The iterative procedure described above does not attempt to "optimize" traffic operations at an intersection, but rather represents a reasonably efficient operation under evacuation conditions. The establishment of a TCP at an intersection could well provide greater operational performance than is represented by the calibrated DYNEV model. Thus, if all TCPs are manned in a timely manner by experienced personnel, it is possible that the ETEs predicted by the model might be somewhat longer than achievable in the real world under these ideal circumstances. It is our belief that ETEs should represent reasonable, but not optimal expectations. Therefore, no allowance is made for TCP operations.

When there are competing traffic movements at an intersection or juncture, the real estate within the intersection must be time shared by these competing movements in order to afford safe passage. This is the situation during normal conditions as well. This process is implemented in the simulation model by the analyst determining the allocation of effective green time as described above. Thus, depending upon circumstances, one or more of the competing traffic flows may be delayed at the intersection as it would be in the real world, thereby influencing the travel time of evacuees. Figures 7-3 through 7-6 illustrate the resulting queuing that can take place as a result of this time sharing process when the traffic demand exceeds the intersection capacity at the indicated locations and times.

A.3 The final two paragraphs of Section 9 of the ETE report discuss the use of Intelligent Transportation Systems (ITS) technologies and signage to facilitate the evacuation process and to reduce the manpower and equipment needs for implementing the traffic management plan.

As discussed in the third paragraph of Section 7 of the ETE report, southbound traffic servicing the population in Zone 3 traveling toward the Thomas Johnson Bridge is problematic to evacuees from Zone 3 of the EPZ (the most populous Zone in the EPZ). A sensitivity study was conducted wherein evacuees were permitted to evacuate northbound and southbound on Route 2/4. As shown in Appendix I (page I-3), this results in a decrease in ETE of 4 hours and 40 minutes for an evacuation of the full EPZ (Region R03) relative to the routing of evacuees southbound only.

A sensitivity study was also conducted to estimate the effect on ETE of contra-flowing traffic on the Thomas Johnson Bridge. As discussed in Appendix I (page I-5), this tactic does not affect ETE as traffic departing Zone 3 is metered by the traffic signal at the intersection of Route 2/4 and Rousby Hall Rd (the only access point to southbound Route 2/4 for the majority of the population in Zone 3).

Since the report was prepared, a new connector to southbound Route 2/4 in Lusby has been constructed. Given the chokepoint that existed at the intersection of Rousby Hall Rd and Route 2/4, as described in the response to RAI 13.03-11D, this new connector could provide a material reduction in ETE, reduce the number of evacuees traveling north past the CCNPP and open the possibility that a contra-flow treatment of the bridge could provide further benefits. A series of sensitivity studies could explore these and other options, by introducing the new collector into the analysis network. This will be addressed in a future revision of the ETE report.

B. As stated in Appendix 4 of NUREG-0654, Rev. 1, "...evacuation time estimates should be updated as local conditions change." The response to Part A.3 above is presented with this regulatory requirement in mind. However, in contrast with the actual existence of a new connector in Lusby, this comment identifies *needs* for a potential widening of Route 2/4 and a second bridge span. Given the early stage of such planning, the associated uncertainties and lack of preliminary design specifics, an ETE analysis is premature, absent a specific request by the applicant or government.

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

NRC RAI 13.03-17

ETE-17: Subject: Consultations with other Agencies
Basis: 10 CFR 52.79(a)(21), 10 CFR 50.47, 10 CFR Part 50 Appendix E, NUREG-0654/FEMA-REP-1; Appendix 4 Section V.C
SRP ACCEPTANCE CRITERIA: Requirements A, B, E, and H; Acceptance Criterion 11

Section 1.2, "Summary," (page 1-2) states that Rev. 6 of the Evacuation Time Estimate (ETE) will be reviewed with Maryland Emergency Management Agency, Maryland Department of the Environment, Maryland Department of Natural Resources, and emergency management officials from Calvert, St. Mary's and Dorchester Counties. Discuss when revision 6 of the ETE will be reviewed with State and local officials.

Response

A draft ETE report was provided to Constellation Energy (owner/operator of Calvert Cliffs Units 1 and 2) on December 11, 2007. The report was reviewed by Constellation Energy and distributed to emergency management officials from Calvert, St. Mary's and Dorchester Counties and from the State of Maryland to solicit comments. Comments were consolidated from February 14 through February 25, 2008. These comments were addressed accordingly and a final report was submitted to Constellation Energy on April 21, 2008. Additional sensitivity studies and ETE cases were deemed necessary thereafter. An addendum to the ETE report was issued on August 22, 2008 to document the additional ETE cases considered (Enclosure 3).

COLA Impact

No changes to the CCNPP Unit 3 COLA are required.

Enclosure 2

Calvert Cliffs Nuclear Power Plant

Development of Evacuation Time Estimates

Enclosure 3

Addendum to Calvert Cliffs Nuclear Power Plant

Development of Evacuation Time Estimates

Enclosure 4

Large Scale Traffic Map of the Calvert Cliffs Site Region

Enclosure 5

Page Markups for the "Calvert Cliffs Nuclear Power Plant Unit 3, Emergency Response Plan" and "CCNPP Unit 3 Impact to CCNPP Units 1 & 2 Emergency Preparedness Program Evaluation"

Page Markup for the Calvert Cliffs Nuclear Power Plant Unit 3, Emergency Response Plan

PART III: Appendices

Appendix 5: Evacuation Time Estimates

~~{On August 30, 2002, Constellation Energy issued Revision 6 to the "Evacuation Time Estimates Within the Plume Pathway Emergency Planning Zone for the Calvert Cliffs Nuclear Power Plant."~~Evacuation time estimates are described in the "Calvert Cliffs Nuclear Power Plant Development of Evacuation Time Estimates, Final Report, dated April 2008, and the Addendum to Calvert Cliffs Nuclear Power Plant Development of Evacuation Time Estimates, Revision 0, dated August 2008}

The results are provided separately in Part ~~11~~ 5 of the COL Application.

Page Markup for the CCNPP Unit 3 Impact to CCNPP Units 1 & 2 Emergency Preparedness Program Evaluation

CCNPP UNIT 3 IMPACT TO CCNPP UNITS 1 & 2 EMERGENCY PREPAREDNESS PROGRAM EVALUATION

(6) Address the applicability of the existing ETE or provide a revised ETE, if appropriate.

~~The current ETE study report conducted for the CCNPP site is dated August 30, 2002 and is sufficient for the operation of Unit 3.~~

~~A Traffic Impact Analysis was performed to assess the impact of construction of Unit 3 on the current transportation routes near the site. The results of this study were provided in the CCNPP Unit 3 Environmental Report Section 4.4.1.5, Transportation Routes of the Environmental Report, and concluded that additional mitigation during the construction period will be needed. The types of mitigation suggested to address the construction impact include both physical improvements and management measures (such as staggered shift changes). Thus, the impacts to the surrounding communities from construction traffic, although expected to be moderate, will be temporary and manageable with the additional mitigation.~~

~~Additionally, a special site evacuation scenario considering the Unit 3 construction workforce will be developed to determine the potential impact on the existing ETEs that could occur prior to Unit 3 construction. If changes to the ETEs are warranted based upon this analysis, the ETE study report will be revised~~

A revised ETE study report conducted for the site, "Calvert Cliffs Nuclear Power Plant Development of Evacuation Time Estimates", Final Report, dated April 2008 and the "Addendum to Calvert Cliffs Nuclear Power Plant Development of Evacuation Time Estimates", Revision 0, dated August 2008, is provided for CCNPP. The revised ETE contains special site evacuation scenarios which consider the CCNPP3 construction workforce to determine the potential impact on the existing ETEs that could occur.