2. STUDY ESTIMATES AND ASSUMPTIONS

This section presents the estimates and assumptions utilized in the development of the evacuation time estimates.

2.1 Data Estimates

1. Population estimates are based upon Census 2000 data, projected to year 2007 by Enercon Services using regression analysis on County-specific projections. Estimates of employees who commute into the EPZ to work are based upon the state Journey to Work Database for 2000, projected to year 2007 using U.S. Department of Labor job growth rates.
2. Population estimates at special facilities are based on available data from county emergency management offices.
3. Roadway capacity estimates are based on field surveys and the application of Highway Capacity Manual 2000.
4. Population mobilization times are based on a statistical analysis of data acquired from the telephone survey.
5. The relationship between resident population and evacuating vehicles is developed from the telephone survey. Average values of 2.62 persons per household and 1.44 evacuating vehicles per household are used. A sensitivity study was conducted to measure the effect on ETE of increasing the number of evacuating vehicles per household. (See Appendix I)
6. The relationship between persons and vehicles for special facilities is as follows:
   a. Shopping: 1 vehicle per family
   b. Employees: 1.03 employees per vehicle (telephone survey results)
   c. Parks: 2 people per vehicle
7. ETE are presented for the evacuation of the 100^{th} percentile of population for each Region and for each Scenario, and for the 2-mile, 5-mile and 10-mile distances. ETE are presented in tabular format and graphically showing the values of ETE associated with the 50^{th}, 90^{th} and 95^{th} percentiles of population. A Region is defined as a group of Emergency Response Planning Areas (ERPA) that is issued an Advisory to Evacuate.

2.2 Study Methodological Assumptions

1. The Evacuation Time is defined as the elapsed time from the Advisory to Evacuate issued to a specific Region of the EPZ, to the time that Region is clear of people.
2. The ETE are computed and presented in a format compliant with NUREG 0654, CR-1745 and CR-6863. The ETE for each evacuation area ("Region" comprised of included ERPA) is presented in both statistical and graphical formats.
3. Evacuation movements (paths of travel) are generally outbound relative to the power station to the extent permitted by the highway network, as computed by the computer models. All available evacuation routes are used in the analysis.
4. Regions are defined by the underlying "keyhole" or circular configurations as specified in NUREG 0654. These Regions, as defined, display irregular boundaries reflecting the geography of the ERPA included within these underlying configurations.
5. Voluntary evacuation is considered as indicated in the accompanying Figure 2-1. Within the circle defined by the distance to be evacuated but outside the Evacuation Region, 50 percent of the people not advised to evacuate are assumed to evacuate within the same time-frame. In the outer annular area between the circle defined by the extent of the Evacuation Region and the EPZ boundary, it is assumed that 35 percent of people will voluntarily evacuate. In the area between the EPZ boundary and a 15-mile circular area centered at the plant (the "shadow region"), it will be assumed that 30 percent of the people will evacuate voluntarily. Sensitivity studies explored the effect on ETE, of increasing the percentage of voluntary evacuees in this area (Appendix I). The basis for our assumptions on voluntary evacuation is testimony proffered by Dennis Miletti, a professor at Colorado State University, and one of the nations top disaster response experts, at Atomic Safety and Licensing Board (ASLB) hearings, which were deemed acceptable. There are limited data pertaining to nuclear evacuations in the United States. The numbers we use are Professor Miletti's best estimates based on his years of experience in evacuation planning and emergency preparedness.

6. A total of 12 “Scenarios” representing different seasons, time of day, day of week and weather are considered. These Scenarios are tabulated below:

Scenario	Season	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Midweek	Midday	Ice	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Midweek, Weekend	Evening	Good	None
12	Summer	Midweek	Midday	Good	New Plant Construction

7. The models of the IDYNEV System were recognized as state of the art by Atomic Safety & Licensing Boards (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik[1]). The models have continuously been refined and extended since those hearings and have been independently validated by a consultant retained by the NRC.

[1] Urbanik, T., et. al. Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code, NUREG/CR-4873, Nuclear Regulatory Commission, June, 1988

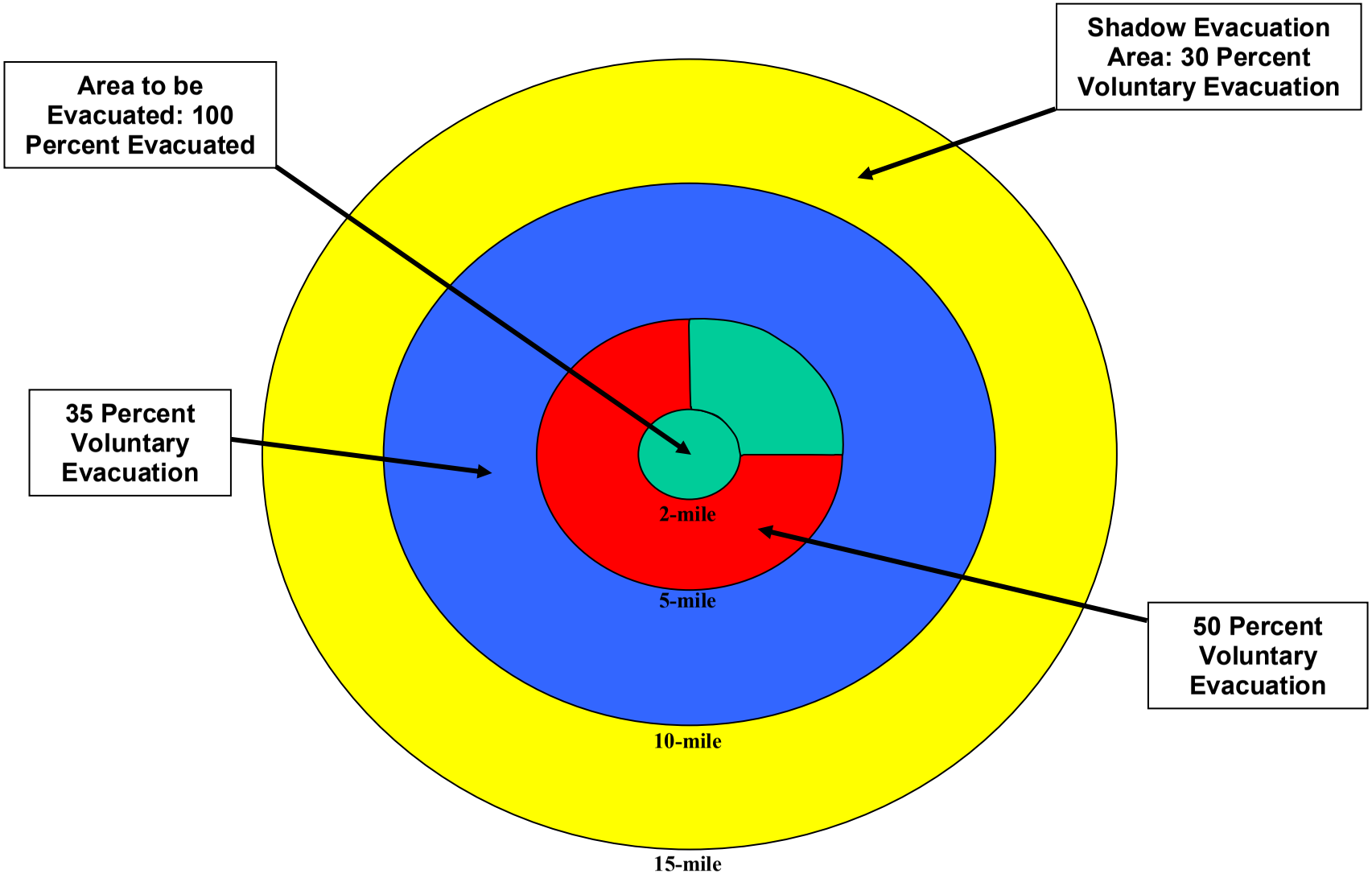

Figure 2-1. Voluntary Evacuation Methodology

2.3 Study Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating accident that requires evacuation, and includes the following:

   a. Advisory to Evacuate is announced coincident with the siren notification.

   b. Mobilization of the general population will commence within 10 minutes after siren notification.

   c. ETE are measured relative to the Advisory to Evacuate.

2. It is assumed that everyone within the group of ERPA forming a Region that is issued an Advisory to Evacuate will, in fact, respond and evacuate in general accord with the planned routes.

3. It is further assumed that:

   a. Schools will be given the earliest notification possible so they can begin evacuating prior to notification of the general public, if conditions permit. In the case of a rapidly escalating accident, however, this may not be possible.

   b. 68 percent of the households in the EPZ have at least 1 commuter; 71 percent of those households with commuters will await the return of a commuter before beginning their evacuation trip, based on the telephone survey results.

4. The ETE will also include consideration of “through” (External-External) trips during the time that such traffic is permitted to enter the evacuated Region. “Normal” traffic flow is assumed to be present within the EPZ at the start of the emergency.

5. Access Control Points (ACP) will be staffed within approximately 1 - 2 hours following the siren notifications, to divert traffic attempting to enter the EPZ. Earlier activation of ACP locations would delay returning commuters. It is assumed that no vehicles will enter the EPZ after this 1 – 2 hour time period.

6. Traffic Control Points (TCP) within the EPZ will be staffed over time, beginning at the Advisory to Evacuate. Their number and location will depend on the Region to be evacuated and resources available. It is assumed that drivers will act rationally, travel in the directions identified in the plan, and obey all control devices and traffic guides.

7. Buses will be used to transport those without access to private vehicles:

   a. If schools are in session, transport (buses) will evacuate students directly to the assigned Reception Centers or host schools.

   b. Medical facilities are required to have a detailed evacuation plan

and to provide adequate transportation for all residents. Buses needed to evacuate special facilities are provided through private contracting.

c. Schoolchildren, if school is in session, are given priority in assigning transit vehicles.

d. Bus mobilization time is considered in ETE calculations.

e. Analysis of the number of required "waves" of evacuating transit vehicles is presented.

8. Provisions are made for evacuating the transit-dependent portion of the general population to reception centers by bus, based on the assumption that some of these people will ride-share with family, neighbors, and friends, thus reducing the demand for buses. We assume that the percentage of people who rideshare is 50 percent. This assumption is based upon reported experience for other emergencies,[2] which cites previous evacuation experience.

9. Two types of adverse weather scenario are considered. Rain may occur for either winter or summer scenarios. In the case of rain, it is assumed that the rain begins at about the same time as the evacuation advisory is issued. Ice occurs in winter scenarios only. No weather-related reduction in the number of transients who may be present in the EPZ is assumed.

   Adverse weather scenarios affect roadway capacity and the free flow highway speeds. The factors assumed for the ETE study are:

Scenario	Highway Capacity*	Free Flow Speed*	Mobilization Time
Rain[3]	90%	90%	No Effect
Ice	85%	85%	No Effect
*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.			

10. School buses used to transport students are assumed to transport 70 children per bus for elementary schools, and 50 children per bus for middle and high schools. Transit buses used to transport the transit-dependent general population are assumed to transport 30 people per bus.

[2] Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The report indicates that 6,600 people of a transit-dependent population of 8,600 people shared rides with other residents; a ride share rate of 76% (Page 5-10).

[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.