UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ATTACHMENT #3

NOV 07 1980

NOTE TO: G. Lainas, Assistant Director for Safety Assessment, DL
T. Novak, Assistant Director for Operating Reactors, DL

FROM: L. Rubenstein, Assistant Director for Core and Containment Systems, DSI

SUBJECT: IP-2 EVENT VS CURRENT LICENSING CRITERIA

50-247

Enclosed is a discussion paper prepared by the Containment Systems Branch on the subject comparison.

L. S. Rubenstein

Lester S. Rubenstein, Assistant Director
for Core and Containment Systems
Division of Systems Integration

Enclosure:
Discussion paper

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DISCUSSION PAPER

1. Could an IP-2 event occur at other plants?

An IP-2 event could occur at any operating plant if the following conditions, which characterize the IP-2 event, are present:

a) operation of the normal sump pumps is not monitored in the control room, and the pumps are inoperable;

b) normal sump level instrumentation is inoperable or indications of water collection are ignored by operators;

c) system leakage detection capability is not provided or is ineffective below a certain leakage rate; and

d) visual surveillance of containment conditions is infrequent during plant operation.

2. Are IP-2 events routinely analyzed in licensing case reviews?

IP-2 events, i.e., flooding of the containment floor and/or the reactor cavity during reactor power operation, as a result of water leakage from low energy systems, are not design basis events that are analyzed in licensing case reviews.

3. Does adequate guidance presently exist which can be applied in evaluating plant design provisions to preclude IP2 events?

The appropriate application of Item II.9 of SRP 6.2.2 and Item II.11 of SRP 6.2.4 should be sufficient to preclude IP2 events, but only for safety related systems since the two SRPs are only applied to such systems II.9 of SRP 6.2.2 is concerned with the instrumentation to monitor containment heat removal system operability and II.11 of SRP 6.2.4 is concerned with

Enclosure

the preservation of containment integrity following an accident. Present guidelines would have to be expanded to include the surveillance of non-safety grade systems. Regulatory Guide 1.45 (Reactor Coolant Pressure Boundary Leakage Detection Systems) specifies that (normal) sump level and flow monitoring should be one of three leakage detection methods employed. This capability alone would be adequate to preclude an IP-2 event. However, in the case of Indian Point 2, indication of sump pump operation is not provided in the control room and the operators chose to ignore the sump level instrument because of past erratic behavior. One way to correct this is to revise Regulatory Guide 1.45 to stipulate more stringent design and performance criteria for sump level instrumentation and sump pump controls.

4. To what extent can leak testing provide assurance of continuing system integrity?

Appendix J to 10 CFR Part 50 and the changes that have been proposed only address components, systems and structures that comprise the containment boundary. Consequently, systems which do not constitute a containment isolation barrier would not be subject to leak testing.

The service water system at Indian Point 2 is an open system in that it draws water from, and returns it to, the Hudson River; however, the portion of the system inside containment constitutes a containment isolation barrier. The proposed changes to Appendix J would require periodic hydrostatic testing of the service water system to assure its integrity.

Hydrostatic leak testing of systems is being addressed in licensing case reviews, and probably should be imposed more vigorously in advance of revising Appendix J. Other guidance may have to be developed, outside Appendix J, if it is found that all liquid filled systems inside containment should be periodically leak tested to demonstrate continuing integrity.

5. Should the implementation schedule for TMI Action Plan Item II.F.1 (containment water level monitor) be accelerated?

It should be noted that II.F.1 of the TMI Action Plan only applies to emergency sumps. Therefore, the scope of II.F.1 may have to be expanded to include normal sump instrumentation if there is a desire to accelerate the implementation schedule for II.F.1. Furthermore, the decision to accelerate the implementaiton schedule for containment water level monitors should be based on the availability of reliable, safety grade instrumentation. The IP-2 operators ignored the readings from the level monitors based on past erratic behavior. Therefore, if operators refuse to respond to plant instrumentation, accelerating the implementation schedule will not result in improved safety.

6. Should new requirements be imposed?

IP-2 events should be included as part of a normal case review. Consequently, guidelines must be established which emphasize the need for monitoring the integrity of systems inside containment which could potentially flood the containment during normal operation. Both safety and non-safety grade systems must be addressed. The scope of Regulatory Guide 1.45 (which presently focuses attention on the reactor coolant pressure boundary) should be expanded to accomplish this.

Sump level instrumentation needs upgrading so that operators respond in a positive way to indications of water collecting in the sump. Normal sump pump controls need upgrading for more reliable pump performance and indication of operation. The sump level instrumentation and the monitoring of sump pump operation do provide some diversity in detecting the excessive collection of water in the containment; in this regard, sump level instrumentation should be separate from that used for sump pump control. In this regard, Item II.F.1 of the TMI Action Plan (which only pertains to emergency sumps) should be revised to consider both normal and emergency sump instrumentation requirements.

The Service Water System (SWS) at Indian Point 2 has a post-accident safety function and, therefore, automatic isolation of the system will not occur under accident conditions; local manual isolation valves are provided. In view of the lack of maintenance of the integrity of the SWS during normal plant operation, the following actions should be considered at IP-2 and other operating plants, and in licensing case reviews:

1. Systems having a post-accident safety function and which become extensions of the containment boundary, should be equipped with remote manual isolation valves, operable from the control room; local manual valves should no longer be accepted. Closed loop and open systems should be treated alike.

2. Proposed system leakage detection methods should be evaluated in sufficient detail to determine their effectiveness in alerting the operator of the need to isolate a system train to preserve containment integrity following an accident. (It should be noted that RG 1.97 presently contains no such requirements.)

3. Hydrostatic leak testing of systems which become extensions of the containment boundary following an accident should be required; criteria for test acceptance and performance frequency must be established.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AEOD/E104

MAR 2 1981

MEMORANDUM FOR: Thomas A. Rehm, Assistant for Operations
to the Executive Director for Operations

FROM: Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

SUBJECT: ENGINEERING EVALUATION OF FEEDWATER TRANSIENT AND SYSTEM PIPE BREAK AT TURKEY POINT UNIT 3

References: (1) Letter, William J. Dircks, Executive Director for Operations, Nuclear Regulatory Commission to The Honorable Dante B. Fascell, United States House of Representatives, dated January 29, 1981.

(2) Letter, Honorable Dante B. Fascell, Member of Congress, House of Representatives, to Mr. Carlton C. Kammerer, Director Office of Congressional Affairs, NRC, dated December 5, 1980.

(3) Letter, Warren Hoskins, President Conchshell Alliance to Congressman Dante B. Fascell, dated December 2, 1980.

Pursuant to your request, AEOD has reviewed the NRC response (Reference 1) to Congressman Fascell's letter of December 5, 1980 (Reference 2). The enclosure to Congressman Fascell's letter contained a letter from Mr. Warren Hoskins (Reference 3) concerning the series of events that occurred at Turkey Point Nuclear Power Station, Unit 3, on November 19, 1980. It is our belief that the issues presented and the information enclosed was responsive to Mr. Hoskin's concerns. Although the IE evaluation did not address the specific failures leading to the sequence of events, AEOD concurs in general with the NRC letter.

Based on our review of the letters, AEOD conducted an engineering evaluation to determine the causes for the reactor trips and the break of an alternate feedwater pipe from Fossil Unit No. 2. Our brief evaluation has concluded that the multiple failures of the Copes-Vulcan feedwater valves lead to the feedwater flow instabilities and subsequent reactor trips. The feedwater instabilities induced severe vibration in the secondary cooling system which apparently sheared the two-inch ancillary feedwater pipe. Enclosed is a description and sequence of occurrences at Turkey Point 3 and our evaluation of the event.

Carlyle Michelson

Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

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Enclosure:
As stated

ENGINEERING EVALUATION OF FEEDWATER TRANSIENT AND SYSTEM PIPE BREAK AT TURKEY POINT UNIT 3 ON NOVEMBER 19, 1980

by the

Office for Analysis and Evaluation

of Operational Data

February 1981

Prepared by: Stephen P. Sands
Reactor Systems Engineer

DESCRIPTION AND SEQUENCE OF OCCURRENCES

The findings and evaluation contained in this report are based on information gathered through informal channels between Florida Power and Light Company and the Nuclear Regulatory Commission.

The following is a description of events taking place at Turkey Point Unit 3 on November 19, 1980. The sequence of occurrences (shown on Figure 1) is clarified in further detail below.

During power operation, a reactor trip was initiated at Turkey Point 3 due to a steam flow/feed flow (SF/FF) mismatch coincident with steam generator (S/G) low level signal on the "A" steam generator. The cause of the initial trip was believed to be due to a loose connection on the signal converter associated with the feedwater control valve to the "A" S/G. All systems responded as expected to the trip. The loose connection was repaired, the valve stroked and the Unit returned to power. However, during the power ascension stage, feedwater control problems were experienced on all three steam generators. In an attempt to stablize this condition, a second feedwater pump was placed into service to help stabilize the level oscillations in the steam generators and increase the feedwater pressure. Following the initiation of the second feedwater pump, secondary system vibration increased significantly. Based on these occurrences, load was being reduced in order to remove the urit from the line. During the load reduction, a two-inch alternate feed line connection to the "B" feedwater bypass line (shown on Figure 2) ruptured resulting in a reactor trip due to SF/FF mismatch coincident with low steam generator level on "C" S/G. The pipe rupture was manually

isolated within thirty minutes. Investigation revealed that the plug had separated from the stem on valve FCV-3-489 (indicated on Figure 2), S/G "B" feedwater flow control bypass valve. Repairs to the flow control valve and the ruptured two-inch alternate feed line were completed and the unit was returned to power.

During this second power ascension, feedwater control problems were again encountered due to inability to achieve flow through FCV-3-478, S/G "A" main feedwater flow control valve. The load increase to the unit was terminated at approximately 90 MWe. Control problems were also associated with FCV-3-479, S/G "A" feedwater flow control bypass valve such that the flow controller would only respond to permit flow between 30 and 100 percent. The unit was taken off line. Investigation revealed that the stem had separated from the plug on the S/G "A" main feedwater flow control valve and the flow control bypass valve was out of calibration. Repairs were made to the valves in question and the unit was returned to power and remained at power until the 26th of November when it was taken off line due to increased leakage in the "B" steam generator from 0.6 to 11.0 gallons per hour.

FINDINGS CONCERNING THE EVENT

The underlying cause of the series of occurrences was the plug/stem separation of valve FCV-3-478, steam generator "A" main feedwater flow control valve. According to the licensee, the apparent cause of the stem failure was improper load distribution between the stem and plug due to the taper on the valve stem caused by improper manufacturing tolerances. This stem failure was the most probable cause of the flow oscillation and the feed control valve failing closed on the first reactor trip. When the unit tripped, the stem on the feed control valve was driven back into the plug on the feedwater isolation signal (reactor trip signal and low Tavg. < 554°F). There is evidence to support this in that three rows of threads above the break on the stem were damaged.

However, this was not known at the time of the initial trip. It was assumed that the loose connection on the signal converter associated with the feedwater control valve was the cause of the trip. After effecting repairs to the converter the valve was stroked to verify operability. This by itself, would not have indicated that the plug had separated from the stem but rather that stem travel had been demonstrated. The feedwater control problems that resulted in the second reactor trip were probably precipitated when the broken plug dislodged from the stem. As the upward forces under the valve plug closely approximated the weight of the plug, oscillations were induced into the feedwater system. These oscillations were further enhanced when the second feedwater pump was placed into service in an attempt to stabilize the level fluctuations in the steam generators. The end result was a reactor trip due to SF/FF mismatch coincident with low steam generator level on "C" S/G. However, according to the licensee, the damage to the main feedwater control valve was not discovered because the trip was attributed to visible

damage to FCV-3-489, feedwater flow control bypass valve, and the break of the two-inch ancillary feedwater pipe rather than the main feedwater control valve.

Hot feedwater flowing from the break (located on the main turbine deck outside containment) resulted in the loss of several hundred gallons per minute for approximately 30 minutes. Licensee personnel using air eductors and water hoses cleared the area of steam vapor (caused by hot feedwater flashing to steam), located the break, and manually isolated the ruptured line. There was no blow-down from the steam generator through the break. This was prevented by closure of the feedwater flow control bypass valve and the upstream check-valve in the main feedwater line. Therefore, radioactivity release to the outside from the primary to secondary leakage was essentially non-existent. According to the resident inspector, radiological surveys conducted after the break showed no signs of contamination. The auxiliary feedwater system functioned normally and maintained S/G levels without difficulty. All safety systems functioned normally following the trip.

The resident inspector attended licensee management meetings which covered their recovery plans. Action items involved during this time included: (1) repair of "B" feedwater flow control bypass valve (FCV-3-489), (2) calibration of all feedwater flow control bypass valves, (3) PCM (Plant Change Memo) issued to remove and capweld the remaining two-inch alternate feed sources to the bypass feed lines, and (4) visual inspection of all feed and condensate systems inside and outside containment. After the actions were completed the unit was brought back up to power. However, during this second power ascension stage, feedwater control problems were again exhibited by inability to pass flow through the steam generator "A" main feedwater flow control

valve. Control problems were also associated with the S/G "A" feedwater control bypass valve, in that the controller would only respond to a flow between 30 and 100 percent. The unit was removed from the line and investigation revealed the broken stem/plug on the main feed flow control valve and the bypass valve was out of calibration. Repairs were made to the valves and the unit was returned to power.

Because of these problems associated with this type of feedwater flow control valve (Copes-Vulcan), the licensee has inspected all valve stem/plug interfaces on Units 3 and 4. The results of the investigation showed evidence of cracking at the interface point on two of three valves on Unit 4 in addition to the two valves repaired on Unit 3. This issue is not a new problem and has been identified in the past at this plant according to plant personnel . The original cage, plug and stem in the feedwater flow control valves were replaced with a modified cage, plug and stem in accordance with a Plant Change/Modification (PC/M) originating in 1974. Vendor replacement parts were not available and evidently the tolerances on the manufactured stem and plug were unacceptable. The valve stems on all three valves of both Units No. 3 and 4 have been replaced. Additionally, all connections to the alternate feedwater system from Fossil Unit No. 2 have been removed and caps welded in place.

EVALUATION

Although there was no evidence of a water hammer at Turkey Point Unit 3 during this event, there are generic concerns arising from such flow control instability and the unnecessary challenges to the feedwater system which

could compromise safety-related equipment and systems associated with it and the feedwater system itself. The flow control valves in main feedwater systems have the potential for producing significant water hammer loads as the result of relatively high fluid velocities and short closure and opening times. Twenty-two events are attributed to main feedwater flow control valve opening, closing, or instability.[1/] In several of these events the water hammer resulted from a sudden flow rate decrease following valve failure in which the plug separated from the valve stem. These valve failures could be attributed in part to piping vibrations during normal operation. Components damaged as the result of these water hammer events include piping supports and restraints, valve bodies and operators, and the piping. Resolution of feedwater control valve instability problems and measures to minimize operational transients would reduce the challenges to the safety systems.

COMMENT

AEOD believes that there may be a potential need for informing the licensees of operating reactors regarding the possibility of valve failures due to this mechanism of improper load distribution between the stem and plug. We believe that an IE Circular or Information Notice might be considered which cautions licensees to review their feedwater flow control valves and bypass valves to assure that those plants which utilize Copes-Vulcan valve components in their feed system are aware of this failure mode and can take steps to modify their system. However, unless additional events of this nature occur at another plant, we are not recommending any action at this time.

1/ Water Hammer in Nuclear Power Plants, NUREG-0582, July 1979.

SEQUENCE OF OCCURRENCES

Date	Time (Approx)	Occurrence
11/05/80	0500	S/G tube leak at 0.4 gph
11/19/80	1000	Reactor trip due to steam flow/feed flow mismatch and low S/G "A" level.
		Possible feedwater isolation.
		EFW actuated manually.[1/] Steam generator "A" feedwater valve failed closed. Initially believed to be due to loose wire on feedwater control valve (most probable cause was separation of plug from stem).
	1238	Feedwater control problems during power accession.
		Started second feedwater pump.
		Secondary system vibration increased.
		Started load reduction.
		Two-inch line rupture on auxiliary circulating feedwater line connected to bypass feedwater line.
	1410	Reactor trip on steam flow/feed flow mismatch and S/G "C" low level.
		Possible feedwater isolation.
	later	EFW actuated manually.[1/]
		Isolated break and repaired line.
		Discovered broken bypass valve on S/G "B" (stem/plug separated on FCV-3-489).

1/ EFW turbine automatically start, but manual opening of EFW valves required

Date	Time (Approx)	Occurrence
11/20/80	1200	Return to power.
		Experienced feedwater control problems with S/G "A" feedwater valve (FCV-3-478) and bypass feedwater control valve (FCV-3-479).
		Unit removed from grid.
		Discovered S/G "A" feedwater valve broken (stem/plug separated).
		Discovered S/G "A" bypass feedwater valve out of calibration.
11/21/80	0500	Return to power.

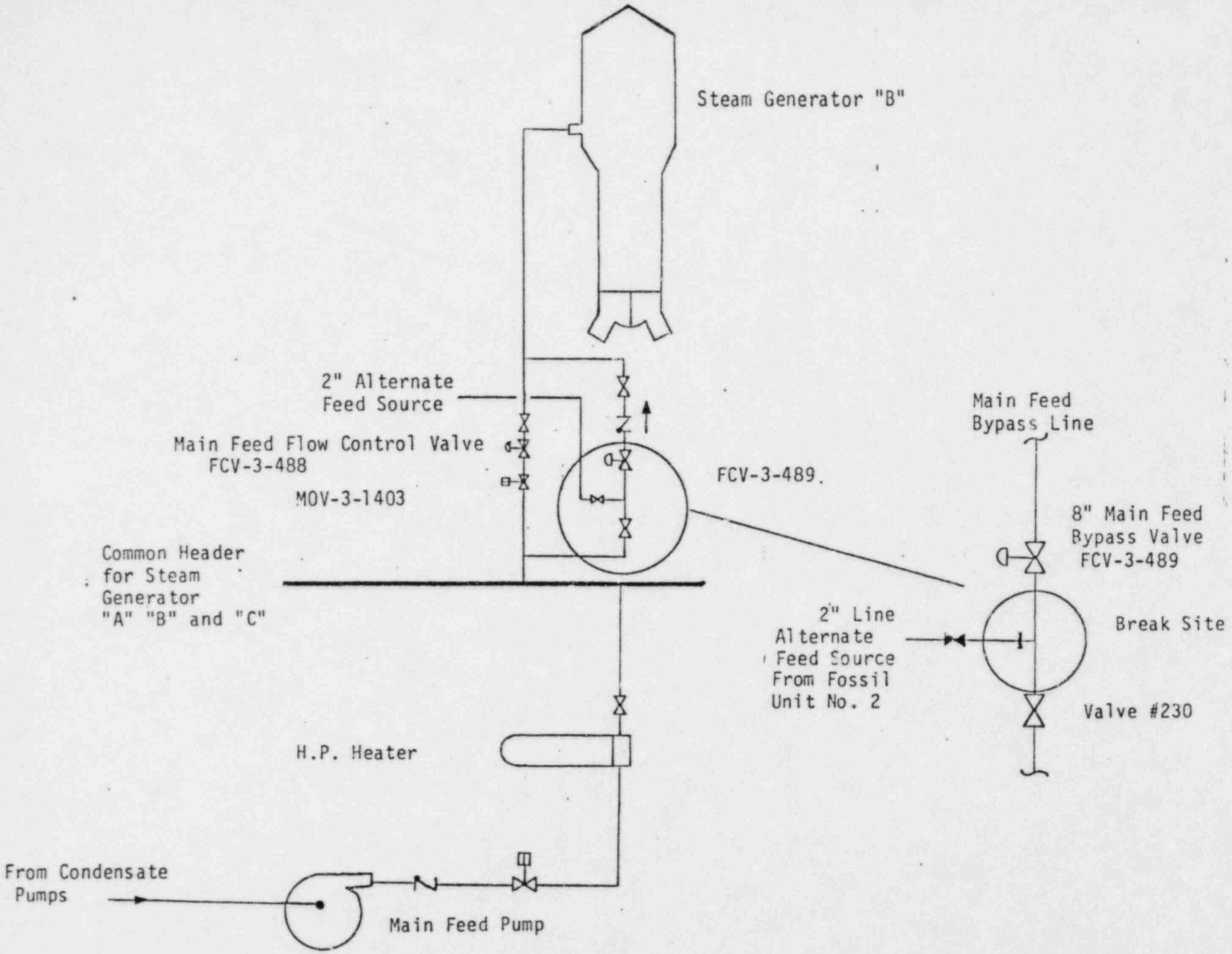

FIGURE 2 - TYPICAL FEEDWATER SYSTEM LAYOUT

LIC Exh 52

Evacuation Time Estimates

for the Plume Exposure Pathway EPZ at

Three Mile Island Nuclear Generating Facilities

8108050134

prepared for
General Public Utilities Service Corporation

prepared by
Parsons Brinckerhoff Quade & Douglas, Inc.

March 3, 1981

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I. INTRODUCTION

In Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants (NUREG-0654, FEMA-REP-1: Rev. 1 November 1980; hereafter referred to as NUREG-0654, the U.S. Nuclear Regulatory Commission (NRC) and the Federal Emergency Management Agency (FEMA) called upon power plant licensees and state and local agencies to include in their emergency response plans time estimates for evacuation of the population within the 10 mile radius plume exposure emergency planning zone (EPZ). The approach for preparing the evacuation time estimates is specified in Appendix 4 of that document and is reprinted in Appendix A.

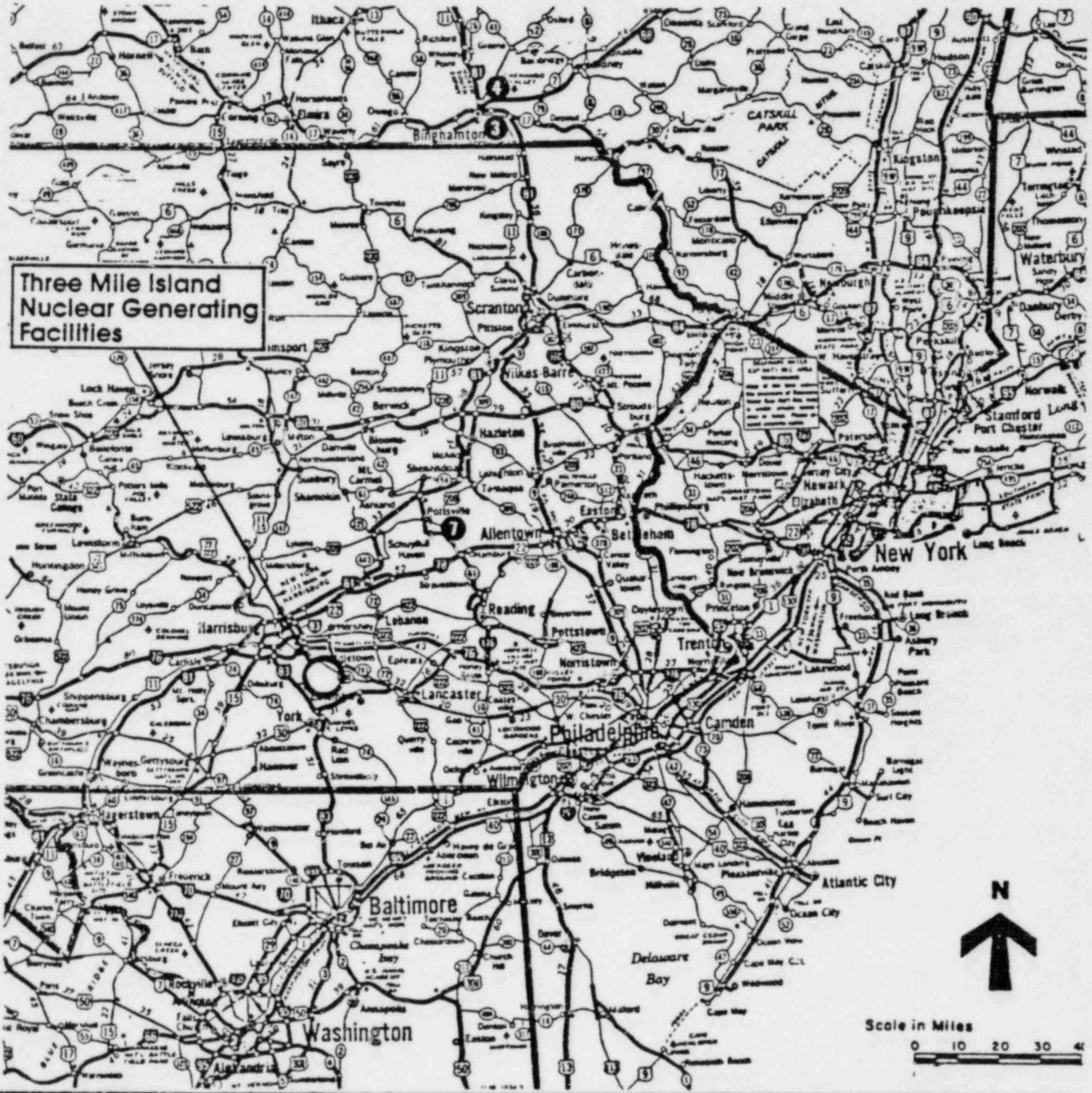
A. Site Location and Emergency Planning Zone

This report presents the estimates of time required to evacuate both the general population and special facilities (as defined in Section II) that lie within the 10 mile radius EPZ of the Three Mile Island Nuclear Generating Station (TMI) in Londonderry Township, Dauphin County, Pennsylvania. TMI is located approximately 10 miles southeast of the City of Harrisburg, 12.5 miles north of the City of York and 21 miles west-northwest of the City of Lancaster. The location of TMI with reference to these and other major population centers is shown in Figure 1. Figure 2 which shows the 10 mile radius EPZ super-imposed on a composite U.S. Coast and Geodedic Survey (USCGS) map of the region focuses on the political jurisdictions which are within the EPZ and the transportation network.

The USCGS maps were last updated in the early 1970's. Therefore the roadway network was modified to reflect recently completed roadway segments. These modifications were incorporated in the base map used in Figures 3-18 and 20.

B. General Assumptions And Methodology

Both the general assumptions and methodologies used to produce these evacuation time estimates are detailed in the relevant sections of this report or in its appendices. For example, population information which was obtained from Census data, from regional planning agencies, and through telephone and written contacts with employers, institutions, and other facilities is detailed in Section II. DEMAND ESTIMATION. Also, roadway capacity information and the comupter model used in this analysis are summarized in Section III. EVACUATION ROUTES and IV. EVACUATION TIMES ANALYSIS and detailed in APPENDIX C.



ig. 1 Location Map

Parsons
Brinckerhoff

Three Mile Island
Emergency Response Plan
10-Mile EPZ

II. DEMAND ESTIMATES

A. Emergency Planning Zone and Sub-areas

A Plume Exposure Pathway EPZ hereafter referred to as the EPZ has been defined in accordance with NUREG-0654, for the purpose of determining the general population and the population of special facilities which would possibly be evacuated in the event of a general emergency at TMI. As can be seen from Figure 2, this EPZ represents an irregularily shaped border which approximates a 10 mile radius extending from the approximate center of Reactor Units 1 and 2, latitude 40 degrees, 9 minutes, 12 seconds-longitude 76 degrees, 46 minutes, 28 seconds. These irregularities in the border occur because the perimeter of the EPZ follows either physical or political boundaries where practical to facilitate description of the potential risk area to the public. Furthermore, this boundary encompasses, where reasonable, entire populated urban areas which lie near the 10 mile radius, but would otherwise be bisected if a physical boundary were used to define the EPZ.

Within the EPZ, sub-areas have been delineated according to NUREG-0654 by 90° sectors which lie between 0° true north and 90° east, 90° east and 180° south, 180° south and 270° west and 270° west and 360° true north at distances of two, five and ten miles from TMI. These sectors are defined as:

Sectors A, B, C and D - Four approximately 90° quadrants at the closest defineable boundary beyond a two-mile radius.

Sector E - A 360° sector which encompasses the entire two-mile radius.

Sectors F, G, H and I - Four approximately 90° quadrants including the area within the closest defineable boundary beyond the 5 mile radius.

Sector J - A 360° sector which generally encompasses the entire five-mile radius.

Sectors K, L, M and N - Four approximately 90° quadrants including the area within the boundary of the 10 mile EPZ.

Sector O - A 360° sector encompassing the entire 10 mile EPZ.

The boundaries of these sectors, like the EPZ, usually follow physical or political boundaries; thus forming an irregularly shaped boundary which generally encompasses the 90° and 360° degree sectors. A description of these sector boudaries is presented in Appendix B.

For purposes of estimating the various population components, the sectors have been further subdivided into Emergency Response Planning Areas (ERPA's). An ERPA generally corresponds to a political subdivision such as a township or borough or a definable portion thereof. Table 1 shows the Emergency Response Planning Areas (ERPA's) and their associated political jurisdictions. The Sectors and associated ERPA's are shown in Figures 3-17.

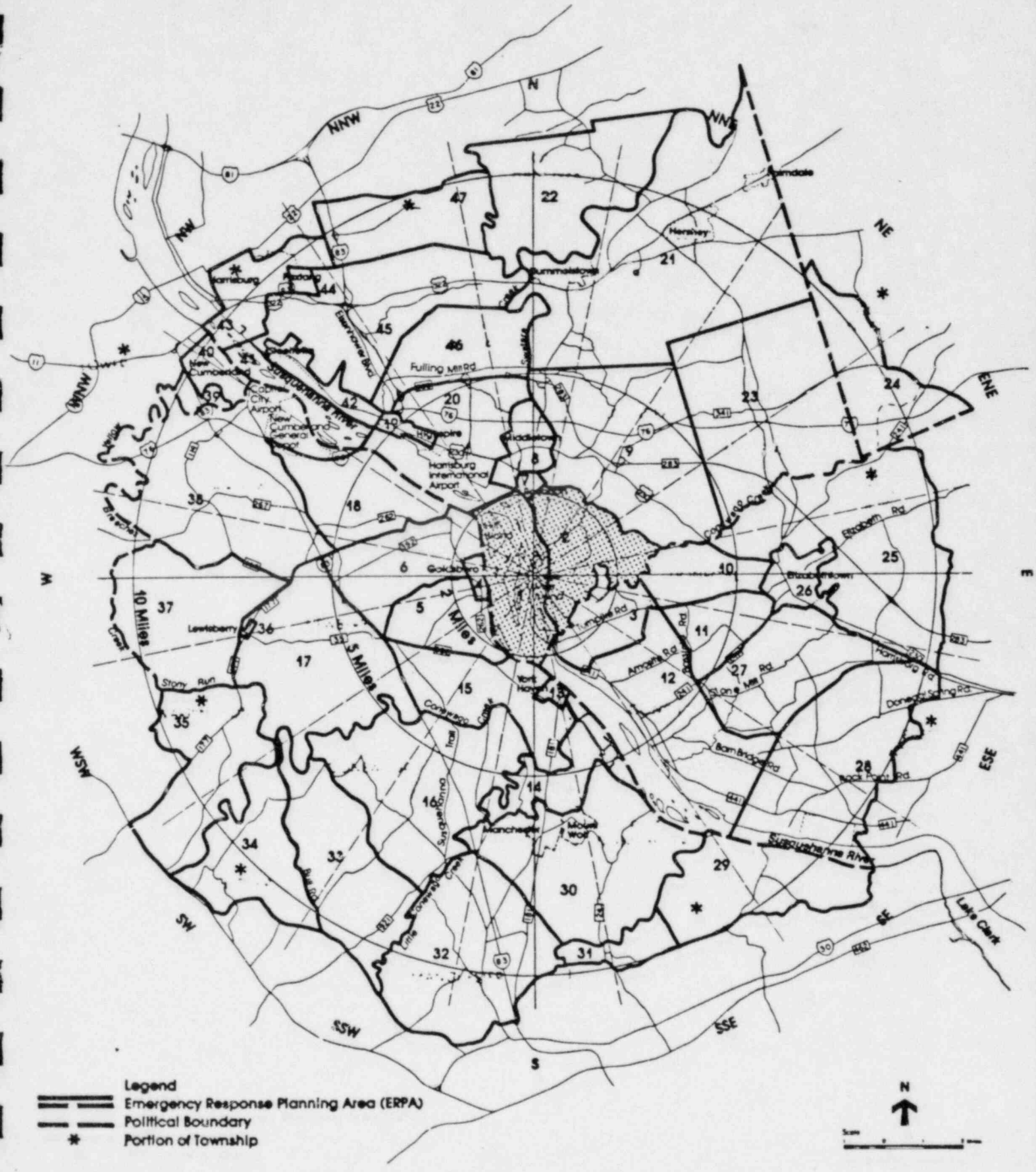


Fig. 3 Sector A —90 Degrees NE
2-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Parsons
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THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 1

ERPA DESCRIPTION BY
MUNICIPAL JURISDICTION

ERPA Number(s)	Municipal Jurisdiction
1	Londonderry - Three Mile Island
2, 9	Londonderry Township
3, 12	Conoy Township
4	Goldsboro Borough
5, 6, 15, 17	Newberry Township
7	Royalton Borough
8	Middletown Borough
10, 11	West Donegal Township
13	York Haven Borough
14	East Manchester Township (Portion)
16, 23, 33	Conewago Township
18, 37, 38, 41	Fairview Township
19	Highspire Borough
20, 46	Lower Swatara Township
21	Hummelstown Borough - Derry Twp.
22	South Hanover Township
24	South Londonderry Township*
25	Mount Joy Township*
26	Elizabethtown Borough
28	East Donegal Township*
29	Hellam Township*
30	East Manchester Township and Mount Wolf Borough
31	Springettsbury Township*
32	Manchester Township*
34	Dover Township*
35	Warrington Township*
36	Lewisberry Borough
39	Lower Allen Township*
40	New Cumberland Borough
42	Steelton Borough
43	Harrisburg City*
44	Paxtang Borough
45	Swatara Township and Susquehanna Township*
47	Lower Paxton Township*

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* Note: Only a portion of the political jursidiction and population lie within the EPZ.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 1

ERPA DESCRIPTION BY
MUNICIPAL JURISDICTION

ERPA Number(s)	Municipal Jurisdiction
1	Londonderry - Three Mile Island
2	Londonderry Township
3, 12	Conoy Township
4	Goldsboro Borough
5, 6, 15, 17	Newberry Township
7	Royalton Borough
8	Middletown Borough
10, 11	West Donegal Township
13	York Haven Borough
14	East Manchester Township (Portion)
16, 23, 33	Conewago Township
18, 37, 38, 41	Fairview Township
19	Highspire Borough
20, 46	Lower Swatara Township
21	Hummelstown Borough - Derry Twp.
22	South Hanover Township
24	South Londonderry Township*
25	Mount Joy Township*
26	Elizabethtown Borough
28	East Donegal Township*
29	Hellam Township*
30	East Manchester Township and Mount Wolf Borough
31	Springettsbury Township*
32	Manchester Township*
34	Dover Township*
35	Warrington Township*
36	Lewisberry Borough
39	Lower Allen Township*
40	New Cumberland Borough
42	Steelton Borough
43	Harrisburg City*
44	Paxtang Borough
45	Swatara Township and Susquehanna Township*
47	Lower Paxton Township*

* Note: Only a portion of the political jursidiction and population lie within the EPZ.

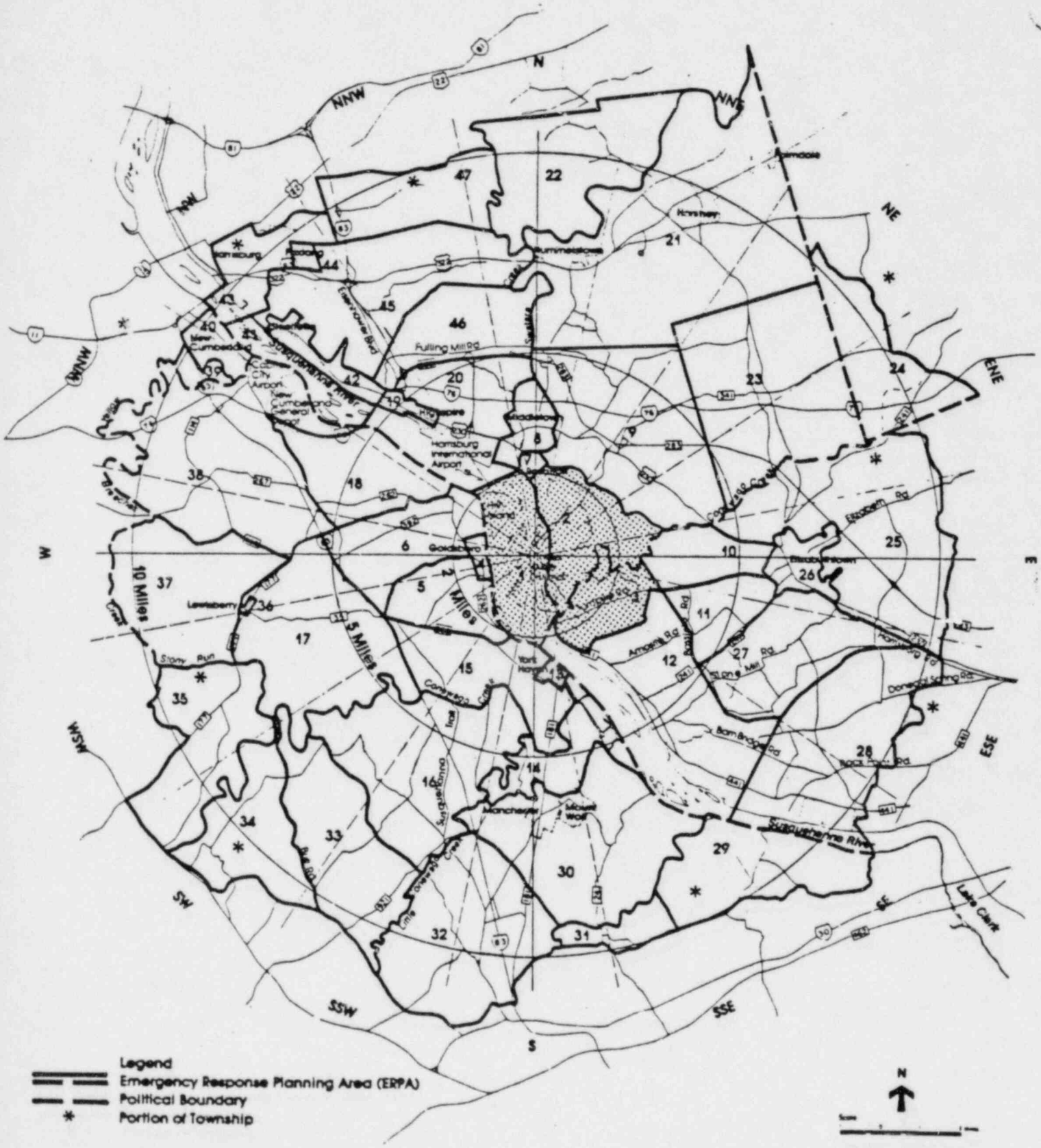

Fig. 4 Sector B —90 Degrees SE
2-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

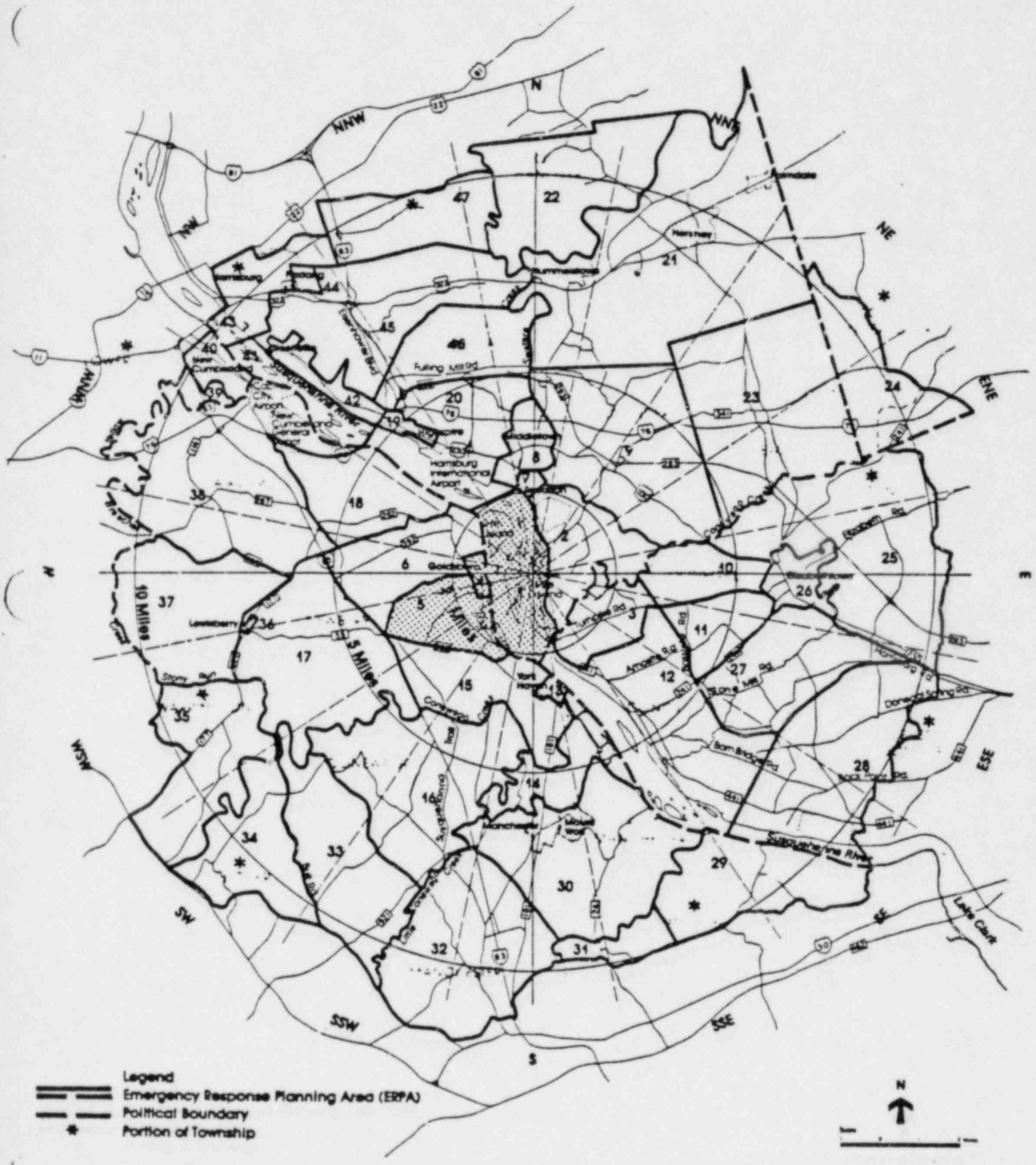

Fig. 5 Sector C —90 Degrees SW
2-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

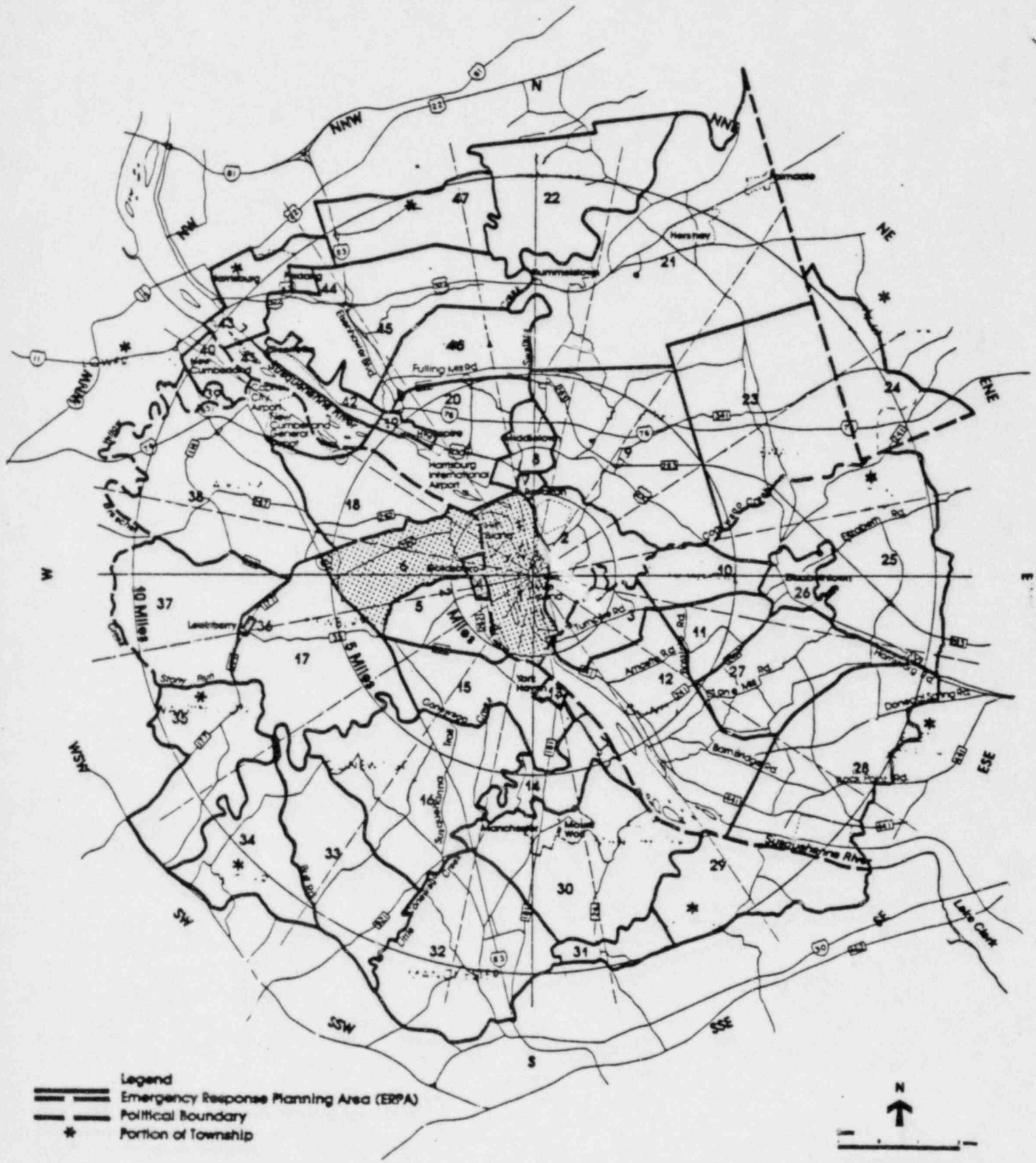

Fig. 6 Sector D —90 Degrees NW
2-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 7 Sector E —360 Degrees
2-Mile Radius

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Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 8 Sector F —90 Degrees NE
5-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

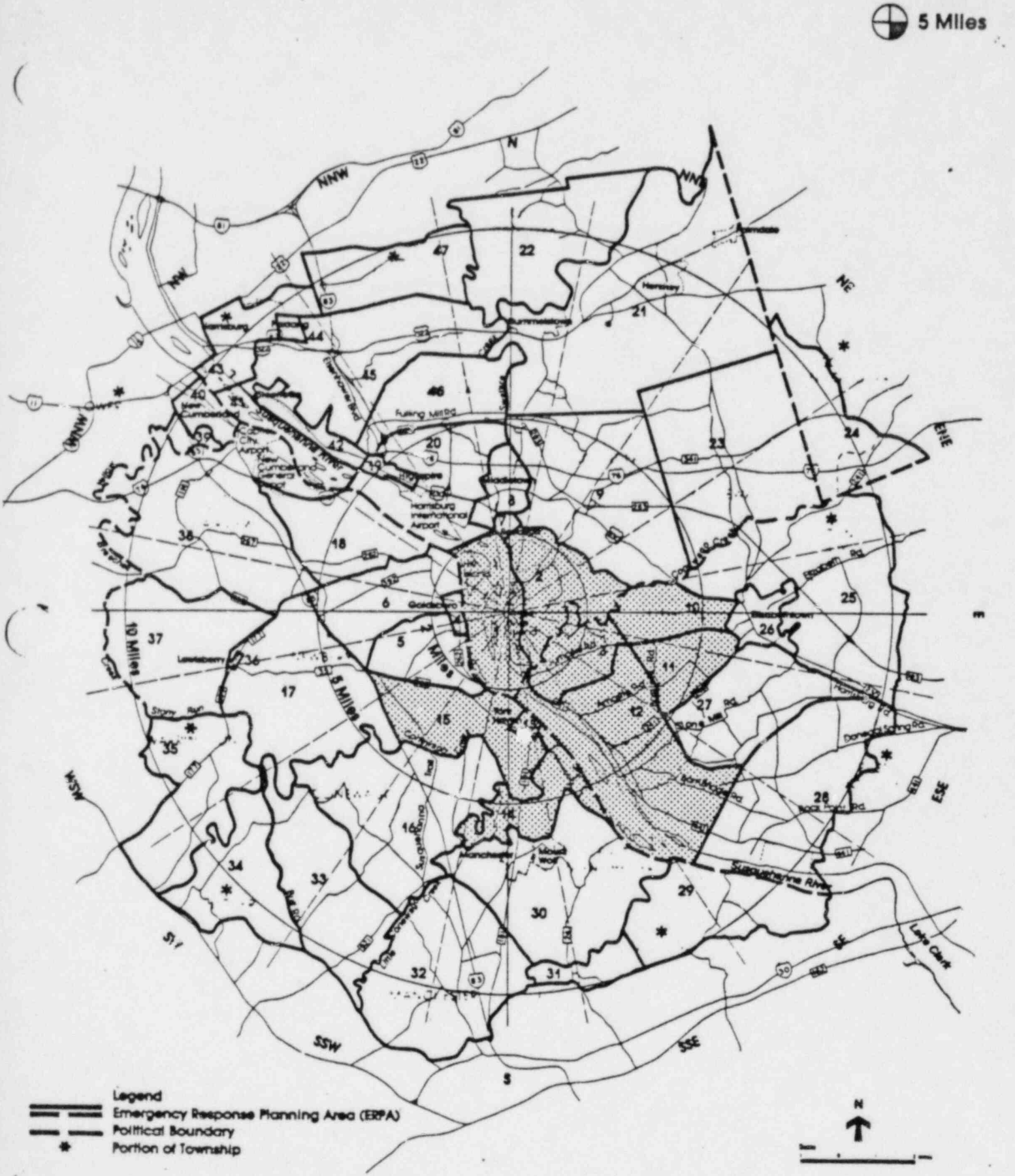

Fig. 9 Sector G —90 Degrees SE
5-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 10 Sector H —90 Degrees SW
5-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

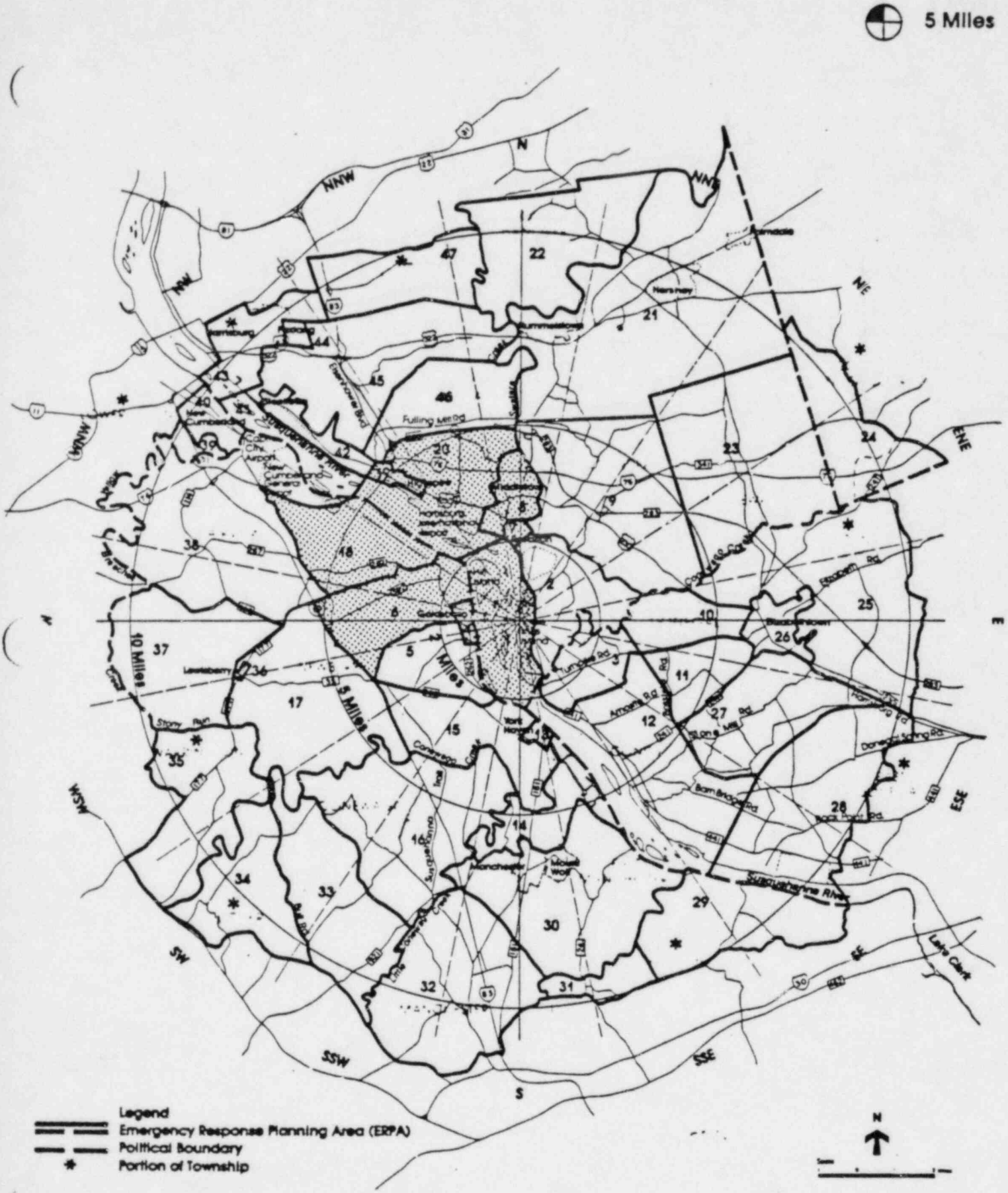

Fig. 11 Sector I —90 Degrees NW
5-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 12 Sector J —360 Degrees
5-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 13 Sector K —90 Degrees NE
10-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 14 Sector L —90 Degrees SE
10-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 15 Sector M —90 Degrees SW
10-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Fig. 16 Sector N —90 Degrees NW
10-Mile Radius

Three Mile Island
Emergency Response Plan

Fig. 17 Sector O —360 Degrees
10-Mile Radius

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Table 2 shows the relationship between Sectors and Emergency Reponse Planning Areas (ERPA's) and the corresponding figures upon which they are depicted.

B. Population Estimates

Estimates of population for the 10 mile EPZ were made for three population components as described in NUREG-0654: i.e. Permanent Resident Population, Transient Population and persons in Special Facilities. Population estimates which are in the county emergency plans and were presented in previous evacuation time estimates were based on projections of 1970 census or regional planning data for the total resident population.[1][2][3] These projections did not provide separate figures for transient or special facility populations. Therefore, population estimates were developed for each population component based on preliminary 1980 Census data.[4]

1. Permanent Resident Population: An estimate of this population component was made using preliminary resident population figures by appropriate 1980 Census tracts. Figures by political jurisdiction or portions thereof which are within the EPZ were estimated based on apportionment by area, then refined by topography, location of demographic concentrations, and published local estimates and finally balanced to 1980 preliminary Census housing units. These 1980 resident population estimates are listed in Table 3 by municipal jurisdiction.

Since the Census resident population includes all persons residing in households and group quarters in an area, residents of long-term care facilities and penal facilities were subtracted from these figures to derive estimates of permanent resident population by Emergency Response Planning Area. A similar apportionment procedure was then followed in allocating the estimated resident population to ERPA's as shown in Table 4.

Table 4 also shows a further division of the estimated permanent resident population into persons with and without automobile. This estimate of persons without automobiles was predicated upon previous local estimates and 1970 Census data regarding households without autos for the respective Census tracts.[1][2]

2. Transient Population According to NUREG-0654, this population group which constitutes a component of the general population consists of tourists coming to and those passing through the EPZ, visitors both for business and social purposes, migrant workers and employees who immigrate on a daily basis into an area. Available data regarding each of these sub-groups was obtained from the Chambers of Commerce, the Hotel and Motel Association, Regional Planning Agencies, the Pennsylvania & U.S. Department of Commerce, major employers and 1970 Census Journey to Work.[5][6][7][8][9][10]

a. Recreation/Vacation and Business Travelers - Estimates of these elements of the transient population were made from the 1977 National

Three Mile Island
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Table 2
Relationship between Sectors
and
Emergency Response Planning Areas

Figure	Sector	Emergency Response Planning Areas
3	A	1,2
4	B	1,2,3
5	C	1,4,5
6	D	1,4,6
7	E	1-6
8	F	1,2,7-10
9	G	1-3,10-15
10	H	1,4-6,14-17
11	I	1,4,6-8,18-20
12	J	1-20
13	K	1,2,7-10,21-26
14	L	1,2,3,10-15,25-31
15	M	1,4-6,14-17,30,32-37
16	N	1,4,6-8,18-20,22,37-47
17	O	1-47

A description of the boundaries of each Evacuation Sector can be found in Appendix B.

TABLE 3

ESTIMATED 1980 RESIDENT POPULATION
BY COUNTY AND MUNICIPAL JURISDICTION
WITHIN THE 10 MILE EMERGENGY PLANNING ZONE (EPZ)

County and Municipal Jurisdiction	1970 Census Resident Population	1980 Prel. Census Total Housing Units	1980 Prel. Census Resident Population
Cumberland County			
New Cumberland Borough	9,803	3,278	8,063
Lower Allen Township*	(13,690)	(4,857)	(14,051)
Within EPZ	685	243	703
TOTAL CUMBERLAND COUNTY	10,488	3,521	8,766
Dauphin County			
Conewago Township	1,124	814	2,456
Derry Township	16,045	6,660	18,010
Hershey (U)	7,407	4,912	13,215
Palmdale(U)	1,724	620	1,397
Harrisburg City*	(68,061)	(25,966)	(53,113)
Within EPZ	37,434	14,281	29,212
Highspire Borough	2,947	1,261	2,952
Hummelstown Borough	4,723	1,748	4,265
Londonderry Township	3,453	2,080	5,138
Lower Paxton Township*	(26,517)	(14,215)	(34,782)
Within EPZ	3,978	2,132	5,217
Lower Swatara Township	5,267	2,389	6,777
Middletown Borough	9,080	4,255	10,211
Paxtang Borough	2,160	720	1,661
Royalton Borough	1,040	362	982
South Hanover Township	1,943	1,370	4,054
Steelton Borough	8,556	2,636	6,492
Susquehanna Township*	(17,008)	(7,344)	(18,017)
Within EPZ	513	220	541
Swatara Township	17,178	6,951	18,725
TOTAL DAUPHIN COUNTY	115,441	47,879	116,693
Lancaster County			
Conoy Township	1,977	794	2,318
East Donegal Township*	(3,003)	(1,400)	(4,072)
Within EPZ	2,252	1,050	3,054
Elizabethtown Borough	8,072	3,042	8,242
Mount Joy Township*	(4,228)	(1,646)	(5,128)
Within EPZ	2,325	905	2,820
West Donegal Township	3,719	1,335	4,859
TOTAL LANCASTER COUNTY	18,345	7,126	21,293
Lebanon County			
South Londonderry Township*	(3,754)	(1,361)	(3,771)
Within EPZ	1,319	482	1,387
TOTAL LEBANON COUNTY	1,319	482	1,387

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 3
(Continued)

County and Municipal Jurisdiction	1970 Census Resident Population	1980 Prel. Census Total Housing Units	1980 Prel. Census Resident Population
York County			
Conewago Township	3,719	1,720	4,955
Dover Township*	(8,975)	(4,346)	(12,560)
Within EPZ	449	217	628
East Manchester Township	1,735	1,286	3,542
Fairview Township	9,248	4,255	11,971
Goldsboro Borough	576	191	477
Hellam Township*	(3.158)	(1,681)	(4,487)
Within EPZ	158	84	224
Lewisberry Borough	490	113	310
Manchester Borough	2,391	781	2,028
Manchester Township*	(6,979)	(2,718)	(7,578)
Within EPZ	6,630	2,582	7,199
Mount Wolf Borough	1,811	560	1,526
Newberry Township	5,978	3,477	10,063
Springettsbury Township*	(19,399)	(7,050)	(19,634)
Within EPZ	970	353	982
Warrington Township*	(2,494)	(1,214)	(3,561)
Within EPZ	125	61	176
York Haven Borough	671	263	746
TOTAL YORK COUNTY	34,951	15,943	44,829
TOTAL EPZ	180,544	74,951	192,968

NOTES: Total housing units includes all occupied and unoccupied housing units as defined by Census Bureau. Resident population includes for Census purpose all persons residing in households and group quarters in an area, including residents of institutions and other group quarters.

(U) Unincorporated communites as defined by Census Bureau.

* Only a portion of the political jurisdiction and population lie within the EPZ. Figures for sub-jurisdiction areas are estimates based on apportionment by area, refined by topography, location of demographic concentrations, and published local estimates.

SOURCE: U.S. Bureau of the Census, Preliminary Report, 1980 Census of Population and Housing.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 4

ESTIMATED NUMBER OF PERSONS WITH AUTOMOBILES AND WITHOUT AUTOMOBILES BY EMERGENCY RESPONSE PLANNING AREA

Emergency Response Planning Area (ERPA)	1980 ERPA Permanent Resident Population	Number of Persons Without Automobiles	Number of Persons Using Automobiles
1	0	0	0
2	1,541	108	1,433
3	579	64	515
4	477	43	434
5	805	57	748
6	2,013	143	1,870
7	982	118	864
8	9,851	1,389	8,462
9	3,529	247	3,282
10	926	103	823
11	636	71	565
12	1,739	193	1,546
13	746	68	678
14	1,063	75	988
15	3,220	228	2,992
16	3,964	281	3,683
17	4,025	286	3,739
18	2,594	184	2,410
19	2,952	490	2,462
20	4,722	567	4,155
21	20,192	2,362	17,830
22	4,054	284	3,770
23	2,456	172	2,284
24	1,387	86	1,301
25	2,820	313	2,507
26	6,952	1,098	5,854
27	2,522	280	2,242
28	3,054	339	2,715
29	224	16	208
30	6,033	428	5,605
31	982	70	912
32	7,199	511	6,688
33	991	70	921
34	628	45	583
35	178	13	165
36	310	28	282
37	2,591	184	2,407
38	6,786	482	6,304
39	703	67	636
40	8,063	621	7,442
41	0	0	0
42	6,492	1,759	4,733
43	29,177	11,029	18,148
44	1,661	199	1,462
45	18,320	2,198	16,122
46	1,355	163	1,192
47	5,007	601	4,406
	186,501	28,133	158,368

Travel Survey,[11] 1979 Highlights of Travel Development in Pennsylvania and U.S.A.,[12] indices of local hotel/motel facilities[9,13] and data on the campsites and major parks in the area.[14,15]

Estimates of tourist/visitor and business travel within the EPZ were developed by ERPA and are presented in Table 5. The basic data on travel to and through Pennsylvania: which are used to derive these estimates is as follows:

Total Person Trips	=	42,611,000
Total Person Nights	=	57,493,000
Recreation/Vacation Person Trips	=	20,000,000
Recreation/Vacation Person Nights	=	32,301,000
Non Recreation/Vacation Person Trips	=	22,611,000
Non Recreation/Vacation Person Nights	=	25,192,000

The approximate person-days for the two subcategories are:

Recreation/Vacation Person Days	=	38,179,000
Non Recreation/Vacation Person Days	=	43,163,000

Recreation/Vacation trips were allocated to the region based on the state study that indicated that 6.6 percent of the total non-business trips in or to Pennsylvania are to the Harrisburg-York-Lancaster area. These trips were then proportioned to the EPZ using population. The EPZ represents about 17 percent of the Harrisburg-York-Lancaster area in population. Non-Recreation/Vacation trips, which include business trips, were allocated to the region for initial estimates on the basis that the EPZ contains approximately 2 percent of total state employment.

Seasonal variation also was derived from the state study which indicated that in the Harrisburg-York-Lancaster area 19.7 percent of the non-business trips were during the winter. This percentage was used for all trips except business trips (13 percent of total trips) which were assumed to be constant year-round. Thus, in the area, the winter trips averaged about five-sixths of the typical weekday estimates.

In order to provide a basis to estimate the travel patterns of the tourist-transient group within the EPZ, the day figures for recreation/vacation travelers within the region were statistically allocated to each ERPA based on population. Non-recreation/vacation figures were allocated for the day scenario based on employment. The figures for the City of Harrisburg within the EPZ were treated as a special case and were adjusted upward due to the proximity of the government center. The figures for recreation/vacation and non recreation/vacation were then totaled by ERPA.

The estimates for the night scenario were based on available data for hotel/motel facilities and campsites plus parks in the area and total person-nights derived from the state totals. The figures were allocated to individual ERPAs by location of hotel/motel and campsite/major park

THREE MILE ISLAND
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TABLE 5

ESTIMATE OF
TOURIST/TRANSIENT POPULATION

ERPA	Day Scenario	Night Scenario	Adverse Weather Scenario
1	41	0	37
2	21	7	17
3	99	153	23
4	6	2	5
5	10	3	8
6	24	8	19
7	13	4	10
8	141	45	111
9	50	16	39
10	13	4	10
11	19	6	15
12	25	8	20
13	9	3	7
14	12	4	9
15	39	13	30
16	47	15	36
17	212	265	61
18	31	10	24
19	41	13	32
20	81	26	65
21	1029	1964	244
22	56	18	44
23	34	11	27
24	9	3	6
25	249	443	56
26	115	37	91
27	36	12	28
28	66	21	55
29	2	1	2
30	72	23	55
31	12	4	9
32	86	28	66
33	12	4	9
34	8	3	6
35	520	1026	303
36	4	1	3
37	31	10	24
38	169	344	142
39	11	4	9
40	131	42	106
41	0	0	0
42	140	45	116
43	2,179	711	1,897
44	23	7	18
45	316	786	230
46	18	6	14
47	73	161	58
Total EPZ	6,335	6,320	4,196

facilities with the remainder proportioned by the total figures assigned to an ERPA from the day scenario. The adverse weather figures were derived in a similar manner using the seasonal variations.

b. Resident/Non-Resident Employment - The number of employees in the portions of the five counties which are encompassed by the 10 mile EPZ were estimated from the 1970 Census Journey to Work. An update of this data was made using 1970-78 county business patterns extrapolated to 1980.[16] The employee estimates were apportioned to each ERPA based on population and demographic features after deleting known major industrial employment concentrations. The number of employees in the latter group such as Bethlehem Steel Corporation, Hershey Foods, New Cumberland Army (Supply) Depot, Harrisburg International Airport, TMI and Capitol City Airport were obtained from the 1980 Pennsylvania Industrial Directory, Chambers of Commerce and contacts with employers.(9),(17),(18),(19),(20),(21),(22) The estimated 1980 total employment and transient employment by ERPA is presented in Table 6.

In order to reduce the impact of double counting of employees who reside in an ERPA in estimating the transient employment category, a separate estimate of the number of employees who work in an ERPA but reside elsewhere was made. Since data involving employee commutation patterns by political jurisdiction within a county is not readily available, the percentage of employment distribution was estimated on a county and major sub-division level from the 1970 Census, Journey to Work for the Harrisburg, Lancaster and York SMSA's.[8] This distribution (which is shown in Table 7) presents the percentage of employees who reside outside the EPZ and commute to work in the five counties and the City of Harrisburg which lie within the EPZ. This table also shows the percent distribution of employees who live and work within the six areas as well as commute between areas.

A separate estimate of the number of employees by ERRA was made for day and night to coincide with the selected scenarios defined in Section IV-A. Information on the number of employees by shift was obtained from area industrial employers.[9]

Data on permanent staff (approximately 1,140 employees) and the contractors (about 500 workers) employed at Three Mile Island who would be evacuated in the event of an incident were provided by General Public Utilities.[9] It is anticipated that the contract work force will be on site until Units 1 and 2 are made operational. The anticipated completion dates are 1981 and 1986 respectively.

Estimates of the number of personnel by major employers or public facilities who would be required to remain behind for security, shut-down or maintenance of facilities was not readily available.

3. Special Facility Population:[8],(23),(24),(25),(26),(27) An estimate of the average number of people confined to or enrolled at special facilities which were identified in the 10 mile EPZ and the name of each facility is presented in Tables 8 and 9 by county. These facilities include schools (Table 8), colleges, long-term care facilities, hospitals and penal institutions (Table 9) which require special evacuation techniques

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 6

ESTIMATED
1980 EMPLOYMENT AND
TRANSIENT EMPLOYMENT BY ERPA
AND SCENARIO

ERPA	Total Employment	Transient Employment		
		Day	Night	Adverse
1	1,602	1,202	400	601
2	478	88	10	44
3	178	32	4	16
4	112	21	2	11
5	184	34	4	17
6	460	85	9	42
7	292	54	6	27
8	3,107	478	159	239
9	1,089	201	22	100
10	284	52	6	26
11	423	78	9	39
12	542	100	11	50
13	174	32	4	16
14	245	45	5	23
15	736	136	15	68
16	899	166	18	83
17	920	170	19	85
18	593	110	12	55
19	903	167	18	84
20	1,871	288	96	144
21	6,771	1,249	139	625
22	1,221	225	25	113
23	743	137	15	69
24	50	9	1	5
25	872	161	18	81
26	2,556	472	52	236
27	799	148	16	74
28	1,851	341	38	171
29	51	9	1	5
30	1,380	255	28	128
31	225	41	5	21
32	1,635	302	33	151
33	225	41	5	21
34	145	27	3	14
35	41	7	1	4
36	72	14	1	7
37	593	110	12	55
38	5,032	774	258	387
39	280	51	6	26
40	3,220	594	66	297
41	0	0	0	0
42	3,965	610	203	305
43	37,545	6,927	770	3,464
44	505	94	10	47
45	5,842	1,078	120	539
46	398	74	8	37
47	1,593	294	33	147
Total EPZ	92,700	17,583	2,696	8,799

TABLE 7

EMPLOYEE COMMUTING PATTERNS BY COUNTY AND CITY OF HARRISBURG

	All Means of Transportation	Percent	Private Auto	Percent
Harrisburg City:				
Living in Harrisburg	27,647	100.0	18,287	100.0
Working in Harrisburg	15,802	57.2	9,199	50.3
Working Outside Harrisburg:				
EPZ Counties:	6,667	24.1	5,846	32.0
Remainder of Dauphin Co.	3,854	13.9	3,262	17.8
Cumberland Co.	2,406	8.7	2,229	12.2
Lancaster Co. (Outside City)	94	0.3	83	0.5
Lebanon Co.	62	0.2	62	0.3
York Co. (Outside York City)	251	0.9	210	1.1
Elsewhere	5,178	18.7	3,242	17.7
Working in Harrisburg	56,886	100.0	46,898	100.0
Living in Harrisburg	15,802	27.8	9,199	19.6
Living Outside Harrisburg:				
EPZ Counties:	34,867	61.3	32,007	68.2
Remainder of Dauphin Co.	19,550	34.4	17,569	37.5
Cumberland Co.	11,483	20.2	10,907	23.3
Lancaster Co. (Outside City)	942	1.7	780	1.7
Lebanon Co.	726	1.3	706	1.5
York Co. (Outside City)	2,166	3.8	2,045	4.4
Elsewhere	6,217	10.9	5,692	12.1
Remainder of Dauphin County:				
Living in Rem. of Dauphin Co.	66,005	100.0	56,507	100.0
Working in Rem. Dauphin Co.	31,136	47.2	25,045	44.3
Working Outside Rem. Dauphin Co.:				
EPZ City/Counties:	27,707	42.0	25,244	44.7
Harrisburg City	19,550	29.6	17,569	31.1
Cumberland Co.	4,881	7.4	4,653	8.2
Lancaster Co.(Outside Lan.)	842	1.3	751	1.3
Lebanon Co.	765	1.2	747	1.3
York Co. (Outside York)	1,669	2.5	1,524	2.7
Elsewhere	7,162	10.9	6,218	11.0
Working in Rem.of Dauphin Co.	51,668	100.0	43,751	100.0
Living in Rem.ofDauphin Co.	31,136	60.3	25,045	57.2
Living Outside Rem.of Dauphin Co.:				
EPZ City/Counties:	16,543	32.0	15,067	34.4
Harrisburg City	3,854	7.5	3,262	7.5
Cumberland Co.	4,547	8.8	4,264	9.7
Lancaster Co.(Outside Lan.)	2,428	4.7	2,027	4.6
Lebanon Co.	3,369	6.5	3,290	7.5
York Co. (Outside York)	2,345	4.5	2,224	5.1
Elsewhere	3,989	7.7	3,639	8.3

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 7
(Continued)

	All Means of Transportation	Percent	Private Auto	Percent
Total Dauphin County:				
Living in Dauphin County	93,652	100.0	74,794	100.0
Working in Dauphin County	70,342	75.1	55,075	73.6
Working Outside Dauphin Co.:				
EPZ Counties:	10,970	11.7	10,259	13.7
Cumberland Co.	7,287	7.8	6,882	9.2
Lancaster (Outside City)	936	1.0	834	1.1
Lebanon Co.	827	0.9	809	1.1
York (Outside City)	1,920	2.1	1,734	2.3
Elsewhere	12,340	13.2	9,460	12.6
Working in Dauphin County	108,554	100.0	90,649	100.0
Living in Dauphin County	70,342	64.8	55,075	60.8
Living Outside Dauphin Co.:				
EPZ Counties:	28,006	25.8	26,243	29.0
Cumberland Co.	16,030	14.8	15,171	16.7
Lancaster (Outside City)	3,370	3.1	2,807	3.1
Lebanon Co.	4,095	3.8	3,996	4.4
York (Outside City)	4,511	4.2	4,269	4.7
Elsewhere	10,206	9.4	9,331	10.3
Cumberland County:				
Living in Cumberland Co.	65,513	100.0	56,176	100.0
Working in Cumberland Co.	38,817	59.3	31,812	56.6
Working Outside Cumberland Co.:				
EPZ Counties:	18,031	27.5	17,039	30.3
Dauphin Co.	16,030	24.5	15,171	27.0
Lancaster (Outside City)	452	0.7	390	0.7
York (Outside City)	1,549	2.4	1,478	2.6
Elsewhere	8,665	13.2	7,325	13.0
Working in Cumberland Co.	56,273	100.0	48,022	100.0
Living in Cumberland Co.	38,817	69.0	31,812	66.2
Living Outside Cumberland Co.				
EPZ Counties:	12,019	21.4	11,238	23.4
Dauphin Co.	7,287	12.9	6,882	14.3
Lancaster (Outside City)	1,228	2.2	1,083	2.3
Lebanon	134	0.2	120	0.2
York (Outside City)	3,370	6.0	3,153	6.6
Elsewhere	5,437	9.7	4,972	10.4

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 7
(Continued)

	All Means of Transportation	Percent	Private Auto	Percent
Lancaster Co. (Outside of City):				
Living in Co. Outside of City	109,695	100.0	87,705	100.0
Working in Co. Outside of City	70,807	64.5	52,599	60.0
Working Outside:				
EPZ Counties:	6,858	6.3	5,924	6.8
Cumberland Co.	1,228	1.1	1,083	1.2
Dauphin Co.	3,370	3.1	2,807	3.2
Lebanon Co.	424	0.4	403	0.5
York (Outside of City)	1,836	1.7	1,631	1.9
Elsewhere	32,030	29.2	29,182	33.3
Working in Co. Outside of City	83,671	100.0	63,823	100.0
Living in Co. Outside City	70,807	84.6	52,599	82.4
Living Outside:				
EPZ Counties	3,470	4.1	3,188	5.0
Cumberland Co.	452	0.5	390	0.6
Dauphin Co.	936	1.1	834	1.3
Lebanon Co.	932	1.1	894	1.4
York (Outside of City)	1,150	1.4	1,070	1.7
Elsewhere	9,394	11.2	8,036	12.6
York County (Outside of City:				
Living in Co. Outside of City	92,899	100.0	81,896	100.0
Working in Co. Outside of City	51,722	55.7	43,501	53.1
Working Outside:				
EPZ Counties	9,031	9.7	8,492	10.4
Cumberland Co.	3,370	3.6	3,153	3.9
Dauphin Co.	4,511	4.9	4,269	5.2
Lancaster (Outside of City)	1,150	1.2	1,070	1.3
Elsewhere	32,146	34.6	29,903	36.5
Working in Co. Outside of City	70,203	100.0	60,582	100.0
Living in Co. Outside of City	51,722	73.7	43,501	71.8
Living Outside:				
EPZ Counties	5,305	7.6	4,843	8.0
Cumberland Co.	1,549	2.2	1,478	2.4
Dauphin Co.	1,920	2.7	1,734	2.9
Lancaster Co.(Outside of City)	1,836	2.6	1,631	2.7
Elsewhere	13,176	18.8	12,238	20.2

NOTE: In addition to the above Counties, a small portion of Lebanon County lies within the EPZ; because the County is not within an SMSA, only partial data is available.

SOURCE: U. S. Bureau of the Census, Journey to Work, 1970, June 1973.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 8

SCHOOLS LOCATED IN EPZ

Cumberland County

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
40	1	Manor Elementary School * Elm & Coolidge Streets New Cumberland	142	11	West Shore
40	2	St. Theresa Park Avenue New Cumberland	340 CCD Program - 300 (7:00 - 8:15 PM, M & W)	22 20	Diocese of Harrisburg
40	3	New Cumberland Middle School* 9th Street New Cumberland	622	40	West Shore
40	4	Hillside Elementary School* 7th and Sharon Streets New Cumberland	487	45	West Shore

continued

* Majority of students walk to school

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

Dauphin County

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
7	5	Northumberland Elem. School*** 105 Northumberland Avenue Royalton	150	*	Middletown
8	6	George D. Mansberger Elem. School Ann & Woods Streets Middletown	150	*	Middletown
8		Middletown Christian School**			Diocese of
	7	Spruce & Emaus Streets	51	5	Harrisburg
	8	and Union Street	55	4	
		Middletown			
8	9	Seven Sorrows School**** Race & Conewago Streets Middletown	240	19	Diocese of Harrisburg
8	10	G.W. Feaser High School*** 214 Race Street Middletown	450	*	Middletown
8	11	L.J. Fink Elementary School*** Race Street Middletown	365	*	Middletown
8	12	Grandview Elementary School*** Catherine Street Middletown	540	*	Middletown
9	13	Londonderry Township School 260 Schoolhouse Road Middletown	549	*	Lower Dauphin
19	14	Highspire Main Elementary School**** Roop & Penn Streets Highspire	225	13	Steelton- Highspire

* Information not provided
** Buildings at two locations
*** Majority of students walk to school
**** No bus transportation available.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

Dauphin County
- Continued -
-2-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
20	15	Middletown Area High School 1155 North Union Street Middletown	850	*	Middletown
21	16	Annie B. Nye Elementary School*** High & John Streets Hummelstown	391	*	Lower Dauphin
21	17	Lower Dauphin Jr. and Sr. High School Lard Street Hummelstown	JHS - 561 SHS - 1303	*	Lower Dauphin
21		Price Elementary School **			
	18	Water & High Streets	185	8	Lower Dauphin
	19	Short & John Streets Hummelstown	196	27	
21	20	St. Joan of Arc 300 W. Areba Street Hershey	300	17	Diocese of Harrisburg
21	21	Hershey Sr. High School Hershey	636	*	Derry Twp.
21	22	Hershey Elementary School Hershey	920	*	Derry Twp.
21	23	Hershey Jr. High School E. Granada Road Hershey	812	*	Derry Twp.
21	24	Hershey Intermediate School Hershey	Elem. - 400 JHS - 200 SHS - 600	42 20 62	Derry Twp.
21	25	Hershey School Milton Hershey	1250 - 1300 All Residential	600	Derry Twp.

* Information not provided
** Buildings at two locations

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
THE 10 MILE RADIUS

TABLE 8
(Continued)

Dauphin County
- Continued -
-3-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
22	26	South Hanover Elementary School W. Union Deposit Road Union Deposit	402	*	Lower Dauphin
23	27	Conewago Elementary School Schoolhouse Road Conewago Township	201	*	Lower Dauphin
42	28	Assumption of the Blessed Virgin Mary School ** 833 South 2nd Street Steelton	150	12	Diocese of Harrisburg
	29	St. Peter School ** 385 South 2nd Street Steelton	81	6	Diocese of Harrisburg
42	30	Steelton Main Elementary School*** 4th & Walnut Streets Steelton	445	45	Steelton-Highspire
43	31	Foose Elementary School 1301 Sycamore Street Harrisburg	512	42	Harrisburg City
43	32	Sacred Heart School 823 S. Cameron Street Harrisburg	195	9	Diocese of Harrisburg
43	33	Shimmell Elementary School 548 S. 17th Street Harrisburg	427	30	Harrisburg City
43	34	Melrose Elementary School 2041 Berry Hill Street Harrisburg	534	40-45	Harrisburg City

* Information not provided
** Majority of students walk and/or driven to school
*** No school bus transportation assigned

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

Dauphin County
- Continued -
-4-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
43	35	Lincoln Elementary School 1601 State Street Harrisburg	383	35	Harrisburg City
43	36	John Harris High School 2451 Market Street Harrisburg	1344	75	Harrisburg City
43	37	D.A. Marshall Elementary School 301 Hale Street Harrisburg	411	30	Harrisburg City
43	38	Holy Family School* 25th & Berry Hill Streets Harrisburg	218	12	Diocese of Harrisburg
43	39	St. Francis of Assisi 1424 Market Street Harrisburg	167	9	Diocese of Harrisburg
44	40	Paxtang Elementary School Paxtang Avenue Paxtang	299	15	Central Dauphin
45	41	St. Catherine Laboure School 4000 Derry Road Oakleigh	325	24	Diocese of Harrisburg
45	42	Rutherford Elementary School 65th Street Rutherford Heights	277	15	Central Dauphin
45	43	Chamber Hill Elementary School Chamber Hill Road Swatara Township	236	11	Central Dauphin
45	44	Swatara Jr. High School Bennett & Carton Streets Oberlin Gardens	571	52	Central Dauphin
45	45	Oberlin Elementary School* Oberlin	120	25	Capital Area Intermediate Unit

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

Dauphin County
- Continued -
-5-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
45	46	Tri-Community Elementary School Swann & Montaur Streets Oberlin	382	20	Central Dauphin
45	47	Bishop Newman School: St. John School High & Livingston Streets Enhaut	55	5	Diocese of Harrisburg
		and			
45	48	St. Ann School Reyneders Street Steelton	106	14	Diocese of Harrisburg
45	49	Steelton-Highspire Jr. and Sr. High School Swatara Street & Reyneders Avenue Steelton	695	67	Steelton-Highspire
46	50	John C. Kunkel Elementary School Lumber & Fulling Mills Road Middletown	380	*	Middletown
47	51	Southside Elementary School Union Deposit Road Woodland View	565	27	Central Dauphin
47	52	Central Dauphin East High School 626 Rutherford Road Lakewood Hills	1002	79	Central Dauphin
47	53	Central Dauphin East Jr. High School 628 Rutherford Road Lakewood Hills	1026	76	Central Dauphin
47	54	E.H. Phillips Elementary School Berkley Street Poplar Gardens	457	22	Central Dauphin
	55	Dauphin County Vo-Tech School*** 6001 Locust Lane Harrisburg	975	82	**

* Information not provided
** A Vocational Technical School serving the 6 school districts within Dauphin County area.
*** Students transported by district school buses

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

Lancaster County

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
12	56	Bainbridge Elementary School Second Street Bainbridge	325 (incl. 54 Kindergarten)	16	Elizabethtown Area
25	57	Fairview Elementary School Route #3 Elizabethtown	176 (incl. Kindergarten: 25-AM, 18-PM)	15	Elizabethtown Area
26	58	East High St. Elementary School 800 East High Street Elizabethtown	300	22	Elizabethtown Area
26	59	Elizabethtown Area Middle and Senior School 600 East High Street Elizabethtown	Middle - 1100 Senior - 800	150	Elizabethtown Area
26	60	Mill Road Elementary School Elm Road Elizabethtown	175	12	Elizabethtown Area
26	61	Elizabethtown Elementary School* 70 South Poplar Street Elizabethtown	145	8	Elizabethtown Area
26	62	St. Peter 55 Washington Street Elizabethtown	108	4	Diocese of Harrisburg
27	63	Rheems Elementary School School Lane Rheems	300 - AM 21 - PM	20	Elizabethtown Area
28	64	Maytown Elementary School North River Street Maytown	430	30	Donegal

Majority of students walk to school

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

York County

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
15	65	York Haven-Newberry Elem. School Manchester	167	14	Northeastern
16	66	Conewago Elementary School Manchester	408	25	Northeastern
17	67	Newberry Elementary School RD 2 Etters	580	52	West Shore
30	68	Manchester Elementary School Harding Street Manchester	210	14	Northeastern
	69	Orendorf School Maple & Hartman Streets Manchester	680	35	Northeastern
30	70	Mount Wolf Elementary School 6th & Maple Streets Mount Wolf	247	19	Northeastern
30	71	Northeastern Jr. & Sr. High Sch. High Street Manchester	JHS - 540 SHS - 820	40 66	Northeastern
32	72	Hayshire School 2801 Hayshire Drive Lakeview Heights	460	30	Central York
32	73	Roundtown Elementary School Church & Lewisberry Roads Roundtown	147	12	Central York
32	74	York Christian Elementary School Greenbriar & Church Roads Fousttown	500	36	Non-public School

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

York County
- Continued -
-2-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
38	75	Mount Zion Elementary School RD 2 Lewisberry	320	22	West Shore
38	76	Red Land Senior High School RD 2 Lewisberry	1320	118	West Shore
38	77	Fishing Creek Elementary School RD 2 Lewisberry	603	55	West Shore
~~38~~	~~78~~	~~Locust Grove Elementary School~~ ~~RD 9~~ ~~York~~	~~274~~	~~40~~	~~Red Lion Area~~
38	79	Fairview Elementary School 480 Lewisberry Road Fairview Township	260	30	West Shore

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 8
(Continued)

York County
- Continued -
-2-

ERPA	Map No.	Facility/Address	Enrollment	Staff	School District
38	75	Mount Zion Elementary School RD 2 Lewisberry	320	22	West Shore
38	76	Red Land Senior High School RD 2 Lewisberry	1320	118	West Shore
38	77	Fishing Creek Elementary School RD 2 Lewisberry	603	5[illegible]	West Shore
[redacted]					
38	79	Fairview Elementary School 480 Lewisberry Road Fairview Township	260	30	West Shore

THREE MILE ISLAND
ACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 9

SPECIAL FACILITY POPULATION
ESTIMATES BY ERPA AND COUNTY

DAUPHIN COUNTY

ERPA	Map No.	Facility/Address	Max. Cap.	Avg. No.	Ambulatory	Wheelchair	Stretcher
		Hospitals:					
21	80	Hershey Medical Center 500 University Drive Hershey	350	315	104	211	--
		Nursing & Group Homes:					
8	81	Frey Village Retirement Center 1020 N. Union Street Middletown	230	230	152	61	17
8	82	Oddfellows Home of Pa. 999 W. Harrisburg Pike Middletown	169	130	50	80	--
9	83	Children's Care Center Hummelstown	70	68	--	68	--
21	84	Alpine Retirement Center Ruhenhaus Lane Hershey	200	183	92	91	--
45	85	Dauphin County Home and Hospital Paxton & S. 28th Streets Harrisburg	563	535	143	92	300
45	86	Aspin Center Paxton & S. 28th Streets Harrisburg	21	21	--	21	--

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 9
(Continued)

ERPA	Map No.	Facility/Address	Max. Cap.	Avg. No.	Ambulatory	Wheelchair	Stretcher
45	87	Beistline House South 28th Street Harrisburg	200	110	110	--	--
47	88	Leader Nursing & Rehab. Center 800 King Russ Road Harrisburg	240	210	105	53	52
47	89	Villa Theresa Nursing Home 1051 Avila Road Harrisburg	Administrator would not supply information				
		Colleges:					
8	90	Penn State University Capitol Campus Middletown	Students - 1600 commuting; 700 resident, regular semesters Faculty & Staff - 345, regular semesters; 245, summer; 200, between semesters				
21	91	State Police Academy Route 743 Hershey	80 residential (year round)				
		Prisons:					
45	92	Dauphin County Prison	280	280			

THREE MILE ISLAND
ACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 9
(Continued)

LANCASTER COUNTY

ERPA	Map No.	Facility/Address	Max. Cap.	Av. No.	Ambulatory	Wheelchair	Stretcher
		Hospitals:					
25	93	Elizabethtown Children's Hospital Elizabethtown	45	42	--	21	21
		Nursing & Group Homes:					
11	94	Masonic Home Masonic Drive Elizabethtown	725	725	275	225	225
26	95	Leader Nursing Home & Rehab Center 320 S. Market Street Elizabethtown	87	87	65	22	--
27	96	Lehman's Guest & Boarding Home Broad St. & Heisy Avenue Rheems	50	50	35	10	5
		Colleges:					
26	97	Elizabethtown College	Per Semester: 1416 (1203 - residential 213 - commuting)				

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

CAMPGROUND/RECREATIONAL VEHICLE PARKS - POPULATION ESTIMATES BY ERPA

TABLE 9

(Continued)

ERPA	MAP NO.	FACILITY/ADDRESS	NO. OF SITES	FAMILY CAMPING	ATTENDANCE
45	98	Harrisburg East Campground 1135 Highspire Road Harrisburg, Pa. 17111	62	Year-Round	• Season (Summer Months): 50-75 persons/day (Average) • Off-Season (Winter): 20 persons/day (Average)
21	99	Hershey Highmeadow Camp One Chocolate Avenue Hershey, Pa. 17033	260	Year-Round	• Season (Summer Months): 30,000 camper units @ 4 persons/unit
3	100	Shaw-N-Tee Campground R.D. 4 Box 200 Elizabethtown, Pa. 17022	74	Year-Round	• Season (Summer Months): 300 persons/day (Maximum) 150 persons/day (Average) • Off-season (Winter): 20 persons/day
25	101	Ridge Run Camp Sites R.D. 1 Box 842 Elizabethtown, Pa. 17022	117	Year-Round	• Season (Summer Months): 100-500 persons/day • Off-Season (Winter): 25 persons/day
17	102	Park Away Parks Campground R.D. 2 Etters, Pa. 17319	110	Year-Round	• Season (Summer Months): 75% sites occupied/day @ average 3 persons/unit • Off-season (Spring/Fall): 40%-50% sites occupied/day @ average 3 persons/unit (Winter): 25 persons/day (maximum)
35	103	Gifford Pinchot State Park R.D. 1 Lewisberry, Pa. 17339	340	Year-Round	• No cabins • 3 persons/site (Average) • Total Visitors/Month: June 1980 60,800 July 1980 144,000 Aug. 1980 77,000 Sept 1980 46,000 Oct. 1980 16,000 Dec. 1980 15,000

and vehicle transportation. Separate estimates for day and nighttime populations were made to account for resident schools and colleges and staff differentials. The locations of these facilities by map number are shown in Figure 18.

In addition, several summer camps were identified in the EPZ and approximately one hundred summer cottages are located on the several islands near TMI in the Susquehanna River. One of the largest of these islands, Shelley Island lies within the Exclusion Radius for TMI and is almost entirely owned by Metropolitan Edison Company (Met.Ed.). The cottages on this island are used by Met. Ed. employees. According to Met. Ed., these cottages, like those on Hill Island and a number of smaller islands in the EPZ, are inhabited by summer visitors and are accessible only by small boat. In an emergency, these visitors (most of whom are area residents) would be within the warning siren coverage area. According to Met. Ed., it takes less than fifteen minutes to reach the mainland by boat; therefore, evacuation of these visitors should not pose a problem. Also, it was noted by PEMA, that the river is used by local residents for fishing and boating. Likewise, these daytime visitors could be evacuated in a short period. An estimate of the number of recreational visitors for both the islands and river area is not readily available, but both PEMA and Met. Ed. believe that such activity is rather small.

Campers and day visitors to the area's parks (such as Gifford Pinchot State Park) and to campsites were also considered. An estimate of the number of visitors was compiled from data furnished by the State Department of Community Affairs and camp directors. Because these visitors are within the proposed siren coverage area and would self-evacuate, they were included in the transient population component. The location of the campsites and major park facilities are identified on Figure 18 and are listed in Table 9.

The special facilities and their locations were identified either through review of the County emergency plans, various planning maps or by contact with state and county agencies and facility administrators.

Data regarding the makeup of a facility's population was generally obtained by contacting the various facility administrators. An estimate of the special facility population in each ERPA by facility type for both day and night is presented in Section IV.A., Table 22. For conservatism, this estimate is based on the facility's maximum capacity rather then present population listed in Tables 8 and 9.

In addition to these special facilities, data on approximately 20 Day Care Centers and 186 at-home child care facilities which accommodate approximately five children was obtained from the Office of Children Youth and Families.[28] Because these facilities normally do not provide door to door transportation, it is assumed that the children will be picked up by their parents or guardians; therefore a separate evacuation time estimate for these facilities has not been made. A list of the major Day Care Centers is provided in Table 10.

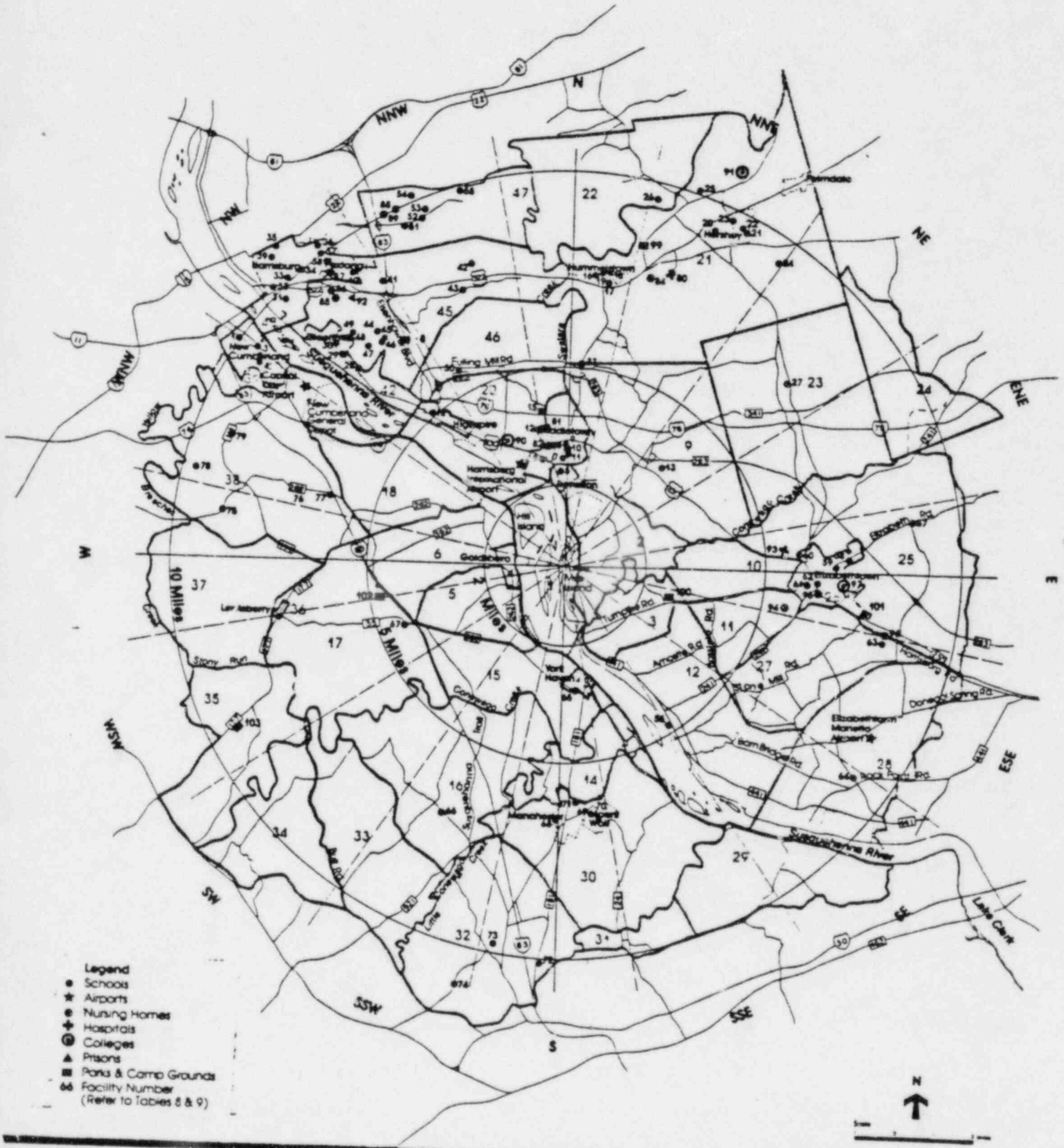

Fig. 18 Special Facilities

Three Mile Island
Emergency Response Plan
10-Mile EPZ

TABLE 10
MAJOR DAY CARE CENTERS

County	Name of Facility	Capacity
Dauphin	George Frey Center 210 Oakley Ave. Harrisburg 17111	15
	Dauphin County Child Care Services (A-D)	
	A. Hill Area Child Development Center 15 and Forster Sts. Harrisburg 17111	35
	B. Middletown Area Child Development Glad Tidings Assembly of God Church 1325 Vince St. Middletown 17057	25
	C. Steelton Child Development Center 130 Watson St. Steelton 17113	50
	D. Dauphin County Group and Family Day Care Homes 17 South Second St. Harrisburg 17101	110
	Downtown Day Care 21 South River St. Harrisburg 17101	37
	Dauphin County Headstart Centers Cloverly Heights Church of God 1019 South 19th St. Harrisburg 17104	30
	Neighborhood Day Care Centers (A,B)	129
	A. Boas School DCC 909 Reen St. Harrisburg	
	B. Glenwood Center 1950 Locust Lane Harrisburg	60
	Marcus Garvey Camp Center YMCA 6 and Woodbine Sts. Harrisburg 17110	128

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 10
(Continued)

County	Name of Facility	Capacity
Dauphin	Little People - Hershey 667 Cherry Dr. Hershey 17033	1[illegible]
	Little People - Harrisburg East 4075 Londonderry Rd. Harrisburg 17109	110
	Playmate Day Care Center 4900 Constitution Ave. Harrisburg	63
	Strawberry Garden Ltd. 1107 North 17th St. Harrisburg	47
York	Sunshine Day Care Center Missionary Alliance Church R.D. 2 Box 10A New Cumberland 17070	66
	York CPC Child Development Center Main St. Wellsville 17365	40
Cumberland	Arthur Bursel West Shore Childrens Center Grace V. M. Church 313 Herman Ave. Lemoyne 17045	23
	Brookside Learning Center Poplar and Erford Rd. Camp Hill 17011	43
	Heimbach's Day Care Center St. Paul's V. M. Church Front and Locust Sts. Wormleysburg 17043	54
Lancaster	Elizabethtown Child Care Center 75 East High t. Elizabethtown 17022	60

NOTE: Not included in the list above are 186 day care centers, each with approximately 5 children maximum capacity. Although they are not listed, they have been accounted for in the residents population estimates.

4. Summary of Population Components: As required by NUREG-0654 section J.10.b, a summary of the three major population components has been prepared for the two, five and ten mile radius at 22½ degree increments. These resulting sub-areas are designated as 22½ degree Sectors. The 22½ degree Sectors as shown in Figures 19 a,b,c, are centered about the sixteen major compass points and defined in terms of their compass direction and the radius rings between which they lie. The estimates for the various population components by 22½ Sector are listed in Tables 11-13.

C. Vehicle Estimates

1. Permanent Resident Population with Autos - An estimate of the number of automobiles which might be generated by this component of the general population was made by proportioning the number of autos registered by county in 1978 according to the county population and to the respective populations in the political jurisdictions which lie within the EPZ. Table 14 shows the projected number of automobiles by permanent residents by ERPA.

2. Permanent Resident Population without Auto - Based on procedures set forth in the various county emergency plans, this component of the general population will be evacuated by private and available school buses from predesignated assembly or pickup points in each political jurisdiction to assigned reception centers for the community. The assembly or pick-up points by jurisdiction are listed in Table 15.

It was noted by PEMA, that approximately one hundred of the residents without an auto located principally in the portion of Lancaster County in the EPZ are Amish. The Mennonite Council has assured PEMA that their people would self-evacuate in the event of an incident at TMI. (9)

3. Transient Population - Recreational/Vacation and Business: An estimate of the number of autos generated by these components of the transient population are based on assumed vehicle occupancy rates:(29)

Recreation/Vacation Travelers - 3.0 persons per vehicle
Non-Recreation/Vacation Travelers - 1.6 persons per vehicle

4. Transient Population - Employment: The estimate of the number of vehicles generated by transient employment in the EPZ is based on the number of autos per employee by county as derived from the 1970 Census Journey to Work for the Harrisburg, Lancaster and York SMSA's.(8) These figures are statistically apportioned to account for vehicles generated by employees living within a county and those working outside a county or major sub-area in the EPZ as shown in Table 7. Thus, separate factors were developed for each county in the EPZ and the City of Harrisburg to be applied to the employment estimated by ERPA. This statistical vehicle generation factor accounts for those people who work at home, use public transit, walk to work or are at locations other than their normal place of business. The vehicle generation factors by county and the City of Harrisburg are presented in Table 16.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 11
RESIDENT POPULATION
POPULATION ESTIMATES FOR 22½° SECTORS
Day (Night)

	Distance from TMI (Miles)					
Direction	0 - 2		2 - 5		5 - 10	
N	154	(189)	7,654	(9,439)	9,280	(11,538)
NNE	175	(216)	1,122	(1,378)	13,100	(16,394)
NE	251	(308)	842	(1,034)	2,353	(2,831)
ENE	150	(185)	659	(809)	1,409	(1,759)
E	63	(77)	566	(792)	6,696	(9,731)
ESE	38	(46)	219	(317)	1,698	(2,364)
SE	73	(97)	397	(539)	2,195	(3,959)
SSE	250	(324)	472	(594)	3,835	(4,619)
S	0	(0)	1,851	(2,228)	6,545	(8,836)
SSW	7	(8)	1,296	(1,557)	2,653	(3,186)
SW	13	(16)	881	(1,059)	1,158	(1,392)
WSW	162	(196)	1,319	(1,586)	2,157	(2,593)
W	275	(333)	1,557	(1,874)	2,920	(4,006)
WNW	7	(9)	961	(1,227)	5,898	(10,721)
NW	0	(0)	724	(893)	17,369	(24,442)
NNW	0	(0)	3,433	(4,409)	11,013	(13,698)
	1618	(2004)	23,953	(29,735)	90,279	(122,069)
			Total Population		115,850	(158,226)

Note: Data obtained from the U.S. Bureau of the Census, 1980 Preliminary Census Predictions.

Reference tables to Figure 19 a for location of sectors.

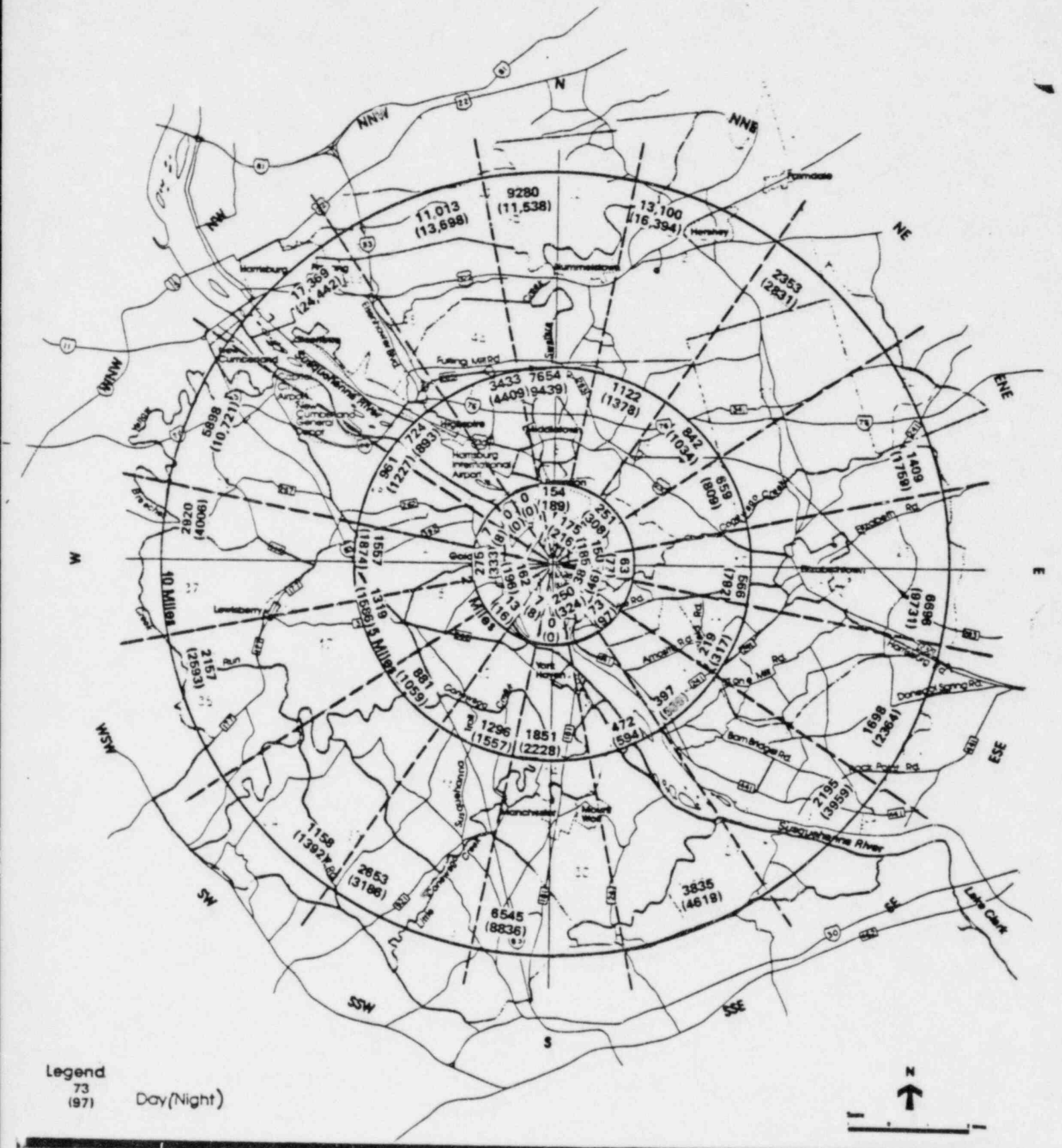

Fig. 19a Population Summary
Permanent Resident
Population

Three Mile Island
Emergency Response Plan
10-Mile EPZ

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 12
TRANSIENT POPULATION
POPULATION ESTIMATES FOR 22½° SECTORS
Day (Night)

	Distance from TMI (Miles)					
Direction	0 - 2*		2 - 5		5 - 10	
N	14	(2)	607	(184)	827	(434)
NNE	15	(2)	102	(15)	1,915	(1,919)
NE	22	(3)	78	(11)	204	(48)
ENE	14	(2)	60	(9)	176	(41)
E	5	(1)	64	(10)	1,178	(524)
ESE	9	(1)	117	(154)	194	(32)
SE	19	(1)	44	(6)	465	(68)
SSE	52	(4)	60	(6)	226	(40)
S	0	(0)	124	(20)	478	(75)
SSW	0	(0)	87	(13)	173	(27)
SW	1	(0)	67	(9)	144	(13)
WSW	16	(2)	240	(263)	733	(1,044)
W	19	(3)	111	(16)	337	(121)
WNW	1	(0)	70	(10)	1,195	(533)
NW	0	(0	233	(11)	4,310	(1,036)
NNW	0	(0)	249	(106)	1,036	(548)
	187	(21)	2,313	(843)	13,591	(6,503)
			Total Population		(6,503)	(7,367)

Note:
- o Data obtained from the U.S. Bureau of the Census, 1980 Preliminary Census Predictions.
- o Reference tables to Figure 18 for location of sectors.
- o Transient employees are defined as those working in the EPZ but leaving in communities outside.

*These population estimates do not include the total daytime/night employment population, 1202 (400) respectively for TMI.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 13
SPECIAL FACILITIES*
POPULATION ESTIMATES FOR 22½° SECTORS
Day (Night)

	Distance from TMI (Miles)			
Direction	0 - 2	2 - 5	5 - 10	
N	-	3,260 (1,099)	2,706	(70)
NNE	-	-	4,900	(630)
NE	-	549 (0)	201	(0)
ENE	-	- -	-	-
E	-	- -	4,864	(2,060)
ESE	-	- -	350	(50)
SE	-	325 (0)	430	(0)
SSE	-	- -	-	-
S	-	167 (0)	2,644	(0)
SSW	-	- -	408	(0)
SW	-	- -	-	-
WSW	-	580 (0)	-	-
W	-	- -	320	(0)
WNW	-	- -	3,708	(0)
NW	-	- -	6,577	(1108)
NNW	-	3335 (715)	4,461	(0)
Total	-	8,216 (1814)	31,569	(3918)
		Total Population	39,785	(4,732)

Note: Figures given represent resident population for those special facilities identified in this study.

Reference tables to Figure 19 for sector location.

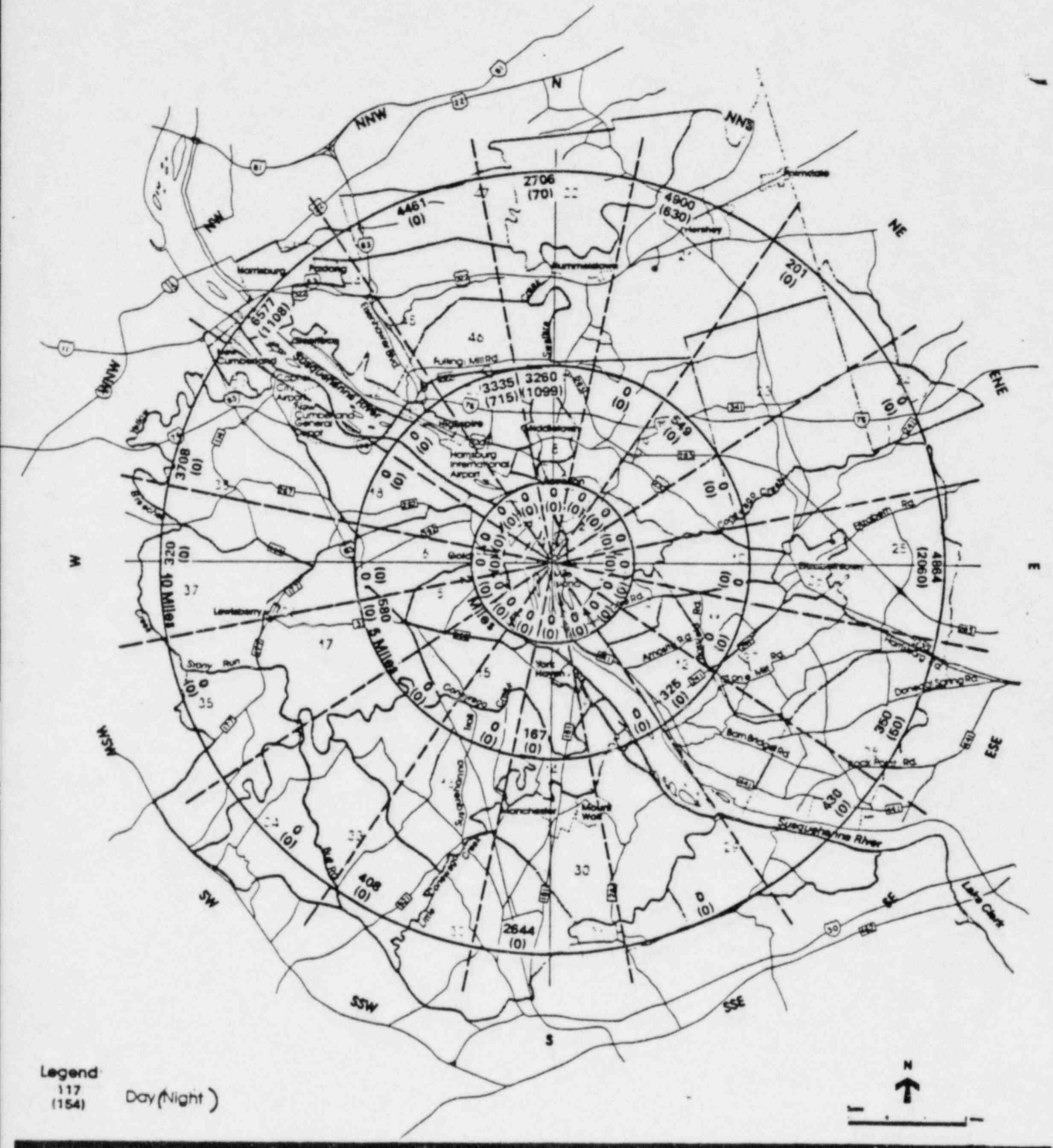

Fig. 19c Population Summary
Special Facilities
Population

Three Mile Island
Emergency Response Plan
10-Mile EPZ

Parsons
Brinckerhoff

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 14

PROJECTED NUMBER OF AUTOMOBILES
USED BY PERMANENT RESIDENTS
BY EMERGENCY RESPONSE PLANNING AREA

Emergency Response Planning Area (ERPA)	Number of Persons Using Automobiles	Projected Number of Automobiles Used By Permanent Residents
1	0	0
2	1,433	797
3	515	256
4	434	222
5	748	383
6	1,870	957
7	864	480
8	8,462	4,705
9	3,282	1,825
10	823	410
11	565	281
12	1,546	770
13	678	347
14	988	506
15	2,992	1,532
16	3,683	1,886
17	3,739	1,914
18	2,410	1,234
19	2,462	1,369
20	4,155	2,310
21	17,830	9,913
22	3,770	2,096
23	2,284	1,270
24	1,301	637
25	2,507	1,248
26	5,854	2,915
27	2,242	1,117
28	2,715	1,352
29	208	106
30	5,605	2,870
31	912	467
32	6,688	3,424
33	921	472
34	583	298
35	165	84
36	282	144
37	2,407	1,232
38	6,304	3,228
39	636	334
40	7,442	3,807
41	0	0
42	4,733	2,632
43	18,148	10,090
44	1,462	813
45	16,122	8,964
46	1,192	663
47	4,406	2,450
	158,368	84,910

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 15

LOCAL PICKUP POINTS
FOR POPULATION WITHOUT AUTOS

County	Municipality	ERPA	Assembly Areas
Cumberland	New Cumberland Township	40	1. Manor School 2. Hillside School
	Lower Allen Township**	39	1. Cedar Cliff School
York			Determined by Local Plans for pickup points
Lancaster	Conoy Township West Donegal Township	3,12 11,27	1. Bainbridge Fire Company 2nd Street Bainbridge, Pennsylvania
	Mount Joy Township** East Donegal Township** Elizabethtown Borough	25 28 26	1. Maytown Fire Company 117 E. High Street Maytown, Pennsylvania 2. Friendship Fire Company North Mount Joy Street Elizabethtown, Pennsylvania 3. Rheems Fire Company Harrisburg Avenue Rheems, Pennsylvania
Dauphin	Conewago Townwhip	23	1. Elementary School on Rt. 2. Texaco Station
	Derry Township	21	1. Dutch Village 2. Stoverdale Church 3. Fishburn Church 4. St. Pauls Church 5. Sand Hill & Foxanna 6. Mine & Leorden Rds. 7. Church & McCorkle 8. I-HOP Restaurant 9. Fritli Trailor Court 10. Briarcrest Gates 11. Nate Hose Garage 12. Palmdale Car Wash 13. Acme Auto Parts 14. Hershey Jr. High School 15. St. Joan of Arc 16. Front & Sand Beach Road 17. Derry & Park 18. Areba & Lyndon 19. Masonic Homes 20. Bachmanirile Saltymill 21. Meadowland & Eby 22. Spring Creek

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 15
(Continued)

County	Municipality	ERPA	Assembly Areas
Dauphin (Continued)	Harrisburg City	43	1. Marshall School 2. Melrose School 3. Edison School 4. Schimmel School 5. Lincoln School 6. 14th & Market Streets 7. Webster School 8. Boas School 9. Front & Vine Streets 10. Foose School 11. 17th & Hanover Streets 12. 19th & Sycamore Streets
	Highspire Borough	19	1. Flour Mill 2. 2nd & Race Streets 3. Firehouse 4. Boro Hall Eshelman Street 5. Franklin & Eshelman Streets
	Hummelstown Borough	21	1. Boro Building
	Londonderry Township*	2,9	
	Lower Paxton Township**	47	1. Vocational Technical School 2. Union Deposit Mall
	Lower Swatara Township	46,20	1. Market Street Exit 2. Olmstead Plaza 3. Shopes Garden Civic Ctr. 4. Lower Swatara Fire Co. 5. Route 441 & Longview Drive 6. Youth for Christ, Eisenhower Blvd.
	Middletown Borough	8	1. Market & Catherine 2. Middletown Plaza 3. Giant Store Parking Lot 4. Liberty Fire House 5. Pineford Rental Office 6. Grandview School 7. Oakhill & Spruce 8. Deatrich & Fry
	Paxtang Borough	44	1. Boro Building
	Royalton Borough	7	1. Boro Building 2. Strawsburg & Penn Street

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 15
(Continued)

County	Municipality	ERPA	Assembly Areas
Dauphin (Continued)	South Hanover Township	22	
	Steelton Borough	42	1. Burdoffs Front & Chambers 2. Boro Building 3. VFW Parking Lot 4. Higenic Fire Co., Bessemer St. 5. Cottage Hill Field 6. East End Recreation Center
	Swatara Township	45	1. Chamber Hill Fire Co. 2. Bressler Fire Co. 3. Oberlin Square 4. Oberlin Gardens Fire Co. 5. Enhaut Fire Co. 6. Good Shepard Lutheran Church 7. St. Catherine - Derry Street 8. Long Manor Comm. Ctr, 19th 9. Lawnton School 10. Rutherford Lions Club 11. T & C Parking Lot
Lebanon	South Londonderry Township**	24	1. Lawn Elementary School

Notes: * The County Plan does not list any pickup points for these municipalities
** Only a portion of the political jurisdiction and population lie within the 10 mile EPZ.

TABLE 16

VEHICLE GENERATION
FACTORS FOR EMPLOYMENT
BY COUNTY & CITY OF HARRISBURG

	Vehicles Per Total Employees
Working in Harrisburg:	
Living in Harrisburg	0.430
Living Outside Harrisburg	0.720
Remainder of Dauphin Co.	0.703
Cumberland Co.	0.760
Elsewhere	0.724
Total	0.640
Working in Remainder Dauphin Co.:	
Living in Remainder Dauphin Co.	0.662
Living Outside Remainder Dauphin Co.	0.765
Harrisburg	0.670
Cumberland Co.	0.836
Elsewhere	0.768
Total	0.703
Working in Cumberland County:	
Living in Cumberland County	0.691
Living Outside Cumberland County	0.772
Harrisburg	0.693
Remainder of Dauphin Co.	0.829
Elsewhere	0.763
Total	0.716
Working in Lancaster Co. (Outside City):	
Living in Co. (Outside City)	0.629
Living Outside Co. (Outside City)	0.717
Total	0.642
Working in York Co. (Outside City):	
Living in Co. (Outside City)	0.723
Living Outside Co. (Outside City)	0.758
Total	0.733

NOTE: Vehicles per total employment represents the number of automobiles associated with total employment in a locality. Employee base is total employment as used in this study, which includes persons who on the day of enumeration walked to work or worked at home. In addition to the above Counties, a small portion of Lebanon County lies within the EPZ; because the County is not within an SMSA, data by place of work is not available.

SOURCE: U. S. Bureau of the Census, Journey to Work, 1970, June 1973.

5. Special Facilities - Hospitals/Nursing Homes[1], [30] - According to the county emergency plans, the specific transportation needs for these facilities will be determined at the time of an incident based on patient or resident characteristics such as number of ambulatory or non-ambulatory persons. County transportation resources including ambulances and buses would then be allocated to each facility to supplement facility owned or operated vehicles to evacuate the facility to a predesignated host center.

A list of the primary transportation resources identified in the County plans is presented in Table 17. Secondary resources from adjacent counties as identified in the County Plans have also been assumed to be available. ~~These secondary resources are listed is Section V SUGGESTED ACTION under D. Potential Additional Vehicle Needs.~~

6. Special Facilities - Schools/Colleges[1] [23] [30] - It has been determined in the county emergency plans that evacuation of school children will be among their first priorities. The children who normally are assigned to district school buses will be taken to designated reception centers where they will be released to the custody of parents or guardians. Where schools do not normally provide bus transportation, students who normally walk to school will be sent home to evacuate with their families or provisions will be made for parents to pick them up at the school. According to discussions with school administrators, parochial school children who relie on public transportation, would have to find their own means of transport if district school bus are not provided. The schools without existing bus transportation are denoted in Table 8. Where a resident student population exists, it has been assumed that bus transportation will be allocated from the County's transportation resources. For students who drive to class, primarily those attending colleges and high school, the county emergency plans assume that they will self-evacuate, presumably to their homes to leave the risk area with their family. A list of the number and size of available school buses by county, school and school district is shown in Table 18.

Because the concept for evacuation of school children varies by county emergency plan and by school district, a conservative approach has been taken in this evacuation time estimate. It is assumed that available school buses will be allocated to all schools in the EPZ to evacuate the student population to their designated reception centers.

7. Special Facilities - Penal Institutions[1], [24] - The only major penal facility identified in the EPZ is the Dauphin County Prison. The vehicle estimate for the evacuation of staff and inmates was extracted from the draft of the Dauphin County Emergency Plans and confirmed by contact with the prison warden. Three buses with a capacity of 40-50 passengers (including guards) will be supplied by the National Guard to transport male inmates to the Huntington State Prison. The buses will travel along Route 22 to Huntington, Pennsylvania. Female inmates will be transported in two caged-station wagons to the State Correctional Institution for Women at Muncy, Pennsylvania. A convoy will be formed with two police cars at the front and rear of the convoy and one police car between each bus.

TABLE 17

TRANSPORTATION RESOURCES
BY COUNTY FOR THE EVACUATION
OF GENERAL AND RESIDENTIAL POPULATION

County	Bus Transportation Resource	Approximate Number of Vehicles Available	Vehicle Capacity	Ambulance Transportation Resource	Approximate Number of Vehicles Available
York	York Area Transit Authority	20 buses	40 seated, 20 standing	Fairview Twp. Ambulance Club R.D. #1 Box #60 New Cumberland, PA 17070	1
	York Transportation Club	17 vans 1 bus	10 people/van 20 people/bus with wheelchair facilities	Lewisberry Fire Co. Ambulance Club Front Street Lewisberry, PA 17339	1
	Red Lion Transit Bus Company*	18 motor coaches 110 school buses	39-49 people/coach 72 people/bus	Manchester Ambulance Club 201 York Street Manchester, PA 17345	1
Dauphin	Capital Area Transit*	20 buses	55 people/bus	Conewago Township	0
	Greyhound Bus Co.	15 buses	55 people/bus	Derry Township Harrisburg City	3 5
	Capital Bus Company*	53 buses 1 van	46 people/bus 12 people/van	Highspire Boro Hummelstown Boro Londonderry Township	1 2 1
	Central Dauphin* School District	82 buses	72 people/bus	Lower Paxton Township Lower Swatara Township Middletown Boro	3 1 2
	Harrisburg City* School District	40 buses	72 people/bus	Paxtang Boro Royalton Boro South Hanover Township	1 0 0
	Lower Dauphin* School District	41 buses	72 people/bus	Steelton Boro Susquehanna Township Swatara Township	2 1 5
	Schlagel Bus Co.*	23 buses	66 people/bus		
	Harris Buses	15 buses	72 people/bus		

Source: Three Mile Island Emergency Evacuation Plans (Drafts) for Lancaster, Dauphin, Lebanon, York and Cumberland County, April 1979

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 17

(Continued)

County	Bus Transportation Resource	Approximate Number of Vehicles Available	Vehicle Capacity	Ambulance Transportation Resource	Approximate Number of Vehicles Available
Lancaster	Red Rose Transportation Authority	35 buses	72 people/bus	Warwick	1
				Leola	1
	Conestoga Bus Co.	13 coaches	45 people/coach	Hempfield	1
				Manheim Township Ambulance	2
	Penn Highway Trans. Company	7 coaches	43 people/coach	East Lampeter	1
				New Holland	1
				West End	1
	Johnson Bus Service*	90 buses	55 people/bus	Christiana	1
				Armstrong (R.D.)	1
	Warfel Bus Service*	65 buses	48 people/bus	Conestoga View	1
				Lancaster Medical Transport	1
	Schultz Transportation*	30 buses	48 people/bus	Howmet	1
				Providence Township	1
	Raymond E. Groff* Buses	23 buses	72 people/bus	Strasburg	1
Cumberland	West Shore District*	2 buses	24 people/bus	New Cumberland (Ambulance 10)	
		4 buses	84 people/bus		
		24 buses	66 people/bus	Lower Allen (Ambulance 112 and 212)	
		34 buses	72 people/bus		
	Sunderland Chevrolet	50 buses	66-72 people/bus	Lisburn (Ambulance 24)	
		17 vans	10 people/van		
Lebanon	A.P. Bucks and Sons	17 buses	72 people/bus	Lawn Fire Co. Ambulance Lawn, PA	1
		3 vans	12 people/van		
		3 station wagons	9 people/wagon		

Source: Three Mile Island Emergency Evacuation Plans (Drafts) for Lancaster, Dauphin, Lebanon, York and Cumberland County, April 1979.

* Note: These bus companies are contracted to evacuate all students from schools before assisting in the evacuation of the general and resident population (see table 18).

THREE MILE ISLAND
EVACUATION TIME ESTIMATE
FOR THE 10 MILE RADIUS EPZ

TABLE 17

(Continued)

County	Bus Transportation Resource	Approximate Number of Vehicles Available	Vehicle Capacity	Ambulance Transportation Resource	Approximate Number of Vehicles Available
Lancaster	Red Rose Transportation Authority	35 buses	72 people/bus	Warwick	1
				Leola	1
	Conestoga Bus Co.	13 coaches	45 people/coach	Hempfield	1
				Manheim Township Ambulance	2
	Penn Highway Trans. Company	7 coaches	43 people/coach	East Lampeter	1
				New Holland	1
	Johnson Bus Service*	90 buses	55 people/bus	West End	1
				Christiana	1
	Warfel Bus Service*	65 buses	48 people/bus	Armstrong (R.D.)	1
				Conestoga View	1
	Schultz Transportation*	30 buses	48 people/bus	Lancaster Medical Transport	1
				Howmet	1
	Raymond E. Groff* Buses	23 buses	72 people/bus	Providence Township	1
				Strasburg	1
Cumberland	West Shore District*	2 buses	24 people/bus	New Cumberland (Ambulance 10)	
		4 buses	84 people/bus		
		24 buses	66 people/bus	Lower Allen (Ambulance 112 and 212)	
		34 buses	72 people/bus		
	Sunderland Chevrolet	50 buses	66-72 people/bus	Lisburn (Ambulance 24)	
		17 vans	10 people/van		
Lebanon	A.P. Bucks and Sons	17 buses	72 people/bus	Lawn Fire Co. Ambulance Lawn, PA	1
		3 vans	12 people/van		
		3 station wagons	9 people/wagon		

Source: Three Mile Island Emergency Evacuation Plans (Drafts) for Lancaster, Dauphin, Lebanon, York and Cumberland County, April 1979.

* Note: These bus companies are ~~contracted~~ to evacuate all students from schools before assisting in the evacuation of the general and resident population (see table 18).

Corrected P43

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 18

TRANSPORTATION RESOURCES BY COUNTY
FOR THE EVACUATION OF SCHOOL FACILITIES

County	Transportation Resource	Approximate Number of Vehicles Available	Vehicle Capacity
York	Red Lion Transit Bus Co.*	110 buses 18 motor coaches	72 students/bus 39-40 students/ Motor Coach
	West Shore School District*	2 buses 4 buses 24 buses 34 buses	24 students/bus 84 students/bus 66 students/bus 72 students/bus
	Gross School Bus Service	25 buses	72 students/bus
	Central York School District	31 buses	62 students/bus
Cumberland	West Shore School District*	66 buses	66-84 students/bus
Lancaster	Red Rose Transit Authority*	10 buses	40-50 students/bus
	Conestoga Transportation Co.*	2 buses 3 buses 5 buses 3 buses	49 students/bus 47 students/bus 45 students/bus 41 students/bus
	Johnson Bus Company*	90 buses	55 students/bus
	Warfel Bus Service*	65 buses	48 students/bus
	Schultz Transportation*	30 buses	48 people/bus
	Raymond E. Groff Buses	23 buses	72 people/bus
Dauphin	Capital Area Transit*	20 buses	55 people/bus
	Capital Bus Company	53 buses 1 van	46 people/bus 12 people/van
	Central Dauphin School District	82 buses	72 people/bus
	Harrisburg City School District	40 buses	72 people/bus
	Lower Dauphin School District	41 buses	72 people/bus
	Schlagel Bus Company*	23 buses	66 people/bus
	Harris Buses*	15 buses	72 people/bus

*Note: These bus companies are ~~contracted~~ to evacuate all students from schools before assisting in the evacuation of the general population (see table 17).

III. EVACUATION ROUTING

A. Route Selection - The primary evacuation routes used in this evacuation are shown in Figure 20. These routes represent a composite of the original evacuation route network which was selected by the Pennsylvania Emergency Management Agency (PEMA) in concert with the Pennsylvania Department of Transportation (PENNDOT) and supplemental routes which were selected by Parsons Brinckerhoff.[31] These primary routes generally include the major State and Interstate highways as well as major local routes in the 10 mile EPZ. The primary routes were selected to provide a contigious network which if expanded beyond the 10 mile EPZ could be used to expedite an evacuation of the population out to 20 miles as suggested in the Pennsylvania Emergency Response Plan.[33] The supplemental routings circumvent, where practical, potential bottleneck locations (32). The selected evacuation routes were then traveled in order to assess their sufficiency for evacuation purposes and to determine the characteristics (number of lanes, lane and shoulder widths or lateral clearance, location and operation of traffic controls, and operating and posted speeds) required for capacity determinations.

The majority of local roads are of a rural character which, based on limited field observations made by Parsons Brinckerhoff on January 5-6, 1981 constitute narrow two lane pavements 18 to 22 feet in width with abrupt vertical curves, no shoulders and little side clearance and in some instances sharp horizontal alignment. These geometric restrictions not only limit a driver's sight distance; but restrict traffic carrying capacity and travel speed. Thus, these routes are used as secondary evacuation routes for local residents to access the primary routes. In the event a primary route is blocked, local roads could provide a back-up capability for the local communities.

In selecting the original primary evacuation routes, PENNDOT established several objectives upon which to base their decision including their knowledge of the physical and operating characters of roadways in the EPZ:[34]

- The route must be in the general direction of the Reception Centers to which the community has been assigned.
- The route from a community should be as direct as possible causing the least interference with internal traffic movements and evacuation routings from adjacent communities.
- The route should provide the safest and quickest controlled path from the risk area.
- Traffic should be distributed to routes in such a manner as to minimize potential delays because of overloading.
- Routes where physical conditions exist such as narrow bridges, flooding or abrupt changes in available traffic lanes should be avoided.

B. Traffic Management Procedures - PENNDOT has also indicated that special traffic management procedures will be enacted to facilitate the flow of traffic from the risk area.[34] Such procedures would include:

- Assigning traffic control personnel at major points where evacuation routes meet and at interchange ramps.
- Detouring through-traffic on limited access facilities by barricading the roadway at the EPZ and at strategic interchanges.
- Directing motorists to use two lanes at single lane on-ramps where shoulders are sufficient.
- Opening right-of-way gates to limited access highways such as at the Middletown Service Area on Route 76, at Highspire and at Colebrook.

In addition, PENNDOT has arranged with the Pennsylvania Turnpike Authority to open the toll barriers on Route 76 to expedite the flow of evacuees from the area. Moreover, it is assumed that the primary evacuation routes would operate with normal two-way traffic patterns except on any existing one-way streets or ramps. This operational strategy would not only permit emergency units, special transportation vehicles and residents of the evacuation zone to circulate in the EPZ, but would also minimize the possibility of a total blockage of a route because of an incident such as a vehicle accident. If an accident did occur, other traffic could be directed around that point in the opposing travel lane(s). However, in the event a primary route would become impassible, local roads could be utilized.

The rerouting of evacuees to a local roads would be at the direction of the State Police or PENNDOT. The actual implementation of such a diversion could be accomplished by traffic control personnel assigned to strategic detour locations and/or by emergency radio broadcasts.

C. Roadway Link Characteristics[31],[32],[35]

The characteristics of the selected evacuation routes are summarized in Table 19. These characteristics are identified by the major links in the evacuation route network as shown in Figure 20. A link represents a contiguous roadway segment where the physical and operating characteristics are similar, a portion of a contiguous route which is intersected by another primary evacuation route or where additional traffic is loaded onto the route. When a route crosses a Sector boundary, the number is extended one link beyond the sector being evaluated to facilitate time estimates. The links are identified by route name and/or number, number of lanes (outbound direction), free flow travel speed, designated capacity and route classification, i.e.:

(LA) - Limited Access Highway;
(PH) - Primary Highway;
(SH) - Secondary Highway;
(SR) - Slip Ramp;
(LR) - Loop Ramp;
(DC) - Direct Connnection;

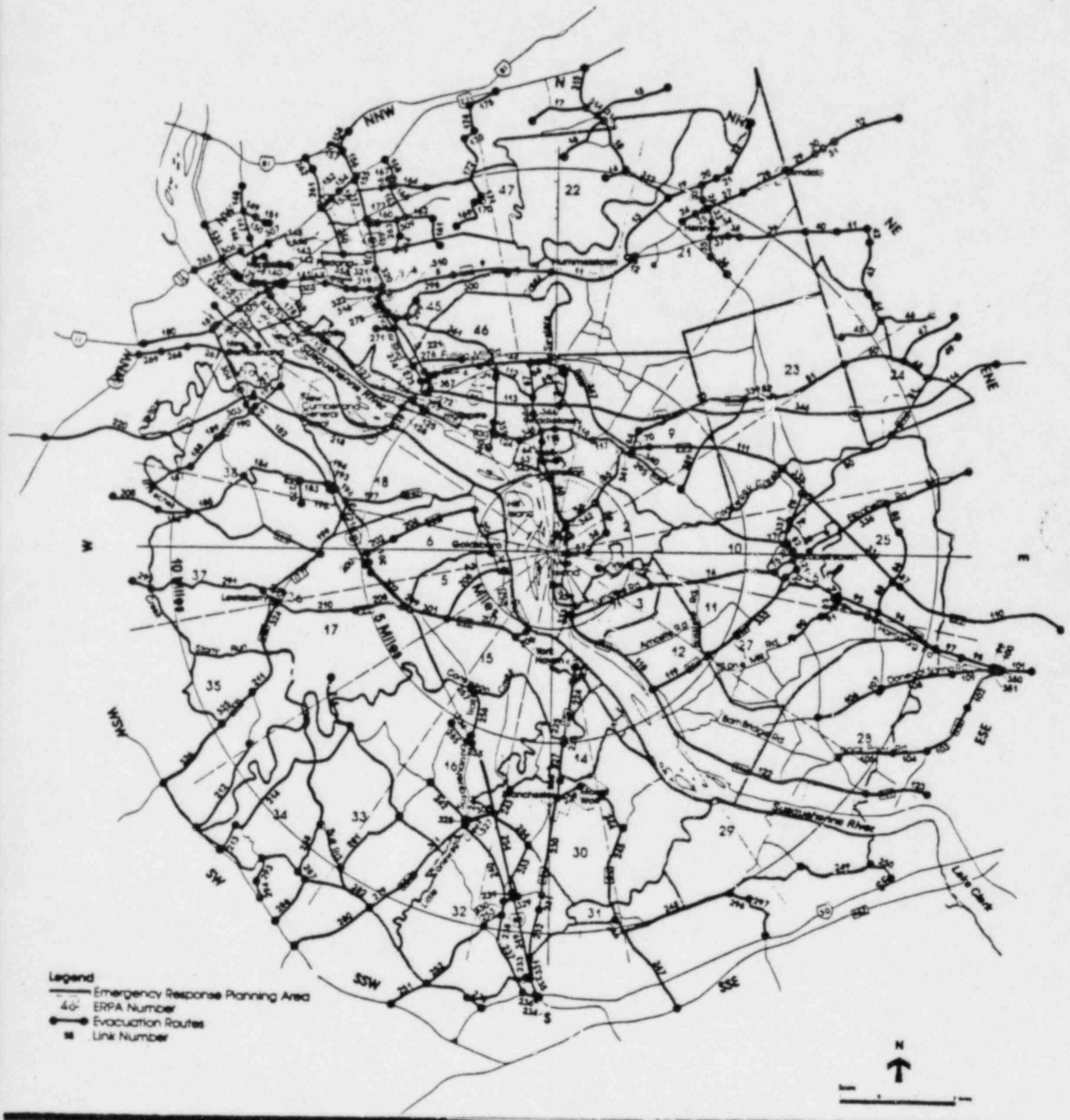

Fig. 20 Evacuation Route Links

Parsons Brinckerhoff

Three Mile Island
Emergency Response Plan
10-Mile EPZ

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

SELECTED PRIMARY EVACUATION
ROUTE CHARACTERISTICS

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
1	AIR ACC RD	HAR AIRPRT	EXIT 283E	1.6	55	2	4000	LIMITED ACCESS
2	AIR ACC RD	EXIT 283E	RT 283W OC	0.3	55	1	1600	PRIMARY HWY
3	RAMP	AIR.ACC RD	RTE.283W	0.3	35	1	1500	RAMP
4	RTE 283W	AIRPT CONN	I283N RAMP	1.1	55	2	4000	LIMITED ACCESS
5	I283N	I-283W RMP	CH HL RAMP	1.6	55	2	4000	LIMITED ACCESS
6	I283N	CH.HL.RAMP	BEGIN SEVR	0.0	55	2	4000	LIMITED ACCESS
7	RAMP	BEGIN SR	RTE 322E	0.3	35	1	1200	RAMP
8	RTE 322E	I 283W ACC	MUSH HL RD	3.5	55	2	1400	LIMITED ACCESS
9	RTE 322E	MUSH HL RD	CH HL RD	1.0	55	2	950	PRIMARY HWY
10	RTE 322E	CH HL RD	LO SWAT LN	0.6	55	2	3800	PRIMARY HWY
11	RTE 322E	LO SWAT LN	RT 39 LOOP	1.3	55	2	3800	PRIMARY HWY
12	RAMP	BEGIN LR	END LR	0.2	20	1	800	RAMP
13	RT 39	END LR	JNCT39/743	2.2	45	1	550	PRIMARY HWY
14	GRANDVIEWR	MARGATE DR	RTE 39	0.8	25	1	1140	SECONDARY HWY
15	DEVONSHIRE	ESTHNVRTWS	RTE 39	1.1	25	1	1060	SECONDARY HWY
16	RED TOP RD	STOUDT RD	RTE 39	1.5	25	1	1060	SECONDARY HWY
17	GRN VALLEY	HOERNERSTN	RTE 39	1.5	30	1	1060	SECONDARY HWY
18	RTE 39	GRNDVEW DR	RED TOP RD	1.3	50	1	1300	PRIMARY HWY
19	RTE 743	JNCT743/39	SND BCH RD	4.0	45	2	2330	PRIMARY HWY
20	RTE 743	SND BCH RD	SSA 743EXT	1.0	45	2	3920	PRIMARY HWY
21	RTE 743	SSA 743EXT	INTGRVL RD	0.6	45	1	1200	PRIMARY HWY
22	RTE 743	INTGRVLRD&	DERRYTWSPL	0.7	45	1	1600	PRIMARY HWY
23	RTE 743S	RTE 743N	CHOC.AVE.	0.5	35	1	100	PRIMARY HWY
24	CHOC AVE	ORCHARD RD	RIDGE RD	0.3	35	1	1490	PRIMARY HWY
25	CHOC AVE	RIDGE RD	JNCT 743N	0.1	35	1	1490	PRIMARY HWY
26	CHOC AVE	JNCT 743N	JNCT 743S	0.0	35	1	1490	PRIMARY HWY
27	CHOC AVE	JNCT 743S	HOMESTEDRD	0.1	25	1	1490	PRIMARY HWY
28	W MAIN ST	HOMESTED R	S LINGEL A	1.6	40	1	1490	PRIMARY HWY
29	W MAIN ST	S LINGEL A	N&S RR ST	1.2	25	1	1490	PRIMARY HWY
30	W MAIN ST	N&S RR ST	N&S GRNT S	0.1	35	1	1320	PRIMARY HWY
31	W MAIN ST	N&S GRNT S	JNCT 117S	0.3	35	1	950	PRIMARY HWY
32	RTE 422	JNCT 117S	N LOND TWN	1.2	45	2	3800	PRIMARY HWY
33	RTE 743S	RTE 422	ELM AVE	0.2	25	1	1230	SECONDARY HWY
34	RTE 743S	ELM AVE	GOVERNOR R	0.5	35	1	410	SECONDARY HWY
35	RTE 743S	GOVERNOR R	FISHBURN R	0.5	35	1	1140	PRIMARY HWY
36	RTE 743S	FISHBURN R	MULENBRG A	0.6	35	1	1490	PRIMARY HWY
37	RTE 322E	RT 743 N&S	HMESTD RD.	0.5	40	1	560	PRIMARY HWY
38	RTE 322E	HMESTD RD.	MEADOW LA	0.7	40	1	1490	PRIMARY HWY
39	RTE 322E	MEADOW LA	DPHN CO LN	1.2	55	1	1490	PRIMARY HWY
40	RTE 322E	DPHN CO LN	LYMAR AVE	0.7	35	1	1490	PRIMARY HWY
41	RTE 322E	LYMAR AVE	JNCT 117NS	0.7	35	1	500	PRIMARY HWY
42	CLBROOK RD	RTE 322E	BELL RD	0.3	30	1	990	SECONDARY HWY
43	BELL RD.	CLEBRK RD	LAWN RD	1.0	30	1	1410	SECONDARY HWY
44	BELL RD	LAWN RD	PATRICK RD	1.5	45	1	1410	SECONDARY HWY
45	PATRICK RD	LBNN CO LN	RTE 117	1.2	45	1	1060	SECONDARY HWY
46	PATRICK RD	RTE 117	LAWN RD	1.5	45	1	1060	SECONDARY HWY

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
47	EPLER RD.	RTE 117	RTE 341	1.8	30	1	1060	SECONDARY HWY
48	RTE 341E	RTE 341	WATER RD.	0.7	45	1	1140	PRIMARY HWY
49	WATER ST	RTE 341W	RTE 341	1.5	55	1	1140	PRIMARY HWY
50	RTE 341W	BORDER LA	EPLER RD.	1.6	45	1	1140	PRIMARY HWY
51	RTE 341W	RTE 743	LBNN CO LN	2.0	45	1	1140	PRIMARY HWY
52	RTE 341W	OLD HRSHYR	RTE 743	3.5	45	1	1140	PRIMARY HWY
53	RTE 341W	CLBROOK RD.	ACC RT.283	3.0	35	1	1060	PRIMARY HWY
54	ACC RD 283	RTE283E	RTE 341	0.5	45	1	1490	PRIMARY HWY
55	GYRSERS CH	HILLSDLE D	HARSBRGPKE	1.6	35	1	1140	SECONDARY HWY
56	GYRSERS CH	RIVER RD	HILLSDLE D	0.8	45	1	1060	SECONDARY HWY
57	PECKS RD	RIVER RD.	ZION RD	0.5	45	1	1060	SECONDARY HWY
58	ZION RD	PECKS RD	HILLSDLE D	0.6	45	1	1060	SECONDARY HWY
59	HILLSDLE D	ZION RD	GYRSERS CH	1.0	45	1	1140	SECONDARY HWY
60	RTE 441N	GYRERS CHR	ROYALTON	1.5	45	1	1490	PRIMARY HWY
61	RTE 441N	ROYALTON	BURD ST	0.5	35	1	1490	PRIMARY HWY
62	BURD ST.	N UMBERL S	CANAL ST.	0.2	20	1	1140	PRIMARY HWY
63	UNION ST	RTE 441	EAMUS E&W	0.2	25	1	700	PRIMARY HWY
64	UNION ST	EAMUS E&W	W MAIN ST	0.2	25	1	490	PRIMARY HWY
66	UNION ST	E ROOSVELT	OBERLIN RD	0.5	40	1	1140	PRIMARY HWY
67	UNION ST	OBERLIN RD	283E RAMP	0.8	35	1	1140	SECONDARY HWY
68	RAMP	OBERLIN RD	RTE 283E	0.3	40	1	1200	RAMP
69	RAMP	MDLTWN RD	RTE 283E	0.3	35	1	1000	RAMP
70	RAMP	ACC RD 283	RTE 283E	0.2	40	1	1200	RAMP
71	FALMOUTHRD	RTE 441	HILLSDLERD	2.1	35	1	1060	SECONDARY HW
72	HILLSDLERD	CREEK RD	FALMOUTHRD	0.8	35	1	1060	SECONDARY HWY
73	CREEK RD	COVERBR RD	HILLSDLERD	0.8	35	1	1060	SECONDARY HWY
74	FALMOUTHRD	HILLSDLERD	W.HIGH ST	4.3	40	1	1060	SECONDARY HWY
75	W.HIGH ST	FALMOUTHRD	MARKET ST	0.5	40	1	1060	SECONDARY HWY
76	MARKET ST	WSEHIGH ST	LINDEN AV	0.5	25	1	1410	PRIMARY HWY
77	LINDEN AV	MARKET ST	N.HANOVER	0.2	35	1	1140	SECONDARY HWY
78	HERSHEY RD.	MT GRETNA	28E RAMP	0.8	35	1	1200	PRIMARY HWY
79	RAMP	HERSHEY RD.	RTE 283E	0.5	40	1	1200	RAMP
80	MT GRETNA	RTE241/743	LEBAN CO L	4.0	45	1	1140	PRIMARY HWY
81	MT GRETNA	LEBAN CO L	RAILROADST	1.7	55	1	1140	PRIMARY HWY
82	N.HANOVER	EHMMLSTWN	LINDEN ST	0.2	35	1	1490	SECONDARY HWY
83	E.HIGH ST	S MARKETST	CHESTNUTST	0.5	25	1	1410	PRIMARY HWY
84	ELIZTWN RD	GRNTREE ST	SNNYBURNRD	2.2	40	1	1410	PRIMARY HWY
85	GRNTREE RD	ELIZTWN RD	RIDGE RD	0.8	45	1	1060	SECONDARY HWY
86	GRNTREE RD	RIDGE RD	ENT 283E	1.3	45	1	1060	SECONDARY HWY
87	RAMP	GRNTREE RD	RTE 283E	0.5	40	1	1200	RAMP
88	CLOVERLFRD	RTE 230	ENT 283E	1.0	40	1	1410	PRIMARY HWY
89	CLOVERLFRD.	LHRRSBRGRD	RTE 230	0.1	10	1	1060	SECONDARY HWY
90	MAYTOWN RD	STONEMILRD	743/FRMNRD	0.2	40	1	1140	PRIMARY HWY
91	FOREMAN RD	743/FRMNRD	ANCHOR RD	1.0	35	1	1060	SECONDARY HWY
92	FOREMAN RD	ANCHOR RD	FOREMAN RD	0.0	35	1	1060	SECONDARY HWY
93	ANCHOR RD	FOREMAN RD	SCHWANGERR	0.1	35	1	1230	SECONDARY HWY

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THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
94	SCHWANGERR	ANCHOR RD	S MARKETST	0.0	35	1	1140	SECONDARY HWY
95	RTE 230	SCHWANGERR	CLOVERLFRD	1.0	55	1	1070	PRIMARY HWY
96	RTE 230	CLOVERLFRD	SNYDER RD.	2.0	55	2	3680	PRIMARY HWY
97	RTE 230	SNYDER RD	S.ANGLE ST	0.6	35	1	660	PRIMARY HWY
98	RTE 230	S.ANGLE ST	NEW HAVEN	0.7	35	1	740	PRIMARY HWY
99	RTE 230	NEWHAVENST	SMARKETST.	0.1	35	1	720	PRIMARY HWY
100	RTE 230	S MARKETST	N BARBARAS	0.2	35	1	660	PRIMARY HWY
101	RTE 230	N BARBARAS	EBYCHOESRD	2.0	35	1	1490	PRIMARY HWY
102	MARIETTAST	RICHLANDLA	WDNGALSPRG	1.1	25	1	1060	PRIMARY HWY
103	MARIETTAST	ROCKPOINT	RICHLANDLA	3.2	40	1	1140	PRIMARY HWY
104	ROCKPOINT	COLEBROO	RTE 141	0.8	50	1	2140	PRIMARY HWY
105	~~ROCKPOINT~~	RTE 743N	COLEBROOKR	1.5	35	1	1140	PRIMARY HWY
106	DNGALSPRGS	MAYTOWN RD	COLEBROOKR	1.8	40	1	1060	SECONDARY HWY
107	COLEBROOKR	MTNGHSERNR	DNGAL.PRGS	0.0	10	1	1060	SECONDARY HWY
108	DNGALSPRGS	COLEBROOKR	S.ANGLE ST	2.0	35	1	1060	SECONDARY HWY
109	W DNGAL ST	S ANGLE ST	NEW HAVEN	1.0	35	1	1140	SECONDARY HWY
110	RTE 283E	GRANT ST	MT.JOY RDY	4.6	55	2	3760	LIMITED ACCESS
111	RTE 283E	RTE 230AAA	LANCAST CO	3.7	55	2	3760	LIMITED ACCESS
112	OBERLIN RD	UNION ST	AIRPORTACC	1.5	35	1	1060	SECONDARY HWY
113	I-76	JCT 283	MIDDLTW RD	2.2	55	2	3760	LIMITED ACCESS
114	I 76	LEBAN CO L	RTE 117	3.5	55	2	3760	LIMITED ACCESS
115	E MAIN ST	N UNION ST	VINE ST	0.2	30	1	810	PRIMARY HWY
116	E MAIN ST	VINE ST.	COLEBROOKR	1.1	35	1	1410	PRIMARY HWY
117	E MAIN ST	COLEBROOKR	GEYERS CH	0.8	50	2	3800	PRIMARY HWY
118	RIVER RD	FALMOUTHRD	RTE 241N	3.0	50	1	1490	PRIMARY HWY
119	RTE 241N	RTE 441	BOSSLER RD	1.8	40	1	1140	PRIMARY HWY
120	RTE 241N	MASONIC DR	S MARKETST	0.3	25	1	260	PRIMARY HWY
121	S MARKETST	BAINBR ST	E.HIGH ST	0.1	25	1	770	PRIMARY HWY
122	RTE 441E	RTE 241N	RTE 743N	6.7	55	1	1010	PRIMARY HWY
123	RTE 441E	RTE 743N	RTE 23N	2.6	55	1	1490	PRIMARY HWY
124	HARSBRGPKE	WILSON ST	AIR ACC RD	1.0	45	2	3800	PRIMARY HWY
125	SECOND ST	LUMBER ST	BROAD ST	0.1	35	1	950	PRIMARY HWY
126	SECOND ST	BROAD ST	EISEN BLVD	0.1	35	1	1410	PRIMARY HWY
127	S FRONT ST	EISEN BLVD	SWATARA ST	2.8	35	1	1410	PRIMARY HWY
128	S FRONT ST	SWATARA ST	LOCUST ST.	0.1	25	1	1410	PRIMARY HWY
129	S FRONT ST	LOCUST ST	CONESTOGA	0.2	30	1	1410	PRIMARY HWY
130	CAMERUN ST	SYCAMOREST	PAXTON ST	0.3	35	1	1410	PRIMARY HWY
131	~~FRONT ST~~	TAYLOR BR	MACLAY ST	1.0	35	3	1370	PRIMARY HWY
132	~~FRONT ST~~	WALNUT ST	TAYLOR BR	0.5	35	3	1370	PRIMARY HWY
133	~~FRONT ST~~	MAPLE ST	WALNUT ST	0.0	35	3	2380	PRIMARY HWY
134	~~FRONT ST~~	CHESTNUTST	MAPLE ST	0.0	35	3	2370	PRIMARY HWY
135	~~FRONT ST~~	LINE ST	CHESTNUTST	0.2	35	3	3320	PRIMARY HWY
136	~~PAXTON ST~~	~~S.2ND ST~~	LINE ST	0.0	35	2	1790	PRIMARY HWY
137	PAXTON ST	CAMERON ST	S.2ND ST	0.2	35	2	3520	PRIMARY HWY
138	PAXTON ST	CAMERON ST	S.13TH ST	0.3	35	2	1290	PRIMARY HWY
139	PAXTON ST	S.13TH ST	S.17TH ST	0.3	35	2	1560	PRIMARY HWY

Second St. Second St. Second St. Second St. Second St.

S. 2nd St. Paxton St,

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
94	SCHWANGERR	ANCHOR RD	S MARKETST	0.0	35	1	1140	SECONDARY HWY
95	RTE 230	SCHWANGERR	CLOVERLFRD	1.0	55	1	1070	PRIMARY HWY
96	RTE 230	CLOVERLFRD	SNYDER RD.	2.0	55	2	3680	PRIMARY HWY
97	RTE 230	SNYDER RD	S.ANGLE ST	0.6	35	1	660	PRIMARY HWY
98	RTE 230	S.ANGLE ST	NEW HAVEN	0.7	35	1	740	PRIMARY HWY
99	RTE 230	NEWHAVENST	SMARKETST.	0.1	35	1	720	PRIMARY HWY
100	RTE 230	S MARKETST	N BARBARAS	0.2	35	1	660	PRIMARY HWY
101	RTE 230	N BARBARAS	EBYCHUESRD	2.0	35	1	1490	PRIMARY HWY
102	MARIETTAST	RICHLANDLA	WDNGALSPRG	1.1	25	1	1060	PRIMARY HWY
103	MARIETTAST	ROCKPOINT	RICHLANDLA	3.2	40	1	1140	PRIMARY HWY
104	ROCKPOINT	COLEBROOKR	RTE 141	0.8	50	1	1140	PRIMARY HWY
105	ROCKPOINT	RTE 743N	COLEBROOKR	1.5	35	1	1140	PRIMARY HWY
106	DNGALSPRGS	MAYTOWN RD	COLEBROOKR	1.8	40	1	1060	SECONDARY HWY
107	COLEBROOKR	MTNGHSERNR	DNGALSPRGS	0.0	10	1	1060	SECONDARY HWY
108	DNGALSPRGS	COLEBROOKR	S.ANGLE ST	2.0	35	1	1060	SECONDARY HWY
109	W ONGAL ST	S ANGLE ST	NEW HAVEN	1.0	35	1	1140	SECONDARY HWY
110	RTE 283E	GRANT ST	MT.JOY RDY	4.6	55	2	3760	LIMITED ACCESS
111	RTE 283E	RTE 230AAA	LANCAST CU	3.7	55	2	3760	LIMITED ACCESS
112	OBERLIN RD	UNION ST	AIRPORTACC	1.5	35	1	1060	SECONDARY HWY
113	I-76	JCT 283	MIDDLTN RD	2.2	55	2	3760	LIMITED ACCESS
114	I 76	LEBAN CO L	RTE 117	3.5	55	2	3760	LIMITED ACCESS
115	E MAIN ST	N UNION ST	VINE ST	0.2	30	1	810	PRIMARY HWY
116	E MAIN ST	VINE ST.	COLEBROOKR	1.1	35	1	1410	PRIMARY HWY
117	E MAIN ST	COLEBROOKR	GEYERS CH	0.8	50	2	3800	PRIMARY HWY
118	RIVER RD	FALMOUTHRD	RTE 241N	3.0	50	1	1490	PRIMARY HWY
119	RTE 241N	RTE 441	BOSSLER RD	1.8	40	1	1140	PRIMARY HWY
120	RTE 241N	MASONIC DR	S MARKETST	0.3	25	1	260	PRIMARY HWY
121	S MARKETST	BAINBR ST	E.HIGH ST	0.1	25	1	770	PRIMARY HWY
122	RTE 441E	RTE 241N	RTE 743N	6.7	55	1	1010	PRIMARY HWY
123	RTE 441E	RTE 743N	RTE 23N	2.6	55	1	1490	PRIMARY HWY
124	HARSBRGPKE	WILSON ST	AIR ACC RD	1.0	45	2	3800	PRIMARY HWY
125	SECOND ST	LUMBER ST	BROAD ST	0.1	35	1	950	PRIMARY HWY
126	SECOND ST	BROAD ST	EISEN BLVD	0.1	35	1	1410	PRIMARY HWY
127	S FRONT ST	EISEN BLVD	SWATARA ST	2.8	35	1	1410	PRIMARY HWY
128	S FRONT ST	SWATARA ST	LOCUST ST.	0.1	25	1	1410	PRIMARY HWY
129	S FRONT ST	LOCUST ST	CONESTOGA	0.2	30	1	1410	PRIMARY HWY
130	CAMERUN ST	SYCAMOREST	PAXTON ST	0.3	35	1	1410	PRIMARY HWY
131	FRONT ST	TAYLOR BR	MACLAY ST	1.0	35	3	1370	PRIMARY HWY
132	FRONT ST	WALNUT ST	TAYLOR BR	0.5	35	3	1370	PRIMARY HWY
133	FRONT ST	MAPLE ST	WALNUT ST	0.0	35	3	2380	PRIMARY HWY
134	FRONT ST	CHESTNUTST	MAPLE ST	0.0	35	3	2370	PRIMARY HWY
135	FRONT ST	LINE ST	CHESTNUTST	0.2	35	3	3320	PRIMARY HWY
136	PAXTON ST	S.2ND ST	LINE ST	0.0	35	2	1790	PRIMARY HWY
137	PAXTON ST	CAMERON ST	S.2ND ST	0.2	35	2	3520	PRIMARY HWY
138	PAXTON ST	CAMERON ST	S.13TH ST	0.3	35	2	1290	PRIMARY HWY
139	PAXTON ST	S.13TH ST	S.17TH ST	0.3	35	2	1560	PRIMARY HWY

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

passenger car equivalents

LINK NUMBER	LINK DESCRIPTION MAINLINE	FROM	TO	LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
140	RAMP	S.17TH ST	I-83W	0.0	20	1	1000	RAMP
141	S.17TH ST	PAXTON ST	I-83W RAMP	0.1	25	1	1230	SECONDARY HWY
142	DERRY ST	19TH ST	17TH ST	0.1	25	1	1230	PRIMARY HWY
143	DERRY ST	17TH ST	12TH ST	1.2	25	1	1410	PRIMARY HWY
144	12TH ST	DERRY ST	MARKET ST	0.1	25	1	1410	PRIMARY HWY
145	MARKET ST	12TH ST	CAMERON ST	0.1	25	1	1230	PRIMARY HWY
146	CAMERON ST	MARKET ST	HERR ST	0.5	35	2	2110	PRIMARY HWY
147	RTE230	HERR ST	ROUTE 22	0.7	35	2	880	PRIMARY HWY
148	RTE230	ROUTE 22	ELMERTONAV	0.5	35	2	1680	PRIMARY HWY
149	RTE 22E	INFTRY HDG	CAMERON ST	0.3	35	1	1490	PRIMARY HWY
150	RTE 22E	17 TH ST	INFTRY HDG	0.5	35	1	1490	PRIMARY HWY
151	RTE 22E	HERR ST	17 TH ST	0.0	35	1	630	PRIMARY HWY
152	RTE 22E	S PRGRSSST	WLNT/FOXST	0.5	35	2	2070	PRIMARY HWY
153	RTE 22E	WLNT/FOXST	LCST/PNRSE	0.3	35	2	1540	PRIMARY HWY
154	RTE 22E	LCST/PNRSE	ENT83WLNUT	0.6	35	2	3800	PRIMARY HWY
155	RAMP	RTE 22E	I-83N	0.0	20	1	800	RAMP
156	I-83N	RTE 22 ENT	I-83W RAMP	0.8	55	3	5760	LIMITED ACCESS
157	RAMP	I-83N	I-81W	0.5	50	2	3000	RAMP
158	RAMP	I-83N	I-81E	0.5	45	2	3000	RAMP
159	UNIONDPOST	I-83N RAMP	E PARK RD	0.1	35	3	4980	PRIMARY HWY
160	UNIONDPOST	E.PARK RD	DOWNDNER	0.5	35	1	1490	PRIMARY HWY
161	PAGE RD	EVELYN RD	NEWSIDE RD	0.8	40	1	1140	SECONDARY HW
162	NEWSIDE RD	PAGE RD	UN.DEP.STR	0.5	40	1	470	SECONDARY HI
163	RUTHRFORD	UNIONDPOST	LOCUST LA	0.8	35	1	680	SECONDARY HW
164	LOCUST LA	MARERE DR	PRINCE ST	0.8	35	1	580	SECONDARY HWY
165	LOCUST LA	PRINCE ST	RUTHERFORD	0.0	35	1	580	SECONDARY HWY
166	RTHRFORDRD	LOCUST LA	VIRGINIAST	0.1	35	1	1410	SECONDARY HWY
167	VIRGINIAST	RTHRFORDRD	PRINCE ST	0.0	25	1	1410	SECONDARY HWY
168	PRINCE ST	VIRGINIA	RTE 22	0.5	25	1	550	SECONDARY HWY
169	CONWAY RD.	LYTER LA	UNIONDPOST	0.3	35	1	1140	SECONDARY HWY
170	UNIONDPOST	CONWAY RD	NYES RD	0.2	35	1	1140	SECONDARY HWY
171	NYES RD	UNIONDPOST	UNIONDPOST	0.0	35	1	1140	SECONDARY HWY
172	NYES RD	UNIONDPOST	DVNSHRHGTS	1.7	40	1	1140	SECONDARY HWY
173	DVNSHRHGTS	NYES RD	DEAVON RD	0.5	25	1	1140	SECONDARY HWY
174	DEAVON RD	DVNSHRHGTS	JONESTOWNR	0.6	25	1	1140	SECONDARY HWY
175	JONESTOWNR	DEAVON RD	RTE 22	0.8	40	1	1140	SECONDARY HWY
176	I-83N	EISEN BLVD	UN.DEPOSIT	1.5	55	2	3760	LIMITED ACCESS
177	RAMP	UNIONDPOST	I-83N	0.1	40	1	1200	RAMP
178	I-83W	17TH ST	2ND STRAMP	0.8	45	2	3760	LIMITED ACCESS
179	SOUTH BR	2ND STRAMP	W END BR	0.6	35	2	3240	LIMITED ACCESS
180	US11	I-83S	RTE 15	2.0	55	2	3760	LIMITED ACCESS
181	RAMP	I-83N	RTE 11W	0.2	35	1	1000	RAMP
182	I-83N	RTE262ENDR	RTE 76 ACC	2.5	55	2	3760	LIMITED ACCESS
183	RTE 262W	I-83	PLESANTVIW	0.5	45	1	1410	PRIMARY HWY
184	RTE 262W	PLESANTVIW	JNCTRTE114	2.2	40	1	1410	SECONDARY HWY
185	RTE 114	LEWISBRRYR	CMBRLNDCOL	1.7	40	1	1140	SECONDARY HWY

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
186	RTE 114	CMBRLNDCOL	LISBURN RD	0.8	25	1	1140	SECONDARY HWY
187	FORGE RD	OLDSTAGERD	LISBURN RD	1.2	40	1	1140	SECONDARY HWY
188	FORGE RD	SPNGRSMLLR	OLDSTAGERD	1.0	35	1	1140	SECONDARY HWY
189	FORGE RD	LEWISBERRY	SPNGRSMLLR	0.0	35	1	1140	SECONDARY HWY
190	LEWISBERRY	JNCTRTE 83	FORGE RD	1.1	40	1	1140	SECONDARY HWY
191	RAMP	RTE 114	I-83N	0.2	25	1	1000	RAMP
192	RTE 114	SUSQHNNTRL	I-83	1.0	45	1	1490	PRIMARY HWY
193	RTE 262	SUSQUA TRL	I-83N ENT	0.0	35	1	1410	PRIMARY HWY
194	RTE 262	I-83S ENT	I-83N ENT	0.1	35	1	1410	PRIMARY HWY
195	RAMP	RTE 262	I-83N	0.2	25	1	1000	RAMP
196	RTE 262E	SUSQHNNTRL	RTE 177	0.5	45	1	1140	PRIMARY HWY
197	RTE 262E	BIGSPRNGRD	OLD YORKRD	1.6	45	1	1060	SECONDARY HWY
198	RTE 262E	OLD YORKRD	I83OVERPSS	0.2	45	1	1140	SECONDARY HWY
199	WYOMERD	POTTSHILLR	I83OVERPSS	0.3	45	1	1140	PRIMARY HWY
200	RAMP	SUSQHNNTRL	I-83N	0.2	30	1	1000	RAMP
201	OLDYORK RD	RTE 392W	RTE 392E	0.6	40	1	1410	PRIMARY HWY
202	YOCUMTOWNR	REDMILL RD		0.7	40	1	1140	PRIMARY HWY
203	YOCUMTOWNR	VALLEY RD	RED MILL RD	2.2	40	1	1140	PRIMARY HWY
204	VALLEY RD	PINES RD	YOCUMTOWNR	1.6	45	1	1140	PRIMARY HWY
205	WISLER RD	CLY RD	YORK HAVEN	2.0	40	1	1140	SECONDARY HWY
206	REESERSHLL	CLY RD	YORK HAVEN	0.3	30	1	1140	SECONDARY HWY
207	YORKHAVENR	REESERSHLL	WISLER RD	2.6	40	1	1230	PRIMARY HWY
208	RTE 382W	I83 NB	YORK RD.	1.5	35	1	1490	PRIMARY HWY
209	RAMP	RTE 382	I-83N	0.1	30	1	1000	RAMP
210	RTE 382W	YORK RD	RTE 117	2.2	35	1	1490	PRIMARY HWY
211	RTE 177S	LEWISBRYRD	BORINGBRIDGE	1.6	55	1	1490	PRIMARY HWY
212	BORINGBRIDGE	CONLEY RD	RTE 74S	3.7	45	1	1410	SECONDARY HWY
213	CONEWAGORD	RHLRSCHRCH	OLDCRLSLRD	0.7	45	1	1140	SECONDARY HWY
214	RHLRSCHRCH	LWSBRRY RD	CONEWAGORD	4.8	45	1	1140	SECONDARY HWY
215	YRK/LWBRYR	EKNEY RD	ANDRSNTWNR	1.6	45	1	1060	SECONDARY HWY
216	I-83N	SUSQUEH TR	OVRPSSR262	2.2	55	2	3760	LIMITED ACCESS
217	RAMP	I-83N	I-76W	0.5	25	1	1000	RAMP
218	RTE 76W	76W WENDBR	I-83 ENT	3.6	55	2	3760	LIMITED ACCESS
219	RTE 76W	76W EENDBR	76W WENDBR	1.0	50	2	3240	LIMITED ACCESS
220	RTE 76W	I-83 ENT	RTE 15	5.6	55	2	3760	LIMITED ACCESS
221	RAMP	RTE 283W	I-283N	0.2	45	1	1200	RAMP
222	I-76W	HARRISBRGE	76W EBREND	0.6	55	2	3760	LIMITED ACCESS
223	181S	PENN AVE	SOUTH DR	0.3	25	1	1060	PRIMARY HWY
224	181S	SOUTH DR	WERTZ AVE	1.0	55	1	1140	PRIMARY HWY
225	181S	WERTZ AVE	CONEWAGO	0.5	40	1	1140	PRIMARY HWY
226	181S	CONEWAGO	E MAN BRDG	0.1	20	1	1490	PRIMARY HWY
227	181S	E MAN BRDG	PARKVIEW	1.0	40	1	1140	PRIMARY HWY
228	181S	PARKVIEW	MAPLE ST	0.5	35	1	1140	PRIMARY HWY
229	MAPLE ST	FRONT ST	181 S	0.6	35	1	540	PRIMARY HWY
230	181S	MAPLE ST	BESH SCH R	1.2	35	1	1490	PRIMARY HWY
231	181S	BESH SCH R	EMIG RD	1.5	40	1	1410	PRIMARY HWY

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
232	181S	EMIG RD	WOODVW DR	1.5	40	1	1490	PRIMARY HWY
233	RAMP	181S	I-83S	0.1	40	1	1200	RAMP
234	RAMP	SUSQUA TRL	I-83S	0.3	30	1	1000	RAMP
235	183 S	181S	RTE 250	1.1	55	2	3760	LIMITED ACCESS
236	SUSQUHA TR	LIGHTNER R	RT30 AT 83	0.2	35	1	160	PRIMARY HWY
237	SUSQUHA TR	SINKING SP	LIGHTNER R	2.1	40	1	1410	PRIMARY HWY
238	CHURCH RD	SUSQUHA TR	183 S RAMP	0.1	40	1	1490	PRIMARY HWY
239	RAMP	CHURCH RD	I-83S	0.5	25	1	1000	RAMP
240	SUSQUHA TR	MT.WASH.RD.	CHURCH RD	2.5	45	1	1230	PRIMARY HWY
241	MT.WASH.RD.	SUSQUHA TR	CANAL RD	0.0	25	1	1140	SECONDARY HWY
242	MT.WASH.RD.	BUTLER RD	SUSQHNNTRL	1.3	40	1	1140	SECONDARY HWY
243	RTE 921S	MISSLER ST	I-83	0.5	40	1	1140	SECONDARY HWY
244	SHERMAN ST	LONG RD	CORUSFRNCE	0.7	40	1	1140	SECONDARY HWY
245	RTE 24S	SHERMAN ST	MT ZION RD	2.5	45	1	1140	SECONDARY HWY
246	MT ZION RD	SHERMAN ST	DRUCKVALLY	0.3	35	1	1200	PRIMARY HWY
247	MT ZION ST	DRUCKVALLY	JNCTRTE230	1.6	35	1	1140	PRIMARY HWY
248	DRUCKVALLY	CRYDERCREK	MT ZION RD	3.2	35	1	1140	SECONDARY HWY
249	FURNACE RD	MILLSTONE	ACCOMAC RD	1.3	40	1	1060	SECONDARY HWY
250	ACCOMAC RD	FURNACE RD	JNCTRTE230	1.3	40	1	1060	SECONDARY HWY
251	RTE 238W	MNCHSTRTWL	RTE 74 NES	1.0	35	1	1140	PRIMARY HWY
252	RTE 238W	LWSBERRYRD	MNCHSTRTWL	2.6	40	1	1140	PRIMARY HWY
253	SNKNGSPRGS	SUSQHNNTRL	LWSBERRYRD	0.6	40	1	1140	PRIMARY HWY
254	I-83S	RTE295 E&W	RTE 238E&W	4.5	55	2	3760	LIMITED ACCESS
255	RAMP	RTE295 E&W	RTE I-83 S	0.2	40	1	1200	RAMP
256	SUSQUA TRL	I-83S ENT	HYKESMILL	1.2	40	1	1410	PRIMARY HW
257	BRIDGE	HYKESMILLR	ENDOFBRDGE	0.5	20	1	1060	PRIMARY HW
258	TMI NBRDGE	NORTH LOTS	RTE 441N	0.5	20	1	1140	SECONDARY HWY
259	TMI NBRDGE	SOUTH LOTS	RTE 441S	1.2	10	1	1060	SECONDARY HWY
260	PROGRESSAV	OLDTWNSHP	RTE 22	1.2	35	1	1230	PRIMARY HWY
261	PROGRESSAV	RTE 22	ELMERTONAV	1.0	35	1	700	PRIMARY HWY
262	PROGRESSAV	ELMERTONAV	I-81	0.3	35	1	1230	PRIMARY HWY
263	DOWNOWER	UNIONDPOST	GALION ST	0.5	30	1	1140	SECONDARY HWY
264	GALION ST	DOWNOWER	ETTA RD	0.3	30	1	1140	SECONDARY HWY
265	TAYLOR DR	FRONT ST	OPHNCOLINE	0.7	35	2	3520	PRIMARY HWY
266	BRIDGE ST	10TH ST	MARKET ST	1.5	35	1	1410	PRIMARY HWY
267	CARISLE RD	BRANDT ST	18TH ST	1.1	35	1	1230	PRIMARY HWY
268	CARISLE RD	18TH ST	SMPSNFRRYR	0.5	35	1	620	PRIMARY HWY
269	SMPSNFRRYR	CARISLE RD	RTE15OVRPS	0.5	35	1	1230	PRIMARY HWY
270	PLES VW DR	PRIVATE RD	RTE 262	0.5	35	1	380	SECONDARY HWY
271	RTE 441	HARRISB ST	EISENH BLV	0.5	35	1	510	PRIMARY HWY
272	RAMP	I76 ACC RD	I-76E	0.5	30	1	1000	RAMP
273	EISEN BLVD	FULLING RD	I76 ACC RD	0.6	45	1	1550	PRIMARY HWY
274	EISEN BLVD	RTE 441	FULLING RD	0.7	45	1	1040	PRIMARY HWY
275	EISEN BLVD	CHAM HL RD	RTE 441	0.5	45	1	910	PRIMARY HWY
276	FULLING RD	NISSLEY DR	EISENH BLV	1.0	40	1	470	PRIMARY HWY
277	MIDDLTW RD	RTE 283	RTE 76	1.1	40	1	1490	PRIMARY HWY

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
278	ROOSEVELT	MAN TWN LN	RTE 30 OVP	0.3	40	1	1410	PRIMARY HWY
279	RTE 921	MIL CRK RD	BULL ROAD	1.2	40	1	700	PRIMARY HWY
280	RTE 921	BULL ROAD	RTE 74	1.6	40	1	700	PRIMARY HWY
281	BUTLER RD	LEWISBY RD	BULL RD	1.6	40	1	1410	SECONDARY HWY
282	BULL ROAD	BUTLER RD	RTE 921	1.5	40	1	700	PRIMARY HWY
283	BOARD ROAD	RTE 238	T941	1.5	35	1	1140	PRIMARY HWY
284	T941	BOARD ROAD	RTE 921	1.3	35	1	1140	PRIMARY HWY
285	CLOVERLEAFRD.	BUTLER RD	RTE 295	0.6	35	1	1140	SECONDARY HWY
286	GEORGE ST.	NURSURY RD	RTE 74	1.0	40	1	1140	SECONDARY HWY
287	NURSURY RD	GEORGE ST.	GEORGE ST.	0.1	40	1	1140	SECONDARY HWY
288	CHERRYORCHRD.	BULL ROAD	NURSURY RD.	1.0	40	1	1140	SECONDARY HWY
289	DECDATE RD	RTE 230	RTE 341	3.0	40	1	1230	PRIMARY HWY
290	RTE 382	RTE 117	SIDDENBURG	0.3	25	1	1490	PRIMARY HWY
291	SIDDENBURG	RTE 382	LEWISBERRY RD	2.5	35	1	1140	PRIMARY HWY
292	LEWISBERRY RD	SIDDENBURG	T916	0.3	35	1	1140	PRIMARY HWY
293	MOUNTAINRD	NURSURY RD	OLDCARLISLE	0.5	35	1	1140	SECONDARY HWY
294	OLDCARLISLE	MOUNTAINRD	RTE 74	0.3	35	1	1140	SECONDARY HWY
295	RTE 230	SILDENBURG	I283 ACCRD	1.7	40	1	1410	PRIMARY HWY
296	KREUTZCR.RD.	DRUCKVALLY	KREUTZCR.RD.	0.5	35	1	1140	SECONDARY HWY
297	KREUTZCR.RD.	T948	RTE 30	1.1	40	1	1140	PRIMARY HWY
298	RTE 441	I-283N ACC	KECKLER RD	0.5	40	1	1490	PRIMARY HWY
299	KECKLER RD	RTE 441	CHMBRHLLRD	0.5	35	1	1140	PRIMARY HWY
300	CHMBRHLLRR	KECKLER RD	80TH ST	2.5	40	1	1140	PRIMARY HWY
301	RTE 382	WISLER RD.	I-83N	1.0	40	1	1230	PRIMARY HWY
302	I 83N	RTE 382	SUSQUE TRL	1.5	55	2	3760	LIMITED ACCESS
303	RTE 183N	RTE 114	I 76	0.2	55	2	3760	LIMITED ACCESS
304	RTE 183N	I76	RTE 11W	2.0	55	2	3760	LIMITED ACCESS
305	RTE 114	LISBURN RD	LANTZ CEM	1.1	25	1	1140	SECONDARY HWY
306	FOSTER ST.	7TH.ST.	FRONT ST.	0.5	35	3	5820	PRIMARY HWY
307	STATE ST	FOSTER ST	18TH.ST.	1.0	35	3	5820	PRIMARY HWY
308	RTE 921	I-83	COPENHAFER	0.7	40	1	1410	PRIMARY HWY
309	UN.DEPOSIT	DOWNDNER	RUTHERFORD	0.2	35	1	1490	PRIMARY HWY
310	RAMP I283N	RT 441	I-283N	0.2	40	1	1200	RAMP
311	RTE 921	SUSQUA TRL	MIL CRK RD	1.8	40	1	1410	PRIMARY HWY
312	RTE 39	JNCT743/39	GRNDVEW RD	1.5	50	1	1300	PRIMARY HWY
313	RTE 39	RED TOP RD	DVNSHRE RD	0.1	50	1	1300	PRIMARY HWY
314	RTE 39	DVNSHRE RD	GRNHLL RD	0.3	50	1	1300	PRIMARY HWY
315	RTE 39	GRNHLL RD	RTE 22	0.7	50	1	1300	PRIMARY HWY
316	I-283N	RTE 322	I-83N	0.3	55	2	3760	LIMITED ACCESS
317	I-83N	UN.DEPOSIT	RT.22	1.0	55	2	3760	LIMITED ACCESS
318	PAXTON ST	29TH ST	I-83E	0.7	35	2	3520	PRIMARY HWY
319	I-83E	PAXTON ST	I-83N RAMP	0.5	50	2	4000	LIMITED ACCESS
320	I-83N	I-83E RAMP	EISEN BLVD	0.6	55	2	3760	LIMITED ACCESS
321	RAMP	I-83E	I-83N	0.2	30	1	1000	RAMP
322	RTE-322E	I-83N RAMP	I-283W RMP	0.3	55	2	4000	LIMITED ACCESS
324	LEWISBRYRD	RTE 382W	RTE 177S	0.7	35	1	1490	PRIMARY HWY

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 19

(continued)

LINK NUMBER	LINK DESCRIPTION			LINK LENGTH (MILES)	SPEED (MPH)	NUMBER OF LANES OUTBOUND	PRACTICAL CAPACITY OUTBOUND (PCE/HOUR)	ROADWAY CLASSIFICATION
	MAINLINE	FROM	TO					
325	RTE 177	ALPINE RD	RD TO PARK	1.0	55	1	1490	PRIMARY HWY
326	RTE 177	RD TO PARK	RTE 74S	2.2	55	1	780	PRIMARY HWY
327	RTE 921	MT.WASH.RD.	SUSQUE TRL	0.7	40	1	1410	PRIMARY HWY
328	SUSQUE TRL	MT.WASH.RD.	RTE 921	0.7	45	1	1230	PRIMARY HWY
329	RTE 238	BOARD RD	I-83S RAMP	0.1	40	1	1490	PRIMARY HWY
330	SUSQUE TRL	SINK SPRNG	RTE 238	0.3	40	1	1140	PRIMARY HWY
331	RTE 181S	WOOD VW.DR	I-83S	0.5	40	1	1490	PRIMARY HWY
332	RTE 241	BOSSLER RD	MASONIC DR	2.7	40	1	1140	PRIMARY HWY
333	RTE 441	FALMOUTHRD	TMI S.BRDG	0.3	55	1	1490	PRIMARY HWY
334	SUSQUA TRL	I-83N RMPS	I-83S RMPS	0.0	40	1	1410	PRIMARY HWY
335	ELIZ.TWN R	CHSTNUT ST	GRND TREE	2.3	45	1	1140	PRIMARY HWY
336	RTE 283E	HNVER ST	GRANT ST	3.2	55	2	3760	LIMITED ACCESS
337	NHANOVERST	LINDEN ST	MT.GRETNA	0.6	35	1	1200	PRIMARY HWY
338	RTE 283E	LNC CO LN	HNVER ST	1.0	55	2	3760	LIMITED ACCESS
339	RTE 341W	OLDHRSHYRD	LR22009	0.5	35	1	1060	PRIMARY HWY
340	ACCRD 283E	RTE 230	EB ON RMP	0.1	45	1	1490	PRIMARY HWY
341	RTE 230	GYRSERS CH	ACCRD 283	0.5	40	1	1410	PRIMARY HWY
342	RTE 441	TMI N.BRDG	GRYSERS CH	0.2	45	1	1490	PRIMARY HWY
343	RTE 441N	BURD ST	EAMUS ST	0.3	25	1	1490	PRIMARY HWY
344	UNION ST	MAIN ST	E ROSEVELT	0.5	25	1	1490	PRIMARY HWY
345	MAIN ST	UNION ST	WILSON ST	0.5	35	1	1490	PRIMARY HWY
346	I-76	MIDDLTW RD	LEBAN CO L	7.6	55	2	3760	LIMITED ACCESS
347	RTE 283S	MIDDLTWNRD	ACC RTE230	2.8	55	2	3760	LIMITED ACCE
348	RTE 293	AIR ACC RD	UNION ST	1.5	55	2	3760	LIMITED ACCI
349	I 83S	RTE 238	RTE 181	2.2	55	2	3760	LIMITED ACCE
350	MARIETTAST	WDNGLSPRGS	RTE 230	0.1	25	1	1060	PRIMARY HWY
351	DNGLSRPGSR	NEWHAVENRD	MARIETTA	0.1	35	1	1140	SECONDARY HWY
352	I-83W	W ENDSBRDG	I-83S	0.7	50	2	3760	LIMITED ACCESS
353	RTE 283S	UNION ST	MIDDLETWNR	0.8	55	2	3760	LIMITED ACCESS
354	S FRONT ST	CONESTOGA	SYCAMOREST	1.5	35	1	1410	PRIMARY HWY
355	EISENHOWER	I76 ACC RD	RTE 230	0.5	45	1	700	PRIMARY HWY
356	I76 ACC RD	EISENHOWER	I-76 TOLL	0.1	30	2	4000	PRIMARY HWY
357	RAMP	I-76 TOLL	I-76W	0.2	30	1	1000	RAMP
358	RAMP	PAXTON ST	I-83E	0.1	25	1	1000	RAMP
359	RAMP	HARSBRGPKE	AIR ACC RD	0.5	35	1	1200	RAMP
360	RAMP	HI AIRPORT	RTE 230	0.7	45	1	1500	RAMP
361	OBERLIN RD	GARDEN DR	KECKLER RD	3.0	35	1	1140	PRIMARY HWY

These characteristics have been compiled from previous evacuation time estimates, review of regional maps, discussions with officials at PEMA and PENNDOT limited field observations and a physical inventory of the selected evacuation route network. This inventory was made by members of Parsons Brinckerhoff's staff on February 11,-14, 1981.

D. Capacity Determination

The principal roadway capacities were determined by procedures presented in the Federal Highway Administration's 1965 Highway Capacity Manual and the Traffic Engineering Series: Capacity Analysis Procedure for Signalized Intersections published by the Traffic Institute, Northwestern University. Capacities were estimated at roadway operating Levels of Service (L.O.S. D and E). These values were used to approximate a range for evacuation time estimates representing an upper and lower bound determined by limiting the roadway capacity to L.O.S. D and E respectively. This range is used to approximate the range of evacuation times for the best estimate and typical weekday scenarios as defined in Section IV.A. The upper and lower bounds of this range are defined as:

- Upper Bound - A relative value of time which reflects a poor state of readiness of emergency forces and resources due to the sudden development of a possible future incident at TMI which leads to a spontaneous order for a General Evacuation.

- Lower Bound - A relative value of time which assumes a good state of readiness and nearly full deployment of emergency forces and resources. Such a state could occur as a potential incident at TMI developes slowly and various levels of action are invoked: for example the general population and special facilities are placed on an alert status during which time emergency forces are mobilized followed by a declaration of a site emergency, selective evacuation and finally a general emergency.

For an adverse weather condition, the evacuation time estimates are computed using a restrained roadway capacity as defined by L.O.S. D minus twenty percent. This restrained capacity reflects the longer headways between vehicles and reduced manueverability resulting from poor driving and roadway conditions which also produces lower travel speeds. It is used herein to represent an upper bound for evacuation time estimates. The lower bound is estimated by using L.O.S. D which still reflects the poor driving and roadway condition which may still be prevalent under such adverse conditions and type of incident.

In urban aras, the impact of existing traffic control signals was considered in determining link approach capacities. Basedon a first estimate of evacuation times for the selected network assuming normal operation

of all controls, potential bottlenecks at such controlled locations were identified as described in Section IV.E Critical Locations. A second estimate was then prepared assuming that traffic control personnel would be assigned to these critical locations.

A detailed explanation of the methodology used to determine roadway capacity is provided in Appendix D. Separate capacities though have been selected with the concurrence of PENNDOT and assigned to all interchange ramp links because of the possible sensitivity of interchange ramps as noted in NUREG-0654.[37] The capacities (shown below) are based on typical design capacities for single lane ramps based on geometric conditions published by the American Association of State Highway and Transportation Officials.[38]

- Loop ramp - 800 to 1000 passenger cars per hour (pcph)
- Slip ramp with acceleration/deceleration lane - 1000 to 1200 pcph
- Direct connection between limited access highways - 1500 pcph

These capacities do not account for terminal conditions where a ramp intersects local streets. Major at-grade intersection points on evacuation routes, were evaluated separately as described in Section IV.E, Critical Locations to identify potential critical bottlenecks.

E. Reception Centers

As described in the county emergency plans, reception centers have been designated in areas well beyond the 10 mile EPZ, in most cases more than 20 miles from TMI.[1] These centers, according to PEMA, would serve as staging areas and registration locations for school children and the general population who are in need of assistance. Each center has been assigned to serve a political jurisdiction and schools therein. The location of these centers in relation to the 10 mile EPZ and to the major routes in the area are shown in Figure 21. The centers are identified in Tables 20 and 21 by Map Number. These centers are listed by ERPA's and schools which they serve as previously described in Tables 4 and 8 respectively.

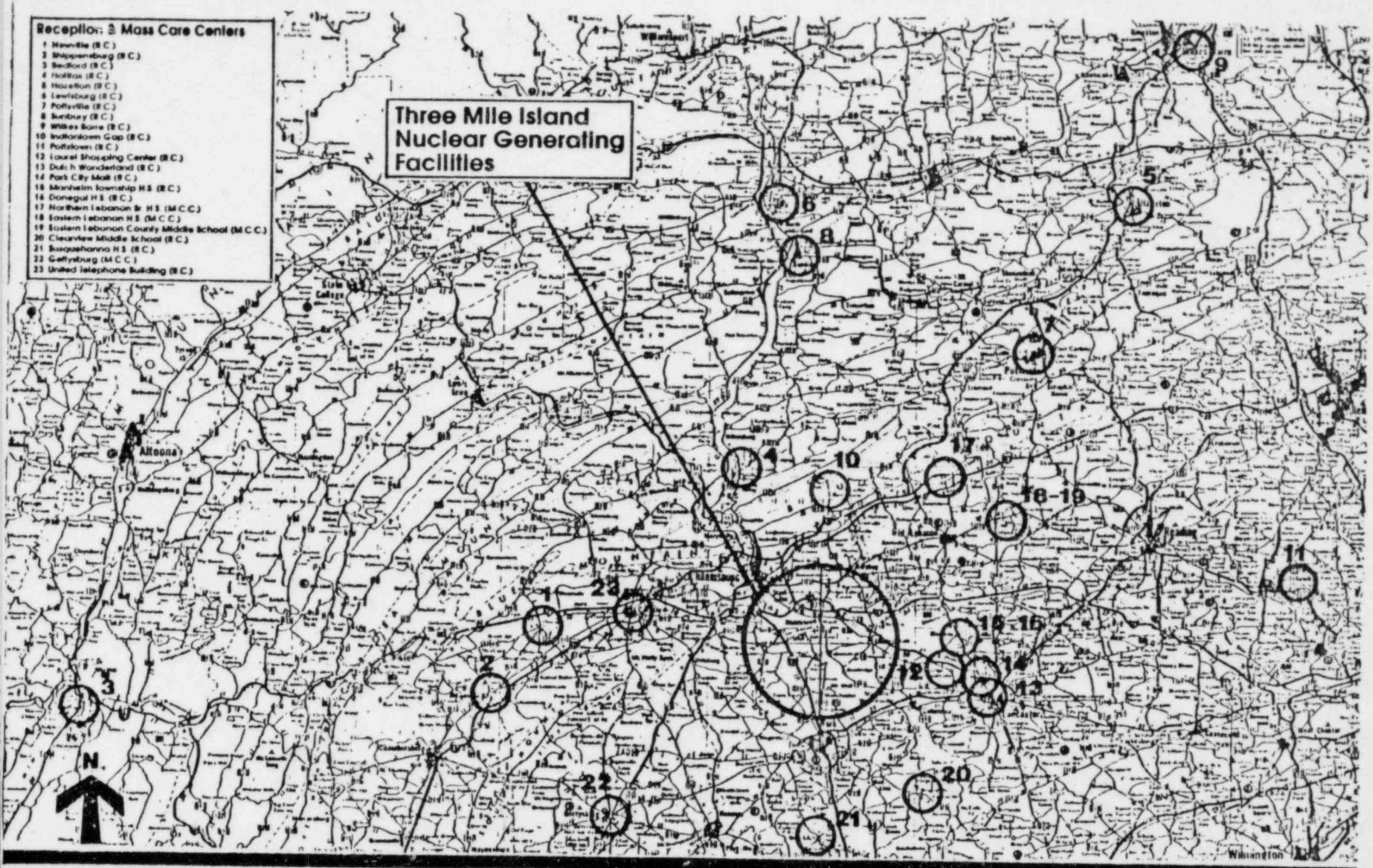

Fig. 21 Reception & Mass Care Centers

Parsons Barkmeierhoff

Three Mile Island Emergency Response Plan

40-Mile EPZ

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 20

PRIMARY RECEPTION CENTERS

Map No.	County	Municipality	ERPA	Reception Center
1	Cumberland	New Cumberland	40	Newville (Big Spring School Dist.)
2		Lower Allen	39	Shippensburg (Shippensburg School District)
7	Dauphin	Conewago	23	Pottsville
9		Derry	21	Wilkes Barre
8,6		Harrisburg	43	Sunbury or Lewisburg
3		Highspire	19	Bedford
7		Hummelstown	21	Pottsville
7		Londonderry	2,9	Pottsville
9		Lower Paxton	47	Wilkes Barre
7		Lower Swatara	46,20	Pottsville
5		Paxtang	44	Hazelton
7		Royalton	7	Pottsville
5		South Hanover	22	Hazelton
3		Steelton	42	Bedford
7		Swatara	45	Pottsville
14	Lancaster	Conoy	3,12	Park City Mall
13		West Donegal	11,27	Dutch Wonderland
13		Mount Joy	13	Dutch Wonderland
13		Elizabethtown	26	Dutch Wonderland
13		East Donegal	28	Dutch Wonderland
19	Lebanon	South Londonderry Township	24	Eastern Lebanon County Middle School
20,21	York	Conewago Township	16,23	Susquehannock School Complex or Clearview Middle School
22		Dover Township	34	Gettysburg
20,21		East Manchester Township	30	Gettysburg
20		Hellam Township*	29	Clearview Middle School
22		Lewisberry Borough	36	Gettysburg
20,21		Manchester Borough	32	Clearview Middle School
20,21		Manchester Twp.	32	Susquehannock School Complex
20,21		Mount Wolf Borough	30	Clearview Middle School
20,21,22		Newberry Township	5,6, 17,15	Gettysburg or Susquehannock School Complex
2o,21		Springettsbury	31	Susquahannock High School
22		Warrington Township	35	Gettysburg
20,21		York Haven Borough	13	Susquehannock School Complex

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 21

SCHOOL RECEPTION CENTER

County	Name of Facility	Municipality	ERPA	Reception Center
Dauphin	Central Dauphin School District	Swatara Twp. Lower Paxton Twp. Paxtang Boro.	45 47 44	1. Indiantown Gap 2. Pottsotwn
	Derry Township School District	Derry Township	21	1. Indiantown Gap
	Middletown School District	Middletown Boro Royalton Boro	8 7	1. Gov. Mifflin School District
	Harrisburg City School District	Harrisburg City	43	1. Sunbury
	Lower Dauphin School District	Conewago Twp. Hummelstown Boro Londonderry Twp S. Hanover Twp.	23 21 2,9 22	1. Indiantown Gap
	Steelton-Highspire School District	Steelton Boro Highspire Boro	42 19	1. Bedford Fairgrounds
	Milton-Hershey* School	Derry Township	21	
	Dauphin County Vo Tech	Lower Paxton Twp.	47	1. Indiantown Gap
	C.A.I.U. Oberlin Elementary School	Swatara Township	45	1. Laurel Shopping Ctr.
	Diocese of Harrisburg	Middletown Boro Harrisburg Cith Steelton Boro Swatara Townghip Derry Township	8 43 42 45 21	1. Pottsville Nativity High School 2. Pottsville Catholic Church
Cumberland	Diocese of Harrisburg	New Cumberland Boro	40	1. Pottsville Nativity High School
	West Shore School District	New Cumberland Boro	40	1. Shippensburg Sr. High School
Lancaster	Bainbridge Elementary School	Conoy Township	12	1. Manheim Township High School
	Elizabethtown Elementary Sch.	West Donegal Twp.	26	1. Manheim Township High School
	East High Street Elementary Sch.	West Donegal Twp.	26	1. Manheim Township High School

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 21
(continued)

County	Name of Facility	Municipality	ERPA	Reception Center
Lancaster continued	Mill Road Elementary Sch.	West Donegal Twp.	26	1. Manheim Township High School
	Fairview Elementary School	West Donegal Twp.	25	1. Manheim Township High School
	Rheems Elementary School	West Donegal Twp.	27	1. Manheim Township High School
	Elizabethtown Elementary Sch.	West Donegal Twp.	26	1. Manheim Township High School
	Maytown Elementary School	East Donegal Twp.	28	1. Donegal High School
	Diocese of Harrisburg	West Donegal Twp.	26	1. Pottsville Nativity School
York	York Christian* Elementary Sch.	Manchester Twp.	32	
	Northern School District	East Manchester Twp.	30	1. Susquehannock Mid School
	West Shore School District	Fairview Twp. Newberry Twp.	38 17	1. United Telephone Building, Carlisle
	Central York School District	Manchester Twp.	32	1. Susquahannock Middle School
	Red Lion Area School District	Fairview Twp.	38	1. Clearview Middle School

* Note: Reception Centers to be identified for these schools

IV. EVACUATION TIME ANALYSIS

A. Scenarios

Evacuation time estimates for TMI's 10 mile EPZ were prepared to serve as approximate indicators and tools to assist PEMA, PENNDOT and local emergency coordinators in refining their emergency response plans as well as to aid emergency officials in selecting protective actions. Since the estimates of the resident population and employment represent the current total figures and the population of special facilities excluding schools represent the capacities of these facilities, the only population group which may vary is the tourist/visitor and business traveler element of the transient population. Based on the estimates presented in Table 22b for a Typical Weekday, this component accounts for less than five percent of the general population in the 10 mile EPZ. Assuming the normal seasonal and day of week fluctuations in tourism for the Harrisburg -Lancaster -York area as developed by the Pennsylvania Department of Commerce and the location of the major tourist attractions in this area which primarily lie outside the EPZ, the variations in population number would not be significant in terms of this time estimate. With these guidelines, three scenarios were selected to model a best estimate, a typical weekday and an adverse weather condition. The scenarios are described as follows:

- Best Estimate - A night when most families are together at home, special facilities have reduced staff and tourist/business travelers are at local transient accommodations;
- Typical Weekday (Normal Condition) - An afternoon when children are in school, businesses are in operation (the family unit is separated), tourist and business travelers are dispersed throughout the area and special facilities are operating with normal staff;
- Adverse Weather - A winter morning following an average snowfall when businesses are open but worker absence is increased and tourist/visitor and business travel is curtailed (it is assumed that approximately 50 percent of the transient employees are unable to drive to work), classes have been cancelled at local schools and colleges, and other special facilities are operating with reduced staff.

These scenarios encompass the typical variations in population concentrations which can be reasonably approximated in the 10 mile EPZ. The adverse weather scenario assumes a snow emergency condition when roads would be rendered temporarily impassable until the Pennsylvania Department of Transportation and local jurisdictions could clear them of accummulated snow. PENNDOT estimated that it should take about four hours after a snow storm to plow all major routes which are normally given priority.[34] An estimate of the population for each of these scenarios is presented in Table 22. These estimates have also been compiled for the various 90 degree sectors and the EPZ as shown in Table 23.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 22A

POPULATION IN EPZ BY ERPA

Scenario: Best Estimate

ERPA	Residents			Schools	Nursing & Group Homes				Hospitals				Colleges	Prisons	Total Spec. Facilities				Transient Population		
	Total	With Auto	W/O Auto		Max. Cap.	Amb.	Wheel-Chair	Stchr	Max. Cap.	Amb.	Wheel-chair	Stchr			Total	Amb.	Wheel-chair	Stchr	Total	Transient/ Visitor	Employee
1																					
2	1	0	0	0																	
3	2	1541	1433	108															400	0	400
4	3	579	515	64															17	7	10
5	4	477	434	43															157	153	4
6	5	805	748	57															4	2	2
7	6	2013	1870	143															7	3	4
8	7	982	864	118															17	8	9
9	8	9851	8462	1389		399	217	165	17						399	217	165	17	10	4	6
10	9	3529	3282	247		70	-	70	-						70	-	70	-	204	45	159
11	10	926	823	103															38	16	22
12	11	636	565	71		725	275	225	225										10	4	6
13	12	1739	1546	193											725	275	225	225	15	6	9
14	13	746	678	68															19	8	11
15	14	1063	988	75															7	3	4
16	15	3220	2992	228															9	4	5
17	16	3964	3683	281															28	13	15
18	17	4025	3739	286															33	15	18
19	18	2594	2410	184															284	265	19
20	19	2952	2462	490															22	10	12
21	20	4722	4155	567															31	13	18
22	21	20192	17830	2362	1900	200	100	100	-	350	116	234		715	715	715	-	-	122	26	96
23	22	4054	3770	284										90	2530	2196	334		2103	1964	139
24	23	2456	2284	172															43	18	25
25	24	1387	1301	86															26	11	15
26	25	2820	2507	313					45	23	22	-			45	23	22	-	4	3	1
27	26	6952	5854	1098		87	65	22	-				1203		1290	1268	22	-	461	443	18
28	27	2522	2242	280		50	35	10	5						50	35	10	5	89	37	52
29	28	3054	2715	339															28	12	16
30	29	224	208	16															59	21	38
31	30	6033	5605	428															2	1	1
32	31	982	912	70															51	23	28
33	32	7199	6688	511															9	4	5
34	33	991	921	70															61	28	33
35	34	628	583	45															9	4	5
36	35	178	165	13															6	3	3
37	36	310	282	28															1027	1026	1
38	37	2591	2407	184															2	1	1
																			22	10	12

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continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 22A

(continued)

Scenario: Best Estimate

	Residents				Nursing & Group Homes				Hospitals						Total Spec. Facilities				Transient Population						
ERPA	Total	With Auto	W/O Auto		School	Max. Cap.	Amb.	Wheel-chair	Stchr.	Max. Cap.	Amb.	Wheel-chair	Stchr.	Col-lege	Pri-son		Total	Amb.	Wheel-chair	Stchr.		Total	Trans-ient	Em-ploy				
38	6786	6304	482																			602	344	258				
39	703	636	67																			10	4	6				
40	8063	7442	621																			109	43	66				
41	0	0	0																			0	0	0				
42	6492	4733	1759																			248	45	203				
43	29177	18148	11029			44	36	5	3								44	36	5	3		1481	711	770				
44	1661	1462	199																			17	7	10				
45	18320	16122	2198			784	350	118	316						280		1064	630	118	316		906	786	120				
46	1355	1192	163																			14	6	8				
47	2097	1496	601			240	120	60	60								240	120	60	60		194	161	33				
TOTAL	86501	58369	28133		1900	2599	1199	775	626	395	139	256	-	1283	280		7172	5515	1031	626		9016	6320	2696				

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THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ
Scenario: Typical Weekday

TABLE 22B

POPULATION IN EPZ BY ERPA

	ERPA	Residents		School	Nursing & Group Homes				Hospitals							Total Spec. Facilities					Transient/ Visitor	Employ						
					Max. Cap.	Amb.	Wheel-chair	Stchr.	Max. Cap.	Amb.	Wheel-chair	Stchr	College	Prison		Total	Amb.	Wheel-chair	Stchr.										
1																													
2	1	0		0												0					1243	41	1202						1
3	2	1253		0												0					109	21	88						2
4	3	428		0												0					131	99	32						3
5	4	394		0												0					27	6	21						4
6	5	669		0												0					44	10	34						5
7	6	1674		0												0					109	24	85						6
8	7	806		150												150	150	-	-		67	13	54						7
9	8	7977		1851	399	217	165	17								2250	2068	165	17		619	141	478						8
10	9	2872		594	70	-	70	-								664	994	70	-		251	50	201						9
11	10	686		0												0					65	13	52						10
12	11	278		0	725	275	225	225								725	275	225	225		97	19	78						11
13	12	1280		325												325	325	-	-		125	25	100						12
14	13	618		0												0					41	9	32						13
15	14	882		0												0					57	12	45						14
16	15	2678		167												167	167	-	-		175	39	136						15
17	16	3301		408												408	408	-	-		213	47	166						16
18	17	3347		580												580	580	-	-		382	212	170						17
19	18	2001		0												0					141	31	110						18
20	19	2407		225												225	225	-	-		208	41	167						19
21	20	3594		850									2645			3495	3495	-	-		369	81	288						20
22	21	16109		8404	200	100	100	-	350	116	234		80			9034	8700	334	-		2278	1029	1249						21
23	22	3318		402												402	402				281	56	225						22
24	23	2008		201												201	201	-	-		171	34	137						23
25	24	1345		9												0					18	9	9						24
26	25	2082		176					45	23	22	-				221	199	22			410	249	161						25
27	26	4790		2628	87	65	22	-			1416					4027	4001	22			587	115	472						26
28	27	1946		300	50	25	10	5								350	325	10	5		184	36	148						27
29	28	1499		420												420	420	-	-		407	66	341						28
30	29	196		9												0					11	2	9						29
31	30	5016		2497												2497	2497				327	72	255						30
32	31	816		0												0					53	12	41						31
33	32	5994		1107												1107	1107	-	-		389	96	302						32
34	33	825		0												0					53	12	41						33
35	34	521		0												0					35	8	27						34
36	35	148		0												0					527	520	7						35
37	36	157		0												0					18	4	14						36
38	37	1154		0												0					141	31	110						37

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continued

TI. MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 22B

(continued)

Scenario: Typical Weekday

ERPA	Resident*		School	Nursing & Group Homes: Max. Cap.	Amb.	Wheel-chair	Stchr	Hospitals: Max. Cap.	Amb.	Wheel-chair	Stchr	College	Prison		Total Svcs. Facilities: Total	Amb.	Wheel-chair	Stchr		Transient Population: Total	Transient/ Visitor	Employee
38	3077		2777												2777	2777				943	169	774
39	510		0												0					62	11	51
40	4843		1591												1591	1591	-	-		725	131	594
41	0		0												0	0				0	0	0
42	4101		676												676	676	-	-		750	140	610
43	18739		4191	44	34	5	3								4235	4227	5	3		9106	2179	6927
44	1356		299												299	299	-	-		117	23	94
45	19797		2767	784	350	118	316						280		3831	3397	118	316		1394	316	1078
46	1115		280												380	380	-	-		92	18	74
47	4046		4025	240	120	60	60								4265	4145	60	60		367	73	294
TOTAL	138612		38091	2599	1198	775	626	395	139	256	-	4141	280		45306	43651	1031	626		23918	6335	17583

* Resident Population - Mid Scenario, Baseline population figure minus residents employed in their home ERPA.

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TABLE 22C

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

POPULATION IN EPZ BY ERPA

Scenario: Adverse Weather

ERPA	Resi-dents	School	Nursing & Group Homes: Max. Cap.	Nursing & Group Homes: Amb.	Nursing & Group Homes: Wheel-chair	Nursing & Group Homes: Stchr.	Hospitals: Max. Cap.	Hospitals: Amb.	Hospitals: Wheel-chair	Hospitals: Stchr.	College	Prison		Total Spec. Facilities: Total	Total Spec. Facilities: Amb.	Total Spec. Facilities: Wheel-chair	Total Spec. Facilities: Stchr.		Transient Population: Total	Transient Population: Trans-ient/ Vis.	Transient Population: Employ.
1	0																		638	37	601
2	1541																		61	17	44
3	579																		39	23	16
4	477																		16	5	11
5	805																		25	8	17
6	2013																		61	19	42
7	982																		37	10	27
8	2851		399	217	165	17								399	217	165	17		350	111	239
9	3529		70	-	70	-								70	-	70	-		139	39	100
10	926																		36	10	26
11	636		725	275	225	225								725	275	225	225		54	15	39
12	1739																		90	20	50
13	746																		23	7	16
14	1063																		32	9	23
15	3220																		98	30	68
16	3964																		119	36	83
17	4025																		146	61	85
18	2594																		79	24	55
19	2952																		116	32	84
20	4722										870			870	870	-	-		209	65	144
21	20192	1900	200	100	100	-	350	116	234		80			2530	2196	334			869	244	625
22	4054																		157	44	113
23	2456																		96	27	69
24	1387																		11	6	5
25	2820						45	23	22	-				45	23	22	-		137	56	81
26	6952		87	65	22	-					1291			1290	1268	22	-		327	91	236
27	2522		50	35	10	5								50	35	10	5		102	28	74
28	3054																		226	55	171
29	224																		7	2	5
30	4023																		183	55	128
31	982																		30	9	21
32	7129																		217	66	151
33	991																		30	9	21
34	629																		20	6	14
35	178																		307	303	4
36	110																		10	3	7
37	2591																		79	24	55

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continued

MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 22C

(continued)

Scenario: Adverse Weather

	Nursing & Group Homes						Hospitals						Total Spec. Facilities				Transient Population			
ERPA	Resi-dents*	Schoo.	Max. Cap.	Amb.	Wheel-chair	Stchr.	Max. Cap.	Amb.	Wheel-chair	Stchr.	Col-lege	Pri-son	Total	Amb.	Wheel-chair	Stchr.	Total	Trans-ient/ Vis.	Em-ploy	
38	6786																529	142	387	
39	703																35	9	26	
40	8063																403	106	297	
41	0																0	0	0	
42	6492																421	116	305	
43	29177		44	36	5	3							44	36	5	3	5361	1897	3464	
44	1661																65	18	47	
45	18320		784	350	118	316						280	1064	630	118	316	769	230	539	
46	1335																51	14	37	
47	5097		240	120	60	60							240	120	60	60	205	58	147	
TOTAL	86501	1900	2599	1198	775	626	395	139	256	-	1281	280	7327	5670	1031	626	12995	4196	8799	

* Resident Population - night scenario, baseline population figure minus residents employed in their home ERPA

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THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 23a
ESTIMATED POPULATION BY 90° and 360° SECTORS

Scenario: **Best Estimate**

	Sectors	ERPAs Included	Resident Population**			Transient Population			Special Facilities			
			Total	With Auto	Without Auto	Total	Tourist/Visitor	Employment	Total	Ambulatory	Wheel-chair	Stretcher
A	NE	1,2	1,541	1,433	108	417	7	410	0	--	--	--
B	SE	1,2,3	2,120	1,948	172	574	160	414	0	--	--	--
C	SW	1,4,5	1,282	1,182	100	411	5	406	0	--	--	--
D	NW	1,4,6	2,490	2,304	186	421	10	411	0	--	--	--
E	0-2 miles:	1 - 6	5,415	5,000	415	602	173	429	0	--	--	--
F	NE	1,2,7-10	16,829	14,864	1,965	679	76	603	469	217	235	17
G	SE	1-3,10-15	10,450	9,540	910	662	198	464	725	275	225	225
H	SW	1,4-6,14-17	15,567	14,454	1,113	782	310	472	0	--	--	--
I	NW	1,4,6-8,18-20	23,591	20,657	2,934	810	108	702	1,114	932	165	17
J	0-5 miles:	1 - 20	46,364	41,649	4,715	1,434	605	829	1,909	1,207	460	242
K	NE	1,2,7-10,21-26	54,690	48,410	6,280	3,405	2,552	853	4,334	3,704	613	17
L	SE	1-3,10-15,25-31	33,037	29,583	3,454	1,354	732	622	2,110	1,601	279	230
M	SW	1,4-6,14-17,30,32-37	33,497	31,105	2,392	1,960	1,405	555	0	--	--	--
N	NW	1,4,6-8,18-20,22,37-47	107,800	87,279	20,521	4,455	2,242	2,213	2,462	1,834	582	396
O	0-10 miles:	1 - 47 EPZ	186,501	158,368	28,133	9,016	6,320	2,696	7,172	5,515	1,031	626

* Includes employees who reside in sector or EPZ

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 3b
ESTIMATED POPULATION BY 90° and 360° SECTORS

Scenario: Typical Weekday

	Sectors	ERPAs Included	Resident Population	Transient Population			Special Facilities			
				Total	Tourist/Visitor	Employment	Total**	Ambulatory	Wheelchair	Stretcher
A	NE	1,2	1,253	1,352	62	1,290	0			
B	SE	1,2,3	1,681	1,483	161	1,322	0			
C	SW	1,4,5	1,063	1,314	57	1,257	0			
D	NW	1,4,6	2,068	1,379	71	1,308	0			
E	0-2 miles:	1 - 6	4,418	1,663	201	1,462	0			
F	NE	1,2,7-10	13,594	2,354	279	2,075	3,414	2,928	469	17
G	SE	1-3,10-15	8,103	2,043	278	1,765	1,217	767	225	225
H	SW	1,4-6,14-17	12,945	2,250	391	1,859	1,155	1,155	--	--
I	NW	1,4,6-8,18-20	18,853	2,783	378	2,405	6,470	6,054	399	17
J	0-5 miles:	1 - 20	37,145	4,473	934	3,539	8,989	8,287	460	242
K	NE	1,2,7-10,21-26	43,246	6,099	1,771	4,328	17,053	16,423	613	17
L	SE	1-3,10-15,25-31	24,327	4,022	830	3,192	8,846	8,337	279	230
M	SW	1,4-6,14-17,30,32-37	27,860	3,739	1,124	2,615	4,759	4,759	--	--
N	NW	1,4,6-8,18-20,22,37-47	76,909	16,761	3,525	13,236	24,926	23,948	582	396
O	0-10 miles:	1 - 47 EPZ	138,632	23,918	6,335	17,583	45,416	43,759	1,031	626

** Includes School Children

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 23c
ESTIMATED POPULATION BY 90° and 360° SECTORS

Scenario: Adverse Weather

	Sectors	ERPAs Included	Resident Population	Transient Population			Special Facilities			
				Total	Tourist/Visitor	Employment	Total	Ambulatory	Wheelchair	Stretcher
A	NE	1,2	1,541	699	54	645	0	--	--	--
B	SE	1,2,3	2,120	722	61	661	0	--	--	--
C	SW	1,4,5	1,282	679	50	629	0	--	--	--
D	NW	1,4,6	2,490	715	61	654	0	--	--	--
E	0-2 miles:	1 - 6	5,415	840	109	731	0	--	--	--
F	NE	1,2,7-10	16,829	1,261	224	1,037	469	217	235	17
G	SE	1-3,10-15	10,450	1,051	168	833	725	275	225	225
H	SW	1,4-6,14-17	15,567	1,135	205	930	0	--	--	--
I	NW	1,4,6-8,18-20	23,591	1,506	303	1,203	1,269	1,087	165	17
J	0-5 miles:	1 - 20	46,364	2,348	578	1,770	2,064	1,362	460	242
K	NE	1,2,7-10,21-26	54,890	2,858	692	2,166	4,334	3,704	613	17
L	SE	1-3,10-15,25-31	33,037	2,063	464	1,599	2,110	1,601	279	230
M	SW	1,4-6,14-17,30,32-37	33,897	1,956	671	1,285	0	--	--	--
N	NW	1,4,6-8,18-20,22,37-47	107,800	9,581	2,961	6,620	2,967	1,989	582	396
O	0-10 miles:	1 - 47 EPZ	186,501	12,995	4,196	8,799	7,327	5,670	1,031	626

B. Trip Generation and Assignment

A traffic simulation process has been developed by Parsons Brinckerhoff to estimate evacuation times and evaluate the selected evacuation route network in terms of identifying critical links and delay times. This model uses zone trip generation assigned to a pre-selected evacuation route to estimate evacuation times to the EPZ boundary taking into account the degradation of free flow travel speed and applying calculated delay penalties as the volume to capacity ratio approaches unstable flow and finally forced flow conditions. The two major steps used in this simulation process are described below.

1. Trip Generation

The population estimates presented in Table 22, (except resident population with auto) were converted to vehicle equivalents by applying the estimating procedures derived in Section II D. Where buses are involved, a weighted average capacity was used to account for variations in available bus type, seating capacity and number of units presented in Tables 17 and 18. The number of estimated bus trips was then converted to passenger car equivalents (PCE's) - with each bus equivalent to two PCE's — in order to account for the bus size and operating characteristics which vary from that of a passenger car. Ambulances and vans are assumed to have handling characteristics similar to passenger cars; therefore, no conversion is used. The number of passenger cars estimated for the resident population with auto group is found in Table 14.

2. Zone Trip Assignments

Each ERPA was sub-divided, where necessary, into traffic zones prior to assigning vehicle trips to the selected evacuation route network for each scenario by 90 degree and 360 degree sectors at distances of two, five and ten miles from TMI. A traffic zone identifies a population cluster in an ERPA which is accessible to a selected evacuation route. The relationship of the evacuation routes to each ERPA is shown in Figure 20.

The number of vehicle trips generated in each traffic zone by the general population is assumed to be a function of the number of dwelling units or in an urban area the proportion of area between zones, of the location of major employment centers and of tourist/visitor accommodations and attractions. The allocation of trips from special facilities are related to the location of the facilities within a defined traffic zone. The trips from the Dauphin County Prison and schools are assigned to predesignate routes as stipulated in the county emergency plans.

The number of vehicle trips generated by each traffic zone was then assigned to the selected routes for evacuation based on a general radial dispersion in the direction of the designated reception centers. A computer program was developed which uses as input a description of roadway characteristics (e.g., speed, link length, and capacity) for the selected evacuation routes; the evacuation routes selected for each

traffic zone; the zonal trip generation time; and terminal time (for vehicles originating at home the time to travel to the primary evacuation route and for special vehicles, the time to travel to the assigned traffic zone). The output of the computer program is a summary of travel times and delays for all of the evacuation routes and other statistical information which could be used in evaluating the route selection.

It was assumed that all trips would be on the route at the same instant in making an assignment of PCEs to the evacuation routes. This approach is somewhat conservative because the temporal distribution of evacuees that would most likely occur would not result in all vehicles being on the routes simultaneously.

C. Evacuation Time Estimate Components

In accordance with NUREG-0654, estimates of evacuation times were made separately for the general population (with and without autos) and for special facilities for each selected scenario and sectors at 90° and 360° at distances of two, five and ten miles from TMI. These estimates as requested by NRC are based on evacuation of these population groups to the EPZ boundaries. Such a procedure obviously involves the movement of a larger segment of the population and increases the evacuation time estimates slightly more than actually would occur if an estimate were made to the radius rings. However, according to a discussion with NRC, the approximate evacuation time estimates to the EPZ are intended to serve as a guide to evacuation planners since these estimates then account for some evacuation which would more than likely occur immediately outside the actual risk area[36]. As defined in NUREG-0654, the composition of these population groups are as follows:

- General Population - permanent resident population with auto plus transient population. (Transient population is composed of tourist/visitors, business travelers and employees who commute into the area plus those persons visiting recreational areas including parks and campsites.)

- Special Facilities - persons residing in, attending or employed at hospitals, long term care facilities, schools/colleges and penal institutions and resident population without autos.

The estimates of evacuation times for each of these categories are comprised of the following components:

- Terminal time - for vehicles departing from home, the time to drive via local feeder streets to the predesignated primary evacuation route; for buses and special vehicles, the time to travel from the bus garage, storage or staging area to the assigned traffic zone.

- Roadway travel time - the time required for a vehicle to traverse the entire length of the evacuation route. This time is estimated on normal operating speeds on the road and delays because of conditions where the vehicle volumes approach or exceed

the capacity of the roadway at a particular location. Hence, the roadway travel time is the sum of the time for the first vehicle to traverse the evacuation route, assuming normal operating speeds, and subsequent travel times taking account of speeds at heavier loadings and including delay time.

- o Adverse weather delay time - an additional twenty minutes to account for unpredictable isolated delays associated with adverse weather conditions.

- o General population mobilization time - an additional twenty minutes to account for mobilization at home, at place of employment or at accommodations.

- o Special vehicle round trip time - the roadway travel time where a number of round trips were required by medical transport vehicles and buses for special facilities or to evacuate residents without auto, travel time beyond the evacuation limits to a predesignated host facility for all but the last trip, return time to the special facility for as many round trips as were required, and time for loading and unloading passengers was included. Where the facility administrators of special facilities gave an estimate of mobilization time which was greater than the roadway travel time, the mobilization time plus travel time to the perimeter of the evacuation area became the evacuation time.

It should be noted that the times to evacuate general population without autos and ambulatory patients in special facilities were based on use of bus facilities within or in close proximity to the EPZ. These buses included school buses, senior citizens' buses, special facility buses, and public transit buses as dictated in the respective county emergency plans. For the purpose of assessing the evacuation time for schools, available district school buses were first allocated, to the schools closest to TMI and were then progressively assigned to schools further away.

A detailed description of the simulation model used to estimate roadway travel times during an evacuation is presented in Appendix C. This description also includes a discussion of the correlation of the static model applied herein with a dynamic simulation.

D. Notification and Confirmation Time Estimates[39]

The request for evacuation times in NUREG-0654 Appendix 4 relates primarily to the time required to actually evacuate as opposed to the times required for either notification or confirmation. Notification and confirmation times as related to the general population are based on information obtained from GPU and PEMA for Sectors A-O.

According to GPU, the permanent work force and contractors at TMI would be notified of an incident in less than fifteen minutes. It would then take about one hour to confirm that all non-essential personnel have

been accounted for and discharged from the site. This confirmation procedure would be handled in one of two ways.

- o a muster of all personnel in the Warehouse from where all non-essential personnel would be dismissed or
- o a check of all badge numbers at the Process Center.

As noted in Section II, notification of visitors on the islands adjacent to TMI in the Susquehanna River would occur simultaneously with the sounding of the warning sirens. GPU has arranged with the State Police to make a helicopter sweep (weather conditions permitting) of the islands to confirm that visitors have been notified and evacuated. Such a sweep as estimated by GPU would take about one hour.

In an effort to obtain local approximations of notification and confirmation time as well as procedures. State emergency planners were contacted by GPU. The planners estimate that with present notification capabilities such as siren coverage, emergency broadcasts and telephone, it may take from two to three hour to notify one hundred percent of the population within the 10 mile EPZ after initial contact of the planners by the Utility. However, according to PEMA and GPU, it is estimated that after July 1, 1981, the entire population within the EPZ will be notified within 45 minutes as stipulated by the Nuclear Regulatory Commission (NRC) in NUREG-0654.

PEMA further noted that confirmation would take place during evacuation; therefore extra time is not added to the evacuation time estimates. According to PEMA confirmation that all people in the EPZ who wish to evacuate have done so will be carried out by the State Police. PEMA noted that in an effort to avoid confrontations with residents who wish to stay, the State Police stationed at the periphery of the risk area will monitor the flow of traffic from the area. When, traffic flow eases to a point that only sporadic vehicles are leaving the area, it would be assumed that evacuation from the area is basically complete.

E. Evacuation Time Estimates

Based on the methodologies and time components described previously, simulations of evacuations for each of the Evacuation Sectors (A-O) under best estimate (night), typical weekday (normal condition) and adverse weather conditions were made. From these simulations, a range of approximate evacuation times estimates were developed for both the general population and special facilities to account for varying degrees of readiness of emergency forces and development of an incident. These approximations of evacuation times are summarized in Table 24. The estimates as shown in this table should provide the emergency planner with sufficient information which can be used in conjunction with other inputs as a decision-making tool regarding the course of action to take in the event of an incident at TMI.

- MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24A

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Best Estimate

Evacuation Sector	General Population[1] [2]								Special Facilities[4]					
	Travel Time				Total Evacuation Time[3]				Travel Time		Total Evacuation Time		Travel Time	Total Evacuation Time
	With Auto		Without Auto		With Auto		Without Auto		Schools		Schools			
	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Others	Others
A	0:30	1:45	0:45	2:00	0:50	2:05	1:05	2:20	-	-	-	-	-	-
B	0:30	1:45	0:45	2:00	0:50	2:05	1:05	2:20	-	-	-	-	-	-
C	0:30	0:30	1:00	1:15	0:50	0:50	1:20	1:35	-	-	-	-	-	-
D	0:30	1:45	1:15	2:30	0:50	2:05	1:35	2:50	-	-	-	-	-	-
E	0:30	1:45	1:15	2:30	1:50	2:05	1:35	2:50	-	-	-	-	-	-
F	3:45	5:15	4:15	5:30	4:05	5:35	4:35	5:50	-	-	-	-	5:00	5:00
G	1:45	2:45	2:00	3:00	2:05	3:05	2:20	3:20	-	-	-	-	6:15	6:15
H	1:45	2:00	2:30	2:45	2:05	2:20	2:50	3:05	-	-	-	-	-	-
I	2:15	3:00	2:45	3:30	2:35	3:20	3:05	3:50	-	-	-	-	4:45	4:45
J	3:45	5:15	4:15	5:30	4:05	5:35	4:35	5:50	-	-	-	-	-	-
K	5:30	9:15	5:30	9:00	5:50	9:35	5:50	9:20	-	-	-	-	7:15	7:15
L	2:30	3:45	2:45	4:00	2:50	4:05	3:05	4:20	-	-	-	-	5:45	5:45
M	2:30	3:30	3:00	4:00	2:50	3:50	3:20	4:20	-	-	-	-	-	-
N	5:15	7:15	5:30	7:15	5:35	7:35	5:50	7:35	-	-	-	-	8:00	8:00
O	5:30	9:15	5:30	9:15	5:50	9:35	5:50	9:35	-	-	-	-	-	-

(1) General population consists of residents and transients including non-essential TMI employees.

(2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24B

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Typical Weekday

Evacuation Sector	General Population[1] [2]								Special Facilities[4]					
	Travel Time				Total Evacuation Time[3]				Travel Time		Total Evacuation Time		Travel Time	Total Evacuation Time
	With Auto		Without Auto		With Auto		Without Auto		Schools		Schools			
	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Others	Others
A	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
B	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
C	0:30	1:15	1:00	1:15	0:50	1:35	1:20	1:35	-	-	-	-	-	-
D	1:30	2:00	2:00	2:30	1:50	2:20	2:20	2:50	-	-	-	-	-	-
E	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
F	4:30	6:00	4:45	6:30	4:50	6:20	5:05	6:50	4:45	6:30	5:00	6:45	5:00	5:00
G	1:45	2:45	2:15	3:15	2:05	3:05	2:35	3:35	1:45	2:30	2:00	2:45	6:45	6:45
H	1:45	2:15	2:30	3:00	2:05	2:35	2:50	3:20	0:45	1:45	1:00	2:00	-	-
I	2:45	3:45	3:00	4:15	3:05	4:05	3:20	4:35	3:00	4:15	3:15	4:30	4:45	4:45
J	4:30	6:15	4:45	6:30	4:50	6:35	5:05	6:50	4:45	6:30	5:00	6:45	-	-
K	6:00	10:00	5:45	9:45	6:20	10:20	6:05	10:05	5:45	9:45	6:00	10:00	7:15	7:15
L	2:45	4:30	3:00	4:45	3:05	4:50	3:20	5:05	2:30	4:15	2:45	4:30	6:00	6:00
M	2:15	3:45	2:45	4:15	2:35	4:05	3:05	4:35	2:30	4:00	2:45	4:15	-	-
N	5:30	8:00	5:30	8:00	5:50	8:20	5:50	8:20	5:30	8:00	5:45	8:15	8:00	8:00
O	6:00	10:00	5:45	9:45	6:20	10:20	6:05	10:05	5:45	9:45	6:00	10:00	-	-

(1) General population consists of residents and transients including non-essential TMI employees.

2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24A

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Best Estimate

Evacuation Sector	General Population[1] [2]								Special Facilities[4]					
	Travel Time				Total Evacuation Time[3]				Travel Time		Total Evacuation Time		Travel Time	Total Evacuation Time
	With Auto		Without Auto		With Auto		Without Auto		Schools		Schools			
	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Others	Others
A	0:30	1:45	0:45	2:00	0:50	2:05	1:05	2:20	-	-	-	-	-	-
B	0:30	1:45	0:45	2:00	0:50	2:05	1:05	2:20	-	-	-	-	-	-
C	0:30	0:30	1:00	1:15	0:50	0:50	1:20	1:35	-	-	-	-	-	-
D	0:30	1:45	1:15	2:30	0:50	2:05	1:35	2:50	-	-	-	-	-	-
E	0:30	1:45	1:15	2:30	1:50	2:05	1:35	2:50	-	-	-	-	-	-
F	3:45	5:15	4:15	5:30	4:05	5:35	4:35	5:50	-	-	-	-	5:00	5:00
G	1:45	2:45	2:00	3:00	2:05	3:05	2:20	3:20	-	-	-	-	6:15	6:15
H	1:45	2:00	2:30	2:45	2:05	2:20	2:50	3:05	-	-	-	-	-	-
I	2:15	3:00	2:45	3:30	2:35	3:20	3:05	3:50	-	-	-	-	4:45	4:45
J	3:45	5:15	4:15	5:30	4:05	5:35	4:35	5:50	-	-	-	-	-	-
K	5:30	9:15	5:30	9:00	5:50	9:35	5:50	9:20	-	-	-	-	7:15	7:15
L	2:30	3:45	2:45	4:00	2:50	4:05	3:05	4:20	-	-	-	-	5:45	5:45
M	2:30	3:30	3:00	4:00	2:50	3:50	3:20	4:20	-	-	-	-	-	-
N	5:15	7:15	5:30	7:15	5:35	7:35	5:50	7:35	-	-	-	-	8:00	8:00
O	5:30	9:15	5:30	~~9:15~~ 9:00	5:50	9:35	5:50	~~9:35~~ 9:20	-	-	-	-	8:00	8:00

(1) General population consists of residents and transients including non-essential TMI employees.

(2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

Corrected P75

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24B

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Typical Weekday

Evacuation Sector	General Population[1] [2]								Special Facilities[4]					
	Travel Time				Total Evacuation Time[3]				Travel Time		Total Evacuation Time		Travel Time	Total Evacuation Time
	With Auto		Without Auto		With Auto		Without Auto		Schools		Schools			
	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Others	Others
A	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
B	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
C	0:30	1:15	1:00	1:15	0:50	1:35	1:20	1:35	-	-	-	-	-	-
D	1:30	2:00	2:00	2:30	1:50	2:20	2:20	2:50	-	-	-	-	-	-
E	1:30	2:30	2:00	3:00	1:50	2:50	2:20	3:20	-	-	-	-	-	-
F	4:30	6:00	4:45	6:30	4:50	6:20	5:05	6:50	4:45	6:30	5:00	6:45	5:00	5:00
G	1:45	2:45	2:15	3:15	2:05	3:05	2:35	3:35	1:45	2:30	2:00	2:45	6:45	6:45
H	1:45	2:15	2:30	3:00	2:05	2:35	2:50	3:20	0:45	1:45	1:00	2:00	-	-
I	2:45	3:45	3:00	4:15	3:05	4:05	3:20	4:35	3:00	4:15	3:15	4:30	4:45	4:45
J	4:30	6:15	4:45	6:30	4:50	6:35	5:05	6:50	4:45	6:30	5:00	6:45	-	-
K	6:00	10:00	5:45	9:45	6:20	10:20	6:05	10:05	5:45	9:45	6:00	10:00	7:15	7:15
L	2:45	4:30	3:00	4:45	3:05	4:50	3:20	5:05	2:30	4:15	2:45	4:30	6:00	6:00
M	2:15	3:45	2:45	4:15	2:35	4:05	3:05	4:35	2:30	4:00	2:45	4:15	-	-
N	5:30	8:00	5:30	8:00	5:50	8:20	5:50	8:20	5:30	8:00	5:45	8:15	8:00	8:00
O	6:00	10:00	5:45	9:45	6:20	10:20	6:05	10:05	5:45	9:45	6:00	10:00	8:00	8:00

(1) General population consists of residents and transients including non-essential TMI employees.

2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

Corrected P75

MILE ISLAND
CUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24C

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Adverse Weather

Evacuation Sector	General Population[1] [2]								Special Facilities[4]					
	Travel Time				Total Evacuation Time[3]				Travel Time		Total Evacuation Time		Travel Time	Total Evacuation Time -
	With Auto		Without Auto		With Auto		Without Auto		Schools		Schools			
	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Lower[5]	Upper[6]	Others	Others
A	2:00	2:15	2:30	2:45	2:40	2:45	3:10	3:25	-	-	-	-	-	-
B	2:00	2:15	2:30	2:45	2:40	2:55	3:10	3:25	-	-	-	-	-	-
C	0:30	0:30	1:15	1:15	1:10	1:10	1:55	1:55	-	-	-	-	-	-
D	2:00	2:15	2:30	3:00	2:40	2:45	3:10	3:40	-	-	-	-	-	-
E	2:00	2:15	2:30	3:00	2:40	2:45	3:10	3:40	-	-	-	-	-	-
F	5:30	6:45	5:45	7:00	6:10	7:25	6:25	7:40	-	-	-	-	6:00	6:00
G	2:45	3:15	3:15	3:45	3:25	3:55	3:55	4:25	-	-	-	-	8:00	8:00
H	2:15	2:45	2:45	3:15	2:55	3:25	3:25	3:55	-	-	-	-	-	-
I	3:15	4:00	3:30	4:15	3:55	4:40	4:10	4:55	-	-	-	-	5:20	5:20
J	5:30	6:45	6:00	7:15	6:10	7:25	6:40	7:55	-	-	-	-	-	-
K	9:15	11:30	9:00	11:15	9:55	12:10	9:40	11:55	-	-	-	-	8:45	8:45
L	4:00	4:45	4:15	5:00	4:40	5:25	4:55	5:40	-	-	-	-	7:30	7:30
M	4:00	5:00	4:30	5:30	4:40	5:40	5:10	6:10	-	-	-	-	-	-
N	7:15	9:00	7:15	9:00	7:55	9:40	7:55	9:40	-	-	-	-	9:30	9:30
O	9:15	11:30	9:00	11:15	9:55	12:45	9:40	11:55	-	-	-	-	-	-

(1) General population consists of residents and transients including non-essential TMI employees.

(2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

(7) Includes an additional 20 minutes to account for unknown conditions on the roadway system.

F. Distribution of Population by Time

A further output of the simulation model which may be of use in determining the course of action to take in the event of an incident at TMI is the distribution of the percent of population evacuated under each scenario during the estimated evacuation time period. The model uses assigned traffic volumes in PCE's for each of the population components of a traffic zone and converts these back to population numbers using average vehicle occupancy rates and vehicle equivalency factors for the assigned mode of transportation. Based on the calculated speed along each route, the population which leaves the EPZ boundry is accumulated by time and percent of total population at fifteen minute intervals.

The approximate percent of the accumulated population which would be evacuated from the 360 degree-10 mile EPZ for each scenario is shown in Figures 22a, b, c. Table 25 further shows a comparison of the time estimated to evacuate fifty and ninety percent of the population under each scenario assuming varying degrees of readiness and development of possible incident.

TABLE 25
ESTIMATES OF TIME TO EVACUATE
50 and 90 PERCENT OF THE EPZ
POPULATION

Scenario	Percent Accumulated Population Evacuated			
	50%		90%	
	Estimated Evacuation Time Range (hr. min.)*			
	Lower	Upper	Lower	Upper
BEST ESTIMATE (Night)	2:30	3:30	5:15	~~7:00~~ 8:30
TYPICAL WEEKDAY (Normal)	3:00	4:30	5:45	~~8:15~~ 8:30
ADVERSE WEATHER	4:00	5:00	7:00	~~9:00~~ 11:30

* Based on an evacuation time estimate of the 360 degree-10 mile EPZ.

The range of evacuation times is a relative indicator of the state of readiness of emergency forces and the period of time over which a possible incident at TMI may develop.

Estimated times reflect approximate roadway travel time.

TMI - MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 24C

SUMMARY OF APPROXIMATE EVACUATION TIME ESTIMATES
FOR EACH EVACUATION SECTOR

Scenario: Adverse Weather

Evacuation Sector	General Population[1] [2] Travel Time: With Auto Lower[5]	With Auto Upper[6]	Without Auto Lower[5]	Without Auto Upper[6]	General Population Total Evacuation Time[3] [7]: With Auto Lower[5]	With Auto Upper[6]	Without Auto Lower[5]	Without Auto Upper[6]	Special Facilities[4] Travel Time: Schools Lower[5]	Schools Upper[6]	Total Evacuation Time: Schools Lower[5]	Schools Upper[6]	Travel Time: Others	Total Evacuation Time: Others
A	2:00	2:15	2:30	2:45	2:40	2:45	3:10	3:25	-	-	-	-	-	-
B	2:00	2:15	2:30	2:45	2:40	2:55	3:10	3:25	-	-	-	-	-	-
C	0:30	0:30	1:15	1:15	1:10	1:10	1:55	1:55	-	-	-	-	-	-
D	2:00	2:15	2:30	3:00	2:40	2:45	3:10	3:40	-	-	-	-	-	-
E	2:00	2:15	2:30	3:00	2:40	2:45	3:10	3:40	-	-	-	-	-	-
F	5:30	6:45	5:45	7:00	6:10	7:25	6:25	7:40	-	-	-	-	6:00	6:00
G	2:45	3:15	3:15	3:45	3:25	3:55	3:55	4:25	-	-	-	-	8:00	8:00
H	2:15	2:45	2:45	3:15	2:55	3:25	3:25	3:55	-	-	-	-	-	-
I	3:15	4:00	3:30	4:15	3:55	4:40	4:10	4:55	-	-	-	-	5:20	5:20
J	5:30	6:45	6:00	7:15	6:10	7:25	6:40	7:55	-	-	-	-	-	-
K	9:15	11:30	9:00	11:15	9:55	12:10	9:40	11:55	-	-	-	-	8:45	8:45
L	4:00	4:45	4:15	5:00	4:40	5:25	4:55	5:40	-	-	-	-	7:30	7:30
M	4:00	5:00	4:30	5:30	4:40	5:40	5:10	6:10	-	-	-	-	-	-
N	7:15	9:00	7:15	9:00	7:55	9:40	7:55	9:40	-	-	-	-	9:30	9:30
O	9:15	11:30	9:00	11:15	9:55	~~12:45~~ 12:10	9:40	11:55	-	-	-	-	9:30	9:30

(1) General population consists of residents and transients including non-essential TMI employees.

(2) GPU has stated that as of July 1, 1981, a new warning system will be installed to provide notification of 100% of the population within 45 minutes.

(3) Includes general population preparation time (20 minutes) and the roadway travel time.

(4) For special facilities, it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter. Evacuation times represent the longest estimated time for a special facility in the Sector considered. Time includes terminal time, loading/unloading, travel time, and round trip time as required.

(5) The term Lower Bound reflects a good state of emergency readiness utilizing state emergency resources and allowing the progression of an evacuation to proceed according to the stages defined in PEMA's Disaster Operation Plan.

(6) The term Upper Bound reflects a lack of adequate time necessary for proper deployment of state emergency resources due to an immediate declaration of general evacuation.

(7) Includes an additional 20 minutes to account for unknown conditions on the roadway system.

Corrected p. 76

Corrected p 77

F. Distribution of Population by Time

A further output of the simulation model which may be of use in determining the course of action to take in the event of an incident at TMI is the distribution of the percent of population evacuated under each scenario during the estimated evacuation time period. The model uses assigned traffic volumes in PCE's for each of the population components of a traffic zone and converts these back to population numbers using average vehicle occupancy rates and vehicle equivalency factors for the assigned mode of transportation. Based on the calculated speed along each route, the population which leaves the EPZ boundry is accumulated by time and percent of total population at fifteen minute intervals.

The approximate percent of the accumulated population which would be evacuated from the 360 degree-10 mile EPZ for each scenario is shown in Figures 22a, b, c. Table 25 further shows a comparison of the time estimated to evacuate fifty and ninety percent of the population under each scenario assuming varying degrees of readiness and development of possible incident.

TABLE 25
ESTIMATES OF TIME TO EVACUATE
50 and 90 PERCENT OF THE EPZ
POPULATION

Scenario	Percent Accumulated Population Evacuated			
	50%		90%	
	Estimated Evacuation Time Range (hr. min.)*			
	Lower	Upper	Lower	Upper
BEST ESTIMATE (Night)	2:30	3:30	5:15	~~7:00~~ 8:30
TYPICAL WEEKDAY (Normal)	3:00	4:30	5:45	~~8:15~~ 8:30
ADVERSE WEATHER	4:00	5:00	~~7:00~~ 8:00	~~9:00~~ 11:30

* Based on an evacuation time estimate of the 360 degree-10 mile EPZ.

The range of evacuation times is a relative indicator of the state of readiness of emergency forces and the period of time over which a possible incident at TMI may develop.

Estimated times reflect approximate roadway travel time.

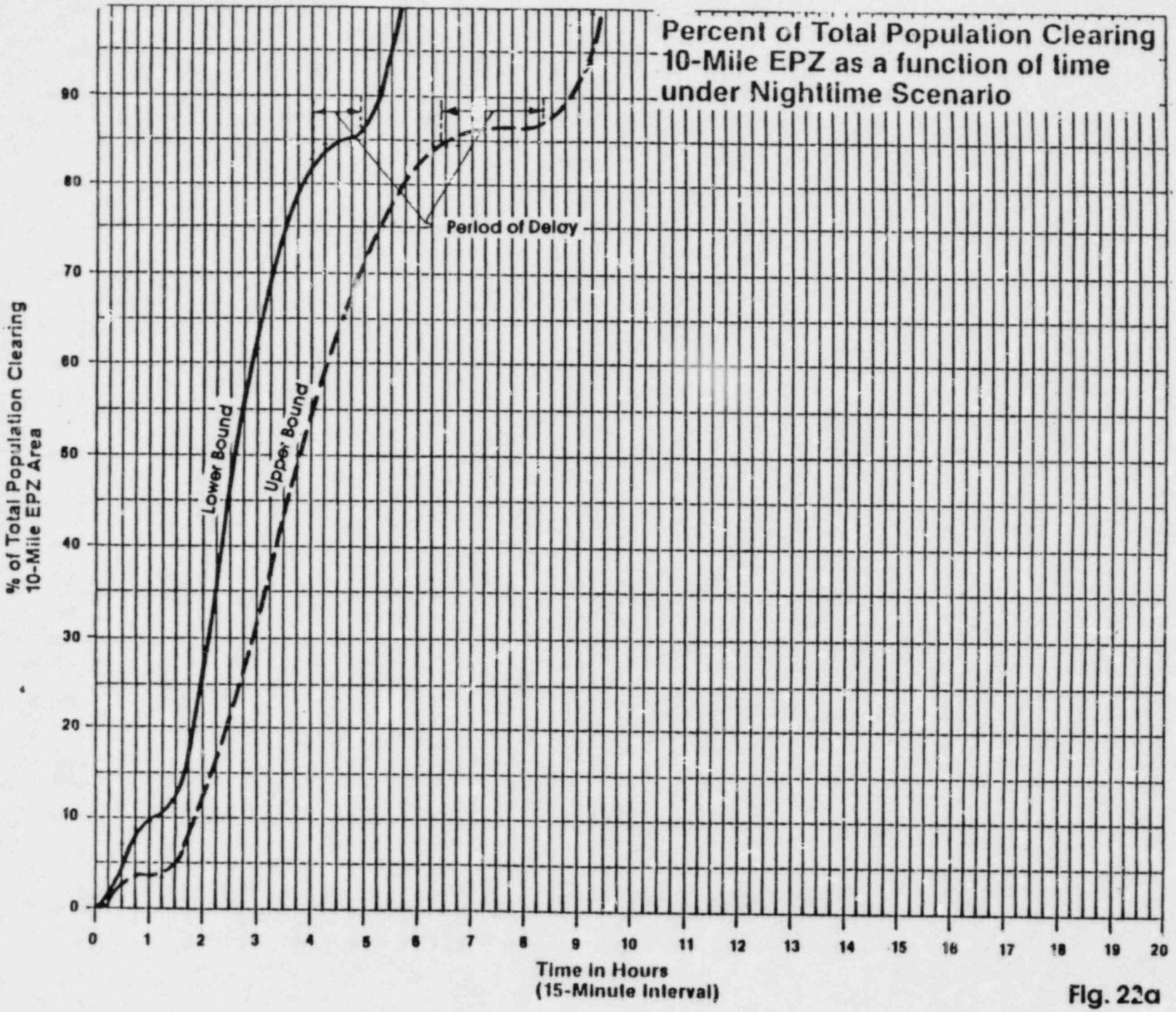
Percent of Total Population Clearing
10-Mile EPZ as a function of time
under Nighttime Scenario
% of Total Population Clearing
10-Mile EPZ Area
Lower Bound
Upper Bound
Period of Delay
0
10
20
30
40
50
60
70
80
90
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time in Hours
(15-Minute Interval)

Fig. 22a

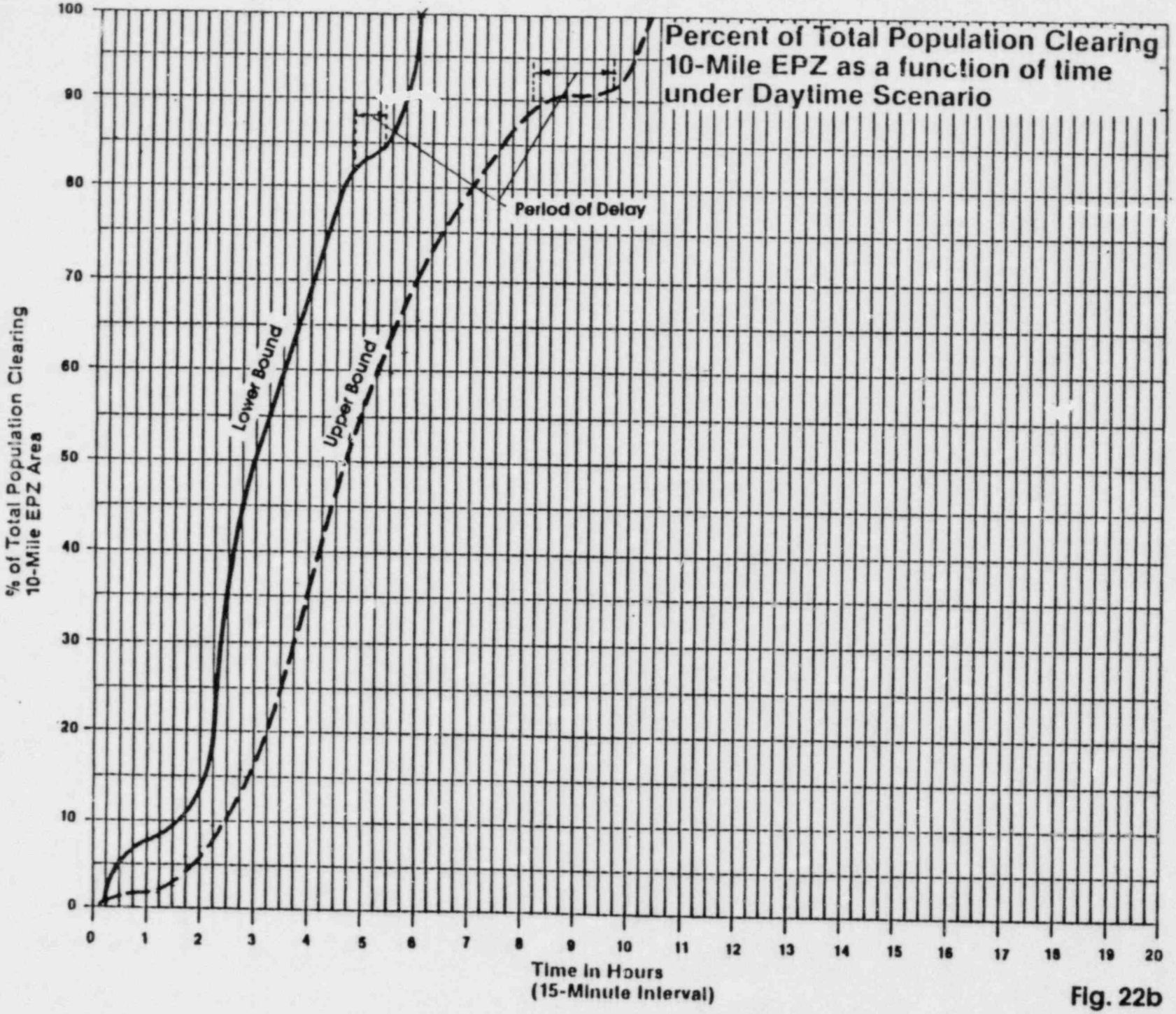
Percent of Total Population Clearing
10-Mile EPZ as a function of time
under Daytime Scenario
% of Total Population Clearing
10-Mile EPZ Area
Lower Bound
Upper Bound
Period of Delay
Time in Hours
(15-Minute Interval)
0
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Fig. 22b

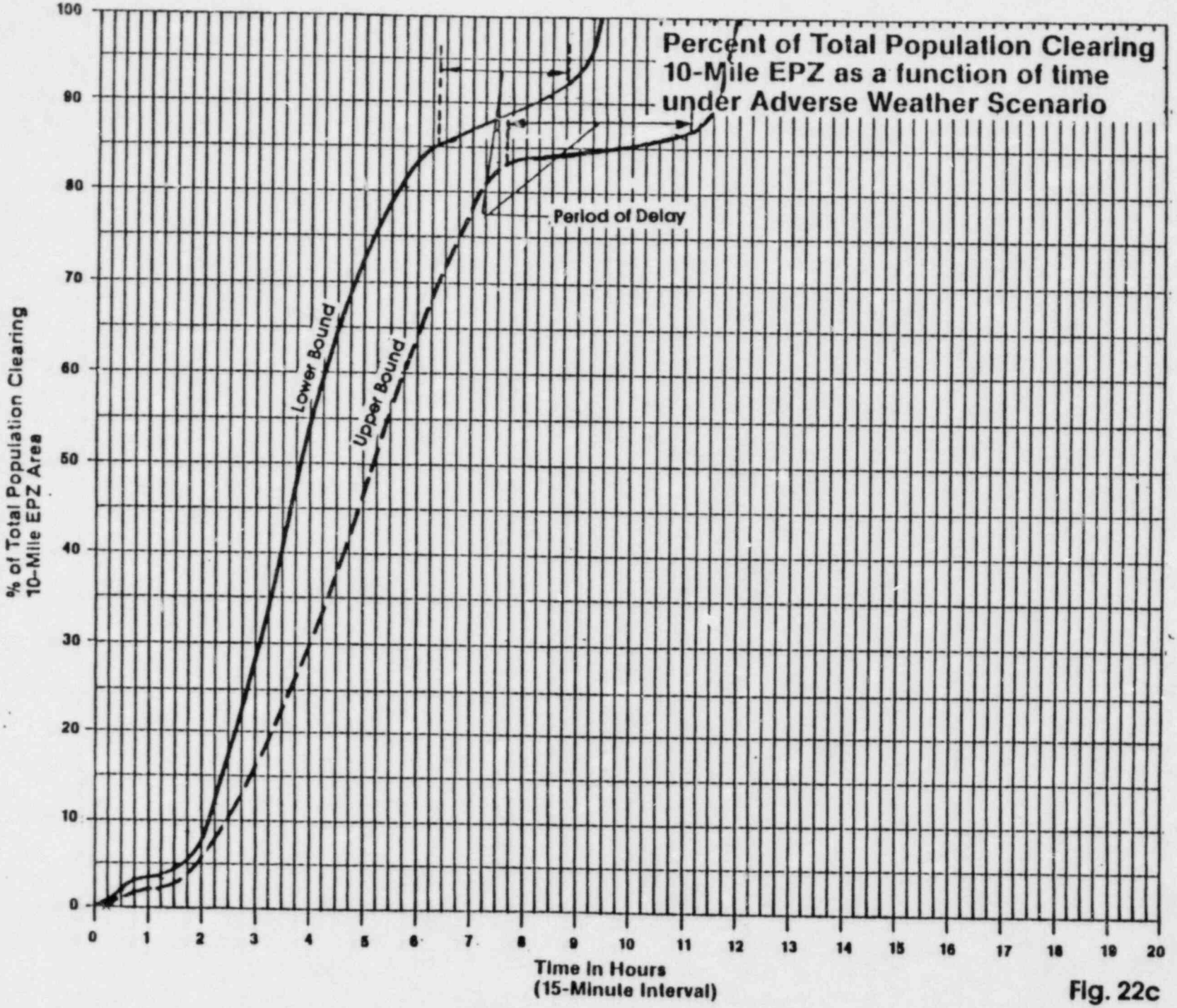
Percent of Total Population Clearing
10-Mile EPZ as a function of time
under Adverse Weather Scenario
Period of Delay
Lower Bound
Upper Bound
% of Total Population Clearing
10-Mile EPZ Area
Time in Hours
(15-Minute Interval)
0
10
20
30
40
50
60
70
80
90
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Fig. 22c

G. Critical Locations

An output of the simulation model is the identification of the critical bottleneck links along each route in the selected evacuation route network. These critical links represent the locations of potential maximum delay for evacuees assigned to that route. Figures 23a, b, and c show these critical links as compared with selected evacuation route network. A list of critical links and the associated delay time is given in Table 26 by scenario for a simultaneous evacuation of the entire 10 mile EPZ. The delay time shown herein is the time penalty imposed by the computer model when the demand traffic volume exceeds the capacity of the link.

It was assumed that traffic control personnel would be required to expedite traffice flow. This assumption was made as the result of a first estimate of evacuation time for a 360 degree sector - 10 mile EPZ, where the operation of fixed traffic controls imposed high delay penalities on evacuees it was assumed that traffic control personnel would be required to expedite traffic flow.

These potential critical locations are also shown in Figures 23a, b, and c and are listed by Scenario in Table 26.

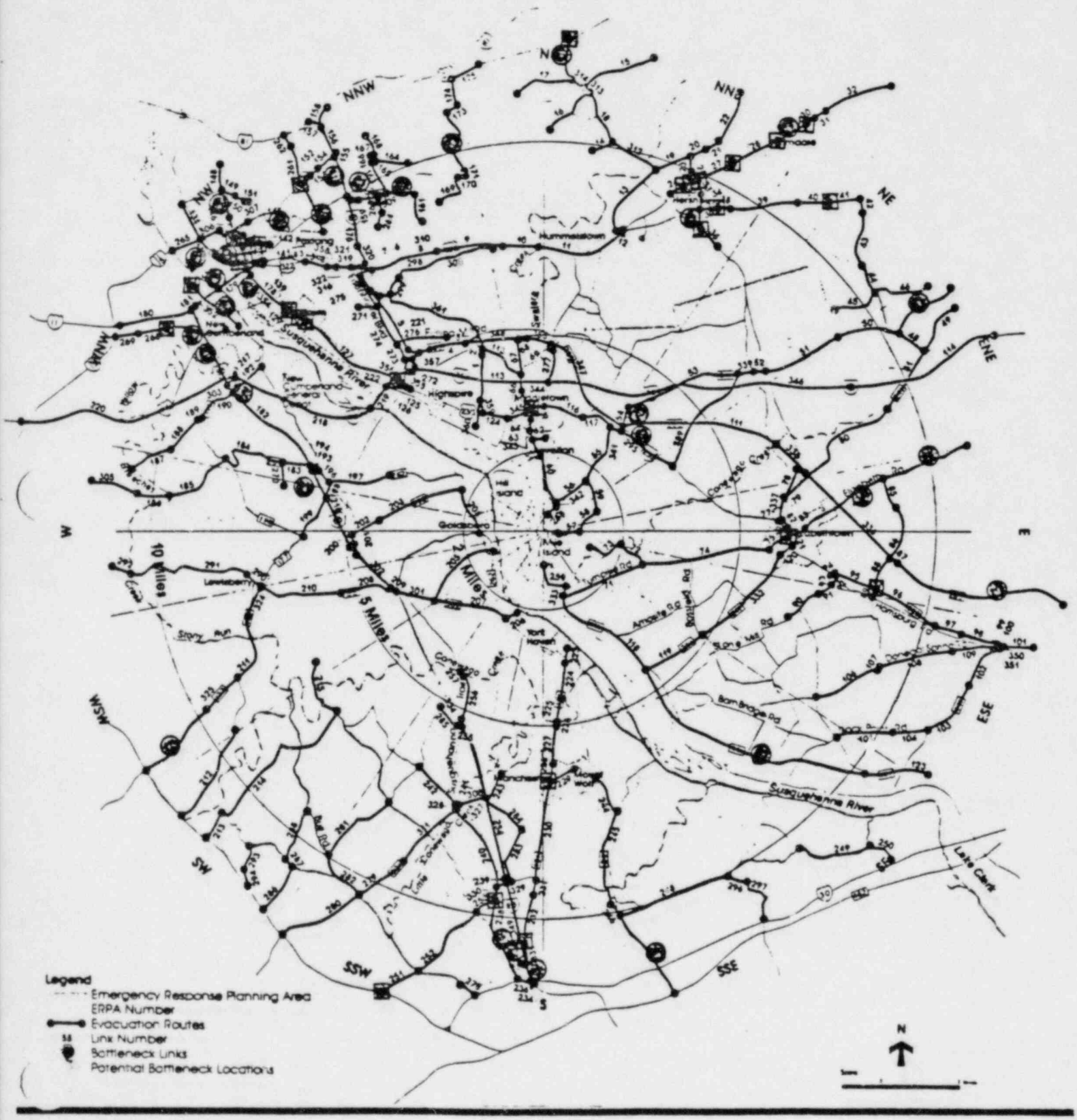

Fig. 23a Critical Bottleneck Links
Scenario: Best Estimate

Three Mile Island
Emergency Response Plan
10-Mile EPZ

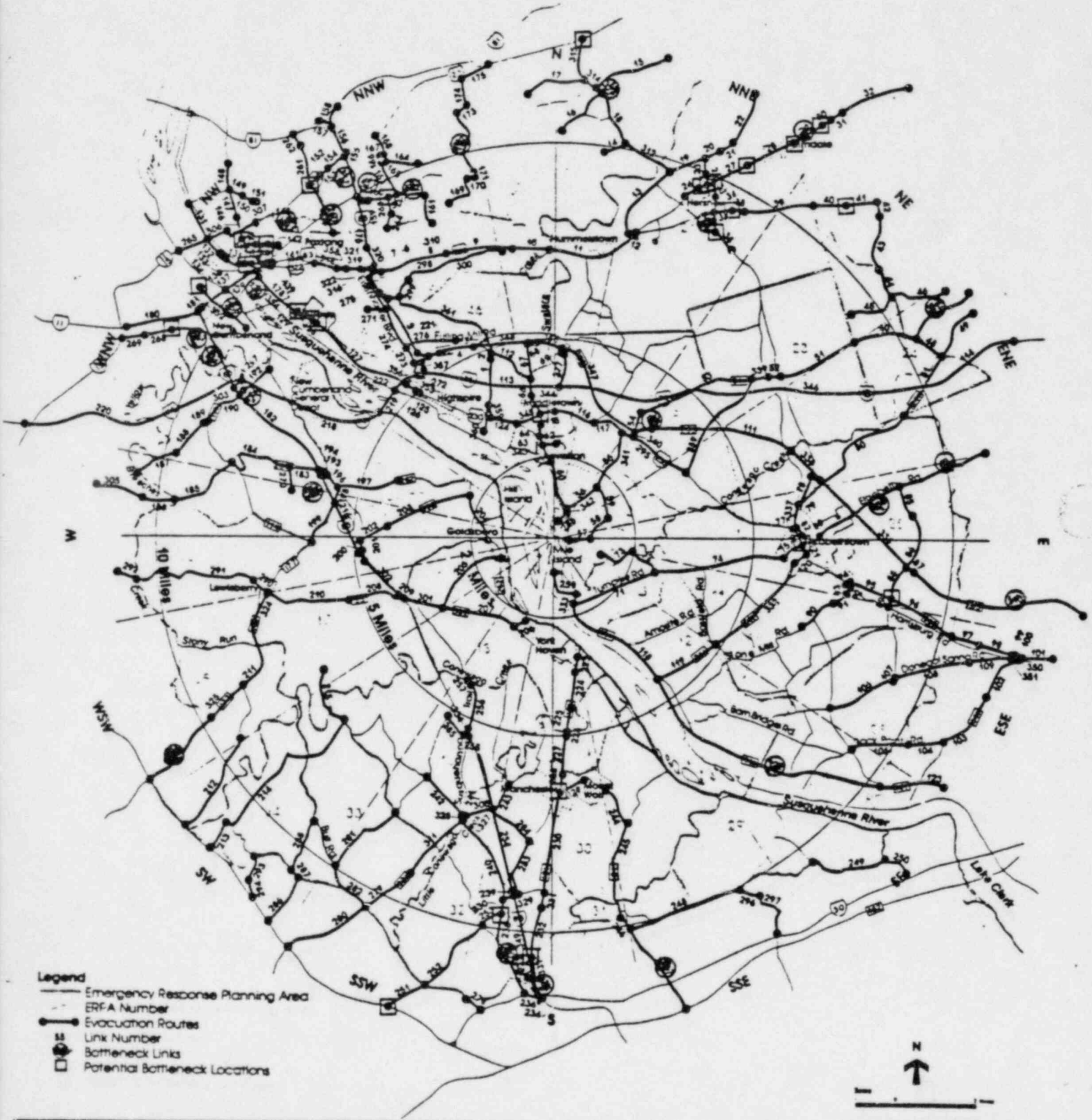

Fig. 23b Critical Bottleneck Links
Scenario: Typical Weekday

Three Mile Island
Emergency Response Plan
10-Mile EPZ

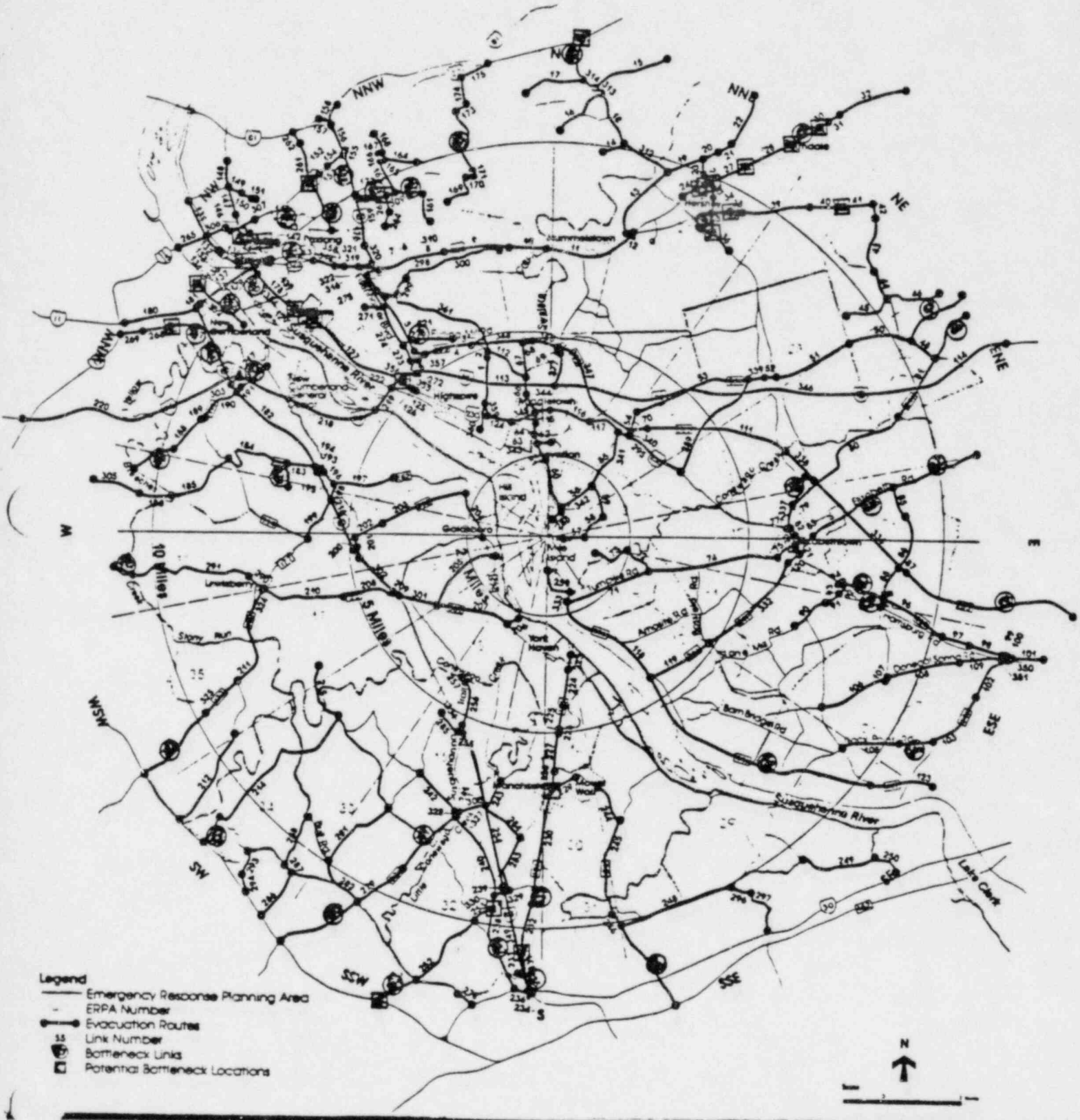

Fig. 23c Critical Bottleneck Links
Scenario: Adverse Weather

Three Mile Island
Emergency Response Plan
10-Mile EPZ

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 26

POTENTIAL CRITICAL LOCATIONS
ON SELECTED EVACUATION ROUTES
(10 mile EPZ)

Critical Bottleneck* Links/Locations	Bottleneck (delay) Time Hour : Minutes		
	Best Estimate	Typical Weekday	Adverse Weather
29/W. Main Street (from S. Lingel Avenue to Railroad)	5:01	5:25	10:50
35/Route 743 (from Governor Road to Fishburn Rd.	2:48	2:56	6:03
47/Epler Road (from Route 117 to Route 341)	1:38	1:47	3:40
49/Water Street (from Route 341 W. to Route 341)	-	-	1:30
70/Ramp (from Access Road 238 to Route 283E)	3:26	4:08	-
78/N. Hanover Street (from Mt. Gretna Street to 28E Ramp)	-	-	4:13
84/Elizabethtown Road (from Grant Street to Sunnyburn Road	1:35	1:47	3:36
89/Colebrook Road (from Ehrrsburg Road to Route 230)	-	-	1:29
95/Route 230 (from Schwanger Road to Cloverleaf Road)	-	-	1:08
104/Rockpoint Road (from Colebrook Road to Route 441)	-	-	1:10
110/Route 283 E (from Grant Street to Mt. Joy Road)	2:21	2:46	3:36
122/Route 441 E (from Route 241N to Route 743N)	1:33	1:55	3:36
125/Second Street (from Lumber Street to Broad St.)	-	1:38	-
130/Cameron Street (from Sycamore Street to Paxton Street)	3:02	3:25	6:50
140/Ramp (from S. 17th Street to I-83W)	1:02	2:31	-
141/S. 17th Street (from Paxton Street to I-83W Ramp)	-	-	3:08
144/13th Street (from Derry Street to Market St.)	1:50	4:31	6:51
160/Union D Post (from E. Park Road to Downhoner Road)	-	-	8:34
162/Newside Road (from Page Road to Un. Dep. Road)	1:07	1:11	2:26

continued

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 26

(continued)

Critical Bottleneck* Links/Locations	Bottleneck (delay) Time Hour : Minutes		
	Best Estimate	Typical Weekday	Adverse Weather
172/Nyes Road (from Union Dep. Road to Devonshire Hgts. Road)	2:10	2:22	4:38
177/Ramp (from Union Dep. Road to I-83 N)	4:56	5:12	-
187/Forge Road (from Old Stage Road to Lisburn Road	-	-	1:44
191/Ramp (from Route 114 to I-83N)	1:51	1:59	-
192/Route 114 (from Susquehanna Trail to I-83)	-	-	2:39
195/Ramp (from Route 262 to I-83N)	1:49	2:01	-
213/Conewago Road (from Rhers Ch. Road to Old Carlisle Road	-	-	1:28
231/Route 181S (from Besh Sch. Road to Emig Road)	-	-	5:01
233/Ramp (from Route 181 S to I-83S)	2:24	2:34	-
235/I-83S (from Route 181 S to Route 250)	1:21	1:27	2:10
237/Susquehanna Trail (from Sinking Sp. Road to Lightner Road)	1:43	1:52	3:49
247/Mt. Zion Street (from Druck Valley Road to Route 230)	1:57	2:10	4:22
251/Route 238 W (from Manchester Town Line to Route 74)	-	-	1:42
260/Progress Avenue (from Old Township to Route 22)	1:31	2:47	4:39
266/Bridge Street (from 10th Street to Market St.)	1:25	1:37	3:14
267/Carlisle Road (from Brandt Street to 18th St.)	1:54	2:08	4:18
270/Ples. Vw. Drive (from Private Road to Route 262)	-	-	3:07
276/Fulling Road (from Nissley Drive to Eisenhower Boulevard)	-	-	1:38
280/Route 921 (from Bull Road to Route 74)	-	-	1:13

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 26

(continued)

Critical Bottleneck* Links/Locations	Bottleneck (delay) Time Hour : Minutes		
	Best Estimate	Typical Weekday	Adverse Weather
292/Lewisberry Road (from Siddenburg Road to T916)	-	-	1:43
304/Route I-83N (from I-76 to Route 11W)	1:42	1:50	2:31
311/Route 921 (from Susquehanna Trail to Mil Crk. Road)	-	-	6:37
313/Route 39 (from Red Top Road to Devonshire Road)	-	1:47	-
315/Route 39 (from Grnhll. Road to Route 22)	1:39	-	3:42
317/I-83N (from Un. Dep. Road to Route 22)	3:36	3:48	5:17
326/Route 177 (from Route to Park to Route 745)	1:43	1:51	3:52
335/Elizabethtown Road (from Chestnut Street to Grand Tree Road)	1:40	1:53	3:50
337/N. Hanover Street (from Linden Street to Mount Gretna Road)	-	-	-
340/Acc. Road 283 E (from Route 230 to EB On-Ramp)	-	-	6:23

The following intersections require traffic control personnel+

Chocolate Avenue and Ridge Road (24, 25)

Chocolate Avenue and 743N (25, 26)

Chocolate Avenue and 743S (26, 27)

Chocolate Avenue and Homestead Road (27, 28)

W. Main Street and S. Lingel Avenue (28, 29)

W. Main Street and Railroad Street (29, 30)

Route 743 and Fishburn Road (35, 36)

Route 322 and Homestead Road (37, 38)

Route 322 and Lymer Avenue (40, 41)

West High Street and Market Street (75, 76, 83, 121)

Colebrook Road and Route 230 (88, 89, 95, 96)

THREE MILE ISLAND
EVACUATION TIME ESTIMATES
FOR THE 10 MILE RADIUS EPZ

TABLE 26

(continued)

The following intersections require traffic control personnel+

Second Street and Eisenhower Boulevard (126,127)

S. Front Street and Swatara Street (127, 128)

S. Front Street and Locust Street (128, 129)

S. Front Street and Conestoga Road (129, 354)

Cameron Street and Paxton Street (130, 136, 137)

Paxton Street and S. Second Street (137, 136)

Derry Street and 17th Street (142, 143)

Derry Street and 13th Street (143, 144)

13th Street and Market Street (144, 145)

Market Street and Cameron Street (145, 146)

Union D. Post and Dowhoner Road (160, 263, 309)

Route 181 S and Maple Street (228, 229, 230)

Route 181 S and Woodview Drive (232, 331)

Susquehanna Trail and Lightner Road (237, 253, 330)

Route 238W and Route 74 (251)

Progress Avenue and Route 22 (260, 261)

Bridge Street and Market Street (266)

Carlisle Road and 18th Street (267, 268)

Route 39 and Route 22 (315)

Main Street and Wilson Street (64, 115, 344, 345)

* For locations refer to Figure 23a-23c

+ Personnel who are stationed at signalized intersections will either manually operate the traffic signals or manually direct traffic

V. SUGGESTED ACTIONS

As stated in NUREG-0654,..."specific recommendations for actions that could be taken to significantly improve evacuation time shall be given." Such actions appear to be limited to those related to the factors and procedures utilized in developing the evacuation time estimates (such as evacuation route selection, route capacity, traffic assignment, special transportation considerations and notification/confirmation methods). During the course of this study, no specific recommendations have been identified that would significantly improve evacuation times other than those described elsewhere in this report including the following local commentary.

VI. LOCAL COMMENTARY

In order to achieve a cooperative and comprehensive planning effort for this study, a number of meetings and discussions were held with State and local emergency planners and officials as well as with members of GPU Emergency Preparedness at Three Mile Island. In addition, numerous contacts have been made to gather relevant information and data not only from State, county and local agencies, but also private transit operators, administrators of special facilities, associations and major industrial employers and military in the five county area encompassed by the EPZ. These contacts are listed in the attached FOOTNOTES Section of this Report. The contributions of these agencies and people has been invaluable in the development of the information and data base used in this study.

On November 26, 1980 a meeting was held in the Transportation and Safety Building in Harrisburg, Pennsylvania at the Office of the Pennsylvania Emergency Management Agency with representatives of the Met. Ed., PEMA, PENNDOT and Parsons Brinckerhoff, to review previous evacuation time studies, obtain information, discuss methodology and assumptions to be used in this study, and review the requirements of NUREG-0654, Appendix 4 of the November 1980 revision. Also, the coordination procedures among those present was established.

On December 18, 1980, the District Traffic Engineer for PENNDOT was contacted to discuss PENNDOT's selection of evacuation routes, route capacities, trip assignment technique, and special traffic management procedures which have been proposed. Concurrence was also obtained on the use of separate capacities of interchange ramps.

At the request of GPU, a meeting was held at the PEMA office in Harrisburg, Pennsylvania with representatives from PEMA district and central offices, the five County Emergency Management (Operations) Coordinators and their deputies, the Manager of GPU-Nuclear Emergency Preparedness and Parsons Brinckerhoff. This meeting was held to review the methodology and assumptions used in this study, the status of the study, and additional data requirements. Also, the preliminary population figures, employment data needs, scenarios and location of the reception centers to be used in this estimate were discussed. Moreover, the description of the EPZ and internal Emergency Response Planning Areas (ERPA's) and the evacuation routes were presented. No objections to the use of these data for the purpose of estimating evacuation times in response to NUREG-0654 Appendix 4 were voiced by those present. The requests made in the November, 1980 revision of NUREG-0654 Appendix 4 were also addressed.

During a conversation on January 30, 1981 with the Manager of Emergency Preparedness for GPU, comments on the draft of the report submitted to GPU on January 16, 1981 for distribution to PEMA were received. It was the consensus of the reviewers that the initial route capacity information provided by PENNDOT was conservative. Through a refined evaluation of individual route capacities it appeared to be possible to develop more realistic route capacities and thus more realistic evacuation time estimates. PEMA noted no objection to the use of alternate or supplementary routing, if such actions would facilitate evacuation.

As directed by GPU, an independent assessment of roadway capacities based on actual physical and operating conditions and by the addition of supplemental routes to alleviate, where possible, potential bottlenecks uncovered in the evaluation of the PENNDOT evacuation route network was made. Such refinement was based an judgments and expertise gained from previous studies to provide an more realistic estimate of evacuation times. According to GPU these estimates are intended for use in the decision making process in conjunction with other variables such as weather, type of incident, and time available in assessing a specific situation and determining the proper protective action to be taken e.g. (sheltering or evacuation) in the event of an incident at TMI requiring the implementation of protective actions by the public.

ERPA 47

- Take Union Deposit Road west to I-83 north.
- Rte 340 west to I-83. North on I-83.
- Follow Newside Road to Rutherford Road. Continue north on Rutherford Road to Virginia Street then turn left on Prince Street north toward Rte. 22.
- Take Conway Road to Union Deposit Road and continue toward Rte 22 as noted for ERPA 45.

ERPA 40

- Take Bridge Street north to Market Street then turn left to Rte. 11.
- Follow same route as ERPA 39

ERPA 42

- Take S. Front Street north to Paxton Street. ~~Turn left on Paxton St. to Front Street north.~~ Continue along Second Street,

ERPA 43

- Take Derry Street west to 12th Street. Follow 12th Street north to Market Street then, turn right from Market Street to Rte. 230 north.
- Enter I-83 at 17th Street and proceed west toward Rte. 15.
- Follow Progress Avenue north to I-81.

ERPA 44

- Follow Progress Avenue north to I-81.

ERPA 45

- Follow Conway Road to Union Deposit Road, take Union Deposit Road to Nyes Road and proceed north toward Route 22.
- Take Paxton Street eastbound to the entrance to I-83 north.
- Take Galion Road north then continue on Dowhoner Rd. to Union Deposit Road. Turn left on Union Deposit Rd. to I-83N.
- Follow Chamberhill Road to Keckler Road. Turn right to Rte 441 west to I-83N.

ERPA 46

- Take Rte. 441 northwest to I-83 north.
- Take Fulling Mill Road westbound to Eisenhower Blvd. Proceed south on Eisenhower Blvd to the entrance of Rte 283 to I-76 and then proceed to I-76 east.

ERPA 34

- Take Anderson-Rohler Church Roads toward Rte 74.
- Take Mountain Road south to Old Carlise Road.
- Follow Cherry Orchard Road southwest to Nursey Road then turn right onto George Street toward Rte. 74.

ERPA 35

- Take Boring Bridge Road toward Rte 74.
- Take Rte 177 toward Rte 74.

ERPA 36

- Take Rte 177 south toward Rte 74.

ERPA 37

- Take Siddenburg Road west to Lewisbury Road and continue.
- Take Lewisberry Road west Lisburn Road and continue.
- Follow Rte. 177 South toward Rte 74.

ERPA 38

- Take Lewisberry Road toward Old Forge Road. Proceed on Old Forge Road to Lisburn Road.
- Take Lewisbury Road (Rte 114 west) to I-83 north.
- Take Fishing Creek Road east and turn north on I-83.

ERPA 39

- Take Simpson Ferry Road west to Carlise Road and continue toward U.S. Rte 15.

ERPA 28

- Take Donagal Spring Road toward Mount Joy.
- Take Rock Point Road toward Rte 141.
- Take Rte 441 east toward Rte 23.

ERPA 29

- Take Furnace Road toward Hauser School Road, then proceed on Cool Spring Road south to Rte 30.
- Follow Kreutz Creek Road south to Rte 30.

ERPA 30

- Take Board Road south to the entrance to I-83 south at Church Road.
- Take Sherman Road south to Mount Zion Road. Proceed on Mount Zion down to Rte 30.
- Take Rte. 181 south to the entrance ramp to I-83 south.

ERPA 31

- Take Mount Zion Road (Rte. 24) south to Rte 30.

ERPA 32

- Take Susquehanna Trail south toward York and I-83.
- Take Rte 181 south to I-83 southbound entrance ramp.
- Take Rte 238 southwest toward Rte 74.

ERPA 33

- Follow Cherry Orchard Road southwest to Nursery Road, then turn right to George Street Town Rte. 74.
- Take Rte 921 toward Rte 74.
- Take Butler Road east, to Bull Road south, then turn right on Rte 921 toward Rte. 74.

ERPA 23

- Take Route 341 east.
- Take Patrick Rd east.

ERPA 24

- Take Patrick Road north to Rte 322.
- Take Rte 241 northeast.
- Take Rte 341 east.

ERPA 25

- Follow Cloverleaf Road south to the entrance to Rte 283 east.
- Take Elizabeth Road east.
- Take Rte 241 northeast.
- Take Hershey Rd. northeast to Rte 283 east.

ERPA 26

- Follow Elizabeth Rd. northeast.
- Take Rte 230 east toward Mount Joy.
- Take Rte 743 to the entrance ramp of Rte 283 east.

ERPA 27

- Take Bainbridge Road north to S. Market St. turn left on S. Market St. and continue to Linden Avenue. Follow Linden Ave. east to No. Hanover St. Proceed north on Hershey Rd. to I. 283 E.
- Take Maytown Road to Foreman Drive turn east on to Rte 230.
- Take Cloverleaf Road north to Rte. 230 east.

ERPA 17

- Take York - Levisbury Roads to Anderson Road. Proceed on Anderson Road southwest to Rohler's Church Road. Continue on Rohler's Church Rd.
- Take the Rte 382 west to Rte 177 South.
- Take Potts Hill Rd. to Susquehanna Trail, then onto the entrance ramp to I-83 n.

ERPA 18

- Take Valley Road to the entrance to I-83 north from Creek Rd.
- Take York Road to the entrance to I-83 north from Creek Rd.

ERPA 19

- Take Rte 230 north to S. Front Street.

ERPA 20

- Take Rte 441 north (Oberline Rd.) to I-283 north. Proceed north on I-283 to I-83 north.
- Take airport connector highway to Rte 283 west. Continue on Rte 283 to I-83 north.

ERPA 21

- Follow Chocolate Avenue (Rte 422) northeast.
- Take Fisburn Rd. (Rte 743) to Governor Road (Rte 322) east.

ERPA 22

- Take Route 340 to Rte 39 north.
- Take Red Top Road to Rte 39 north.

ERPA 11

- Take Rte 241 to Elizabethtown. Turn left on Market Street to E. High St. then turn right on Elizabethtown Road east.
- Take Turnpike Road east and proceed as in ERPA 10.

ERPA 12

- Take Rte 441 southeast to Rte 23.
- Take Rte 241 to Elizabethtown and proceed as in ERPA 11.
- Take Donegal Springs Road toward Mt. Joy.

ERPA 13

- Take Rte 181 south to I-83.

ERPA 14

- Take Rte 181 south to I-83.

ERPA 15

- Take Rte 181 south to I-83
- Take Rte 382 (York Haven Road) northwest to the entrance ramp to I-83 north.
- Take Susquehanna Trail to I-83 south entrance ramp.

ERPA 16

- Take Cloverleaf Road to the Susquehanna Trail entrance to I-83 south.
- Take Mount Washington Road southeast to Susquehanna Trail. Proceed south on Susquehanna Trail to York.

ERPA 6

- Follow Pines Road to York Haven Road. Turn right to the entrance ramp to I-83 north.
- Take Rte. 262 (Yocumtown Road) to the Susquehanna Trail entrance to I-83 north.

ERPA 7

- Take Mudd Pike (Rte. 441 north) to Union Street in Middletown. Turn right on to East Main Street (Rte 230) and proceed to the entrance ramp of Rte. 283 east.

ERPA 8

- Take Middletown Road (Vine Street extension) north to the entrance ramp of Rte. 283 east.
- Take East Main Street (Rte 230) to the entrance ramp of Rte. 283 east.
- Take the Harrisburg Pike (Main Street west) to the Airport Access Road West. Proceed to Rte. 283 west and to turn north onto I-283 - I-83.

ERPA 9

- Take Colebrook Road to the entrance ramp to Rte. 283 east.
- Take Rte 230 to the entrance ramp to Rte. 283 east.
- Follow Colebrook Road (Rte. 341) east.
- Proceed on Deodate Road north to Colebrook Road. Turnright to Colebrook Road (Rte. 341) east.

ERPA 10

- Take Turnpike Road east to High Street, then turn left to Market Street in Elizabethtown. Proceed on Market Street to Linden Avenue. Turn left on to Hanover Street and proceed West on Rte 743 to the entrance ramp to Rte. 283 east.

ERPA 1

- Take Geyers Church Road northeast to Rte 230. Following Rte 230 east to the entrance ramp to Route 283 east.
- Take the north plant bridge to Geyers Church Road and continue as above.
- Take the south plant bridge to Rte 441. Turn right and proceed on Rte. 441 South.

ERPA 2

- Take Hilldale Drive to Geyers Church Road. Follow Geyers Church Road to Rte. 230. Proceed on Rte. 230 to the entrance ramp to Rte. 283 east.
- Take Rte. 230 northwest to the entrance ramp of Rte. 283 east.
- Take Rte. 441 South.

ERPA 3

- Take Falmouth Road east to W. High Street in Elizabethtown. Proceed on W. High Street to East High Street and then continue east on Elizabethtown Road.
- Take Rte. 441 South.

ERPA 4

- Take Valley Road North to Rte. 262 (Yocumtown Rd.) to the Susquehanna Trail entrance to I-83 north.
- Take Wisler Road to Rte. 382. Turn right and proeed west to I-83 north entrance.

ERPA 5

- Take Wisler Road to Rte. 382 Turn right and proceed west to I-83 north entrance.
- Follow York Haven Road to the entrance ramp to I-83 north.

TABLE 2

COMPARISON OF STATIC AND DYNAMIC ASSIGNMENT RESULTS

Evacuation Route	Total Vehicles Using Evacuation Route	Traffic Assignment Methodology	Percent of Total Vehicles Evacuated During the Following Time Period*																
			0:45 1:00	1:45 2:00	2:00 2:15	2:15 2:30	2:30 2:45	2:45 3:00	3:00 3:15	3:15 3:30	3:30 3:45	3:45 4:00	4:15 4:30	4:30 4:45	5:30 5:45	5:45 6:00	6:00 6:15	6:15 6:30	7:15 7:30
East of River																			
Route 6	4,360	Static	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	84	–	100	–	–	–	–	–
Route 120	5	Static	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	33	–	–	100	–	–	–	–	–	–	–	–	–	–	–	–	–
Route 9A	8,690	Static	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–
Taconic Parkway	5,155	Static	–	–	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	92	–	–	–	100	–	–	–	–	–	–	–	–	–	–
Amawalk Road	2,575	Static	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	89	–	100	–	–	–	–	–	–	–	–	–
Total East Routes	20,785	Static	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	93	–	100	–	–	–	–	–
West of River																			
Palisades Parkway	8,655	Static	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	97	100	–	–	–	(97)	–	(100)	–
Route 9W	3,850	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	99	100	–	–	–	(87)	(100)
Route 303	3,310	Static	–	100	–	–	(100)	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	98	–	–	(90)	100	(100)	–	–	–	–	–	–	–	–	–	–
Route 45	1,920	Static	–	–	–	100	–	–	–	–	(100)	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	98	–	100	–	–	(100)	–	–	–	–	–	–	–	–
Little Tor Road	3,025	Static	–	–	–	–	–	–	–	–	100	–	–	–	(100)	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	99	100	–	–	(95)	–	(100)	–	–
Route 304	3,655	Static	–	–	–	100	–	–	–	–	–	(100)	–	–	–	–	–	–	–
		Dynamic	–	–	–	99	–	100	–	–	–	(100)	–	–	–	–	–	–	–
Total West Routes	24,415	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	98	100	–	–	–	(95)	(100)
Total Network Routes	45,200	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	96	100	–	–	–	–	–

* Note: Numbers enclosed by parentheses represent the percent of total vehicles along a route evacuated during the time period using Level of Service D capacities.

Numbers not enclosed by parentheses represent the percent of total vehicles along a route evacuated during the time period using Level of Service E capacities.

Table 2 indicates that a 93 percent correlation between the two assignment model is possible on an aggregate basis for the roadway network east of the Hudson River. That is, in the time that the static assignment estimated complete evacuation of vehicles beyond the EPZ, the dynamic assignment estimated 93 percent of the vehicles would have cleared the EPZ. On a route by route basis, this correlation ranged between 100 percent for the most heavily assigned test route, and 33 percent for a minor test route, which was assigned only 5 vehicles during the evacuation with the second lowest correlation, Amawalk Road, being 89 percent.

On the west side of the Hudson River, where both normal and poor weather conditions were analyzed by both models, the correlations of the overall results between the two model were 98 percent and 95 percent, respectively. Under normal weather conditions, there was little disparity among all six routes, with the results varying between 97 percent (Palisades Parkway) and 99 percent (Route 9W, Little Tor Road, and Route 304). Poor weather conditions resulted in route correlations ranging between 87 percent for Route 9W and 100 percent for Routes 45 and 304.

Overall, for the entire test evacuation network, comparison of the static and dynamic assignment results under normal weather conditions indicated a 96 percent correlation. Generally, when the static model estimated the network would be cleared (total vehicle evacuation), the dynamic model estimated 96 percent of the vehicles would have cleared the EPZ boundary. The dynamic assignment results indicated that complete evacuation of all vehicles beyond the EPZ boundary would occur 15 minutes later than the static assignment estimate under normal weather conditions.

In addition to the evacuation times generated by each assignment technique, the location of bottlenecks by each methodology was compared. The dynamic assignment produced as output for each link the percent of vehicles stopped during the evacuation. This statistic was used as a measure of the degree of congestion on each link. On a network-wide basis, the average percent stops for all links was 35 percent.

The 16 critical bottleneck links identified by the static model were identified in the dynamic assignment output as well. On these links, the average percentage of stops as indicated by the dynamic model output was 50 percent.

4. CONCLUSIONS

The results of the benchmark analysis presented in this report indicate that Parsons Brinckerhoff's static traffic assignment model can be applied to roadway networks to estimate evacuation roadway travel times with a high degree of confidence.

Under identical circumstances, the static assignment model results have proven comparable with those produced by a state-of-the-art, complex dynamic assignment model, which simulates the evacuation process within the framework of time. Roadway travel times were estimated and congested roadways identified with a high degree of correlation using the less complex static assignment methodology. A close correlation between assignment procedures exists for varying roadway types, weather conditions, and loading characteristics.

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TABLE 1

COMPARSION OF STATIC AND DYNAMIC ASSIGNMENT TRAVEL TIME RESULTS

Evacuation Route	Travel Time for Last Vehicle to Clear EPZ (Hr: Min)			
	Level of Service E		Level of Service D	
	Static	Dynamic	Static	Dynamic
East of River				
Route 6	3:50	4:45		
Route 120	0:50	2:30		
Route 9A	3:20	3:30		
Taconic Parkway	2:05	3:15		
Amawalk Road	2:50	3:30		
West of River				
Palisades Parkway	3:35	4:00	5:50	6:30
Route 9W	4:25	4:45	6:25	7:30
Route 303	2:00	3:00	2:40	3:15
Route 45	2:20	3:00	3:40	3:45
Little Tor Road	3:35	4:00	5:45	6:15
Route 304	2:30	3:00	4:00	4:00

*A dynamic analysis at Level of Service D was not performed east of the Hudson River

3.2 Dynamic Assignment Results

Table 1 also shows the results obtained from the dynamic traffic assignment Evacuation roadway travel times based on the output traffic statistics of the model are rounded up to the nearest 15 minutes. Thus, when a route exhibited zero volume within a given 15-minute point in time, it actually was cleared of traffic at some point during the preceeding 15-minute time interval.

Utilizing evacuation capacities calculated for normal weather conditions, roadway travel times ranged from 2 hours 15 minutes to 4 hours 45 minutes for all routes east and west of the Hudson River. West of the river, evacuation capacities calculated for poor weather conditions resulted in roadway travel time estimates ranging between 3 hours and 7 hours 30 minutes.

3.3 Comparison of Results

For the benchmark analysis and evaluation of the test network, the evacuation roadway travel times obtained from the static assignment model were compared to the dynamic assignment model travel times to assess differences in the results of the two models and verify results of the static model.

As shown in Table 1, in all cases, the static assignment evacuation reaches 100 percent completion either before or at the same time as the dynamic assignment evacuation.

3. Comparative Analysis of a Static and a Dynamic Model Results -Indian Point Nuclear Generating Station, New York

The benchmark analysis consisted of a series of static and dynamic assignments to obtain comparable estimates of roadway travel time to evacuate residents of the Indian Point EPZ. Common to all of the traffic assignments, regardless of the model, were the number of trips generated by each zone and the test evacuation network. The test evacuation network consisted of the two southern quadrants of the Indian Point EPZ.

Separate benchmark analyses and evaluations were made for normal and poor weather conditions. The basic difference between these analyses was the roadway carrying capability (evacuation capacity). Level of Service E roadway capacity represented evacuation under normal weather conditions, whereas capacity at Level of Service D represented poor weather evacuation conditions. For poor weather conditions, free-flow speed reductions on the order of 20 percent were put into effect.

The static traffic assignment model was executed once for the entire test evacuation network (each quadrant to the west and east of the Hudson River) to obtain the evacuation roadway travel time estimates for all routes for a given weather condition. Hence, two runs were required to obtain the evacuation time estimates for the test network.

The dynamic traffic assignment model was analyzed separately for each quadrant and each weather condition. Three dynamic traffic assignments were made, which resulted in normal weather evacuation roadway travel time estimates for routes on both sides of the Hudson River, and poor weather evacuation roadway travel time estimates for routes west of the Hudson River.

3.1 Static Assignment Results

For each of the evacuation routes included in the test evacuation network, the roadway travel times to clear the EPZ resulting from the static assignment, as shown in Table 1, ranged from 50 minutes to 4 hours 25 minutes under normal weather conditions (Level of Service E evacuation capacities), and from 50 minutes to 6 hours 25 minutes under poor weather conditions (Level of Service D evacuation capacities). Sixteen critical bottleneck links were identified as an output of the static assignment model runs under both weather conditions.

It is anticipated that during an emergency evacuation, the traffic demand would approximate 90 percent in the direction of outbound movements. In the interest of providing a conservative yet realistic capacity estimate, 80 percent of capacity is assigned to the outbound direction.

Thus, from the above considerations, the base capacities at Levels of Service (LOS) D and E can be computed as follows:

LOS_D Base Capacity = 2000 X 0.58 X 0.80 = 928 vph.
LOS_E Base Capacity = 2000 X 1.00 X 0.80 = 1600 vph.

Each segment of the evacuation roadway network has individual characteristics which further reduce its ability to meet the demand volume. From Table 10.8 of the Highway Capacity Manual, factors associated with the lane widths and side clearances (referred to as a "W" factor) are applied to the base capacities to derive the segment's actual capacity. For example, for a segment with two twelve-foot-wide travel lanes and no shoulders, the base 928 capacity is multiplied by a factor of W = 0.88 to produce a capacity for the segment of 817 vehicles per hour at Level of Service D.

Thus, from the above derivation, the Level D and E capacities for evacuation traffic are computed as shown below where W is the factor from Table 10.8.

Two Lane, Two-Way Roadways

LOS_D Capacity = 928 x W

LOS_E Capacity = 1600 x W.

2. Two Way Street with Parking

Capacity and service volume for an urbanized area are determined by other factors, such as the presence or absence or parking, percent traffic turning, and allowable green time at a signalized intersection. To evaluate the effects of such factors on capacity, the Leisch Nomographs from the Traffic Engineering Series - Capacity Analysis Procedure for Signlized Intersections are used.

3. Four Lane Two-Way Highway, Divided Highway

Table 9.1 and 9.2 in the Highway Capacity Manual are used for this category of road segment. The derivation of Level of Service D capacity assumes that, for emergency evacuation conditions, 0.95 was an appropriate peak hour factor, since the demand would be high and virtually constant during the evacuation period. Thus, as per Table 9.1, 4000 Capacity at LOS_E X 0.90 (reduction for speed impediment) X 0.95 (PHF) = 3420 or Capacity D. W factors from Table 9.2 which adjust for lane and shoulder widths when applied to Capacity D would yield the segment capacity at Level of Service D. Therefore, the calculated capacities for four lane divided highway segments are:

Four Lane Divided Highway

LOS_D Capacity = 3420 X W
LOS_D Capacity = 4000 X W

d. Summary of all destinations and the number of vehicles (by type) and passengers assigned to each.

e. Distribution of the percent of the total population evacuated as a function of time.

B. Evacuation Capacity

A critical element in determining the amount of time needed to evacuate any given area is the capacity of the existing roadways to accommodate the anticipated vehicular volumes. Once the capacity calculations have been developed, the roadway travel time and congestion/delay time occuring during evacuation can be computed.

The procedure used to determine the evacuation area roadway capacities is based on the Federal Highway Administration's 1965 Highway Capacity Manual and the Traffic Engineering Series Capacity Analysis Procedure for Signalized Intersections. Definitions of specific technical terminology used throughout the following paragraphs are based on the Highway Capacity Manual.

The roads and highway in the evacuation area were categorized into four groups:

- two lane, two-way highways
- two-way urban street
- two-way urban streets with parking
- four lane, two-way divided highway.

For each of these groupings, base capacities at Level of Service E and Level of Service D are calculated. Level of service E capacities are used in the adverse weather scenario. The base capacity is determined by using factors which take into account the impact on traffic operation caused by existing roadway width, shoulder area or lateral clearance. Other standard capacity inhibiting factors (such as passing sight distances, percent trucks and type of terrain) are considerably less significant for the emergency evacuation condition and, therefore, are not considered. All applicable factors were abstracted from the Highway Capacity Manual using the tables cited in the following paragraphs or from the charts contained in Capacity Analysis Procedure for Signized Intersections.

1. Two Lane, Two-Way Roadways

Table 10.7 of the Highway Capacity Manual shows the maximum service volume under ideal conditions for passenger cars traveling in both directions on a two lane highway as 2000 vehicles per hour (vph). This value, which represents the base capacity as Level of Service E for two lane, two-way roadways, is modified to represent a one lane outbound flow as described below.

The base capacity for this type of roadway at Level of Service E is further reduced by a factor of 0.58 to determine base capacity at Level of Service D. This factor, which is also shown in Table 10.7, represents a restricted average highway speed of 40 miles per hour with no restraint created by limited passing sight distance.

(V/C) relationship for the link. Finally, the evacuation speed or delay time is computed for each link, depending on whether the V/C ratio was greater or less than 1.0. The formula contained in the Federal Highway Administration August 1973 Traffic Assignment Manual was adopted and modified as follows for use in computing the speed at which evacuees will travel.

$$\text{Evacuation Speed} = \frac{\text{Free-Flow Speed}}{0.25\left[\frac{\text{Demand}}{\text{Capacity}}\right]^4 + 1}$$

Following these calculations, the model computes the roadway travel time for each traffic zone's evacuation route (or routes since some buses and special vehicles had separate routes) by scanning the links comprising the evacuation route to determine the maximum V/C ratio along the route.

When the hourly evacuation capacity exceeds the total demand volume (V/C ratio less than 1.0) for all links along the route, the link evacuation speeds are used to compute link travel time, and the travel times for each link along the path are summed to obtain the zone-to-EPZ-boundary roadway travel time for the route.

When the traffic volume exceeds the hourly evacuation capacity (V/C greater than 1.0) along any link of a traffic zone's evacuation route, the roadway travel time is represented by the maximum link delay time incurred along the route. Link delay time is calculated as the maximum volume/capacity ratio in hours along the route. The link with the maximum ratio is identified as the bottleneck link for the evacuation route for use in future planning. Other links along the route where the volume/capacity ratio exceeded 1.0 are also identified for planning purposes.

The roadway travel time as determined above is added to the terminal time and the free-flow travel time for each zone trip type to determine the total roadway evacuation time. The total roadway evacuation time resulting from this analysis represents the time for the last vehicle in the zone to clear the EPZ.

3. Outputs

The computer program developed for the static assignment process provides five basic reports which are used in the evacuation planning process. The reports are described below:

a. Summary of link statistics; link number, description, length, free-flow speed and time, vehicular demand, evacuation capacity, and demand/capacity ratio.

b. Summary of traffic zone statistics number of trips, evacuation route, destination, terminal time, free-flow travel time, roadway travel time, total evacuation time, and bottleneck link, for each trip type, sorted in ascending order by total evacuation time.

c. Summary of all bottleneck links and the traffic zones which use them.

2. METHODOLOGY

A. Static Traffic Assignment Process

1. Inputs

The static traffic assignment process developed to estimate roadway travel and delay times requires three basic types of input. The first type relates to the characteristics of the evacuation roadway network, which is comprised of one-directional links, each having its own attributes. The links are described in terms of their capability to accommodate evacuating traffic (evacuation capacity), length, and free-flow speed (speed limit).

The second type of input required for this assignment process is zonal vehicle trip generation data. The EPZ is disaggregated into traffic zones, and the numbers of trips by each vehicle type (e.g., autos, buses, ambulances) are estimated in terms of passenger car equivalents (PCE's) for each traffic zone. Buses are weighted as the equivalent of two passenger cars in this analysis. In addition, a terminal time for all trip types for each traffic zone are input. The terminal time for autos represents the time to drive from homes within the traffic zone via feeder streets to the first link of the primary evacuation route. For buses and special vehicles, terminal time represents the total time for a special vehicle to travel from the point of origin (staging area, garages etc.) to the pick-up location; loading time; circulation time (multiple pick-ups); and the time to travel to the first link on a evacuation path.

The third input type used in the static assignment process is evacuation path data. Evacuation routes are designated fixed paths extending from the traffic zones to the EPZ boundary via specific roadways. Separate paths are developed for each trip type (auto, bus, ambulance) and are expressed in terms of connecting link numbers. Destinations (i.e., reception centers) are defined for each traffic zone and input for the purpose of determining the number of vehicles and passengers expected at each destination. Average vehicle occupancies are used to estimate the number of passengers arriving in vehicles at the destination.

2. Static Assignment Algorithm

A computer program was written to process the above input data and compute roadway evacuation times for each trip type by traffic zone.

Initially, the program calculates the total vehicular demand volume (in PCE's) on each link in the network by aggregating the vehicle trips generated by each traffic zone along the evacuation path. Implicit in this assignment is the assumption that all vehicles from all zones using a given evacuation route were on each link along the designated route concurrently. The assignment process is thus considered "static", because the spatial movement of vehicles across the network as a function of time is not explicitly recognized.

For each link in the network, three additional computations are performed. First, the free-flow travel time is calculated as the quotient of the link length and the free-flow speed. Second, the total vehicular demand volume is divided by the hourly evacuation capacity of the link to obtain the volume/capacity

APPENDIX C

METHODOLOGY TO ESTIMATE ROADWAY TRAVEL TIMES DURING EVACUATION

1. INTRODUCTION

On November 29, 1979, the United States Nuclear Regulatory Commission (NRC) requested all nuclear power reactor licensees to submit estimates of the time required to evacuate the population within a 10-mile radius of nuclear facilities. The estimates were to be made primarily for the purpose of providing those officials who would make evacuation decisions in an emergency situation with knowledge of the time required to complete an evacuation of one segment or all of the population.

Subsequent to this request for evacuation time estimates, a document entitled Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants (NUREG-0654/FEMA-REP-1) was published in the Federal Register in November of 1980 by a joint Federal Emergency Management Agency/Nuclear Regulatory Commission Steering Committee. This document, the purpose of which is to provide a basis for NRC licensees, State, and local governments to develop radiological emergency plans and improve emergency preparedness, requires, among other things, an evacuation time assessment study for the 10-mile plume exposure pathway Emergency Planning Zone (EPZ). The evacuation time assessment as described in the document consists of estimates of notification time, preparation time, roadway travel and delay time, and confirmation time.

In response to the initial NRC request in November 1979 and to NUREG-0654/FEMA-REP-1, Parsons Brinckerhoff Quade and Douglas, Inc. developed a fixed route traffic assignment model which loads the network and computes the route travel and delay times. It is a static model which assumes instantaneous loading of the evacuation network and concurrent vehicular demand on each roadway segments.

Section 2 of this report present the methodology, assumptions and traffic assignment algorithm structure used in an emergency evacuation time estimate simulation model. In addition, is an analysis of this static model and DYNEV, a dynamic model developed by KLD Associates with which it was compared specifically in verifying the evacuation time estimates for the Indian Point Nuclear Generating Station is provided in Section 3.

(T845) and go west along this road to Carlisle Road (County Road 74). Continue west on this road to Rosstown Road (County Road 177) (LR 66006), turn northwest on this road to Fortney Road (T912) and then continue northwest on this road to Mount Airy Road (LR 66032). Take this road north to the Warrington Corporate Boundary. Proceed north along this boundary to the Monaghan Corporate Boundary and then continue north along this boundary to the York County/Cumberland County Line. Follow this Line north to Cedar Cliff Road. Continue along this road east to Simpson Ferry Road (LR 21022), then east on this road to State Road 83 and north on this road to New Cumberland Corporate Boundary. Follow this boundary east to the Dauphin County/Cumberland County Line. Take this Line north to the Interstate Route 83 bridge, then cross this bridge, east to the Conrail tracks and then north on these tracks to State Street (State Route 22). Proceed on this street east to the Harrisburg City Line, then go counterclockwise along this Line to Union Deposit Road (LR 22008) and follow on this road east to the Lower Paxton Corporate Boundary. Go north on this Boundary to Locust Street (LR 22071), and then turn east on this road to Nyes Road (T407). Follow on this road east to South Hanover Corporate Boundary and go north along this boundary to the point of origin.

A description of the primary evacuation routes from each of the Emergency Response Planning Areas (ERPA's) is presented in Appendix C. The descriptions depict the total path from each ERPA to the 10 mile Emergency Planning Zone (EPZ). Time estimates for subradii (2 and 5 mile) are based on the use of portions of this total path to the defined border of the respective radius.

Line north to the Interstate Route 83 bridge, cross this bridge, east to the Conrail tracks and then proceed north along these tracks to State Street (State Route 22). Follow this street east to the Harrisburg City Line, follow counterclockwise along this Line to Union Deposit Road (LR 22008) and then proceed east on this road to the Lower Paxton Corporate Boundary. Follow north on this boundary to Locust Street (LR 22071), turn east on this road to Nyes Road (LR 22018) and then proceed north on this road to Red Top Road (T407). Go east on this road to the South Hanover Corporate Boundary. Follow this boundary north to the point of origin.

Sector O (ERPA's 1-47) (Figure 17)

Follow the South Hanover Corporate Boundary clockwise from its intersection with the Lower Paxton/West Hanover Corporate Boundaries to the East Hanover Corporate Boundary. Then follow this boundary clockwise to the Lebanon County/Dauphin County Line. Proceed along this Line south to Stouffers Road (T335), turn northeast on this road to Ville Road (LR 38035) and then go south on this road to Chestnut Kreider Road (T333). Follow this road south to Lawn Road (LR 38001), continue south on this road to Upper Lawn Road (County Road 341) (T331) and then turn east on this road to Lawn Road (LR 38001). Follow this road south to the Lebanon County/Lancaster County Line, proceed along this line west to County Road 241 (FAS280), turn south again along this road to Trail Road (T328) and then continue south along this road to Quarry Road (T855). Proceed south along this road to Miltongrove Road (LR 36004), continue south on this road to Grandview Road (LR 36124) and then follow this road south to Orchard Road (LR 36069). Turn east on this road to Mussler Road (LR 36068), return south on this road to County Road 230 (FAS129) and then turn east to the East Donegal Corporate Boundary. Follow this Boundary south to Donegal Springs Road (LR 36002), turn west on this road to Church Road (T316) and then proceed south on this road to Kraybill Road (T827). Take this road to Colebrook Road (LR 36004), turn south on this road to Rock Point Road (T673) and go west on this road to Fuhrman Road. Proceed south on this road to Maytown Road (County Road 743) (LR 36070), and continue south on this road to a point where the road terminates near the Susquehanna River's eastern shoreline. Follow a straight line across the river to a point directly opposite Accomac Road (LR 66089). Follow this road south to Dark Hollow Road (T776), continue south on this road to Hauser School Road (LR 66018) and then turn west on this road to Furnace Road (LR 66152). Proceed west on this road to Millstone Road, turn south on this road to Spring Road (T783) and then go west again on this road to Druck Valley Road (LR 66019). Continue west on this road to Mount Zion Road (LR 66020), turn north on this road to Druck Street (LR 66021), turn southwest on this road to Mundis Hill Road (LR 66021) and then proceed once more west along this road to Woodland View Drive (LR 66086). Turn southwest along this road to N. George St. (County Road 181) (FAS250) to Lightner Road, continue west along this road to the Susquehanna Trail (LR 66003) and then turn south along this road to State Route 30. Follow this road west to the City of York Corporate Boundary. Take this boundary northwest to the Manchester Corporate Boundary. Follow this boundary clockwise to the Dover Corporate Boundary. Proceed this boundary counterclockwise to Nursery Road (T823), turn west on this road to Old Carlisle Road

on this Line southeast to the East Manchester Corporate Boundary. Take this boundary clockwise to Mundis Hill Road (LR 66021) and then turn west along this road to Woodland View Drive (LR 66086). Proceed southwest along this road to N. George St. (County Road 181) FAS250) to Lightner Road, turn west along this road to the Susquehanna Trail (LR 66003) and then turn south along this road to State Road 30. Follow this road west to the City of York Corporate Boundary. Follow this boundary northwest to the Manchester Corporate Boundary. Proceed along this boundary counter-clockwise to Nursery Road (T823), turn west on this road to Old Carlisle Road (County Road 74). Go west on this road to Rosstown Road (County Road 177) (LR 66006), turn northeast on this road to Fortney Road (T912), and proceed northwest on this road to Mount Airy Rd. (LR 66032). Go north along this road to the Warrington Corporate Boundary, continue north along this boundary to the Managhan Corporate Boundary and then proceed north along this boundary to the York County/Cumberland County Line. Take this Line east to Lewisberry Road (County Road 114) (FAS 416), continue east on this road to Navoo Road (LR 66103) and then turn southeast on this road to House Lane (T927). Take this road east to Ridge Road (T957) and continue east on this road to the Newberry Corporate Boundary. Follow this boundary to the Dauphin County/York County Line on the western shoreline of the Susquehanna River and then follow the shoreline to the Londonderry Corporate Boundary. Follow this boundary across the Susquehanna River to the eastern shoreline and the point of origin.

Sector N (ERPAs 1, 4, 6-9, 18-22, 37-47) (Figure 16)

Follow the South Haven Corporate Boundary clockwise from its intersection with the Lower Paxton/West Hanover Corporate Boundaries to the East Hanover Corporate Boundary. Then follow this boundary clockwise to the Lebanon County/Dauphin County Line. Proceed along this line south to Conewago Corporate Boundary and then follow this boundary counterclockwise to the Dauphin County/Lancaster County Line. Follow this Line west to Deodate Road (T305), then north on this road to Hertzer Road (T303) and then turn west to Brinser Road (T490). Follow this road north to Geyers Church Road (T696), turn southwest on this road to Felker Road (T490) and then turn northwest on this road to Foxianna Drive (T315). Proceed west on this road to Hillside Drive (LR 22077), then turn northwest on this road to the Royalton Corporate Boundary and follow this boundary clockwise to the eastern shoreline of the Susquehanna River. Follow this shoreline south to the Dauphin County/Lancaster County Line, then follow this Line west across the Susquehanna River to where the Line meets the York County Line. Take this Line north to the Goldsboro Corporate Boundary, go along this boundary clockwise to Pines Road (LR 66003) to State Route 83 and then follow this road northwest to the Newberry Corporate Boundary. Proceed west along this boundary to Siddensburg Road (LR 66001) and then turn north on this road to the Managhan Corporate Boundary. Follow this boundary in a northern direction to the York County/Cumberland County Line, then continue along this Line north to its intersection with Green Lane Drive (T957) and then turn west on this road to Cedar Cliff Road. Follow this road east to Simpson Ferry Road (LR 21022), continue east on this road to State Route 83 and turn north on this road to New Cumberland Corporate Boundary. Follow this boundary east to the Dauphin County/Cumberland County Line. Take this

Take the Royalton Corporate Boundary northeast to Hillside Drive (LR 22077) then turn southeast along this road to Foxianna Drive (T315) and then proceed east along this road to Felker Road (T490). Follow this road southeast to Geyers Chruch Road (T696) and then turn northeast along this road to Brinser Road (T490). Proceed along this road south to Hertzer Road (T303), then go east to Deodate Road (T305). Turn south along this road to the Dauphin County/Lancaster County Line, then follow this line east to the Lebanon county/Lancaster County Line. Continue or this line east to county Road 241 (FAS 280), then turn south on this road to Trail Road (T328) and then remain south on this road to Quarry Road (T855). Continue south along this road to Miltongrove Road (LR 36004), then go south on this road to Orchard Road (LR 36069). Proceed east on this road to Mussler Road (LR 36068), then again turn south on this road to County Road 230 (FAS 129) and then return east to the East Donegal Corporate Boundary. Follow this boundary South to Donegal Springs Road (LR 36004), then turn west on this road to Church Road (T316) and then move south on this road to Kraybill Road (T827). Continue along this road to Colebrook Road (LR 36004), proceed south on this road to Rock Point Road (T637) and then turn west on this road to Fuhrman Road. Take this road south to Maytown Road (County Road 743) (LR 36070), then south on this road to a point where the road terminates near the Susquehanna River's eastern shoreline. Take in a straight line south across the River to a point directly opposite Accomac Road (LR 66089). Follow this road south to Dark Hollow Road (T776), continue south on this road to Hauser School Road (LR 66018) and then turn west on this road to Furnace Road (LR 66152). Proceed west on this road to Millstone Road, turn south on this road to Spring Road (T783) and then return west on this road to Druck Valley Road (LR 66019). Follow this road west to Mount Zion Road (LR 66020), turn north on this road to Druck Street (LR 66021), go southwest on this road to Mudis Hill Road (LR 66021) and then turn west along this road to Woodland View Drive (LR 66086). Proceed southwest along this road to N. George St. (County Road 181) (FAS250) to Lightner Road, turn west on this road to the Susquehanna Trail (LR 66003) and then turn south along this road to State Road 30. Follow this road west to the City of York Corporate Boundary. Proceed on this boundary northwest to the Manchester Corporate Boundary. Follow this boundary clockwise to the East Manchester Corporate Boundary, turn north along this boundary to the Conewago Corporate Boundary and then west along this boundary to State Route 83. Follow this road northwest to York Haven Road (County Road 382) (FAS250), turn east on this road to County Road 295 (LR 66002) and then at the termination of this road follow a straight line to the western shoreline of the Susquehanna River. Follow the shoreline to the Londonderry Corporate Boundary and then return eastward to the eastern shoreline of the Susquehanna River to the point of origin.

Sector M (ERPA's 1, 4-6, 14-17, 30, 32-37) (Figure 15)

Follow the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Dauphin County/Lancaster County Line. Proceed along this line west across the Susquehanna River to where this Line meets the York County Line. Follow this Line southeast to the York Haven Corporate Boundary, then follow this boundary counter-clockwise to the Lancaster County/York County Line and then proceed

Boundary. Turn south along this boundary to Harrisburg Avenue (LR 36117) and proceed west along this road to the Elizabethtown Corporate Boundary. Follow this boundary counterclockwise until it intersects Bainbridge Road (County Road 241) (FAS 280), then follow along this road southwest to Bossler Road (LR 36072), turn southeast along this road to Oak Road and then go south on this road to the Conoy Corporate Boundary. Proceed southwest along this boundary to the Lancaster County/York County Line on the western shore of the Susquehanna River. Follow the boundary counterclockwise to the Manchester Corporate Boundary. Then follow this boundary counterclockwise to Manchester Street (T951), and turn west along this route to Locust Point Road (LR 66038). Take this route northwest to the Manchester Corporate Boundary and follow the boundary clockwise to the Newberry Corporate Boundary. Continue on this boundary east to the Susquehanna Trail (T686) and then turn northwest along this road to Old York Road (LR 66215). Follow this road north to the Pennsylvania Turnpike (State Route 76), then proceed east on this road to County Road 283 and continue east on this road to the Londonderry Corporate Boundary which was the point of origin.

Sector K (ERPA's 1-10, 21-26) (Figure 13)

Follow the South Hanover Corporate Boundary clockwise from its intersection with the Lower Paxton/West Hanover Corporate Boundaries to the East Hanover Corporate Boundary. Then follow this boundary clockwise to the Lebanon County/Dauphin County Line. Proceed along this line south to Stouffers Road (T335), turn northeast on this road to Ville Road (LR 38001), go south on this road to Upper Lawn Road (County Road 341) (T331) and then turn east on this road to Lawn Road (LR 38001). Follow this road south to the Lebanon County/Lancaster County Line, take this line west to County Road 241 (FAS 280), then turn south along this road to Trail Road (T328) and again south along this road to Quarry Road (T855). Continue south along this road to Miltongrove Road (LR 36004), and again on this road south to County Road 230 (FAS129). Turn east to the East Donegal Corporate Boundary. Follow this boundary south to Harrisburg Avenue (LR 36117). Proceed west along this road to the Elizabethtown Corporate Boundary and follow this boundary clockwise to Turnpike Road (LR 36001). Then turn west along this road to Black Swamp Road and go south along this road to Keener Road (T861). Take this road west to River Road (FAS 407), then follow this road to the Dauphin County/Lancaster County Line on the eastern shoreline of the Susquehanna River. Following this line west across the Susquehanna River to where it meets the York County Line. Take the York County/Dauphin County Line north along the western shoreline of the Susquehanna River to the Londonderry Corporate Boundary, then return eastward to the eastern shoreline of the Susquehanna River and turn west along the Middletown Corporate Boundary. Proceed north along the Middletown Corporate Boundary to the Lower Swatara Corporate Boundary and then continue north along this boundary to the Lower Paxton Corporate Boundary. Follow this boundary north to the point of origin.

Sector L (ERPA's 1-3, 10-15, 25-32) (Figure 14)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Royalton Corporate Boundary.

line southeast until it meets the western mainland shoreline of the Susquehanna River. Follow the shoreline northwest to a point directly east of Maples Street (LR 66153). Travel directly west to Maple Street (LR 66153) and follow this route southwest to the Mount Wolf Corporate Boundary. Follow the boundary counterclockwise to the Manchester Corporate Boundary. Continue along this boundary counterclockwise to Manchester Street (T951), then proceed west along this route to Conewago Avenue (T940) and west along this route to Locust Point Road (LR 66038). Take this route northwest to the East Manchester Corporate Boundary, then south along this boundary to Lewisberry Road (LR 66003) and then go northwest along this road to Conewago Corporate Boundary. Follow the boundary clockwise to the Newberry Corporate Boundary and then follow this boundary clockwise to the Lewisberry Corporate Boundary. Continue along this boundary counterclockwise until it meets the Newberry Corporate Boundary. Then, follow this boundary to the Dauphin County/York County Line on the western shoreline of the Susquehanna River and follow the shoreline to the Londonderry Corporate Boundary. Take this boundary across the Susquehanna River to the eastern shoreline and the point of origin.

Sector I (ERPA's 1, 4, 6-9, 18-20) (Figure 11)

Follow the eastern shoreline of the Susquehanna River south from the Royalton Corporate Boundary to the Dauphin County/Lancaster County Line. Then proceed on this line west across the Susquehanna River to where the line meets the York County Line. Follow this line north to the Goldsboro Corporate Boundary, and then west along Pines Road (LR 66003), to State Route 83. Follow State Route 83 northwest to the Newberry Corporate Boundary, then east along the boundary to Susquehanna Trail (T686) and then northwest along this road to Old York Road (LR 66215). Take this road north to the Pennsylvania Turnpike (State Road 76), then follow this route east to County Road 283 and then east on this road to the Londonderry Corporate Boundary. Follow this boundary clockwise, to the Conewago Corporate Boundary and then continue on this boundary clockwise south to the Dauphin County/Lancaster County Line. Take this line west to Deodate Road (T305), then proceed north on this road to Hartzer Road (T303) and then turn west to Brinser Road (T490). Follow this road north to Geyers Chruch Road (T696), then proceed southwest on this road to Falker Road (T490) and then turn northwest on this road to Foxianna Drive (T315). Go west on this road to Hillside Drive (LR 22077), then take this road northwest to the Royalton Corporate Boundary. Follow this boundary clockwise to the point of origin.

Sector J (ERPA's 1-20) (Figure 12)

Follow the Londonderry Corporate Boundary eastward from Swatara Creek to the Conewago Corporate Boundary. Proceed along this boundary south to the Dauphin County/Lancaster County Line. Follow this line east to County Road 241 (FAS 280), then turn south along this road to Trail Road (T328) and continue south along this road to Quarry Road (T855). Again proceed south along this road to Miltongrove Road (LR 36004), remain on this road south to Grandview Road (LR 36124) and then continue south on this road to Orchard Road (LR 36069). Turn east on County Road 230 (FAS 129) and then continue east to the East Donegal Corporate

south along this road to Keener Road (T861). Continue along this road west to River Road (FAS 407), then north on this road to the Dauphin County/Lancaster County Line on the eastern shoreline of the Susquehanna River. Following this Line west across the Susquehanna River to where it meets the York County Line. Take the York County/Dauphin County Line north along the western shoreline of the Susquehanna River to the Londonderry Corporate Boundary, then return eastward to the eastern shoreline of the Susquehanna River and proceed west along the Middletown Corporate Boundary. Follow north along the Middletown Corporate Boundary to the Londonderry Corporate Boundary and continue north along this boundary to the point of origin.

Sector G (ERPA's 1-3, 10-15) (Figure 9)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Royalton Corporate Boundary. Proceed along the Royalton Corporate Boundary northeast to Hillside Drive (LR 22077). Turn southeast along this road to Foxianna Drive (T315) and then east along this road to Folker Road (T490). Again proceed southeast along this road to Geyers Church Road (T696) and then northeast along this road to Brinser Road (T490). Continue along this road south to Hertzer Road (T303), and the Dauphin County/Lancaster County Line. Turn east along this Line to Harrisburg Pike (FAS 129) and then east along this road to the Elizabethtown Corporate Boundary. Follow this boundary counterclockwise to Bain Bridge Road (County Road 241) (FAS 280), then southwest along this road to Bossler Road (LR 36072), then southeast along this road to Oak Road south to the Conoy Corporate Boundary. Proceed southwest along this boundary to the Lancaster County/York County Line on the western shore of the Susquehanna River. Follow the mainland shoreline to a point directly east of Maple Street (LR 66153), travel directly west to Maple Street (LR 66153) and follow this route southwest to the Mount Wolf Corporate Boundary. Follow the boundary counterclockwise to the Manchester Corporte Boundary, continue along the boundary counterclockwise to Manchester St. (T951), then west along this route to Conewago Ave. (T940). Continue in a westerly direction along this route to Locust Point Road (LR 66038). Follow this route northwest to the East Manchester Corporate Boundary, then north along this boundary to the Connewago Corporate Boundary and then west along this boundary to State Route 83. Proceed along this road northwest to York Haven Road (County Road 382) (FAS 250), then turn east along this road to County Road 295 (LR66002) and after this road terminates, follow in a straight line to the western shoreline of the Susquehanna River. Continue along the shoreline to the Londonderry Corporate Boundary and then return eastward to the eastern shoreline of the Susquehanna River to the point of origin.

Sector H (ERPA's 1, 4-6, 14-17) (Figure 10)

Follow the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Dauphin County/Lancaster County Line. Then follow this line west across the Susquehanna River to where the line meets the York County Line. Proceed along this line southeast to the York Haven Corporate Boundary, then follow this boundary counterclockwise to the Lancaster County/York County Line and continue on this

Sector D (ERPA's 1,4,6) (Figure 6)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Dauphin County/Lancaster County Line. Take this Line west across the Susquehanna River to where the Line meets the York County Line then along this line north to the Goldsboro Corporate Boundary. West along Pines Road (LR 66003) to State Route 83. Follow State Route 83 northwest to the Newberry Corporate Boundary, then east along this boundary to the Dauphin County/York County Corporate Boundary on the western shoreline of the Susquehanna River. Follow this boundary southeast to the Londonderry Corporate Boundary, then east across the Susquehanna River to the point of origin.

Sector E (ERPA's 1-6) (Figure 7)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Royalton Corporate Boundary. Along the Royalton Corporate Boundary northeast to Hillsdale Drive (LR22077). Southeast along this road to Foxianna Drive (T315) and then east along this road to Felker Road (T490). Southeast along this road to Geyers Church Road (T696) and then northeast along this road to Brinser Road (T490). South on this road to Hertzer Road (T303) then east to Deodate Road (T305). Then south along this road to the Dauphin County/Lancaster County Line and then west along this boundary to Turnpike Road (LR 36001). West along this road to Black Swamp Road and then south along this road to Keener Road (T861). Follow this road west to River Road (FAS 407), then north on this road to the Dauphin County/Lancaster County Line on the eastern shoreline of the Susquehanna River. Following this Line west across the Susquehanna River to where it meets the York County Line. Take the Dauphin County/York County Line north to a point directly east of County Road 295 (LR 66002). Follow in a straight line west to County Road 295 (LR 66002) and then west along this road to County Road 382 (FAS 250). West along this road to State Route 83 and then northwest on this route to the Newberry Indefinite Boundary. East along this boundary on the western shoreline of the Susquehanna River. Follow this boundary southeast to the Londonderry Corporate Boundary, then east across the Susquehanna River to the point of origin.

Sector F (ERPA's 1-3, 7-10, 25) (Figure 8)

Follow the Londonderry Corporate Boundary eastward from the Swatara Creek to the Conewago Corporate Boundary. Along this boundary south to the Dauphin County/Lancaster County Line. Follow this Line east to the Lebanon County/Lancaster County Line east to County Road 241 (FAS 280), then south along this road to Trail Road (T328), and continue south to Quarry Road (T855). South along this road to Miltongrove Road (LR 36004), then south on this road to Grandview Road (LR 36124) and again south on this road to Orchard Road (LR 36069. Turn east on this road to Mussler Road (LR 36068), then south on this road to County Road 230 (FAS 129) and again east to the East Donegal Corporate Boundary. Follow this boundary south to Harrisburg Ave. (LR 36117). Turn west along this road to the Elizabethtown Corporate Boundary and follow this boundary counterclockwise until it intersects with Turnpike Road (LR 36001). Proceed west along this road to Black Swamp Road and then turn

Sectors A (EPRA's 1-2) (Figure 3)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Royalton Corporate Boundary. Following the Royalton Corporate Boundary northeast to Hillsdale Drive (LR 22077). Southeast along this road to Foxanna Drive (T325) and then east along this road to Felker Road (T490). Then southeast along this road to Geyers Church Road (T696) and then northeast along this road to Brinser Road (T490). Along this road south to Hertzer Road (T303), then east to Duedate Road (T305). South along this road to the Dauphin County/Lanster County Line and west along this line to the eastern shoreine of the Susquehanna River. Following this line west acros the Susquehanna River to where it meets the York County Line, then north along the York County/Dauphin County Line on the western shoreline of the Susquehanna River to the Londonderry Corporate Boundary. From this point, return eastward to the eastern shoreline of the Susquehanna River.

Sectors B (ERPA's 1-3) (Figure 4)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Royalton Corporate Boundary. Following the Royalton Corporate Boundary northeast to Hillsdale Drive (LR22077). Southeast along this road to Foxanna Drive (T325) and then east along this road to Felker Road (T490). Then southeast along this road to Geyers Church Road (T696) and then northeast along this road to Brinser Road (T490). Along this road south to Hertzer Road (T303) then east to Deedate Road (T305). South along this road to the Dauphin County/Lancaster County Line and then west along this Line to the Conoy Corporate Boundary. South along this Boundary to Turnpike Road (LR 36001), then west along this road to Black Swamp Road South along this road to Keener Road (T861), and west along this road to River Road (FAS 407), then north on this road to the Dauphin County/Lancaster County Line on the eastern shoreline of the Susquehanna River. Following this Line west across the Susquehanna River to where it meets the York County Line, then north along the York County/Dauphin County Line on the western shoreline of the Susquehanna River to the Londonderry Corporate Boundary. From this point, return eastward to the eastern shoreline of the Susquehanna River.

Sector C (ERPA's 1,4,5) (Figure 5)

Following the eastern shoreline of the Susquehanna River south from the Londonderry Corporate Boundary to the Dauphin County/Lancaster County Line, then following this line west across the Susquehanna River to where the Line meets the York County Line. North on the Dauphin County/York County Line to a point directly east of County Road 295 (LR 6002). Then in a straight line west to County Road 295 (LR 66002). West along this road to County Road 382 (FAS 250). Continuing west along this road to Pines Road (LR 66003). Northeast along Pines Road to Goldsboro Corporate Boundary. Follow this boundary north, then east to the Dauphin County/York County Line along the western shoreline of the Susquehanna River to the Londonderry Corporate Boundary. Follow this boundary east across the Susquehanna River to the point of origin.

Appendix B

Description of Sector Boundaries

(Refer to Figures 3-17)

Table 2: Example of Summary of Results of Evacuation Times Analysis

AREAS	WITHIN TWO MILES	WITHIN FIVE MILES	WITHIN TEN MILES
Permanent Population			
Permanent Pop. Vehicles			
Transient Population			
Transient Pop. Vehicles			
Evacuation Capacity Per Hour			
Notification Time			
Preparation Time			
Permanent Pop. Response Normal Conditions			
Permanent Pop. Response Adverse Conditions			
Transient Pop. Response Normal Conditions			
Transient Pop. Response Adverse Conditions			
General Pop. Evac. Time Normal Conditions			
General Pop. Evac. Time Adverse Conditions			
Confirmation Time			
Special Pop. Evac. Time Normal Conditions			
Special Pop. Evac. Time Adverse Conditions			

Table 1: Example of Roadway Characteristics

Segment	Number[1] of Lanes	Type[2]	Capacity[3]	Comments[4]

NOTES:

[1] Total number of through lanes in both directions. If roadway cross section is not uniform, use section with least number of lanes

[2] F = Freeways and Expressways
U = Urban Streets
R = Rural Highways

[3] If known

[4] Indicate any special conditions that may affect roadway capacity.

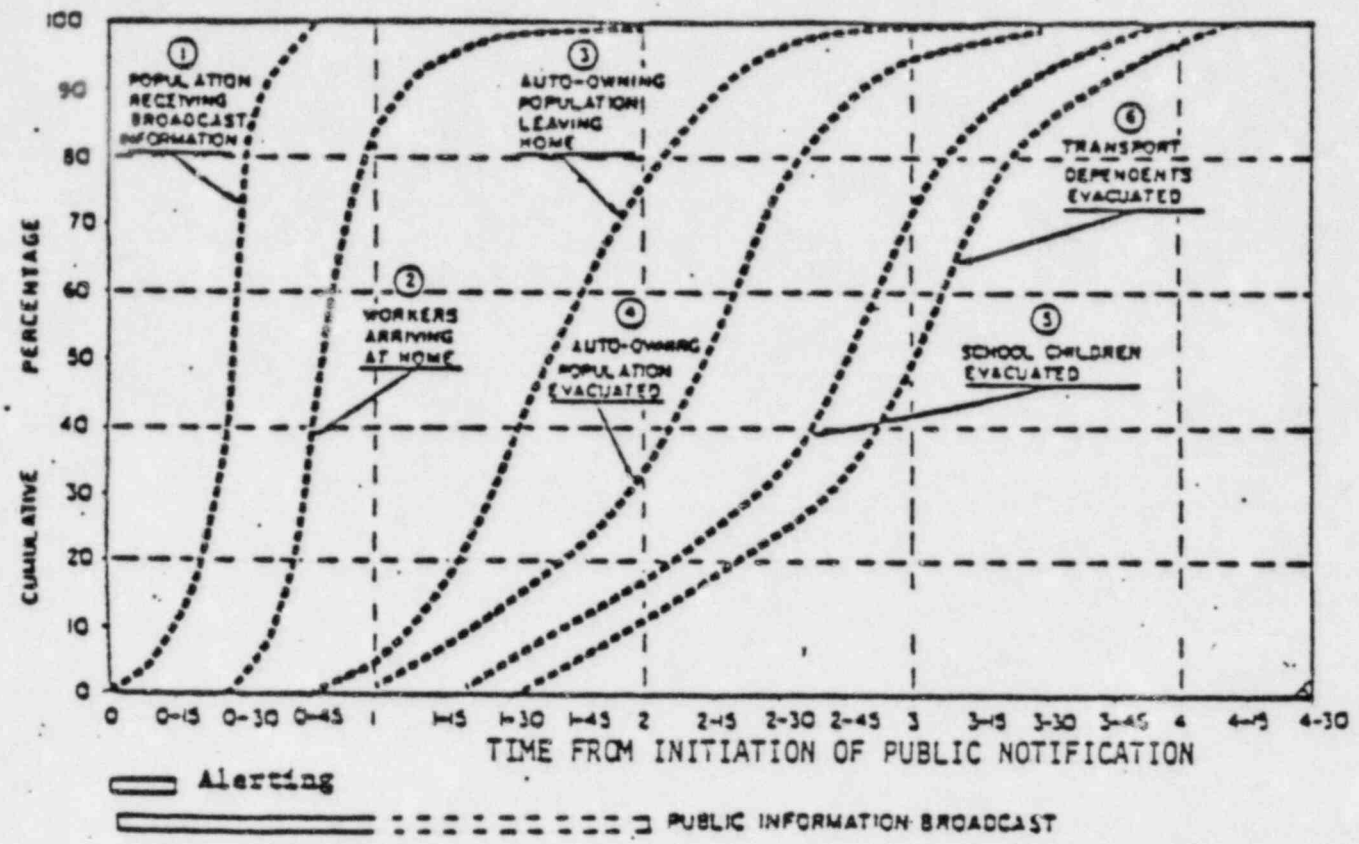


Figure 4: Example of Additional Reporting Format for Time Estimates of Population Evacuation When Probability Distributions Are Used .

Note: These curves are suggestive of a hypothetical 10-mile radius EPZ. Similar curves can be developed for sub-areas of the entire EPZ. The horizontal displacement of these curves along the time axis as well as the slope of the curves will vary depending upon the characteristics of the EPZ or sub-areas of the EPZ.

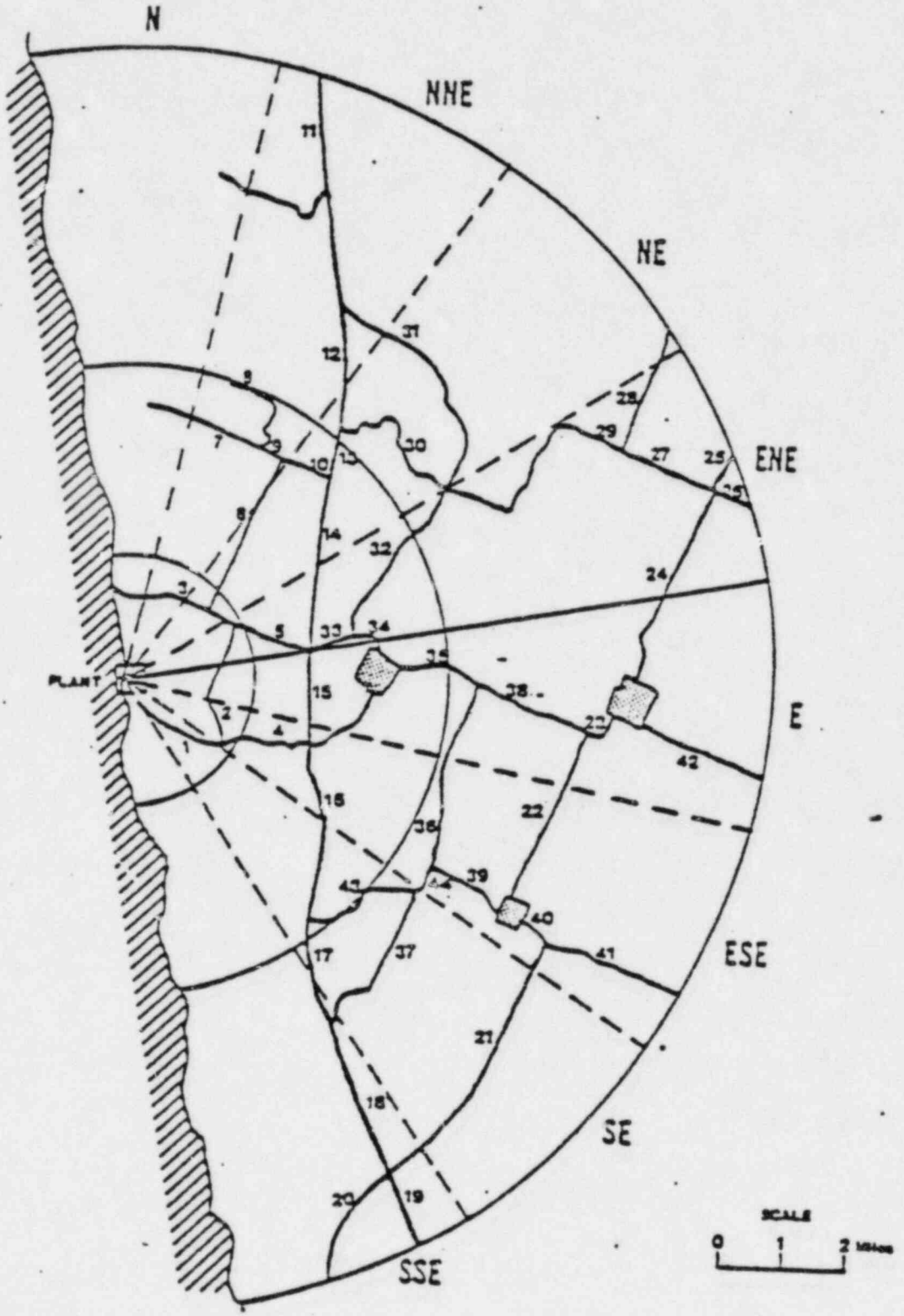
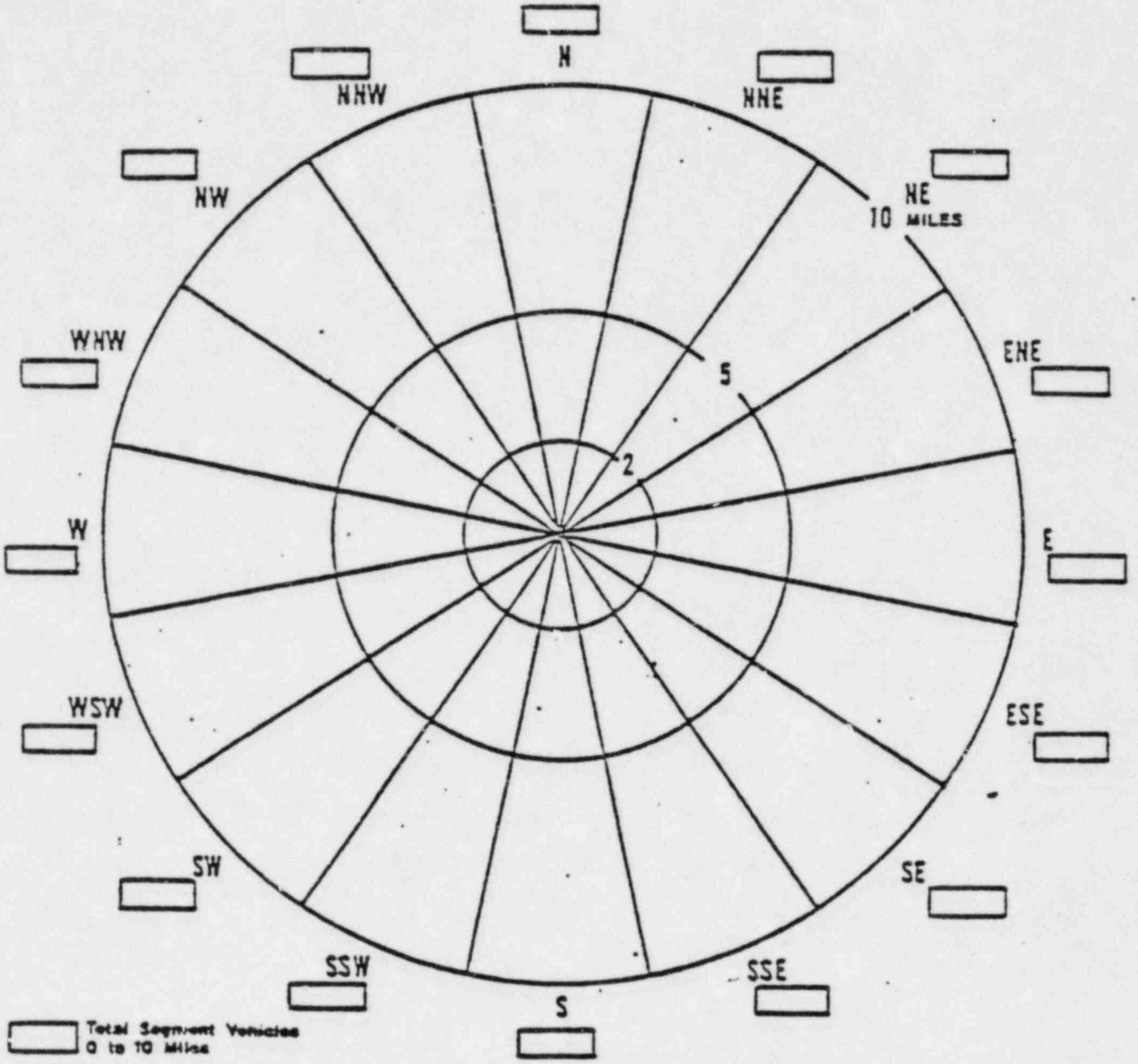
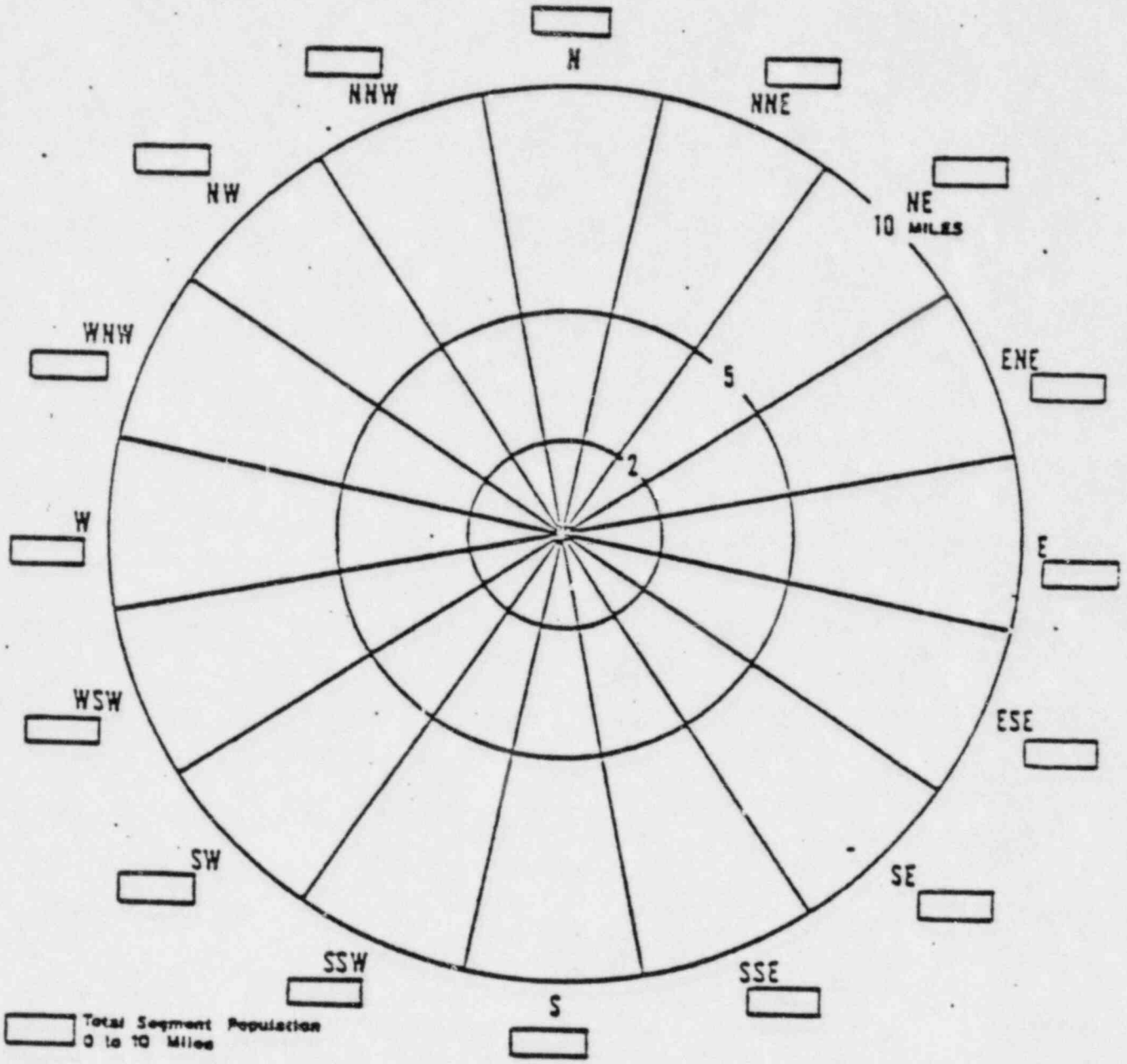


Figure 3: Example of Evacuation Roadway Network



VEHICLES TOTALS			
RING MILES	RING VEHICLES	TOTAL MILES	CUMULATIVE VEHICLES
0 - 2		0 - 2	
2 - 5		0 - 5	
5 - 10		0 - 10	

Figure 2: Example of Format for Presenting Vehicle Data By Sector



POPULATION TOTALS			
RING, MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0 - 2		0 - 2	
2 - 5		0 - 5	
5 - 10		0 - 10	

Figure 1: Example of Format for Presentating Population Data By Sector

their evacuation in order to shut down industrial facilities. Each special facility shall be treated on an individual basis. Weather conditions and time of day conditions shall be considered. Consideration shall be given to the impact of peak populations including behavioral aspects.

All of the results shall be reported in the format previously indicated. This format summarizes the maximum time for each component and for each sector. The components may or may not be directly additive based on the methodology used and stated in the report. Where distribution functions are used the percentage of the population as a function of time should be reported (See Figure 4 for an example format).

V. OTHER REQUIREMENTS

The time required for confirmation of evacuation shall be estimated. Candidate methods include visual confirmation by aircraft or ground vehicles and telephone confirmation.

Specific recommendations for actions that could be taken to significantly improve evacuation time shall be given. Where significant costs may be involved, preliminary estimates of the cost of implementing these recommendations shall be given.

A review of the draft submittal by the principal organizations (State and local) involved in emergency response for the site shall be solicited and comments resulting from such review included with the submittal.

distributions are combined to develop the time distributions for the various population segments departing their home or other facility from which they are being evacuated. For example, for the auto-owning population segment, these vehicles are then loaded onto the roadway network in order to compute travel times and delays.

Regardless of the means by which the time and amount of traffic to be loaded on the network is determined (i.e., sequentially or using distribution functions), it is necessary to calculate the on-road travel and delay times. In this step, traffic from each sector is assigned to available evacuation routes, and, if assigned volumes exceed capacity, delay times must be calculated using a queuing analyses. Traffic queue (backup) locations and estimated delay times should be indicated on the area map.

An estimate of the time required to evacuate that segment of the non-car-owning population dependent upon public transport shall be made, in a similar manner to that used for the auto-owning population. This estimate shall include consideration of any special services which might be initiated to serve this population subgroup. Such services might include fixed-route departures from designated assembly points.

Estimates for special facilities shall be made with consideration for the means of mobilization of equipment and manpower to aid in evacuation, and the needs for designated employees or staff to delay

with long evacuation times. When distribution functions are used, estimates are made of the likelihood that each stage in an evacuation sequence will be accomplished within a given period of time. These conditional probabilities depend upon completion of the preceding stage. For example, formulation of family units or other evacuation groups does not commence until notification is received. Some of these distribution functions must be based on the judgment of the estimators. Computation of the joint distribution functions of evacuation times are made. Typically, the joint distribution assumes the form of an S-shape curve as shown in Figure 4. The evacuation time function is fairly smooth for large homogeneous population segments such as the general public. Special facilities, such as hospitals and industrial centers, produce less smooth functions, or discontinuous ones. The assessment of evacuation time may be easily updated should further analyses be conducted, assumptions changed, or new plans developed.

When distributions are used, distribution functions for notification of the various categories of the evacuee population shall be developed. The distribution functions for the action stages after notification predict what fraction of the population will complete a particular action within a given span of time. There are separate distributions for auto-owning households, school population, and transit dependent populations. These distribution functions can be constructed in a variety of ways, depending greatly on the kinds of data available for the actual site being studied. The previously developed conditional

population should consider rain, flooding, or fog as the adverse condition as well as snow with winter population estimates.

The text accompanying the table shall clearly indicate the critical assumptions which underlie the time estimates; e.g., day versus night, workday versus weekend, peak transient versus off-peak transient, and evacuation on adjacent sectors versus nonevacuation. The relative significance of alternative assumptions shall be addressed, especially with regard to time dependent traffic loading of the segments of the evacuation roadway network.

Some modification of the reporting format may be appropriate, depending on local circumstances.

B. Methodology

The method for computing total evacuation time shall be specified. Two approaches are acceptable. The simplest approach is to assume that events are sequential. That is to say, for example, that no one begins to move until all persons are warned and prepared to leave before anyone starts moving. The time is estimated by simply adding the maximum time for each component. This approach tends to over-estimate the evacuation time.

The second approach, which is more complex and will be discussed further, is to combine the distribution functions for the various evacuation time components. This second approach may result in reduced time estimates due to more realistic assumptions. The added complexity of analysis, therefore, may be warranted at sites

The sector and quadrant boundaries shall also be indicated. (See planning elements J.10.a and b.).

B. Roadway Segment Characteristics

A table such as example Table 1 shall be provided indicating all the evacuation route segments and their characteristics, including capacity. The characteristics of a segment shall be given for the narrowest section or bottleneck if the roadway is not uniform in the number of lanes throughout the segment.

IV. ANALYSIS OF EVACUATION TIMES

As indicated previously, evacuation time is composed of several components. Each of these components shall be estimated in order to determine the total evacuation time.

A. Reporting Format

Table 2 shows the desired format for presenting the data and results for each type of evacuation. Each of the evacuation time components is presented along with the total evacuation time. Two conditions -- normal and adverse -- are considered in the analyses. Adverse conditions would depend on the characteristics of a specific site and could include flooding, snow, ice, fog or rain. The adverse weather frequency used in this analysis shall be identified and shall be severe enough to define the sensitivity of the analysis to the selected events. These conditions will affect both travel times and capacity. More than one adverse condition may need to be considered. That is, a northern site with a high summer tourist

Populations shall be provided by evacuation areas as specified in planning element J.10.b. For the purpose of determining evacuation times it may also be useful to summarize population data by sector and distance from the plant. Figure 1 is an example of such a summary. Separate totals shall be provided for the three population segments. Figure 2 shows the population totals translated into the number of vehicles estimated to be used in evacuation.

III. TRAFFIC CAPACITY

This section of the report shall show the facilities to be used in evacuation. It shall include their location, types, and capacities. A complete review shall be made of the road network. Analyses shall be made of travel times and potential locations for serious congestion in potential corridors. (The analyses may be simplified in extreme rural areas.) The entire road network shall be used but local routes shall be carefully selected and analyzed to minimize their impact on the major routes should queuing or cross traffic conflicts occur. Care shall be taken to avoid depending only on high-capacity interstate and similar type routes because of limitations of on-ramp capacities. Alternatively, special traffic management plans may be developed to effectively utilize available capacity. Evacuation shall be based on general radial dispersion.

A. Evacuation Roadway Network

A map showing only those roads used as primary evacuation routes shall be provided. Figure 3 is an example. The map need not show local access streets necessary to get to the evacuation routes. Each segment of the network shall be numbered in some manner for reference.

D. Emergency Planning Zone and Sub-areas

The sub-areas for which evacuation time estimates are required must encompass the entire area within the plume exposure EPZ. Additionally, evacuation time estimates are also required for simultaneous evacuation of the entire plume exposure pathway. The areas to be considered are as follows:

Radius	Area
about 2 miles	four 90° sectors
about 5 miles	four 90° sectors
about 10 miles (EPZ)	four 90° sectors
about 10 miles (EPZ)	entire EPZ

When making estimates for the outer sectors, assume that the inner adjacent sectors are being evacuated simultaneously. The boundaries of the sub-areas shall be based upon the same factors as the EPZ, namely demography, topography, land characteristics, access routes, and local jurisdictions. To the extent practical, the sector boundaries shall not divide densely populated areas. Where meteorological conditions such as dominant wind directions, warrant special consideration, an additional sub-area may need to be defined and a separate estimate made for this case. The EPZ and its sub-areas shall be identified by mapping on United States Geological Survey (USGS) 7-1/2-minute series quadrant maps when available. Special facilities shall also be noted on these maps, to the extent that their locations can be geographically specified.

without autos. The number of vehicles used by permanent residents is estimated using an appropriate auto occupancy factor. A range of two to three persons per vehicle would probably be reasonable in most cases.

An alternative approach is to calculate the number of vehicles based on the number of households that own vehicles assuming one vehicle per household is used in evacuation. Regardless of the approach used, special attention must be given to those households not having automobiles. The public transport-dependent population must, therefore, be considered as a special case.

B. Transient Populations

Estimates of transient populations shall be developed using local data such as peak tourist volumes and employment data for large factories. Automobile occupancy factors would vary for different transient groups. Tourists might have automobile occupancy factors in the range of three to four while a factory would probably have a factor of less than 1.5 persons per vehicle. This population segment along with the permanent population subgroup using automobiles constitute the general population group for which an evacuation time estimate shall be made.

C. Special Facility Population

An estimate for this special population group shall usually be done on an institution-by-institution basis. The means of transportation are also highly individualized and shall be described. Schools shall be included in this segment.

B. General Assumptions

All assumptions used in the analysis shall be provided. The assumptions shall include such things as automobile occupancy factors, method of determining roadway capacities, and method of estimating populations.

C. Methodology

A description of the method of analyzing the evacuation times shall be provided. If computer models are used, a general description of the algorithm shall be provided along with a source for obtaining further information or documentation.

II. DEMAND ESTIMATION

The objective of this section is to provide an estimate of the number of people to be evacuated. Three potential population segments shall be considered: permanent residents, transients, and persons in special facilities. Permanent residents includes all people having a residence in the area, but not in institutions. Transients shall include tourists, employees not residing in the area, or other groups that may visit the area. Special facility residents include those confined to institutions such as hospitals and nursing homes. The school population shall be evaluated in the special facility segment. Care should be taken to avoid double counting.

A. Permanent Residents

The number of permanent residents shall be estimated using the U. S. Census data or other reliable data, adjusted as necessary, for growth. (See planning element J.10.b.). This population data shall then be translated into two subgroups: 1) those using autos and those

APPENDIX A

EVACUATION TIME ESTIMATES WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE

The following is an example of what shall be included in an evacuation times assessment study and how it might be presented. The example includes a complete outline of material to be covered, but only a few typical tables and explanations are provided. The requirements are intended to be illustrative of necessary considerations and provide for consistency in reporting. Because the evacuation time estimates will be used by those emergency response personnel charged with recommending and deciding on protective actions during an emergency the evacuation time estimates should be updated as local conditions change (e.g., change in type or effectiveness of public notification system).

I. INTRODUCTION

This section of the report should make the reader aware of the general location of the nuclear power plant and plume exposure pathway emergency planning zone, and generally discuss how the analysis was done.

A. Site Location and Emergency Planning Zone

A vicinity map showing the plant location shall be provided along with a detailed map of the plume exposure pathway emergency planning zone (EPZ). The map shall be legible and identify transportation networks, topographical features and political boundaries. (See planning element J.10.a.)

Metropolitan York Pennsylvania: Visual Encyclopedia prepared by Marshall Penn-York Co., 1979.

New Jersey/Pennsylvania Map prepared by American Automobile Association, 1980 edition.

South Eastern Pennsylvania Map: Visual Encyclopedia prepared by Marshall Penn-York Co., 1979.

Map of York: Pennsylvania and Vicinity prepared by Champion Map Corp.

Chamber of Commerce of the Greater Harrisburg Area, Greater Harrisburg, Pennsylvania: City and County, 1974.

Pennsylvania Recreational Guide prepared by Department of Environment Resources: Office of Resources Management and Bureau of State Parks, 1980.

Lancaster Count Pennsylvania, Street and Road Map; Alfred B. Batton, Inc.; 1979.

Southeastern Pennsylvania Zip Code Map; Alfred B. Lanton, Inc., 1974.

33. Pennsylvania Emergency Response Plan, Commonwealth of Pennsylania Department of Health; February 1980.

34. Personal conversation with Mr. Richard S. Hackman, District Traffic Engineer, Pennsylvania Dept. of Transportation. 12-18-80.

35. Disaster Operations Plan Annex E Fixed Nuclear Facility Incident, Commonwealth of Pennsylvania, March 28, 1980 (Revised Edition).

36. Personal conversation with Dr. Stephen S. Salomon, State Programs Officer of the NRC. 12-19-80.

37. Criteria for Preparation and Evaluation of Radiologial Emergency Response Plans and Preparedness in Support of Nuclear Power Plants NUREG-0654, FEMA-REP-1., REV. 1 APPENDIX 4, NOVEMBER 1980.

38. A Policy on Design of Urban Highways and Arterial Streets; American Association of State Highway and Transportation Officials (Washington, D.C.); 1977.

39. Personal conversation with Mr. Thomas Smith, GPU. Emergency Preparedness at TMI. 1-30-81.

40. U.S. Department of Transportation: Federal Highway Administration; Manual on Uniform Traffic Control Devices for Streets and Highways; 1978.

Personal conversation with Mr. Robert Johnson, President of the Johnson Bus Company. 1-13-81.

Personal conversation with Mr. Lester Warfel, owner of the Warfel Bus Service. 1-13-81.

Personal conversation with Mr. Jerry Schultz, owner of Schultz Transportation. 1-13-81.

Personal conversation with Mr. Raymond E. Groff, owner of Raymond E. Groff Buses. 1-13-81.

Personal conversation with Mr. Gerald Smith, Vice President of Traffic for the Capital Area Transit Authority. 1-13-81.

Personal conversation with Mr. Weire, Director of Transportation for the Northeastern School District. 1-13-81.

Personal conversation with Mr. Jim Eastman, executive for the York Area Transit Authority. 1-13-81.

Personal conversation with Mr. Bob Warren, Director of Transportation for the Central York School District. 1-13-81.

Personal conversation with owner of the Red Lion Transit Bus Company. 1-14-81.

Personal conversation with Mr. William Shaffer at the Lebanon County Emergency Preparedness office. 1-14-81.

Personal conversation with Mr. Tom Blosser, Director of Cumberland County Emergency Preparedness Office. 1-14-81.

Personal conversation with Mr. John Brabits, official for the Dauphin County Emergency Preparedness Office. 1-14-81.

Personal conversation with Mr. Paul Reese, County Coordinator for Buses for the Lancaster County Emergency Preparedness Office. 1-14-81.

Personal conversation with an assistant of Ms. Patricia Flinchbaugh, Director for the York Transportation Club. 1-14-81.

Personal conversation with an official for the Gross School Bus Service. 1-14-81.

31. Pennsylvania Emergency Management Agency (P.E.M.A.); Evacuation Time Estimates for Three Miles Island; October 28, 1980, Volume I.

32. Maps Used for Information:

United States Geological Survey Maps (U.S.G.S.); 7 1/2° quadrant maps; Middletown Area is the centroid quadrant with 22 quadrant maps extending outward to encompass a 15-mile radius.

P.E.M.A. (Pennsylvania Emergency Management Agency) Evacuation Route Map: 10-20 mile radius; May 1980.

Frey Village Retirement Center
1020 N. Union St.
Middletown, Pa. 17057

Ms. Isabelle Warren
Homeland Nursing Home
5th & Nuench St.
Harrisburg, Pa. 17102

Mr. George L. M. Deibert
Odd Fellows Home of Pa.
999 W. Harrisburg Pike
Middletown, Pa. 17057

Mrs. Constance May
Child Day Care Center
Hummelstown, Middletown Rd.
near Vine St. Exit

25. Lebanon Valley Chamber of Commerce; Lebanon Valley Industrial Directory; August 1979.

26. Department of Education: Diocese of Harrisburg, Pennsylvania Directory 1980-1981.

27. Office of the Lower Dauphin School District Superintendent; Lower Dauphin School District Emergency and Disaster Administration Plan, September 8, 1980.

28. Personal Conversation with Ms. Tilde Sprickel from the Office of Children Youth and Families and Ms. Constance May from the Childrens Care Center; 12-23-80.

29. Nationwide Personal Transportation Study: Automobile Occupancy; Report No. 1; U.S. Dept. of Transporation: Federal Administration; April 1972.

30. For Bus Transport:

Personal conversation with Ralph Miller, General Manager at the Capital Bus Company. 1-13-81.

Personal conversation with Paul Bachman Director of Transportation of the West Shore School District. 1-13-81.

Personal conversation with the secretary for Klase Sunderland of Sunderland Chevrolet. 1-13-81.

Personal conversation with Redd Rollman Director of the Red Rose Transit Authority. 1-31-81.

Personal conversation with Mr. Gerke, President of the Conestoga Transportation Company. 1-13-81.

Hershey, Pa.

Mr. Saff
Community General Osteopathic Hospital
4300 Londonderry Rd.
Harrisburg, Pa.

Mr. Kelly Weist
Leader Nursing & Rehab. Center
800 King Russ Road
Harrisburg, Pa.

Mrs. Dora Vaughan
Helen O. Snavely Memorial Home
R.D. #1
Hummelstown, Pa. 17036

Mr. Richard Esterly
Alcoholism Services Inc.
1924 N. Second St.
Harrisburg, Pa.

Mr. John Logan, M.D.
Harrisburg State Hospital
Cameron & McClay St.
Harrisburg, Pa.

Mr. William Gibson
Elizabethtown Children's Hospital
Elizbethtown, Pa. 17022

Eugene LaRocco
Beistline House
S. 28th Street
Harrisburg, Pa.

Twin Oaks Nursing Home
90 W. Main St.
Campbelltown, P. 17010

Mrs. Gene Blouch
Palmyra Nursing Home
341 N. Railroad St.
Palmyra, Pa. 17078

Rev. Paul Boll
Lebanon Valley Brethren
1200 Grubb St.
Palmyra, Pa. 17078

Mr. Franklin Grayvill
Annville United Christian Church Home
R. D. #1
Annville, Pa. 17003

Personal conversation with Dr. William Gibson, official at the Elizabethtown Hospital for Children and Youth. 1-6-81.

Personal conversation with Mr. Eyer, an official at the Leader Nursing and Rehabilitation Center Elizabethtown. 1-5-81.

Personal conversation with Mr. Walter Wentzel, an official at the Masonic Home. 1-5-81.

Personal conversation with Ms. Nancy Thompson, an official at the Lehman Guest and Boarding Home. 1-5-81.

Personal conversation with Mr. Carl Bodner, an official at the Annville United Church of Christ Home. 1-5-81.

CORRESPONDENCES MADE FOR SPECIAL FACILITY AND SCHOOL DATA

Mrs. Jayne Coover
Manor E.S.
Elm & Coolidge St.
New Cumberland, Pa. 17070

Mr. A. Richart Bittle
Hillside E.S.
7th and Sharon St.
New Cumberland, Pa. 17070

Mr. Robert Lisse
New Cumberland M.S.
9th & Broad Avenue
New Cumberland, Pa. 17070

Mr. John Whittle
Lawn Elementary School
Lawn, Pa. 17041

Sister Mary Stephen
Villa Teresa Nursing Home
1051 Avile Rd.
Harrisburg, Pa. 17109

Miss McGiven
Dauphin County Home & Hospital
Paxton & South 28th Street
Harrisburg, Pa. 17111

Mr. Prelesnik
Harrisburg Hspital
S. Front and Chestnut St.
Harrisburg, Pa. 17111

Mr. Francis
Hershey Medical Center
500 University Drive

Personal conversation with Mr. Lawrence Kirschenbaum, official from the Jewish Home of Greater Harrisburg. 12-17-80.

Personal conversation with Mrs. Papacostas, official at the Blue Ridge Haven East. 12-18-80.

Personal conversation with Mr. William Landis, official at the Alpine Retirement Center. 12-18-80.

Personal conversation with Ms. Cerveris, Vice President of Planning of Hospitals Council of Pennsylvania. 12-18-80.

Personal conversation with Francis Fillipi and Harvey Wilson from the State Dept. of Justice. 12-23-80.

Personal conversation with Michael Faust, Deputy Warden at the Dauphin County Prison. 12/23/80.

Personal conversation with Ms. Angels Flohr, assistant at the Aspin Center. 12-23-80.

Personal conversation with Mr. Al Goodman in the press office at the Dept. of Public Welfare. 1-2-81.

Personal conversation with Mr. Gene Fasig at the State Dept. of Health Long Term Care Division. 1-5-81.

Personal conversation with Ms. Julia Cox, Emergency Coodinator for Long Term Facilities. 1-5-81.

Personal conversation with Ms. Gerry Fallinger, Long Term Care Division Assistant. 1-5-81.

Personal conversation with Ms. Susan Darhower from the Dept. of Public Welfare Office of Children Youth and Families. 1-6-81.

Personal conversation with Ms. Yuanita Mason, Director of Slyvan Heights Home. 1-6-81.

Personal conversation with Mr. Kevin Lamont, Director of the Lodge at Alpine Home. 1-6-81.

Personal conversation with Mr. William Landis official at the Alpine Retirement Center.

Personal conversation with Sr. Rosemarie Budd from the Mercy Crest Convent. 1-6-81.

Personal conversation with an official at the Alcoholism Services in Harrisburg. 1-6-81.

Personal conversation with Mr. David Mills, official at the Oddfellows Home. 1-6-81.

Personal conversation with Mrs. Curtis, official for St. Theresa School. 1-5-81.

Personal conversation with Mr. Richards, official for the New Cumberland Middle School. 1-5-81.

Personal conversation with Mrs. Connie Mohn, official for the Manor Elementary School. 1-5-81.

Personal conversation with Father Richardson at St. Peters Rectory for Catholic Diocessan office number. 1-2-81.

Personal conversation with Sister Mary Anna, principal of St. Margaret Mary School. 1-5-81.

Personal conversation with Mrs. Kramarich, secretary at the Assumptin of the Blessed Virgin Mary School. 1-5-81.

Personal conversation with Sister Francis, principal of St. John's and St. Ann's Schools. 1-5-81.

Personal conversation with Sister Ann, principal of St. Peters School. 1-5-81.

Personal conversation with secretary at Conewago Elementary School. 1-14-81.

Personal conversation with Mr. Fred Nole, Assistant Director for Catholic Schools. 1-5-81.

24. Special Facility Data

Personal conversation with Mr. Mel Knowlton, official for the State Dept. of Public Welfare. 12-23-80.

Personal conversation with Mrs. Gilde Sprickel for State Department Office of Children, Youth and Families. 12-23-80.

Personal conversation with Ms. Constance May, Director of the Childrens Care Center. 12-23-80.

Personal conversation with Mr. Prelesnik, Director at the Harrisbug Hospital. 12-17-80.

Personal conversation with Mr. Robert Palmer, official at the Polyclinic Medical Center. 12-17-80.

Personal conversation with Mr. Lloyd, Personal Director of the Dauphin County Home and Hospital. 12-17-80.

Personal conversation with Mrs. Phillip Ernst, official from the Alpine Retirement Center. 12-17-80.

Personal conversation with Mrs. Susan Pope, official from Colonial Pines Golden Age Home. 12-17-80.

Personal conversation with Mrs. Harvey, office secretary for York Christian Elementary School. 12-30-80.

Personal conversation with Mr. Stricker, principal of the Bainbridge Elementary School. 12-31-80.

Personal conversation with Mr. Shibley, official from the Locust Grove Elementary School. 1-5-81.

Personal conversation with Mr. Richard Henry, official from the Mt. Zion Elementary School. 1-5-81.

Personal conversation with Mr. Smith, official from the Red Land Sr. High School. 1-6-81.

Personal conversation with Mr. David Pertioro, official from the Lawn Elementary School. 1-6-81.

Personal conversation with Mr. Barbusky, official from the Price Elementary School. 1-6-81.

Personal conversation with Mr. Richard Rudisill from the Milton Heshey School. 1-6-81.

Personal conversation with Mr. Aichele, official from the Hershey Intermediate School. 1-6-81.

Personal conversation with Sister Rita Polchin, principal from St. Catherine Labourne School. 1-6-81.

Personal conversation with Mrs. Lewis, official from the Holy Family School. 1-7-81.

Personal conversation with Mrs. Getz, official from the Hillside Elementary School. 1-7-81.

Personal conversation with Sister Francis, principal from St. Johns School. 1-7-81.

Personal conversation with Sister Pauline, principal from St. Joan of Arc School. 1-7-81.

Personal conversation with Mr. Joe Shiara, official from Bishop McDevitt High School. 1-7-81.

Personal conversation with Mr. Carl DeFebo, official for Susquehanna Township Middle School. 1-5-81.

Personal conversation with Mrs. Miles, official for the Progress Grade School. 1-5-81.

Personal conversation with Thomas Lyons, official for the State Police Academy. 1-5-81.

Personal conversation with Mr. Katz, official from the Steelton-Highspire School District. 12-17-80.

Personal conversation with Mr. John Dunlop, official from the Susquehanna School District. 12-15-80.

Personal conversation with Mr. Ron Samuel, official from the Dauphin County Vo-Tech. 12-16-80.

Personal conversation with Mr. Glenn Motter, official from Harrisburg-Steelton-Highspire Vo-tech. 12-16-80.

Personal conversation with Mr. Bruce Conner, official from C.A.I.U. 12-16-80.

Personal conversation with Dr. Eversold, official from the Harrisburg Area Community College. 12-17-80.

Personal conversation with Mr. Kitch, official from the Central Dauphin School District. 12-18-80.

Personal conversation with Mrs. Booth, official from the Derry Township District. 12-18-80.

Personal conversation with Mr. Williams, official for the East High Elementary School and the Mill Rd. Elementary School. 12-19-80.

Personal conversation with Mr. Paviglianti, official for the Rheems Elementary School and Fairview Elementary School. 12-22-80.

Personal conversation with Mr. Peters, official for the Elizabethtown Senior High School and the Middle School. 12-22-80.

Personal conversation with Mr. John Sauter, principal of the Maytown Elementary School. 12-22-80.

Personal conversation with Mr. Dale Leckrone, principal of the Roundtown Elementary School. 12-29-80.

Personal conversation with Mr. Burton Schellhammer, official from the Central York School District, 12-29-80.

Personal conversation with Mr. Arthur Hendricks official from the Northeastern School District. 12-29-80.

Personal conversation with Mr. Thomas Jenkins, official from the Eastern School District. 12-29-80.

Personal conversation with Ms. Bonnie Forestall, secretary for Sister Joseph Delores, official for Catholic Schools in 10-mile radius area. 12-30-80.

Personal conversation with the owner of the Harrisburg East Campground. 2-18-81.

Personal conversation with Ms. Greta Synder of the Hershey Highmeadow Campground. 2-18-81.

Personal conversation with Mr. Joe Coviello of the Ridge Run Campsites. 2-18-81.

Personal conversation with Ms. Elda Roof of the Shaw-N-Tee Campground. 2-18-81.

Personal conversation with Ms. Dot Greason from the Gifford Pinchot State Park. 2-18-81.

Personal conversation with Mr. Earl Witsil of the Park Away Parks Campground. 2-18-81.

16. U.S. Department of Commerce; County Business Patterns, Pennsylvania, 1970 and 1978.

17. Pennsylvania Department of Commerce: Bureau of Statistics Research and Planning; 1980 Industrial Directory of the Commonwealth of Pennsylvania, 27th edition.

18. U.S. Department of Commerce: Bureau of the Census; 1977 Census of Retail Trade; Pennsylvania, March 31, 1980.

19. U.S. Department of Commerce: Bureau of the Census; 1977 Census of Service Industries; Pennsylvania, December 1979.

20. U.S. Department of Commerce: Bureau of the Census; 1977 Census of Wholesale Trade; Pennsylvania, July 10, 1980.

21. Pennsylvania Department of Commerce: Bureau of Statistics Research and Planning; Pennsylvania Industrial Census Series Release Number M-5-78 (for all five counties), 1980.

22. Cumberland County Industrial Enterprises; Cumberland County, Pennsylvania Industrial Enterprises pamphlet; 35 North Tenth St., Lemoyne, Pennsylvania 17043.

23. For School Data

Personal conversation with Mr. James Buffington, official from the Harrisburg City School District. 12-16-80.

Personal conversation with Mr. Henry Hoerner, official from the Lower Dauphin School District. 12-16-80.

Personal conversation with Mr. Calabrese, official from the Middletown School District. 12-17-80.

Personal conversation with Ms. Margaret Marfise from the State Department Bureau of Travel Development.

Personal conversation with Mr. Dick Hackman, District Traffic Engineer for Pennsylvania Department of Transportation. 1-8-81.

Personal conversation with Ms. Debra Staples from the Hotel/Motel Association of Pennsylvania. 1-8-81.

Personal conversation with Mr. Loomis from the State Department on Labor and Industry. 1-8-81.

Personal conversation with Ms. Daphene Lewis from the Three Mile Island Travel Data Center. 1-8-81.

Personal conversation with Mr. James Rutter, Director of the Bureau of Data Reduction. 1-8-81.

Personal conversation with assistant to Ms. Anita Summers at the Public Management Unit for Wharton School of Business. 1-8-81.

Personal conversation with Major Meyer from the Olmstead Air Force Base. 1-8-81.

Personal conversation with Mr. George Giangi, TMI Emergency Preparedness. 1-13-81.

Personal conversation with Mr. Rayford Williams, Director of the State Department Bureau of Parks and Recreation. 1-15-81.

Personal conversation with Ms. Connie Sutton, assistant to Mr. Greg Gove from the State Department on Community Affairs. 1-16-81.

10. Commonwealth of Pennsylvania; Governors Office of Policy and Planning: The Socio-Economic Impacts of the Three Mile Island Accident; December 1980.

11. U.S. Department of Commerce, National Travel Survey 1977; 1979.

12. Pennsylvania Department of Commerce; Highlights of Travel Development in Pennsylvania and U.S.A., 1980.

13. Hotel and Travel Index: Winter 1980-81; Volume 41; Number 4; Business Publications Division of Ziff-Davis Publishing Co. (New York) pp. B923-B948.

14. Pennsylvania Campground Guide; Pennsylania Bureau of Travel Development (Harrisburg, Pa.); Southeast Region; 1980.

15. Campground/Park Data

Personal conversation with Mr. Greg Gove from the State Department on Community Affairs. 1-16-81.

Personal conversation with the owner of the Harrisburg East Campground. 2-18-81.

Personal conversation with Ms. Greta Synder of the Hershey Highmeadow Campground. 2-18-81.

Personal conversation with Mr. Joe Coviello of the Ridge Run Campsites. 2-18-81.

Personal conversation with Ms. Elda Roof of the Shaw-N-Tee Campground. 2-18-81.

Personal conversation with Ms. Dot Greason from the Gifford Pinchot State Park. 2-18-81.

Personal conversation with Mr. Earl Witsil of the Park Away Parks Campground. 2-18-81.

16. U.S. Department of Commerce; County Business Patterns, Pennsylvania, 1970 and 1978.

17. Pennsylvania Department of Commerce: Bureau of Statistics Research and Planning; 1980 Industrial Directory of the Commonwealth of Pennsylvania, 27th edition.

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19. U.S. Department of Commerce: Bureau of the Census; 1977 Census of Service Industries; Pennsylvania, December 1978.

20. U.S. Department of Commerce: Bureau of the Census; 1977 Census of Wholesale Trade; Pennsylvania, July 10, 1980.

21. Pennsylvania Department of Commerce: Bureau of Statistics Research and Planning; Pennsylvania Industrial Census Series Release Number M-5-78 (for all five counties), 1980.

22. Cumberland County Industrial Enterprises; Cumberland County, Pennsylvania Industrial Enterprises pamphlet; 35 North Tenth St., Lemoyne, Pennsylvania 17043.

23. For School Data

Personal conversation with Mr. James Buffington, official from the Harrisburg City School District. 12-16-80.

Personal conversation with Mr. Henry Hoerner, official from the Lower Dauphin School District. 12-16-80.

Personal conversation with Mr. Calabrese, official from the Middletown School District. 12-17-80.

Personal conversation with Mr. Carl Neu from the York Area Chamber of Commerce. 12-29-80.

Personal conversation with Mr. Edward Messner from Greater West Shore Area Chamber of Commerce. 12-29-80.

Personal conversation with Mr. Bob Walker from the Lancaster County Planning Commission. 12-29-80.

Personal conversation with Mr. Mark McKnight of the York County Planning Commission. 12-29-80.

Personal conversation with Mr. Larry Baugher from the Bureau of Employment Security. 12-29-80.

Personal conversation with Mr. Keith Gingrich from the Department of Commerce Bureau of Statistics. 12-30-80.

Personal conversation with Mr. Peter Uhniat from the Pennsylvania Department of Transportation Bureau of Advance Planning. 12-31-80.

Personal conversation with Mr. Robert Buxton, Chief of Information for the State Division of Motor Vehicles. 12-31-80.

Personal conversation with Mr. Skip Becker from the State Commerce Department Bureau of Travel and Development. 12-31-80.

Personal conversation with the Director of Research at the York Public Library. 1-2-81.

Personal conversation with Ms. Jean Kelly from the Lebanon Valley Regional Travel Promotional Agency. 12-31-80.

Personal conversation with Mr. Dale Vogelsong from the York Area Regional Travel Promotional Agency. 1-8-81.

Personal conversation with Mrs. Lucy Kruger from the Cumberland Area Regional Travel Promotional Agency. 1-9-81.

Personal conversation with Ms. Joanne Garrett from the York Area Chamber of Commerce. 1-2-81.

Personal conversation with Mr. Allwein, Staff Representative for the Greater West Shore Area Chamber of Commerce. 1-5-81.

Personal conversation with Ms. Darleen Koonz, secretary for the Lebanon Valley Area Chamber of Commerce. 1-5-81.

Personal conversation with Ms. Suzanne Snyder from the State Department Bureau of Statistics. 1-6-81.

Personal conversation with Dr. Walter Plosila from the Governor's Office of Policy and Planning. 1-6-81.

FOOTNOTES

1. Three Mile Island Emergency Evacuation Plans (Drafts) (Lancaster, Dauphin, Cumberland, Lebanon and York Counties); Emergency Managment Agency, April 1979.

2. U.S. Bureau of the Census; Characteristics of the Population, 1970 Census of Population, Pennsylvania, 1973.

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Personal conversation with Ms. Fran Cunningham, assistant to Mr. Douglas from the Greater Harrisburg Chamber of Commerce. 12-18-80.

Personal conversation with Mr. Harry Flick from the Pennsylvania Dutch Visitors Bureau. 12-18-80.

Personal conversation with Mr. Richard Blouse from the Lancaster Association of Commerce and Industry. 12-23-80.

Personal conversation with Mr. Mylin Hess from the State Department Bureau of Employment Security. 12-23-80.

Personal conversation with Mr. David Wauls from the Lebanon Valley Chamber of Commerce. 12-29-80.

Personal conversation with Mr. Matthew Douglas from the Greater Harrisburg Chamber of Commerce. 12-29-80.

Personal conversation with Ms. Nancy Hoch from the Greater Harrisburg Chamber of Commerce. 12-29-80.