Evacuation Time Estimates for Areas Near the Site of James A. FitzPatrick and Nine Mile Point Power Plants

prepared for
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I. INTRODUCTION

a. On November 29, 1979, the Nuclear Regulatory Commission NRC requested that the power reactor licensees (the Power Authority of the State of New York and the Niagara Mohawk Power Corporation) prepare evacuation time estimates for the James A. FitzPatrick and Nine Mile Point power plants. The information requested was contained in an enclosure to the NRC's letter of November 29, 1979; the enclosure was entitled "Request for Evacuation Time Estimates (After Notification) for Areas Near Nuclear Power Plants." (Copy of the letter and enclosure are attached in the Appendix.)

b. This document presents the estimate of the time required to implement evacuation of areas near the nuclear power plants. The areas for which evacuation estimates are given have an outer boundary of approximately 10 miles radius, basically corresponding to the plume exposure emergency planning zone (EPZ). See Figure 1.

II. EVACUATION SECTORS AND EVACUATION AREAS

Based on the format specified in the November 29, 1979 letter from the NRC, an evacuation area within a circle with approximately a 10-mile radius was defined. As can be seen from Figure 2, the irregularly shaped evacuation area is, in many places, considerably larger than the area included within the 10-mile radius. These irregularities occur because the perimeter of the evacuation area was constructed to follow either natural or political boundaries to the extent possible. Further efforts were taken to avoid bisecting communities and densely populated areas.

Within this evacuation area, ten internal sectors were developed in conformance with the NRC requirements. The internal sectors include: two 180° sectors within a two-mile radius of the power plant; four 90° quadrants in the area between the two- and five-mile radii; and four 90° quadrants between the five- and ten-mile radii. Similar to the outer 10-mile boundary, the boundaries of the ten internal sectors also follow natural or political boundaries wherever possible. As a result, in many cases there is an overlap in the area covered by adjacent sectors.

Because it is assumed that coterminous inner sectors will always be evacuated simultaneously with the outer sectors, an evacuation area is defined as the combination of sectors that would be evacuated in different situations. For example, if Sector 5 is to be evacuated, the evacuation area would include Sectors 2 and 5. Evacuation of Sector 7 would also require the evacuation of Sectors 1 and 3. The list below identifies the sectors which comprise the evacuation areas which are identified as A through J.

As indicated in the list, Evacuation Area K includes all ten sectors. In this case, the internal boundaries and, hence, the overlapping areas are eliminated as this situation requires evacuation of the entire area.

Following is the list of the evacuation sectors in each evacuation area and the figure on which each evacuation area is shown.

Figure	Evacuation Area	Evacuation Sectors
3	B	2
4	G	2, 5
5	H	2, 5, 9
6	I	2, 6
7	J	2, 6, 10
8	A, C, D, E and F	1, 3, 4, 7, 8
9	K	1 through 10

A brief description of the perimeter boundary of each evacuation area follows:

EVACUATION AREA B (SECTOR 2) (Figure 3)

From Shore Oaks Drive at edge of Lake Ontario, south on Shore Oaks Drive to North Road (Co. Rd. 1). West on North Road to Co. Rd. 29. South on Co. Rd. 29 to Middle Road. West on Middle Road to Creamery Road. North on Creamery Road to North Road (Co. Rd. 1). West on North Road to Lake Road (Co. Rd. 1A). Northeast on Lake Road to fourth road on left. Follow fourth road northwest to Lake Ontario.

EVACUATION AREA G (SECTORS 2, 5) (Figure 4)

From Shore Oaks Drive at edge of Lake Ontario, South on Shore Oaks Drive to North Road (Co. Rd. 1). West on North Road to New Haven/Scriba town line. South along New Haven/Scriba town line to Mud Lake Road (Co. Rd. 51). South on Mud Lake Road to Hall Road (Co. Rd. 4). West on Hall Road to County Road 29. North on County Road 29 to O'Connor Road. West on O'Connor Road to May Fly Road. South on May Fly Road to Hall Road (Co. Rd. 4). West on Hall Road to Oswego City Line. North along Oswego City Line to East Albany Street. West on East Albany St. to Penn-Central Railroad. North along Penn-Central Railroad, continuing north across Middle Road to shoreline on Lake Ontario.

EVACUATION AREA H (SECTORS 2, 5, 9) (Figure 5)

From Shore Oaks Drive at edge of Lake Ontario, south on Shore Oaks Drive to North Road (Co. Rd. 1). West on North Road to New Haven/Scriba

town line. South along New Haven/Scriba town line to Mud Lake Road (Co. Rd. 51). South on Mud Lake Road to Hall Road (Co. Rd. 4). East on Hall Road to North Volney Road (Co. Rd. 6). South along North Volney Road to Clifford Road. East on Clifford Road to Cape Horn Road. South on Cape Horn Road to Mount Pleasant-Palermo Road (Co. Rd. 45). West along Mount Pleasant-Palermo Road to junction with Hawk Road. South, then west on Hawk Road to Silk Rd. South on Silk Rd. to Howard Rd. West along Howard Road to County Road 57. North along County Rd. 57 to Chalone Drive. West on Chalone Drive, crossing Penn-Central Railroad and Oswego River to Cunningham Road (Co. Rd. 85). West along Cunningham Road to Ridge Road. North on Ridge Road to Oswego Town Line. West along Oswego Town Line to Rathburn Road. North on Rathburn Road to Furniss Road. West along Furniss Road to Johnson Road (Co. Rd. 7). North on Johnson Road to Tug Hill Road. West on Tug Hill Road to Bunker Hill Road. North on Bunker Hill Road to Maple Avenue (Co. Rd. 20). West on Maple Avenue to Route 104. North on Route 104 to West Lake Road. West on West Lake Road to Lake Shore Road. North, then east on Lake Shore Road to the road on southwest boundary of Snake Swamp. North along this road to edge of Lake Ontario.

EVACUATION AREA I (SECTORS 2, 6) (Figure 6)

From Butterfly Creek mouth at Lake Ontario, follow creek to North Road (Co. Rd. 1). East on Co. Rd. 1 to Co. Rd. 43. South on Co. Rd. 43 (Tollgate Rd.) Continue south on Co. Rd. 43 to U S Rte 104. West on U S Rte 104 to Egglestone Road. South on Egglestone Road to Stone Road. West on Stone Road to Darrow Road. South on Darrow Road to Co. Rd. 51. West on Co. Rd. 51 to Mud Lake Rd. (Co. Rd. 51). South on Co. Rd. 51 (Mud Lake Rd.) to Hall Rd. (Co. Rd. 4). West on Hall Road (Co. Rd. 4) to Co. Rd. 29. North on Co. Rd. 29 to Middle Road. West on Middle Road to Creamery Road. North on Creamery Road to North Road (Co. Rd. 1). West on North Rd. to Lake Road (Co. Rd. 1A). Northeast on Lake Road to fourth road on left. Follow fourth road northwest to Lake Ontario.

EVACUATION AREA J (SECTORS 2, 6, 10) (Figure 7)

From mouth of Salmon River at Lake Ontario, follow river south to Selkirk Shores State Park boundary. Follow park boundary south to Co. Rd. 28. Co. Rd. 28 south to Daysville Rd. West on Daysville Rd. to Krebs Road Spur. South on Krebs Road Spur to Krebs Road to Manwaring Rd. Manwaring Rd. southeast to Co. Rd. 41. Southwest on Co. Rd. 41 to Smithers Road. Southeast on Smithers Road to U S Rte 104. U S Rte 104 west to Emery Road. South on Emery Road to Standpipe Rd. (Co. Rd. 58). From Standpipe Rd, south and then east on Stone Road to NYS Rte 69. West on NYS Rte 69 to Larson Road. West on Larson Road to Pumphouse Rd. Pumphouse Road south to Pople Ridge Road. West on Pople Ridge Road to NYS Rte 3. South on NYS Rte 3 to Co. Rd. 4. West on Co. Rd. 4 to Co. Rd 35. South on Co. Rd. 35 to Clifford Road. West on Clifford Road to Red School House Road. South on Red School House Road to Co. Rd. 45. West on Co. Rd. 45 to Baldwin Road. Northwest on Baldwin Road to Silk Road. North on Silk Road to Hall Road (Co. Rd. 4). West on Hall Road to Co. Rd. 29. North on Co. Rd. 29 to Middle Road. West on Middle Road to Creamery Road. North on Creamery Road to North Rd. (Co. Rd. 1) West on North Road to Lake Road (Co. Rd.

1A). Northeast on Lake Road to fourth road on left. Follow fourth road northwest to Lake Ontario.

EVACUATION AREA K (SECTORS 1-10) (Figure 9)

From mouth of Salmon River at Lake Ontario, follow river south to Selkirk Shores State Park boundary. Follow park boundary south to Co. Rd. 28. Co. Rd. 28 south to Daysville Rd. West on Daysville Rd. to Krebs Road Spur. South on Krebs Road Spur to Krebs Road to Manwaring Rd. Manwaring Rd. southeast to Co. Rd. 41. Southwest on Co. Rd. 41 to Smithers Road. Southeast on Smithers Road to U.S. Rte 104. U S Rte 104 west to Emery Road. South on Emery Road to Standpipe Rd. (Co. Rd. 58). From Standpipe Rd., south and then east on Stone Road to NYS Rte 69. West on NYS Rte 69 to Larson Road. West on Larson Road to Pumphouse Rd. Pumphouse Road south to Pople Ridge Road. West on Pople Ridge Road to NYS Rte 3. South on NYS Rte 3 to Co. Rd. 4. West on Co. Rd. 4 to Co. Rd. 35. South on Co. Rd. 35 to Clifford Road. West on Clifford Road to Red School House Road. South on NYS Rte 3 to Co. Rd. 4. West on Co. Rd. 4 to Co. Rd. 35. South on Co. Rd. 35 to Clifford Road. West on Clifford Road to Red School House Road. South on Red School House Road to Co. Rd. 45. West on Co. Rd. 45 to junction with Hawk Road. South, then west on Hawk Road to Silk road. South on Silk Road to Howard Road. West along Howard Road to Co. Rd. 57. North along Co. Rd. 57 to Chalone Drive. West on Chalone Drive, crossing Penn-Central Railroad and Oswego River to Cunningham Road (Co. Rd. 85). West along Cunningham Road to Ridge Road. North on Ridge Road to Oswego County Line. West along Oswego County Line to Rathburn Road. North on Rathburn Road to Furniss Road. West along Furniss Road to Johnson Road (Co. Rd. 7). North on Johnson Road to Tug Hill Road. West on Tug Hill Road to Bunker Hill Road. North on Bunker Hill Road to Maple Avenue (Co. Rd. 20). West on Maple Avenue to Route 104. North on Route 104 to West Lake Road. West on West Lake Road to Lake Shore Road. North, then east on Lake Shore Road to the road on southwest boundary of Snake Swamp. North along this road to edge of Lake Ontario. Remaining sectors extend into Lake Ontario.

III. ASSUMPTIONS AND METHODOLOGY

a. Population

The population for the area covering the 10-mile radius, as well as each of the sectors, was derived from the 1970 U.S. Department of Commerce Census and updated by the 1976 Population Estimates and Projections issued January 1979 by the U.S. Department of Commerce Census.

The overall area was divided into ten sectors with each sector extending beyond its quadrant limits and thereby creating overlapping areas. The total area was identified as the 11th Sector. Each sector was subdivided into varying numbers of subsectors.

Subsector perimeters were determined by any or a combination of the following: census tract delineations, town boundaries, park boundaries, highways or roads. The population of the subsectors was determined from census tracts when the full area of the tract was equal to the area of the subsector. When a subsector was less than or greater than the area of the census tract, block statistics were used to compile the population. In some instances where block statistics were unavailable, house counts were made on the New York State Department of Transportation planimetric maps and a predetermined number of occupants per household based on 1970 U.S. Census was used to determine the population. The sector population is the aggregate of the subsector's population. The population of the total area (11th Sector) is not the sum of Sectors 1 through 10's population because of the overlapping boundaries.

Based on the 1970 Census data of households with automobiles, a ratio was established to determine the number of people with automobiles. . Dividing the number-of-people-with-automobiles by the number-of-people-per-household determined the number of automobiles. The following table shows the 1976 population estimates.

b. Evacuation Time Estimates Methodology

To estimate the time required to evacuate the areas surrounding the nuclear power plants, the evacuation process for each sector was simulated. A process was developed whereby evacuation was analyzed for each evacuation area and used as a basis for estimating the time to evacuate the area population. The evacuation analysis estimated the time for evacuation of the area population through the use of existing transportation facilities.

Of primary concern was to minimize the number of primary evacuation routes and to utilize available public bus transit and special vehicles located either within the ten mile limit or in close proximity. This process was used to determine a best estimate and adverse weather estimate of evacuation times for the general population and special facilities. Subsectors within the sectors were disaggregated into smaller areas (zones) of population concentrations which would produce trips using the major roadways. Upon completion of the sector disaggregation to zones, the following steps were executed in estimating the time to evacuate a particular zone and, subsequently, the sectors and evacuation areas.

Step 1 - Zonal Trip Generation
Step 2 - Transportation Facility Identification
Step 3 - Capacity Determination
Step 4 - Modal Trip Assignment
Step 5 - Evacuation Time Estimation

The process required a certain amount of feedback and iteration within the five steps.

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1976 POPULATION ESTIMATE

Evacuation Area	Evacuation Sector	1976 Population Estimate
B	2	1,088
G	2,5	3,733
H	2,5,9	35,973
I	2,6	2,824
J	2,6,10	9,575
K	1 through 10	43,772

SOURCE: 1970 U.S. Department of Commerce Census, updated by 1976 Population Estimates and Projections, U. S. Department of Commerce Census, January, 1979.

Zonal Trip Generation

This step of the process consists of converting population into vehicle trips at a zonal level. For this purpose the zonal population was divided into general population without vehicles and general population with vehicles. Additionally, the populations of special facilities were identified so that separate evacuation plans could be developed.

When estimating the vehicle trips for the general population with vehicles, it was assumed that one vehicle trip would be generated by each family in evacuating the area. Using average family statistical data, the number of vehicles generated by the general population with vehicles was estimated for each zone.

For the general population without vehicles, both school buses and transit buses with capacities of 40 and 50 persons, respectively, were used. The mixture of transit vehicles depended largely on the estimate of time (best estimate or adverse weather) being made. The number of bus trips estimated were converted to passenger car equivalents (PCE) for purposes of assigning the trips jointly with auto trips to the selected routes. For the adverse weather estimate, school bus trips were determined and also converted to PCEs for assignment purposes. A factor of two was used to convert school and transit buses to passenger car equivalents.

Vehicles generated by special facilities were also estimated and where buses were needed these were converted to PCEs. Special facilities often required a mix of ambulances, wheel chair vehicles and buses for evacuation.

The net result of the trip generation process was the estimation of equivalent passenger vehicles for each zone in the ten mile area.

Transportation Facility Identification

Identification of existing transportation facilities required a determination of the primary evacuation routes and an inventory of the existing transit facilities in or around the ten mile limits.

Based on information provided by the New York State Office of Disaster Preparedness, County officials, field reconnaissance, information on file, and general familiarity with the area, the primary and secondary evacuation routes were selected. Each of the selected routes, as well as others, were traveled in order to assess sufficiency for evacuation purposes and to determine the physical characteristics (number of lanes, lane and shoulder widths) needed for capacity computations.

Information regarding transit facilities and special vehicles available for evacuation was obtained through personal contact with transit operators, school districts, emergency vehicle operators, and the special facilities.

Capacity Determination

A critical element in determining the amount of time needed to evacuate any given area is the capacity of the existing roadways to accomodate the anticipated vehicular volumes generated during evacuation. The procedure used in determining the primary evacuation roadway capacities was based on the Federal Highway Administration's Highway Capacity Manual - 1965 Edition. Capacities were estimated at roadway Levels of Service D and E for use in computing travel times for the adverse weather and best estimate conditions, respectively. A more detailed explanation of the method used in determining these capacities is included in the appendix. The New York State Department of Transportation and the Office of Disaster Preparedness were consulted with regard to using these capacities for the time estimates and concur fully with the approach (see C.P. Kole letter to R.W. Tweedie dated January 25, 1980 in the Appendix).

Modal Trip Assignment

The next step in the process is to assign the trips generated by each zone to the selected fixed routes for evacuation. A computer program was developed which would receive as input a description of all the roadway characters (i.e. free flow speed, link length, and capacity) for the selected evacuation routes, the selected evacuation routes for each zone and the zonal trip generation and terminal time; the program output was a summary of travel times and delays for the evacuation routes and other statistical information which could be used in evaluating the evacuation route selection. In some cases, several computer runs were made for an evacuation area to arrive at the best balance between number of evacuation routes and evacuation time.

In making an assignment of PCEs to the evacuation routes, it was assumed that all trips would be on the route at the same instant. This approach is somewhat conservative since all people do not react alike and, hence, the distribution of evacuees that would more likely occur would not result in all trips on the routes simultaneously.

Evacuation Time Estimates

Best estimates and adverse weather estimates of evacuation times were made separately for the general population (with and without vehicles) and for special facilities. The estimates of evacuation times for each of these categories were comprised of the following.

a) Terminal time, which in the case of vehicles departing from home accounts for the time to drive from the home via feeder streets to the primary evacuation route. For buses and special vehicles (such as ambulances and wheelchair vehicles), terminal time represents the time it takes a driver to go from the bus garage or storage area to its assigned evacuation pick-up area.

b) Roadway travel time is the time it takes a vehicle to traverse the entire length of the evacuation route. This time is a function of the roadway free flow speeds and roadway delays owing to 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 free flow speeds, and the delay time (computed at Level of Service E capacity for the best estimate and Level of Service D capacity for the adverse weather condition).

c) Adverse weather delay time penalty of twenty minutes was added to the evacuation times to account for unpredictable isolated delays associated with adverse weather conditions.

d) General population mobilization time amounting to twenty minutes was added to the estimated evacuation times to account for mobilization at the home end. This was in accordance with the New York State Office of Disaster Preparedness' (ODP) recommended mobilization time for the general population only (as per ODP Report entitled Evacuation Analysis, Ten Mile Radius, Indian Point Nuclear Reactors Site dated December 1979).

e) Multiple trip time for special facilities where a number of round trips were required by ambulances and wheelchair vehicles. In these cases, the roadway travel time included travel time beyond the evacuation limits to a point of destination 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. Where the facility administrators estimated a mobilization time greater than the roadway travel time, the mobilization time plus travel time to the evacuation area limits became the evacuation time.

It should be noted that the times to evacuate general population without vehicles and ambulatory patients in special facilities assumed use of bus facilities only. The use of railroad facilities in the area was not considered. Where feasible, use of the existing rail facilities would be expected to reduce evacuation times.

c. Notification and Confirmation

The NRC's November 29, 1979 request for evacuation times relates primarily to the time required to implement an evacuation as opposed to the times required for notification or confirmation that an evacuation has taken place. The local civil defense directors have furnished the notification and confirmation times listed in Section VI of this document. These estimates are based on the notification and confirmation systems presently in use in the area.

d. Future Efforts

It is anticipated the evacuation time estimates could be refined as an evacuation plan is detailed. The development of details such as implementation of improved public notification systems, EPZ refinements, use of rail facilities during evacuation, and additional input from state and local agencies could all affect to some extent, very probably decreasing, the times presented in this document.

IV. SPECIAL FACILITIES

All the important special facilities within the plume exposure EPZ have been considered in the analysis. Note that elementary, middle and high schools have been considered as part of the general population rather than as special facilities. The following three special facilities have been determined to take the longest time to evacuate:

Special Facility	Location	Reference Designation On Figs.3-9
State University, College at Oswego	Oswego	C
Oswego Hospital	Oswego	H
Lake Ontario	----	---

a. Following is a brief discussion of the three facilities based on data furnished by the college or the hospital administration or by the Coast Guard.

State University of New York (SUNY), College at Oswego (C)

During regular Spring and Fall semester, residential student population is approximately 4200; faculty and staff live off-campus. Therefore, after 10 p.m., the residential students and 10 security staff are on-campus. During peak hours (9 a.m. - 1 p.m.) an additional 1800 commuting students, 404 faculty, and 1096 staff are on campus; between 4:30 and 10 p.m., the additional population is about 800 students, staff, and

faculty. Vehicle registration stickers for residential and commuting students number 992 and 1,542, respectively; faculty and staff register 1,978 vehicles.

Residence halls are closed during January. Approximately 25 staff people remain on campus.

During the summer, there are pre-, regular, and post-sessions to which most students commute. The following table indicates campus population througout the summer:

	9.a.m.	4:30-10p.m.	after 10p.m.
pre-session (June)	1,631	260	4
regular session (July)	2,471	575	4
post-session (August)	1,421	155	4

Occasionally, conferences are held during the summer, to which about 75% of attendees drive. The largest conference held on-campus to date had 700 attendees.

The college administration feels the campus population has adequate facilities to provide for its own evacuation.

Oswego Hospital (H)

With a current inpatient population of 162 at Oswego Hospital, there are 49 patients who would require ambulance transport for evacuation; the remaining patients are ambulatory. Staff numbers range from 301 on day-shits to 53 at night, though this latter figure could be increased through an existing telephone alert system to summon staff in case of emergency. Required patient care staff to patient ratio for evacuation would be 1 to 5, 1 to 8, and 1 to 10 during day, evening, and night shifts, respectively. The Hospital owns one pickup truck; most staff drive and could, therefore, provide for its own evacuation.

Lake Ontario

Lake Ontario is considered a special facility requiring separate evacuation time estimates developed from a set of assumptions different from that applied to the special facilities within Oswego County. One such assumption, based on communication with the U.S Coast Guard, is that the Coast Guard Station Oswego will respond in the event of an emergency by assisting with notification and evacuation of all people and crafts from Lake Ontario. Such assistance will be conditional on the availability of Coast Guard resources from other operational commitments.

b. Analysis of the time to evacuate the special facilities has shown the following:

- The facility which would take the longest time to evacuate is the State University, College at Oswego (C).

- In those evacuation areas which contain no special facilities, evacuation of the general population without cars, including school populations, was found to take the longest time.

- Evacuation planning is not necessary for the months of January through March because of weather conditions.

V. EVACUATION TIME ESTIMATES

a. Notification and Confirmation Time Estimates

The following table indicates the times required to notify the public of a need for evacuation and the time required to confirm that evacuation has taken place.

	Time Required for[1]	
Evacuation Area	Notification	Confirmation
B	1 hr	1 hr 30 min
G	1 hr	2 hrs 30 min
H	1 hr	3 hrs 30 min
I	1 hr	2 hrs 30 min
J	1 hr	3 hrs 30 min
K	1 hr	6 hrs minimum

[1] For the detailed response for each evacuation area, see Appendix C.

b. Evacuation Time Estimates and Route Description

The following table summarizes the estimated evacuation times for each of the six areas to be evacuated. As shown, evacuation times were estimated separately assuming two conditions, a best estimate and adverse weather estimate. The best estimate assumes a summer night at 3:00 AM when the family is together at home. The adverse weather estimate assumes a winter condition occurring at mid-afternoon during a weekday when children are in school, businesses are in progress and the roads, although clear of any recent snowfall, have reduced capacity and operating speeds. Both the best estimate and adverse weather estimate have been computed for both general population and special facilities. With regard to evacuating the general population, it is that population without autos which is the determining factor in both the best estimate and advers weather estimate. With the exception of evacuation areas H and K, there is an adequate bus supply in Oswego County to accommodate the general population without vehicles during the night when school is not in session. However, an estimated terminal time of thirty minutes is required for the buses to travel from their garaged location and pick-up the passengers in their designated area. Evacuation Areas H and K require CENTRO buses from Syracuse which need up to an hour to travel to Oswego and pick up passengers.

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EVACUATION TIME ESTIMATES

Evacuation Area	General Population					Special Facilities[5]	
	Additional Notification Time[1]	Best Estimate		Adverse Weather		Best Estimate	Adverse Weather
		Travel Time[2]	Total[3]	Travel Time[2]	Total[4]		
B	45 min	1 hr 10 min	1 hr 55 min	1 hr 30 min	2 hrs 15 min	-	-
G	45 min	1 hr 10 min	1 hr 55 min	1 hr 40 min	2 hrs 25 min	-	-
H	45 min	2 hrs 50 min	3 hrs 35 min	4 hrs 40 min	5 hrs 25 min	2 hrs 10 min	3 hrs 30 min
I	45 min	1 hr 10 min	1 hr 55 min	1 hr 40 min	2 hrs 25 min	-	-
J	45 min	1 hr 30 min	2 hrs 15 min	2 hrs	2 hrs 45 min	-	-
K	45 min	2 hrs 50 min	3 hrs 35 min	4 hrs 40 min	5 hrs 25 min	2 hrs 10 min	3 hrs 30 min

(1) These figures include the additional notification time above fifteen minutes.
(2) Includes general population mobilization time (20 minutes) and the roadway travel time.
(3) Calculated as the sum of the Additional Notification Time plus the Best Estimate Travel Time.
(4) Calculated as the sum of the Additional Notification Time plus the Adverse Weather Travel Time.
(5) For special facilities it is assumed that notification will occur within fifteen minutes and that mobilization and evacuation will begin immediately thereafter.

For the adverse weather condition the situation is complicated by the fact that school children must be transported to reception centers before the buses can return to pick up the general population without autos. Hence, several trips are required by some buses to evacuate school children and general population without vehicles for evacuation areas H and K. SUNY Oswego College takes the longest time to evacuate of the special facilities for both the best estimate and adverse weather estimate. The next longest time of the special facilities to evacuate is that of Oswego Hospital. This is attributable to the time to evacuate wheelchair patients since the wheelchair vehicles are located in Mexico and require an estimated thirty minutes at night to get to Oswego and load patients. In the daytime, first priority of wheelchair vehicles is to evacuate the Board of Cooperative Education Services (BOCES) wheelchair students to Syracuse before returning to Oswego Hospital for their wheelchair patients.

The following are descriptions of the selected primary evacuation routes for each of the six evacuation areas.

Evacuation Area B (Sector 2) (Figure 3)

The primary routes used in evacuating the 2 mile area are Lake Road and County Route 29 in Scriba and Shore Oaks Drive in that portion of New Haven which is in the evacuation area.

Evacuation Area G (Sector 2,5) (Figure 4)

The primary routes used in evacuating the five mile area incorporating parts of Towns of New Haven and Scriba, and the City of Oswego are:

- Shore Oaks Drive south from New Haven, Route 1 West to Route 29 South, to the Town of Volney;
- Lake Road and Route 29 south through the Town of Scriba to the Town of Volney;
- Route 1 in Scriba west to Kocher Road and south to City Line Road; and
- Klocks Corners Road from the town center of Scriba south to the 5 mile limit (Route 4).

Evacuation Area H (Sectors 2,5,9) (Figure 5)

The primary routes used in evacuating the ten mile area to the southwest of the power plant are:

- Shore Oaks Drive south from New Haven to Route 1 west, to Route 29 south, to Silk Road south, to Route 45 south, and finally to Route 6 south to the limits of the 10 mile area;
- Lake Road and Route 29 south following the same path as before for Route 29, from the Route 1 intersection;

- Route 1 in Scriba west to Kocher Road south, to City Line Road south to Route 4 east, Route 53 south to Route 45 east and to Route 176 south to the 10 mile limit at Howard Road;

- Klocks Corners Road from the town center of Scriba south to Route 4, east on Route 4 to Route 176, and south to the 10 mile limit at Howard Road;

- From the City of Oswego to the 10 mile limit, Route 57 south, Route 48 south, Route 25 south, Route 7 south, U.S. 104 west and Hillside Ave/Gardnier Rd/Route 7 south; and

- From other areas within the 10 mile area, west of the power plants, Routes 57 and 8.

Evacuation Area I (Sectors 2,6) (Figure 6)

The primary routes used in evacuating the five mile area southeast of the power plants are:

- Shore Oaks Drive south from New Haven to Route 1 west to Route 29 south to the Town of Volney;

- Lake Road and Route 29 south through the Town of Scriba to the Town of Volney; and

- Hickory Grove Road, Route 6 and Route 104 in the remainder of New Haven.

Evacuation Area J (Sectors 2,6,10) (Figure 7)

The primary routes used in evacuating the 10 mile area southeast of the power plants are:

- Shore Oaks Drive south from New Haven to Route 1 west, to Route 29 south, and to Silk Road south to Route 45;

- Lake Road and Route 29 south following the same path as before for Route 29 from the Route 1 intersection;

- Hickory Grove Drive south to Route 6, south on Route 6 to Route 64 east and south on Route 35 to the 10 mile limit;

- Route 104B from eastern New Haven and northern areas in the Town of Mexico east to Route 3 and north on Route 3 to the 10 mile limit.

- From Arthur in the Town of Mexico via Clark, Countryman, Lanzier and Newcomb Roads to the 10 mile limit; and

- From the Village of Mexico east via Routes 104 and 58 and south via Route 3 to the 10 mile limit.

Evacuation Area K (Sectors 2,5,6,9,10) (Figure 9)

The primary routes used in evacuating the 10 mile area to the south of the power plants are:

- Shore Oaks Drive south from New Haven to Route 1 west, to Route 29 south, to Silk Road south, to Route 45 south and finally to Route 6 south to the limits of the 10 mile area;

- Lake Road and Route 29 south following the same path as before for Route 29, from the Route 1 intersection;

- Route 1 in Scriba west to Kocher Road south, to City Line Road south, to Route 4 east, Route 53 south to Route 45 east, and to Route 176 south to the 10 mile limit at Howard Road.

- Klocks Corners Road from the town center of Scriba south to Route 4, east on Route 4 to Route 176, and south to the 10 mile limit at Howard Road;

- From the City of Oswego to the 10 mile limit, Route 57 south, Route 48 south, Route 25 south, Route 7 south, U.S. 104 west and Hillside Ave/Gardnier Rd/Route 7 south;

- From other areas within the 10 mile area, west of the power plants, Route 57 and 8;

- Hickory Grove Drive south to Route 6, south on Route 6 to Route 64 east and south on Route 35 to the 10 mile limit;

- Route 104B from eastern New Haven and northern areas in the Town in Mexico east to Route 3 and north on Route 3 to the 10 mile limit;

- From Arthur in the Town of Mexico via Clark, Countryman, Lanzier and Newcomb Roads to the 10 mile limit; and

- From the Village of Mexico east via Routes 104 and 58 and south via Route 3 to the 10 mile limit.

In addition to the evacuation of land areas, Lake Ontario, which is considered a special facility, must be evacuated within the limits (2,5 or 10 miles) of the evacuation areas. Based on discussions with the U.S. Coast Guard Station in Oswego, the following information was gathered.

- o The Coast Guard requires five minutes to mobilize and get waterborne.

- o Between five and ten minutes are required to travel to the power plant.

- o Twenty to thirty minutes are needed to cover the ten mile area.

- o The quoted time estimates apply to both day and night operation.

- o Evacuation planning is not necessary for the months of January through March because of weather conditions.

Based on the above information, Lake Ontario can be evacuated within the maximum time to evacuate special facilities as shown in the table of evacuation times.

VI LOCAL OFFICIAL COMMENTARY

Several meetings were held with the New York State Office of Disaster Preparedness and with the local civil defense director for Oswego County relative to the NRC's November 29th request.

The input of those agencies has been invaluable in the development of the information in this document.

The Appendix contains copies of the comments of those agencies to the evacuation estimates and to the assumptions and methods used.

Appendix A

Lambruski / resident

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

Dec 1/31/80
T 1/17/80

November 29, 1979

IP-79-174
JAF-79-164

ALL POWER REACTOR LICENSEES

ROTE DEC 6 1979 WILVERDING

Gentlemen:

This letter, which is being sent to all licensees authorized to operate a nuclear power reactor and to all applicants for a license to operate a power reactor (FSAR docketed), is a request for information regarding estimates for evacuation of various areas around nuclear power reactors. The requested information is in addition to that requested by the October 10, 1979 letter to all power reactor licensees from Darrell G. Eisenhut, Acting Director, Division of Operating Reactors, Office of Nuclear Reactor Regulation.

Although evacuation time estimates are expected to be prepared in the course of the upgrading of the state of emergency preparedness as specified in the October 10, 1979 letter, submission of these estimates to the NRC is being requested on an accelerated time scale so that the NRC can identify those instances in which unusual evacuation constraints exist and special planning measures should be considered. In some cases of extreme difficulty where a large population is at risk, special facility modifications may also be appropriate. The requested information will also enable the NRC to be responsive to a recommendation from the Environment, Energy and Natural Resources Subcommittee of the House Committee on Government Operations. The information requested in the enclosure should be submitted no later than January 31, 1980.

The October 10, 1979 letter indicated that efforts to develop a model plan were continuing. It now appears that the model plan will not be completed on a schedule which will be of use in developing upgraded plans for the requested January 1, 1980 submittal. The upgraded plan development should therefore proceed on a site-specific basis.

Sincerely,

Brian K. Grimes, Director
Emergency Preparedness Task Group
Office of Nuclear Reactor Regulation

Enclosure:
Request for Evacuation Time
Estimates

cc w/enclosure:
Service List

REQUEST FOR

EVACUATION TIME ESTIMATES (AFTER NOTIFICATION)

FOR AREAS NEAR NUCLEAR POWER PLANTS

Background

Prior to recent NRC requests that means for prompt notification to the public be installed around each nuclear power plant site, a significant component of evacuation time estimates was the time required to notify the public of a need for evacuation. Studies of actual evacuations that have taken place generally do not distinguish between the time required for notification, the time required to implement the evacuation, and the time required to confirm that an evacuation has taken place.[1/] The estimates for time required for evacuations now requested relate primarily to the time to implement an evacuation as opposed to the time required for notification. These estimates may be based on previous local experiences (e.g., chemical spills or floods) or may be based on studies related to population density, local geography and road capacities. No standard method for making such estimates is identified for use at this time. The basis for the method chosen should be described in the response. As an independent check on the evacuation time estimates, agreement with or comments on the time estimates made should be obtained from the principal local officials responsible for carrying out such evacuations. Such agreement should be documented or the areas of disagreement indicated in the submittal.

The format given below is appropriate for reporting to the NRC estimates of the time required to implement evacuation of areas near nuclear power plants. These estimates, are to be made for the primary purpose of making available, to those officials who would make evacuation decisions in an emergency situation, knowledge of the time required to complete one of the protective action options (evacuation) available for a particular potentially affected segment of the population. A second purpose of these estimates is to identify to all concerned those instances in which unusual evacuation constraints exist and that special planning measures should be considered. In some cases of extreme difficulty where a large population is at risk, special facility modifications may also be considered.

Given a decision to evacuate rather than shelter in an actual event, fewer or more sectors or different distances than given in the reporting format might be evacuated should this be the chosen protective action. For example, three 22-1/2° sectors might be initially evacuated in a downwind direction (the sector containing the plume and an adjacent sector on each side), followed by the evacuation of other sectors as a precautionary measure.

1/ Hans, J. M., Jr., and T. C. Sell, 1974 Evacuation Risks - An Evaluation, U. S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, EPA-520/6-74-002.

Format for Reporting Information

The areas for which evacuation estimates are required must encompass the entire area within a circle of about 10 miles radius, and have outer boundaries corresponding to the plume exposure EPZ. These areas are as follows:

Distance	Area
2 miles	two 180° sectors
5 miles	four 90° sectors
about 10 miles	four 90° sectors

Estimates for the outer sectors should assume that the inner adjacent sectors are being evacuated simultaneously. To the exent practical, the sector boundaries should not divide densely populated areas. Where a direction corresponding to the edges of areas for which estimates have been made is thought not to be adequately represented by the time estimates for adjacent areas, an additional area should be defined and a separate estimate made for this case. The format for submittal should include both a table and a figure (overlaid on a map) which each give the information requested in items 1 and 2 below. Additional material may be provided in associated text.

Required Information

1. Two estimates are requested in each of the areas defined in item 1 for a general evacuation of the population (not including special facilities). A best estimate is required and an adverse weather estimate is required for movement of the population.

2. The total time required to evacuate special facilities (e.g., hospitals) within each area must be specified (best estimate and adverse weather).

3. The time required for confirmation of evacuation should be indicated. Confirmation times may consider special instructions to the public (e.g., tying a hankerchief to a door or gate to indicate the occupant has left the premises).

4. Where plans and prompt notification systems have not been put in place for areas out to about 10 miles, estimates of the times required to evacuate until such measures are in place for the plume exposure emergency planning zone (EPZ) should also be given. Notification times greater than 15 minutes should be included in the evacuation times and footnoted to indicate the notification time.

5. Where special evacuation problems are identified (e.g., in high population density areas), specify alternative protective actions, such as sheltering, which would reduce exposures and the effectiveness of these measures.

6. A short background document should be submitted giving the methods used to make the estimates and the assumptions made including the routes and methods of transportation used. This document should also note the agreement or areas of disagreement with principal local officials regarding these estimates.

Parsons Brinckerhoff

Appendix B

Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Planners

January 25, 1980

Mr. Ronald W. Tweedie, Director
Transportation Data Services Bureau
New York State Department of Transportation
1220 Washington Avenue
Albany, New York 12226

Dear Ron:

Confirming the conclusions reached during our telephone conference which included Ron Tadross (PBQ&D), Joe Hein (ODP), Dick Herskowitz (ODP), and ourselves, we shall proceed with the evacuation time estimate for Indian Point and Oswego as follows:

1) The optimum, fair weather evacuation time estimate will be derived based on the capacities described in the attached memo entitled Indian Point and Oswego Nuclear Power Plant Evacuation Plans Roadway Capacity Estimates dated 1/25/80. We all agree that this estimated time reflects an optimal program and conditions prior to and during the evacuation period.

2) We will use the Level of Service D capacities as determined in the referenced memo to estimate the adverse weather condition evacuation time.

It was also agreed by all parties that these time estimates are based on what are presently considered reasonable assumptions of a plan and program for evacuation which must subsequently be developed in particular detail.

I am forwarding copies of this letter to the other participants for their information and record.

Yours very truly,

Parsons Brinckerhoff Quade & Douglas, Inc.

Charles P. Kole

CPK/tf
cc: R.A. Herskowitz
J. Hein
R.E. Tadross

One Penn Plaza, 250 West 34th Street • New York, N.Y. 10001
212-239-7900 • Cable: Parklap, New York • Telex WU12-5441 • RCA 232 117

Parsons Brinckerhoff

Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Planners

January 29, 1980

Mr. George Brower, Director
Oswego County
Office of Emergency Preparedness
200 North Second Street
Fulton, New York 13069

Re: Evacuation Analysis, Nine Mile Point and James A. Fitzpatrick Power Plants

Dear Mr. Brower:

This letter provides written confirmation of the following comments expressed by both you and Mr. Gary Burgess of your office at our January 28, 1980 meeting. Our understanding is you essentially agree with evacuation time estimates in the draft copy of the analysis dated January 22, 1980, and you have the following comments (other considerations may be added in the future):

1. The time required to notify the public to evacuate is between 45 and 60 minutes for all evacuation areas up to 10 miles according to the following considerations:

   a. determine the extent and type of release
   b. meteorological factors (wind direction, speed, stability)
   c. which roads within the sectors are and will be effected by the plume
   d. data on radiation levels must be taken (RDO's, monitors, equipped and deployed)
   e. calculation (best estimate) of plume dimensions
   f. data evaluated and authorization made to evacuate.

This time may be significantly reduced if the nature of the accident is such that prior to the complete performance of all the above items an evacuation can be begun.

2. The time required to mobilize the required emergency work staff for all evacuation areas up to 10 miles is between 30 and 45 minutes. Mobilization of the emergency work staff could occur at the same time as the notification of the public to evacuate

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3. The time required to confirm evacuation of the public is as follows for each of the evacuation areas:

EVACUATION AREA	TIME TO CONFIRM EVACUATION TO THE PUBLIC
B	60 to 90 minutes in addition to the time to evacuate
G	2 to 2.5 hours in addition to the time to evacuate
H	3 to 3.5 hours in addition to the time to evacuate
I	2 to 2.5 hours in addition to the time to evacuate
J	3 to 3.5 hours in addition to the time to evacuate
K	a minimum of 6 hours in addition to the time to evacuate.

These estimates of time required to confirm evacuation to the public require the following:

a. A complete list of every individual and their residence within a sector

b. A way to indicate whether a person outside of their sector has reached a staging area

c. Nonindigenous persons (hunters, vacationers, etc.) have to be accounted for

d. Manpower needed to either man a check point and/or travel repeatedly throughout a sector

e. New location of evacuees must be compiled

f. Searching of multiple dwelling buildings.

The time estimates outlined in the preceding three sections are based on the utilization of present existing emergency systems in your jurisdiction.

We wish to thank you for your prompt and detailed review of our preliminary time estimates.

Very truly yours,

Parsons Brinckerhoff Quade & Douglas, Inc.

Bruce E. Podwal

BEP/tf
cc: B.W. Deist (PASNY)

DISASTER RESPONSE

Notification and Mobilization Time Estimates

Action	Minimum	Maximum
NFO to SWP	3 min.	10 min.
SWP to BRH	3 min.	20 min.
BRH to NFO	3 min.	10 min.
BRH discuss w/NFO.	2 min.	5 min.
BRH to SWP	0 min.	3 min.
SWP to ODP	3 min	15 min.
ODP to Local Authority	5 min.	15 min.
Local Authority to Scene	10 min.	30 min.
Organ. of Emergency Forces on the Scene	0 min.	10 min.
	29 min.	118 min.

Legend: NFO - Nuclear Facility Operator
SWP - State Warning Point
BRH - NYS Bureau of Radiological Health
ODP - NYS Office of Disaster Preparedness

Typed from a handwritten communication received January, 1980, from the New York State Office of Disaster Preparedness, Nuclear Protection Planning.

Appendix D

STATE OF NEW YORK
DIVISION OF MILITARY AND NAVAL AFFAIRS
PUBLIC SECURITY BUILDING
STATE CAMPUS
ALBANY, NEW YORK 12226

HUGH L. CAREY
GOVERNOR

VITO J. CASTELLANO
MAJOR GENERAL
CHIEF OF STAFF TO THE GOVERNOR

MNDP

29 January 1980

Mr. Bruce E. Podwal
Assistant Vice President
Parsons Brinckerhoff
One Penn Plaza
New York, NY 10001

Dear Mr. Podwal:

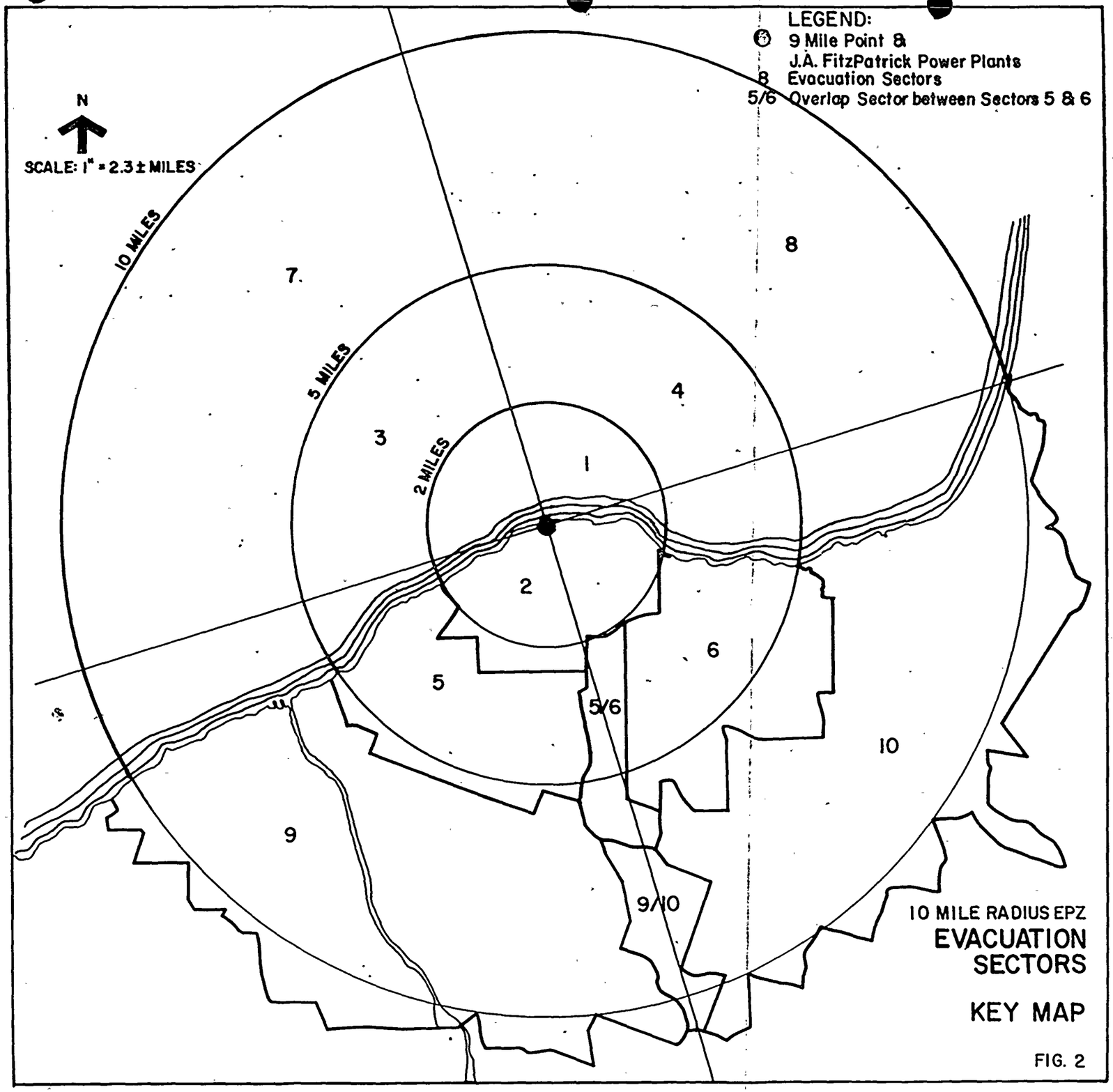
The State Office of Disaster Preparedness concurs in your evacuation analysis time estimates for the Nine-Mile Point and James A. Fitzpatrick Nuclear Power Plant's Emergency Planning Zone for the plume pathway as described in NUREG-0396. According to our Nuclear Civil Protection Planning Section these times are both reasonable and realistic within your definitions of "best estimate" and "adverse weather".

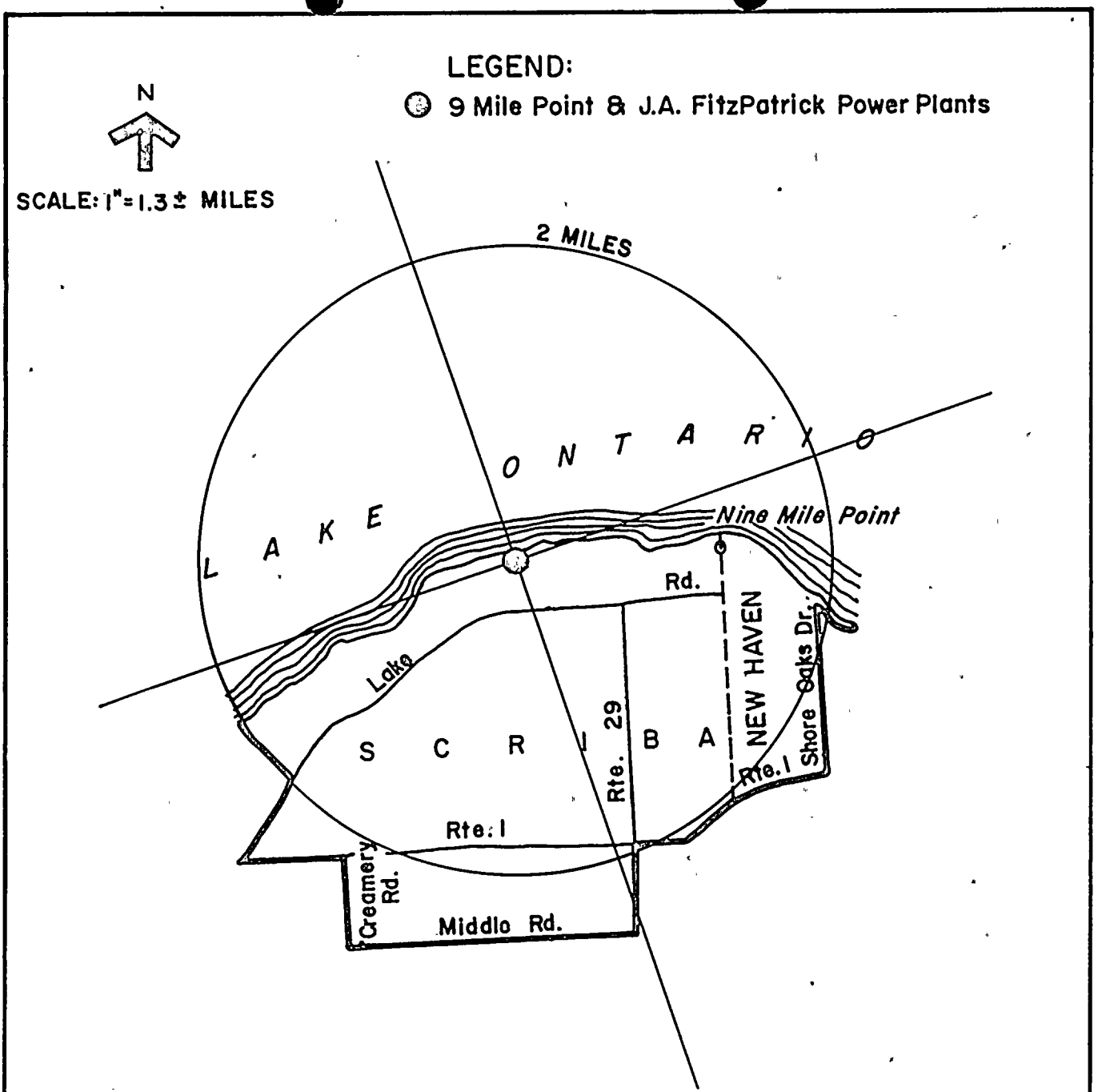
Sincerely,

ARNOLD W. GRUSKY
Director, Disaster Preparedness
Program

eam

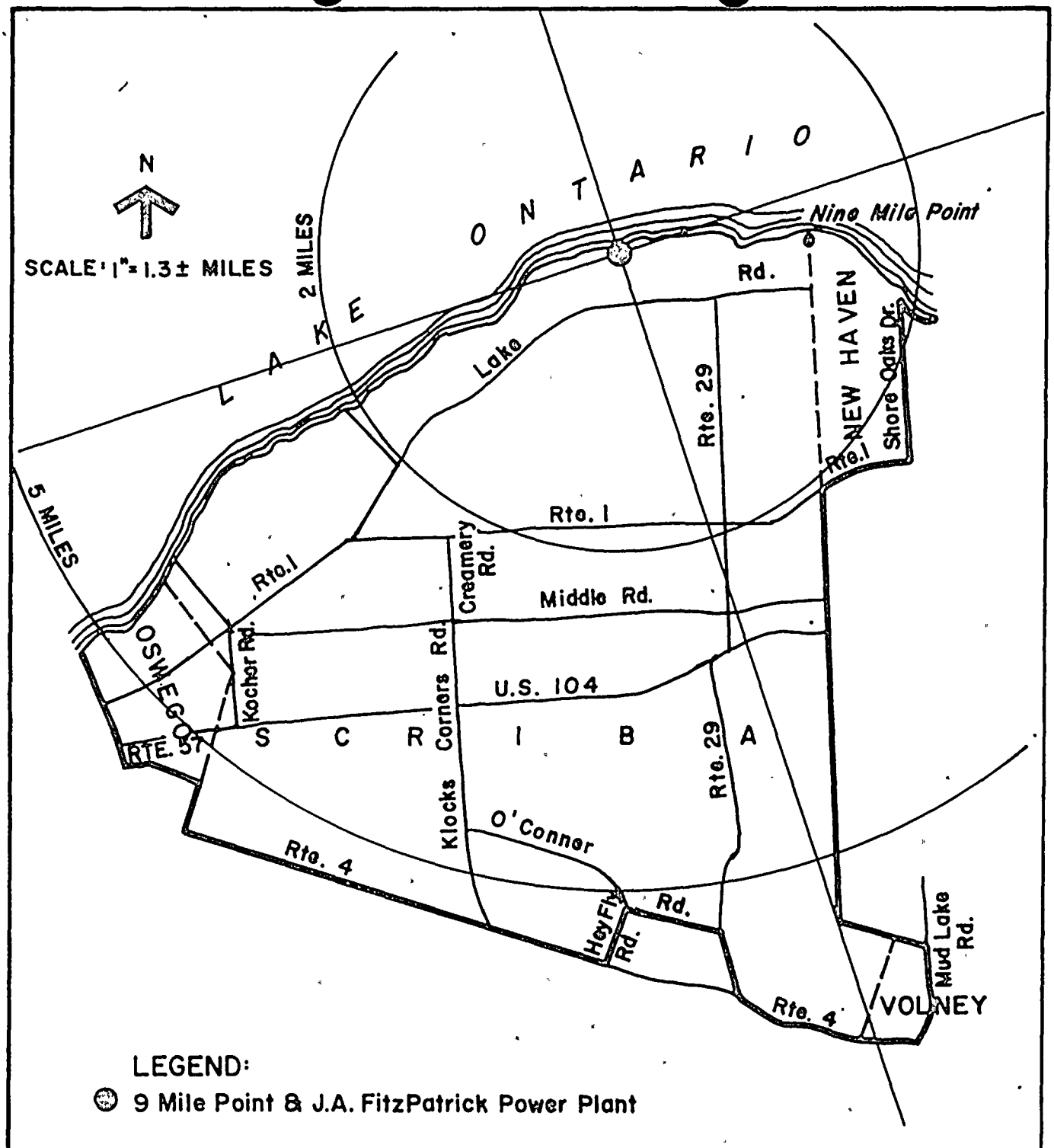

LAKE
ONTARIO
SCALE: 1" = 2 MILES
9 MILE POINT &
J.A. FITZPATRICK
POWER PLANTS
Selkirk
Selkirk Shores State Park
Ramona Beach
Mexico Point
Mexico Bay Beach
Nine Mile Point
Shore Oaks
Pleasant Point
Hickory Grove
Demster Beach
Texas
Butterfly Swamp
North Church
Arthur
Lake View
Lycoming
North Scriba
Walker
Demster
New Haven
Toll Gate
Sage
Hammond's Corners
Scriba
NEW HAVEN
Mexico
South New Haven
Butterfly
OSWEGO
SCRIBA
Lansing
Klocks Corners
Mud Pond
Cumings Bridge
Austin's Corner
Sala
MEXICO
Little Salmon Creek
South Scriba
Crook's Pond
Poddy Pond
Vermilion
Wetwood
North Volney
Seneca Hill
Minetto
Bundyville
Mount Pleasant
Sayle's Corners
Munger's Corners
Clifford
Drake's Corners
10 MILES
PALERMO
Russ Pond
Russ Mills
Catfish
Upson Corners
Palermo
Lewis Corners
Battle Island State Park
VOLNEY
Oswego County Airport
Loomis Corners
East Palermo
Post Corners
Volney
Farley's Corners
Dexter-ville
Granby Center
FULTON
Gilbert Mills
L. Neatahwanta
BALDWINSVILLE
LOCATION MAP
FIG. 1


LEGEND:
9 Mile Point &
J.A. FitzPatrick Power Plants
Evacuation Sectors
5/6 Overlap Sector between Sectors 5 & 6
N
SCALE: 1" = 2.3 ± MILES
10 MILES
5 MILES
2 MILES
1
2
3
4
5
5/6
6
7
8
9
9/10
10
10 MILE RADIUS EPZ
EVACUATION
SECTORS
KEY MAP
FIG. 2



EVACUATION AREA B
(SECTOR 2)

FIG. 3

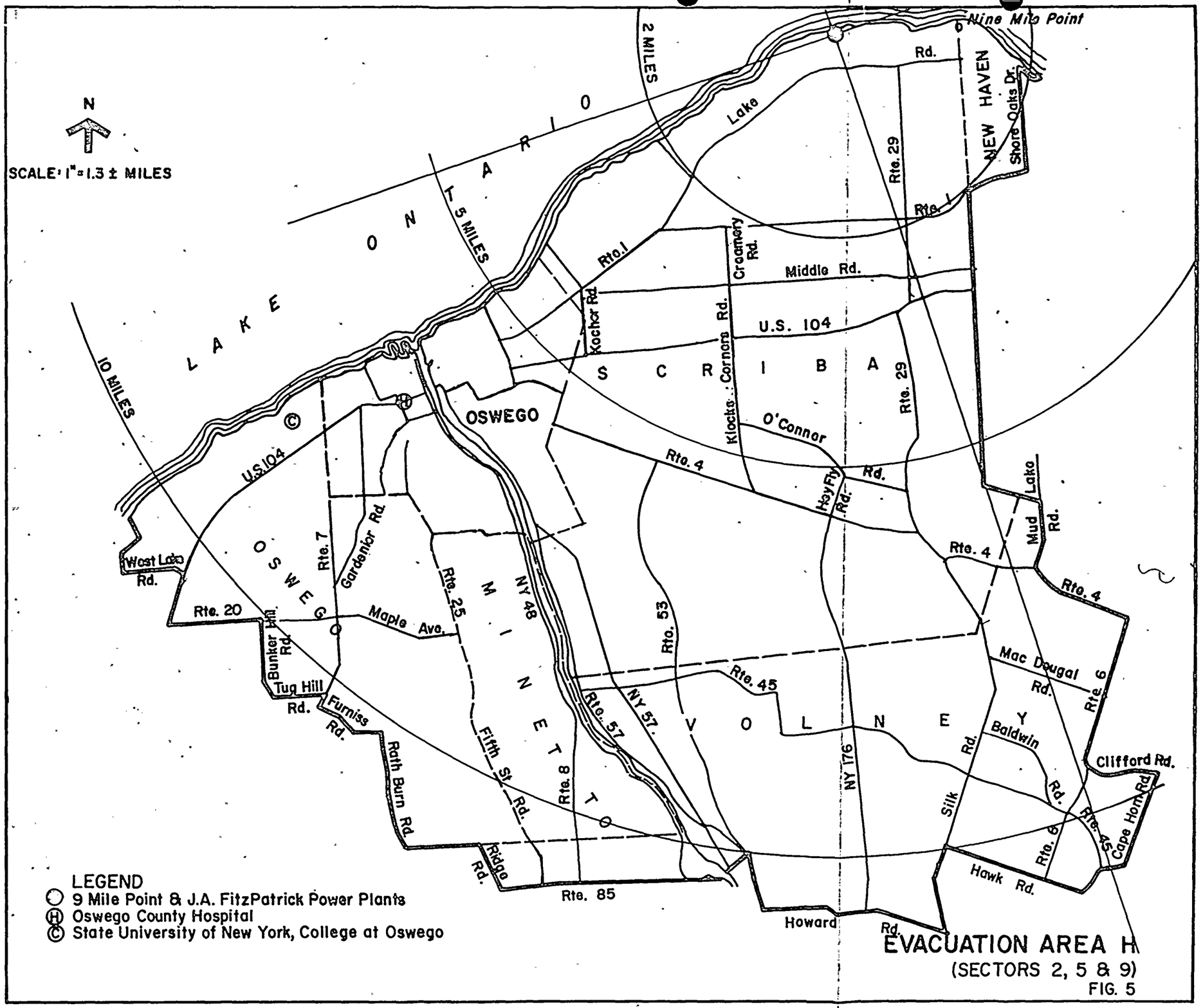


LEGEND:

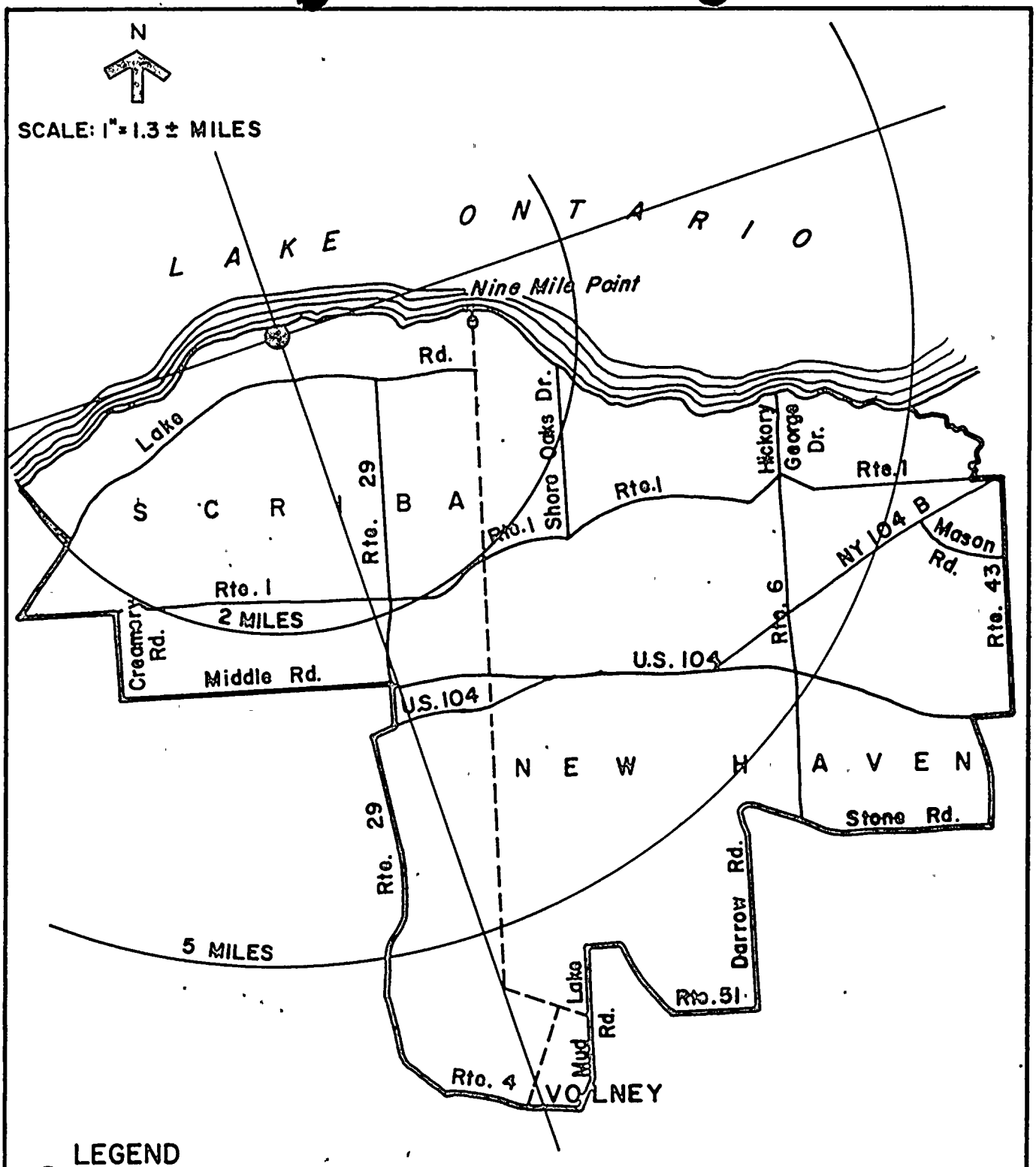
⊕ 9 Mile Point & J.A. FitzPatrick Power Plant

EVACUATION AREA G
(SECTORS 2 & 5)

FIG. 4



EVACUATION AREA H
(SECTORS 2, 5 & 9)
FIG. 5

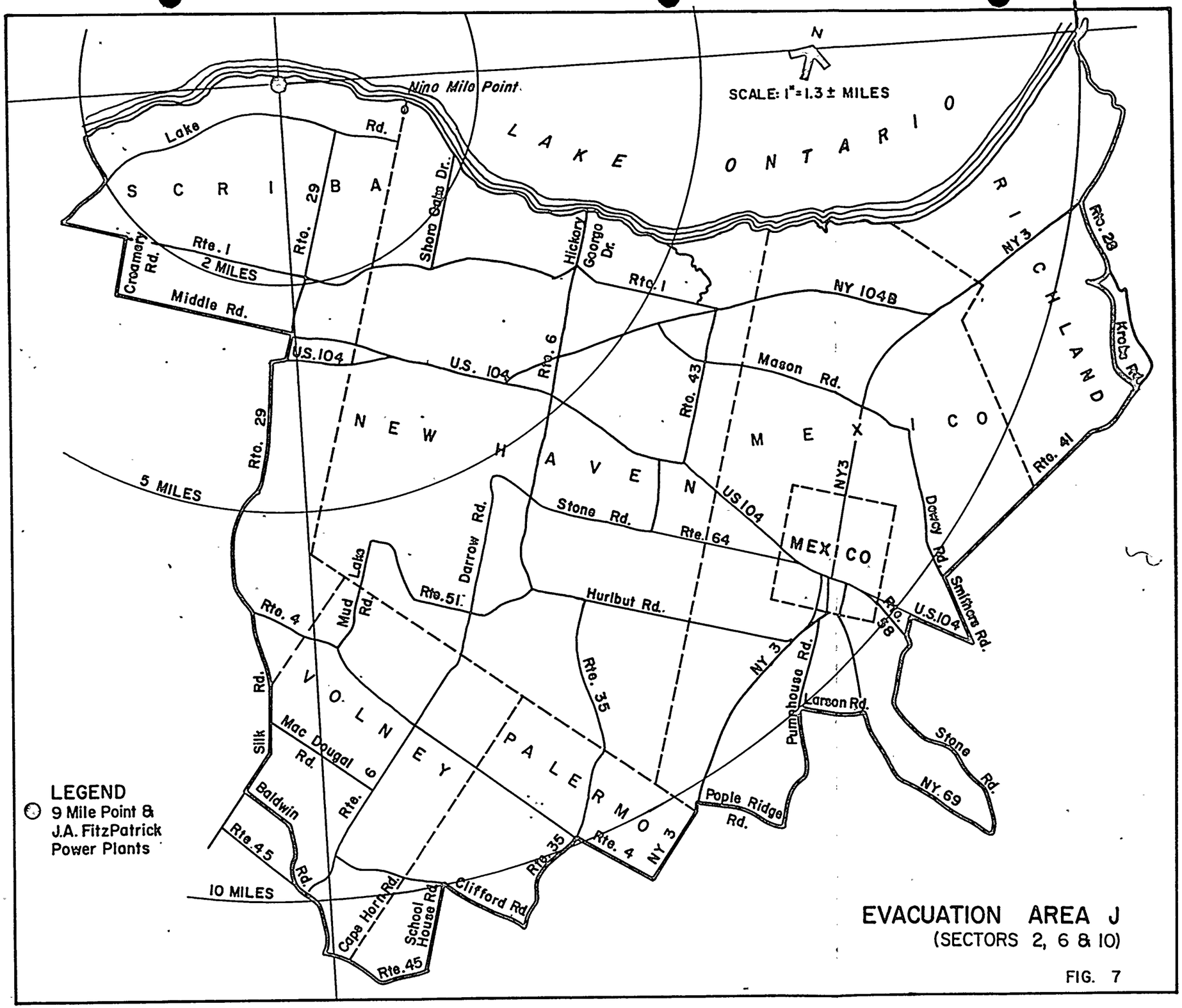


LEGEND

⊗ 9 Mile Point & J.A. FitzPatrick Power Plant

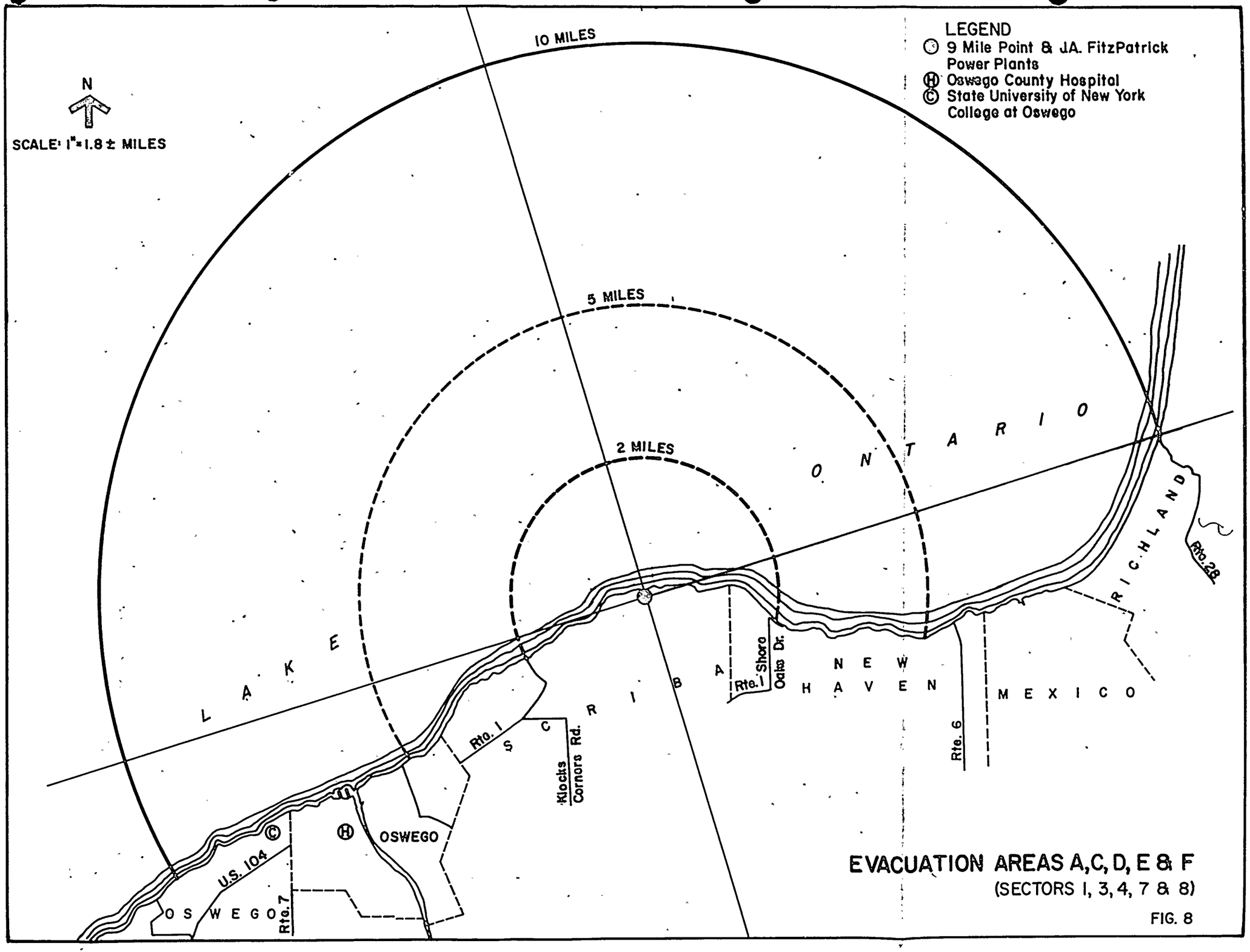
EVACUATION AREA I
(SECTORS 2 & 6)

FIG. 6



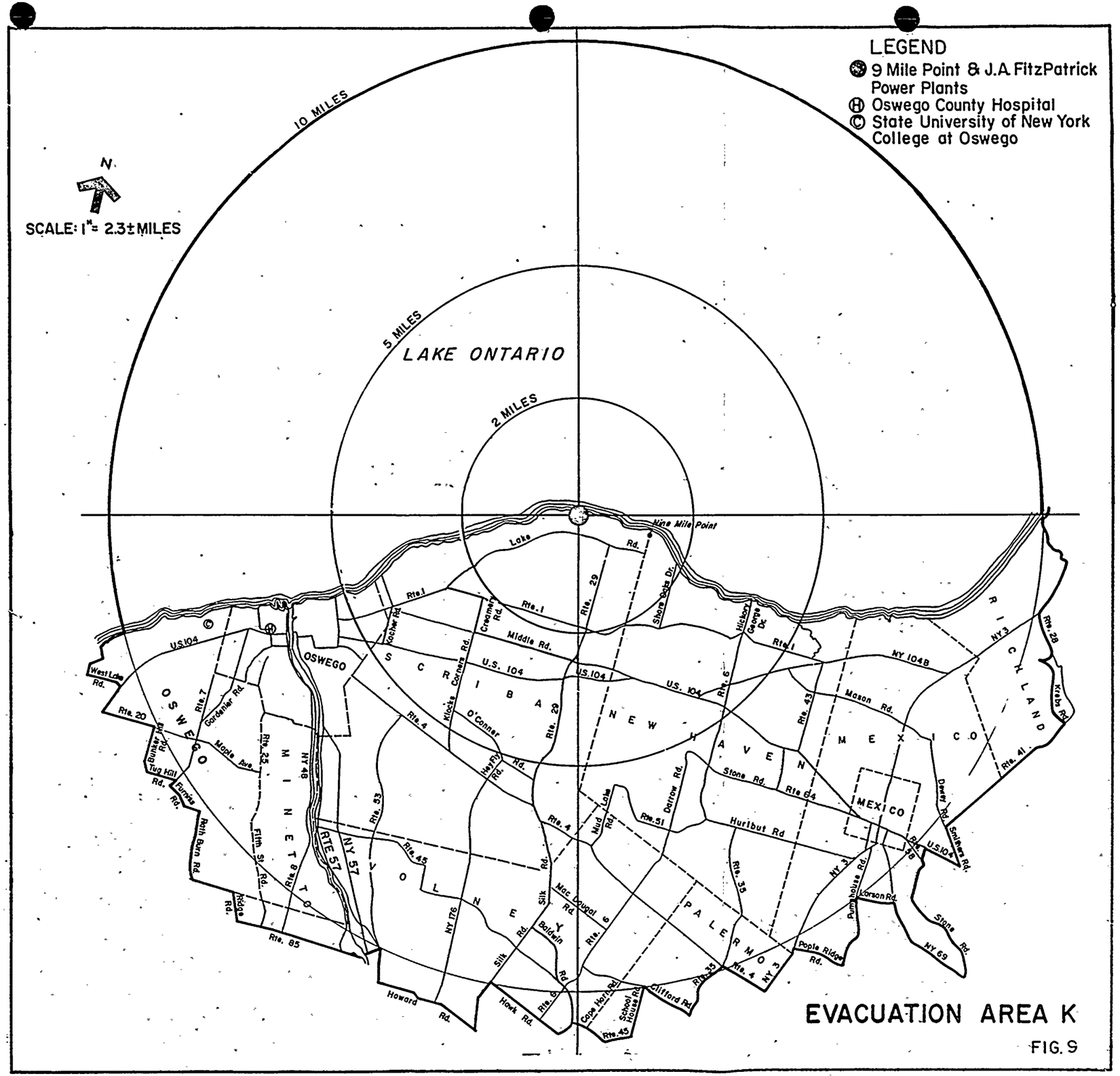
EVACUATION AREA J
(SECTORS 2, 6 & 10)

FIG. 7



EVACUATION AREAS A,C, D, E & F
(SECTORS 1, 3, 4, 7 & 8)

FIG. 8



EVACUATION AREA K

FIG. 9