Nine Mile Point

Nuclear Surveillance Program-

A Summary

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ABSTRACT

Radiological monitoring data from the Nine Mile Point area of Oswego County, New York for the period of 1976-1988 was reviewed to assess the sampling and analytical protocols utilized. Although the data indicated that Nuclear Regulatory Commission standards were not exceeded during the period of review, there are wide variations in results reported for a variety of monitored radionuclides which cannot be explained because of inconsistencies in sampling site locations and/or types of samples collected. Additionally, the availability of documents provided by the Nuclear Regulatory Commission, New York State Department of Health, New York State Department of Environmental Conservation, New York State Power Authority, and Niagara Mohawk Power Corporation for public accessibility was reviewed. The report concludes with 43 recommendations which we believe would significantly improve the current monitoring program and accessibility of public documents. This report was reviewed and edited by James J. Pagano of the SUNY @ Oswego Research Center.

INTRODUCTION

Three nuclear facilities operate at Nine Mile Point (NMP) in the town of Scriba, Oswego County, New York (Figure 1). Niagara Mohawk's Unit I (NMP1), a 620 megawatt (MWe) reactor and the New York Power Authority's James A. FitzPatrick (NYPA), a 821 MWe reactor, started operating in 1969 and 1975, respectively. Both facilities utilize General Electric Mark I Boiling Water Reactors (BWR) with a once through cooling water system. Niagara Mohawk's Unit II (NMP2), a 1080 (NM) MWe General Electric Mark II BWR reactor, which started operating in 1987 has a cooling tower water system. All three reactors use water from Lake Ontario in their cooling water systems.

The New York Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH), along with Niagara Mohawk Power Corporation and the New York Power Authority, (hereafter referred to as "the Utilities") publish annual reports on radiation levels in proximity to the NMP area. These reports are the Annual Report of Environmental Radiation in New York State, issued by the NYSDEC from 1970 to 1981, Environmental Radiation in New York State Annual Report issued by the NYSDOH from 1982 to present and the Annual Radiological Environmental Operating Report issued by the Utilities from start-up to present. The reports from the Utilities include data from a zero to ten-mile radius around the NMP area and contain on-site monitoring data as well as monitoring data beyond the site boundary. The reports from the NYSDEC and NYSDOH include data from the Utilities' site boundary to approximately the ten-mile radius. All reports include data from control sites beyond the ten-mile critical zone used for comparison. The Utilities use control sites in Oswego County and New York State uses various sites around the state. Sites used for routine sampling by the NYSDOH are illustrated in Figure 2.

The Nine Mile Point (NMP) area is located on the southern shore of Lake Ontario in Oswego County, New York. The NMP winds are depicted by the wind rose of the Empire State Electric Energy Research Corporation for the period 1986-1988 (ESEERCO). This wind rose indicates there were two major lobes associated with NMP during this period. One lobe is westerly to southwesterly and the other lobe is southerly to southeasterly. There is also a large lull of winds from the easterly direction (Figure 2). The winds at NMP are seasonally variable and during the summer months NMP has lake and land breezes which create convection cycles, and at other times the winds swirl (Stamm, personal communication). The wind driven longshore current in the nearshore lake environment is predominantly southeasterly, although reversals occur. Storms can cause upwelling in Lake Ontario and flow patterns can change in as little as four hours (United States Atomic Energy Commission / Niagara Mohawk Power Corporation). Severe thunderstorms accompanied by strong winds occur during the spring and summer months and during the winter months intense storms cause lake effect snow squalls. Daily accumulations of three feet or more are possible in some areas. Annual precipitation averages about thirty-five inches in rainfall equivalent.

Oswego County's soil sustains two of its major industries, agriculture and dairy farming. Also, Oswego County has recently experienced a boom in tourism due to its proximity to Lake Ontario and fresh water fishing. Many residents use Lake Ontario recreation beaches in summer months and others reside near the lake year round. NMP is approximately seven miles east of the city of Oswego with a population of 20,000 and the total population of Oswego County is about 120,000.

Radioactive nuclides from nuclear plants are routinely created during normal operations by the fission process and neutron activation. Radionuclides are released regularly into the air and sometimes into the water (NM, NYPA) due to unusual events. These nuclides are released through discharge pipes, emission stacks, and/or vents. NMP nuclear facilities emission stacks for NMP1, NMP2 and JAF are 350 feet, 430 feet, and 385 feet, respectively. The reactor building vent for NMP2 is located 187 feet above ground. The JAF reactor and turbine building vent and the radwaste building vent are 173 feet and 112 feet, respectively. The water discharge from all three operating facilities is piped offshore and released to Lake Ontario.

The Utilities, beginning prior to start-up and continuing to (NRC) to present, have collected and analyzed samples on-site and in proximity (Not currently located on site. NM) to NMP to determine compliance with regulations by the Atomic Energy Commission (AEC) prior to 1975 and Nuclear Regulatory Commission (NRC) after 1975. The Utilities sampling and analyses requirements and standards are determined by the NRC in the Radiological Effluent Technical Specifications (TS NM). The purpose of the TS, standardized in 1985, was to provide a framework for monitoring the liquid and gaseous emissions from the nuclear facilities at NMP. The NMP area is considered as a single site, relative to the Radiological Environmental Monitoring Program (NM), and the two utilities share responsibility of the environmental surveillance program, have independecne (NRC) TS for each facility, and publish separate reports.

The NYSDEC (1970 - 1981) and NYSDOH (1982 to present) have monitored beyond the nuclear facilities boundary. Radionuclide discharge standards are established by the NRC, and the State of New York's Sanitary Code 16 is basically the same as the standards set by the NRC. These monitoring programs are comparable to but not as extensive as the monitoring programs for the Utilities. The NRC has contracted with the State of New York and provides grants for additional monitoring. The NRC specifies that certain sampling sites must be sampled by NYSDOH for comparison purposes to Utilities data. The role of the NYSDOH in the NRC/State of New York cooperative agreement is to analyze the mandatory samples collected for the NYSDOH for radionuclides, compare data from their samples to data from the Utilities same sampling site, and report the results to the NRC. The NYSDOH may also establish additional sampling sites or change sampling sites as part of New York State's independent surveillance program (Condon, personal communication).

The New York State Department of Health (NM) NYSDOH collect some of their own samples for radiological monitoring in the nmp area. EA Science and Technology, Inc., located in Scriba, has been granted the contract to collect some (NM) of the samples required by the Utilities and also provides some of the samples analyzed by the NYSDOH. They prepare, package and ship samples to both NYSDOH and Utilities laboratories for analysis. No radiological analyses are done by EA Science and Technology, Inc. (Koeneke, personal communication). Additionally, Oswego County's Environmental Division serves as an agent for the NYSDOH. They also collect, prepare, package, and ship samples of air particulates, milk and water for the NYSDOH from different sampling site locations than those gathered by EA Science and Technology, Inc. (Jones, personal communication). Oswego County does not analyze the samples for radionuclides and receives the analytical data from the collected samples from the NYSDOH in their annual reports. There is no one at the Environmental Division at Oswego County who reviews the NYSDOH data that is published. Oswego County's last environmental surveillance report they received from the NYSDOH was the 1986 annual report (Rosin, personal communication).

The purpose of this report is to:

1) evaluate the monitoring and sampling protocols associated with the operation of the Nine Mile Point (NMP) nuclear facilities and thereby gain an understanding of the radionuclide discharges at NMP to the environment of Oswego County, New York;

2) review the annual monitoring data from the New York State Department of Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) for the years 1976 to 1988;

3) review and compare protocols from Niagara Mohawk Power Authority (1988) and New York Power Authority Nuclear Facilities (1988 and 1989) to NYSDEC and NYSDOH protocols; and

4) evaluate the availability of documents associated with the environmental impact of the operation of the nuclear facilities at NMP.

METHODS

The annual reports from NYSDEC (1976 to 1981), NYSDOH (1982 to 1988), New York Power Authority (1988 and 1989), and Niagara Mohawk (1989) were reviewed during 1990-1991. In addition to these reports, the Nuclear Regulatory Commission/ State of New York (NRC/NYS) cooperative agreement of 1988 was reviewed. The NYSDEC and NYSDOH (1976 through 1988) sampling data on air particulates, water, milk, direct environmental radiation (TLD), fish, vegetables, and sediment were entered in a Lotus 123 database for review and analysis. The site location maps and various data from NYSDOH and the Utilities were also reviewed.

Graphs were constructed with the Lotus computer program and then evaluated to assess changes in sites and/or trends associated with stationary sites over time. Area maps from the NYSDOH of NMP and its facilities were used with a wind rose from ESEERCO (1986-1988), taken from the meteorological tower at the 200-foot height, superimposed to determine wind directions. This wind rose only depicts two years of data and is not necessarily indicative of the 1976-1988 period. Also some of the nuclear plant emission points are above and some emission points are below the 200-foot height and thus this wind rose does not reflect exact wind direction percentages or wind speeds at these lesser or greater heights.

Minimum, maximum and average values from NYSDEC (1976-1981) and NYSDOH (1982-1988) data were calculated with Lotus and the tables summarized. The minimum value represents the lowest value (NRC) data entry, the maximum value represents the largest value (NRC) data entry and the average value is the average of available data per year during the period 1976-1988. The total n represents the total number of samples taken during the period 1976-1988 by the NYSDEC and NYSDOH. For air, milk and water, the minimum average is the lowest yearly average and the maximum average is the highest yearly average published during the period 1976-1988. The data were tabulated using this technique because the NYSDEC published only the minimum, maximum, average yearly data, and number of yearly samples in their reports during the period 1976-1981. The weekly or monthly data from the NYSDOH annual reports 1982-1988 were entered into Lotus to determine the minimum and maximum range, yearly average, and number of samples per year. NYSDOH data were then combined with the data from the NYSDEC to establish these tables.

The TS and Plant Operational documents available in the NRC Documents Room in the Penfield Library at SUNY Oswego were reviewed to gain an understanding of the Utilities compliance with the NRC regulations and the environmental impact of the nuclear plants at NMP.

SURVEY OF NINE MILE POINT SAMPLING PROTOCOLS

Air Particulates

According to the TS, five air sites for radioactive particulates are required to be sampled every week on an annual basis (NM, NYPA). Samples are taken from three offsite locations, one from a community having the highest calculated deposition quotient (D/Q) and one control sample from a site at least ten miles away (NM). The D/Q value is calculated by a number of variables. Five years of meteorological data are acquired and then averaged. These meteorological data is entered into a computer with data representing the point source height, and data representing a specific location in a meteorological sector. Meteorological sectors are defined by a given radius around the NMP area divided into sixteen 22.5-degree sectors. Data from other variables may also be considered in the computerized calculation. These data are integrated by a computer and the resulting D/Q value is used to determine the areas theoretically receiving the greatest deposition of radionuclides. Areas with the highest D/Q value are areas where the sampling sites are located but the location of a sampling site will also be effected, but not solely (NM) by accessibility. For example, a sampling site must be conveniently located for those who collect the samples (Flanagan, personal communication).

The NYSDOH annual reports use and identify a sole air sampling site as east-southeast of the operating nuclear facilities, labeled as Number 1 in Figure 2. Note that site number 1 is directly south. This site was in the downwind shadow zone for 20% to 25% of the time during the period 1986-1988 as shown by the wind rose of ESEERCO, Figure 2. The downwind shadow zone may be defined as the area which will be directly effected by wind dispersion of radioactive iostopes (NYPA). The cooperative agreement for NRC/NYS data identified the site at the intersection of County Rt. 29 and Lake Road, labeled as Number 1A in Figure 2, which is in the downwind shadow zone for 15% to 20% of the time. This air sampling site was changed four times from 1976 through 1988 by the NYSDEC and NYSDOH. Site A376101 existed during 1976-1977, site 3767001 existed during 1978-1980, site 3767003 existed during 1981-1987, and site 3767001 was once again monitored in 1988. The NYSDEC did not publish maps in their annual reports and there are no changes in NYSDOH maps to reflect these site changes, nor was any reason given for these sampling site changes by either agency. Some of the Utilities' (1988) off-site environmental stations are depicted on Figure 3 which is a copy from the New York Power Authority's annual radiological report.

The Utilities (1988) used glass fiber filters to collect airborne particulates for gamma emitters and charcoal cartridges to collect iodine^{131}. NYSDEC (1976-1981) used regular paper filters to collect airborne particulates and measure gross beta activity. They used charcoal cartridges to collect iodine^{131}. Data from gross beta and iodine^{131} were averaged on a yearly basis. Data from the composite of air particulates were averaged quarterly. NYSDOH (1982-1988) continues in the sampling fashion of the NYSDEC. They use continu-

ous air samplers which run for about a week or two at a time and filter approximately one cubic foot of air per minute. The data reported by the NYSDOH includes weekly results of gross beta and iodine^{131} and quarterly results for air particulates in annual reports. The data from air particulate radionuclides for the period 1976 through 1988 are summarized in Table 1A. As indicated in Table 1A, there were a large range of values from monitored data. For example, zirconium-niobium^{95} had a minimum activity of 0.8 and a maximum activity of 53. Notable differences can also been seen from cesium^{134}, cesium^{137}, and strontium^{89}.

Milk

According to the TS, three milk sites should be sampled within a 3.5-mile distance of the site with the highest D/Q value. If no sites exist within 3.5-miles then a distance of 3.5 to 5 miles may be selected. One control sample should be taken from 9 to 20 miles (NM). At NMP there are no milk sampling sites within the 3.5-mile radius. From the 3.5 mile to 5 mile radius around NMP there are four farms with milk animals but these are not sampled for radionuclides due to inadquate milk sources or because the farmer may not wish to participate in the radiological monitoring program (NM, NYPA). The Utilities monitor 6 sites at distances of 5.5 miles to 9 miles twice a month from April to December and once a month from January to March, if iodine^{131} has been detected during the months of November and December. One milk control sampling site a distance of 17 miles southwest of NMP is also monitored. The Utilities' 1988 milk sampling sites (4, 7, 16, 50, 55, 60, and 65) are depicted on Figure 4. Other sites depicted on the map represent locations of existing farms or farms that no longer have milking animals.

From April to December milk samples are collected monthly by the NYSDOH from farms near the NMP nuclear facilities. Two liters of milk are collected from each farm and analyzed by the NYSDOH for iodine^{131}, cesium^{137}, and periodically for strontium^{90}. Some milk samples are also collected from January to March. The NYSDOH monitors three farms. The New Haven farm site is five miles southeast, the Scriba farm site is five miles southwest and the Mexico farm site is ten miles east-southeast of the NMP power plants. Specific location of these milk sampling sites are not identified nor are they illustrated on any maps in the NYSDEC or NYSDOH reports. The NYSDOH at Albany will not disclose this information because of a right to privacy of the farmers(Huang), personal communication). Milk sampling sites are illustrated on the maps published by the Utilities but it's not possible to identify the specific farms used by either the NYSDEC or NYSDOH. The NYS/NRC (1988) contract identifies and reports data from only the Scriba milk sampling site. The Scriba milk sampling site has been changed six times from 1976 through 1988 but there are no details as to why these sites were changed in NYSDEC or NYSDOH annual reports. The New Haven and Mexico milk sampling sites were identified by the Environmental Division of Oswego County. Jones (personal communication) stated the New Haven milk sampling site was on County Route 1 and the Mexico milk sampling site was on Hurlbut Rd. It is not known if these milk sampling sites are sampled by the Utilities nor can the exact location of

these farms be established from Figure 4. Rosin and Jones of the Oswego County Environmental Division (personal communication) did not know how long these farms have had milk sampled by the NYSDOH. One of these milk sampling sites is sampled by the Niagara Mohawk Power Corporation/ New York Power Authority (NMPC/NYPA) and is a homogenous split sample (NM).

Figure 5 represents cesium^{137} radioactivity from three different milk sampling sites from NYSDEC and NYSDOH data for the 1976-1988 period. As can been seen from this illustration, the cesium^{137} values declined after 1981. The Scriba milk sample site location was changed in 1982 which may (NYPA) account for the decrease in cesium^{137}. A requirement of the TS, although not applicable to NYSDOH sampling (NYPA), is to sample from the site with the highest D/Q value and there is no explanation for this site change in the annual reports. The data from milk radionuclides sampled and analyzed for the period 1976 through 1988 are summarized in Table 1B. As indicated in Table 1B, there were a large range of values from monitored data. In some cases these data are more than an order of magnitude. For example, iodine^{131} had a minimum activity of 0.04 and a maximum activity of 19.4. Notable differences can also been seen from cesium^{137}, strontium^{90}, and strontium^{89}.

Water

According to the TS, one surface water sample from an upstream site and one from downstream site should be sampled. Composite samples are taken once a month and a composite sample for tritium once every three months. Other required TS sampling locations include grab sample ground water monitoring on a quarterly basis, and composite sample drinking water monitoring from a nearby water supply over two-week periods. According to the TS, this drinking water sampling location should represent an area that may be affected by the radioactive discharges from the NMP area in the event of a geological event. However, drinking water sampling is not required by the TS at NMP (NM).

The NYSDOH monitors four water sites including two Lake Ontario "up-current" sites, one at the Oswego City Hall drinking water tap, which is an optional site (NM), and another at the Oswego Steam Station control site. A sampling site in the immediate vicinity of NMP is the inlet canal at Niagara Mohawk's Unit One. A NYSDOH surface water sampling site is located on Dempster Beach Road. These four water sampling sites are illustrated on Figure 6, Letter W. The Utilities (1988 and 1989) annual reports for water sampling sites includes the FitzPatrick inlet (03), NMP1 inlet (09), NMP2 inlet (11), Oswego Steam Station (08, control), and Oswego City water tap (10) as illustrated on Figure 3. This map is from the 1988 Radiological Environmental Surveillance Report from the New York Power Authority and illustrates an assortment of environmental sampling site locations.

Two liters of surface water are sampled by the NYSDOH as grab or continuous samples. The sites in Oswego are analyzed for gross alpha and beta on a weekly basis, and tritiated water (HTO), cesium^{137}, zirconium-niobium^{95}, and ruthenium^{106} on a monthly basis. The New Haven grab sample site is analyzed for gross alpha and beta monthly, and tritiated water (HTO) composite samples

quarterly. The NYSDOH reports do not specifically identify Dempster Beach Road as a ground or surface water sampling site but Jones (personal communication) stated that the site is a surface water site. The Utilities do not sample at the Dempster Beach Road site. No ground water is sampled in the NMP area.

The Oswego City Hall tap water (drinking) and Dempster Beach (lake surface) water samples have been monitored from at least 1976 through 1988 by the NYSDEC or NYSDOH. There is much confusion relative to the location of the water sampling sites at the Inlet Canal, the Scriba reactor discharge and the Oswego Steam Station. The 1981 NYSDEC annual publication identifies the Inlet Canal site as number 3767003. The 1982 through 1985 NYSDOH annual publications identify the Scriba Inlet Canal site as number 3767004 and the Scriba Reactor outlet site as number 3767003 In that very same year (1982-1985), in a different section of the report, the Scriba Inlet site is identified as site number 3767003 which is the same site identification number as the Scriba reactor outlet. NYSDOH annual publications indicate the Oswego Steam Station site number as 3702002 (1986-1987) and as site number 3767004 (1988). In the NYSDOH 1986 report the Scriba Inlet site location number is 3702002, the same site identification number as the Oswego Steam Station. In NYSDOH annual reports for the period 1986 through 1988 the Scriba Inlet site number is 3767004 in one section of the publication and it is identified as site number 3767003 in another section of the book. During this same period (1986-1988) the NYSDOH identified the Scriba reactor outlet as site number 3676003 which is the same site identification number as the Inlet site. The data from water sample radionuclides analysis for the period 1976 through 1988 are summarized, as best as possible, in Table 1C and 1D. As indicated from Tables 1C and 1D there are wide variations for the water samples analyzed for radionuclides. For example, zirconium-niobium had a minimum activity of 7 and a maximum activity of 500 (1986 site 3702001). Other large ranges in data can also be seen with cesium^{137} and ruthenium^{106}. It is not possible to determine the causes for these large differences in activity.

Thermoluminescent Dosimeters (TLD)

According to the TS, thirty-two routine monitoring stations for direct environmental radiation should be sampled. The specifications require an inner ring of stations in each meteorological sector and an outer ring of stations in the four to five-mile meteorologic sector. Other sampling stations are to be established in areas of special interest (ie schools, densely populated areas ect.).

The Utilities monitor sixteen land meteorologic sectors in the inner ring and eight land meteorologic sectors in the outer ring because the outer ring extends over Lake Ontario. Sampling frequency for TLD sampling sites is on a quarterly basis. Some of the off-site TLD monitor sampling sites for the Utilities are depicted in Figure 3.

Four Direct Environmental Radiation monitors which measure only gamma radiation are analyzed on a quarterly basis by the NYSDOH. The monitors are distributed from the western to southeastern perimeter of the plant and are (were until 1988) in the immediate vicinity of the reactors. The wind rose at the 200-foot height from ESEERCO, April 1986 to March 1988 indicates each site is situated in the downwind shadow zone only 20% to 25% of the time as indicated on Figure 2.

The TLD monitors were first installed in 1983 by the NYSDOH and these four sites were consistently monitored until 1987. During 1988 three of the TLD monitors were moved. The 1983-1987 sampling sites are distributed in a western to a southeastern direction (Figure 2 Letter T). In 1988, three of these four monitors were moved a distance of approximately 1.5 miles from NMP. The TLD sampling site at the meteorological tower was the only site not moved. Reasons for moving the other three TLD sampling sites were not included in the NYSDOH manuals, nor were there any changes in the map to illustrate where these sampling sites are now located. The new site locations can be estimated to be downwind approximately 20% to 25% of the time and although the site locations were moved a distance of 1.5 miles from the point source, no change in millirem activity was noted when compared to the former sites. Data from gamma radiation as detected by the TLD sites is summarized in Table 1E. This table indicates the TLD monitoring data was uniform during the period 1983-1988.

Sampling sites and the corresponding data for the Scriba TLDs are depicted in Figure 7. The TLDs are monitored on a quarterly basis and these data indicate there is a seasonal trend associated with monitoring of the gamma radiation. During winter to summer months of each year the gamma activity progressively declines to the minimum activity in the summer months, then during the summer to winter months a progressive increase of the amount of activity is noted and the gamma activity reaches the maximum activity in the winter months. As indicated in Figure 7, the TLD data for the period of 1976 to 1988 also steadily declined progressively from a maximum of about 17 millirems in 1983 to a minimum of about 11 in 1988.

Fish

One sample each of two commercial or recreational fish species in the vicinity of the nuclear plant discharges and one sample of the same species from a distance of five miles from the site are required according to the TS. Sampling frequency is twice a year.

The NYSDOH (1982-1988) and the Utilities (1988 and 1989) data results for annual environmental radiation reports on fish are based on random samples caught in spring and fall offshore of the nuclear plants. The fish sampling site for the NYSDOH is identified as Number 3 on Figure 2. The Utilities analyze fish caught offshore of the FitzPatrick Nuclear Facility, Nine Mile Point, and in the Oswego Harbor. Edible portions of fish fillets are sampled and analyzed for radioactive isotopes. There are no data on the size or

relative ages of the sampled fish in the annual reports by the NYSDEC, NYSDOH, NRC/NYS (1988), Niagara Mohawk (1989) or by James A. FitzPatrick (1988 and 1989).

The NYSDEC (1976-1981) collected and analyzed fish samples on an annual basis in the spring or in the fall. The annual reports are not specific for species with the exception of the eel in 1976. The NYSDOH analyze fish samples collected during spring and fall. The annual reports 1982 through 1988 do not list fish species, however, James Huang (personal communication) of the NYSDOH identified the species as lake trout and brown trout. The Utilities analyze fish samples in the spring and fall and identify the species of fish. The Utilities also used the Oswego Harbor as a control sampling site during 1988 and 1989. There are no control sites listed in the NYSDEC or NYSDOH reports for fish sampling. The NYSDEC and NYSDOH fish monitoring data 1976 through 1988 is summarized in Table 1F. As can be seen form these data, reported radionuclide concentration varied significantly and for several nuclides varied by more than an order of magnitude. For example, strontium^{90} had a minimum activity of 8 and a maximum activity of 1800.

Sediment

According to the TS, one sample of sediment taken from a "downstream" location with existing or potential recreation value (ie, beaches or picnic areas) is necessary. Sampling frequency is twice a year.

A sample of several pounds of sediment (NM) is taken offshore from NMP. The cooperative agreement for NRC/NYS 1988 and the Utilities reports identifies this site as Sunset Bay, Number 2A on Figure 2. However, the NYSDOH annual reports specify the sediment site in the vicinity of the inlet canal of Niagara Mohawk's Unit One, identified as Number 2 on Figure 2. There is no indication of when and/or if this offshore sediment site has changed in NYSDOH reports. The Utilities collect sediment from Sunset Beach (05) and at Langs Beach (06, control), Figure 3. The NYSDEC, NYSDOH and the Utilities annual reports do not specify the type of sediment collected. Data from NYSDEC and NYSDOH sediment sampling radionuclides are summarized in Table 1G. As can be seen from these data, the sediment radionuclide concentrations varied considerably during the period 1981-1988. The most significant range of values can be seen in thorium^{232} range of values from a minimum activity of 396 to a maximum value of 690000. These wide ranges of values can also be seen with cesium^{137}, thorium^{234}, uranium^{235} and uranium^{238}.

Cesium^{137} in bottom sediments declined substantially in 1985. Uranium^{238} more than doubled this same year and remained elevated until 1988 as illustrated in Figure 8. These changes are not accounted for in any of the reports reviewed.

Vegetation

According to the TS, three different kinds of broad leaf vegetation grown in areas with the highest D/Q value and one sample of each similar broad leaf vegetation from 9.3 miles in the least prevalent wind direction is required for monitoring.

The NYSDOH annual reports use one site per year and have been, for the most part, consistently testing one area. The exact location of this New Haven site, 3758-005 was not specifically identified, nor was the location of New Haven site 3758-004 used in 1984 specifically identified. The vegetation sites are identified in the New York Power Authority's 1988 annual report and the New Haven sites are shown on Figure 9, Letter P and J. A control sampling site for the Utilities is depicted at M.

Wild (NM) vegetation or edible foods are collected in summer/fall and are monitored once a year. However, the crops analyzed by NYSDEC and NYSDOH are not consistent on a yearly basis. In NYSDOH reports the specific crops sampled and analyzed are not identified for the period 1984 and 1985.

Vegetation is monitored for uptake of radioactive isotopes from the soils and also evaluated for particulate deposition. Wild (NM) broad leaf plants or vegetation (NM) have been selected in some instances because the large flat surface area of the leaf acts as a "collection plate" for airborne radioactive dust particles. At other times garden vegetables have been selected for analysis. The data from vegetable radionuclides are summarized in Table 1H. $Cobalt^{60}$ and $cesium^{134}$ had significant ranges of values during the time period of 1981-1988.

The number of sampling sites, frequency of sampling, and control sites used by the NYSDOH and the Utilities for 1988 are summarized on Table 2 for all sampling protocols.

Accessibility of Information

The Penfield Library at SUNY Oswego serves as the registry for New York State and NRC public documents from the federal, state and local levels for review. At the time of this report, copies of the The Annual Report of Environmental Radiation in New York State published by the NYSDEC are not available in the Penfield Library for any years. There are quarterly reports from 1978 through 1981 which do not include all the monitoring data from the NMP area. The Environmental Radiation in New York State reports by the NYSDOH were not available after 1986. These reports by the NYSDEC and the NYSDOH were also not available on microfiche. There are no hard copies of the Radiological Environmental Operating Report published by the New York Power Authority or by Niagara Mohawk available before 1981. The only bound copies of these annual reports are from Niagara Mohawk 1989 and the New York Power Authority 1985 and 1989. However, these reports are available on microfiche. The Utilities have some semi-annual hard-copy reports available after 1981.

As of September of 1991 all hard copies of the documents in the Penfield library were removed. The only information source for the nuclear operations are Nine Mile Point are on microfiche.

Computer printouts for the microfiche access numbers are available at the information desk at Penfield library from a Penfield Librarian. These printouts became available only after the Nuclear Regulatory Commission (NRC) was notified in 1990 of the absence of hard copies of the Environmental Radiation Reports printed before 1981.

DISCUSSION OF NINE MILE POINT SAMPLING PROTOCOLS

Based on samples and data collected by NYSDEC, NYSDOH, and the Utilities, the radionuclide concentrations in the area in proximity to the Nine Mile Point vicinity did not exceed the standards set by the United States Nuclear Regulatory Commission for the period 1976 through 1988. These results suggest that emissions from the three nuclear generating facilities are not contributing significant amounts of radioactive nuclides into the environment. A review of the data, however, demonstrates that radionuclide concentration have varied significantly during the period 1976 through 1988. The range of results represented in Figures 5,7,8 and Table 1 indicate a difference of two orders of magnitude in some of the sampling data. Broad ranges appear in all of the monitored media, often by more than one order of magnitude, and it is not possible to determine the reason or causes for the noted differences with the data or information that is available.

A review of the sampling protocols indicates that it is not possible to draw conclusions on the data presented by the NYSDEC and the NYSDOH relative to radionuclides emissions from the three nuclear facilities, neither can this sampling data be compared to the sampling data from the Utilities. Listed below are the primary reasons which are addressed more fully later in this report.

1) The one air sampling station of the NYSDOH is not sufficient to sample the diverse winds of NMP area, nor does one station allow for comparisons to other areas which are subjected to radionuclide emissions. The noble gases, which are the most abundant radionuclide emissions, are not being monitored.

2) Milk sampling sites have not remained constant, nor are they specifically identified on a map in NYSDOH reports. Annual comparisons of milk sampling data are therefore not possible. The data from the NYSDEC or NYSDOH can not be compared to data from the Utilities.

3) Control or upcurrent surface water samples may be contaminated by a host of variables (ie. fish, migrating fowl, lake current reversals). Without knowing other parameters, it is not possible to determine whether control water samples have been altered by influencing factors.

4) TLD sites of the NYSDOH situated west to south-east do not sufficiently monitor gamma radiation because of wind variations associated with NMP. North to north-westerly winds are not being effectively monitored.

5) The fish used for radionuclide monitoring are migratory and thus not representable of bioaccumulations of radionuclides in aquatic organisms. Additionally, edible fillets are not the most effective sample for assessing select nuclides. It is well known that strontium 90 accumulates in bone and not in flesh. Other radionuclides concentrate in organs not sampled as a part of the Utilities or NYSDOH protocols.

6) Sediments in the nearshore areas of NMP are sands which are highly mobile and do not effectively adsorb radionuclides.

7) Vegetation sites of the NYSDEC or NYSDOH are not identified on any map and the inconsistent use of produce does not allow for comparison of vegetative data.

8) Information is not readily accessible to the public from the public documents room located in Penfield Library in Oswego (NM).

RECOMMENDATIONS FOR SAMPLING PROTOCOLS

In order to provide meaningful information that can be used in the assessment of the radioactive emissions from the nuclear facilities at Nine Mile Point a reevaluation of the protocols must be made. The monitoring program can be significantly improved, by not necessarily requiring a greater effort or cost, but by providing a more focused program. Recommendations for sampling and analytical protocol changes include the following:

Air Particulates

- Having only one air particulates site (Number 1 or 1A on Figure 2) in a southerly or east-southeasterly location from the reactors and emission points does not adequately ensure that the point source is being monitored appropriately by the NYSDOH, since there are two significant lobes of wind direction as shown by the ESEERCO wind rose for 1986-1988 on Figure 2. The air particulate sampler should be located to the east-northeast of the nuclear facilities; however, effective monitoring of air particulates is dependant on various wind patterns, and obstacles such as buildings and/or trees may influence the winds (Ballentine, personal communication). Also, no assessment or comparisons can be made from only one air station. The NYSDOH should reconsider the location and number of air sampling sites.

- Lake and land breezes create convection cycles which spiral along the coast in the summer (Al Stamm, personal communication). Without a clear understanding of the wind characteristics before and during air sampling it is not possible to determine if the radioactive emissions are being adequately monitored from the nuclear facilities at NMP. All wind data should include meteorological conditions prior to and during sampling.

- Because the D/Q value of a site indicates how much radionuclides it is theoretically receiving, this information should be printed with the air site sampling number so an assessment of the sampling site can be made.

- Reasons for the air sampling site changes of A376101 (1976-1977), 3767001 (1978-1980), 3767003 (1981-1987), and 3767001 (1988) are not published in the NYSDEC or NYSDOH reports. The 1988 NYSDOH report notes a change in the location of the air site in their report but does not change the NMP map. To avoid confusion, any changes in site must be accompanied with a change in the map location and the rationale of why the site was changed should be included.

- The open environmental area north of NMP, Lake Ontario, see Figure 6, is not being monitored for airborne releases, but should be. This region accounts for fifty percent of the perimeter around the plant. Monitors could be placed on buoys from spring to fall.

- The air monitoring stations for the period 1976-1988 had a large range of data as indicated in Table 1A. Zirconium-niobium^{95} varied from a minimum of 0.0003 pCi/m^3 to 0.053 pCi/m^3 representing a difference of more that two orders of magnitude. One order of magnitude can be found for cesium^{137} cesium^{134}, rubidium^{106}, beryllium^{7}, strontium^{90} and strontium^{89}. Reasons for these broad ranges should be determined.

- The noble gases such as Krypton and Xenon are the most abundant radionuclides vented from the nuclear plant and should be monitored and data published (NYPA).

- The reprinted maps from the Utilities locating the sampling sites are very busy, confusing, and difficult to read. Maps must be made as simple and as uncluttered as possible to avoid confusion.

Milk

- The rights to privacy of the farmers (Whuang, personal communication) make it difficult to compare milk data. Data from the NYSDEC and NYSDOH can not be compared with any previous or subsequent data, nor can it be compared to the Utilities data because of unidentified milk sampling sites. Since this information is available from the Environment Division of Oswego County, the farm sampling sites should be identified and mapped in order to enable comparison of monitoring data.

- o Strontium^{90} monitoring should be consistent and maintained because its deposition on land causes accumulations in the milk and presents a dietary pathway for humans. Strontium^{90} is only occasionally monitored. In order to assess annual variations, consistency is required with site locations and monitored radionuclides.

- o As noted in Table 1B, differences for the iodine^{131}, strontium^{90}, tritium, and barium-lanthanum^{140} varied by more than an order of magnitude during the period 1976 through 1988 but there is no way to explain these variations without further details about meteorology, operations at the nuclear facilities, or other variables which may have influenced the range in these radioactive isotopes. Even though these radionuclides are below the maximum permissible concentrations, variables should be addressed and protocols changed to address these differences.

Water

- o Water is sampled on a monthly basis and this should remain the routine, but consideration for additional sampling should be made immediately following unusual releases or shortly after refueling due to leaking vents or purging of the facilities.

- o Water samples taken from Dempster Beach should be analyzed for individual radioactive isotopes and not only for gross alpha, beta and tritium.

- o Groundwater should be sampled as some areas may be affected by rainwater recharge of the groundwater. On site groundwater monitoring should be conducted to assess on-site spills or deposition.

- o The "up-current" location of the Oswego Steam Station used for water sampling may be unsuitable as a sampling station due to potential contamination by other variables, ie, water fowl, fish, and winds.

- o Even though there is a significant dilution effect, the water at public beaches such as Mexico, Brennans and Romona Beaches or Selkirk Shores, which lie "down-current" from the nuclear plants should be monitored. This is especially important in the summer when the beach is frequently used.

- o There should be monitoring for plutonium in the water and suspended sediment (Eichholz 1976) because imperfections in the fuel rods may release this element into the primary cooling water and find its way into Lake Ontario (Gofman 1981). Spills may also introduce this element into the water and sediment.

- o The sample site identification number 3767004 indicates it is a control site at the Oswego Steam Station (1988) and is the same identification number as an indicator site at the Inlet (1982-1987) at NMP. The sampling site identification number must remain constant.

Thermoluminescent Dosimeters (TLD)

- The four locations of the NYSDOH TLDs (1985-1988) do not take into consideration the prevailing or seasonal variations of wind direction. In fact, two of these monitors are located in the area of lull winds (Figure 2). These TLDs should be placed around the NMP site to effectively sample air relative to prevailing wind directions.

- The NYSDOH 1988 location changes of the TLD monitors do not take into consideration prevailing or influencing wind directions. Due to the seasonal variation of the TLDs depicted in Figure 7, additional investigation and/or modelling studies by the NYSDOH should be performed to assess local wind patterns and the effect on TLD monitor placement. Information regarding the D/Q value, which determines the site location of the TLDs should accompany data. Also questionable is why the TLDs were moved in 1988 when previous monitoring data indicated a higher D/Q at the former sampling locations.

- The NYSDOH and the Utilities data from the TLD monitors are difficult if not impossible to compare due to the site specific nature of the ambient air. For example, there are two different TLD locations for the Energy Center in the Utilities annual reports and only one for the NYSDOH. Greater consistency is required to enable effective comparisons.

- What is the minimum sensitivity of the TLDs and how accurate are they? How often are they calibrated? These data are not included in any of the monitoring reports and should be.

- Control stations should be established beyond the fifty-mile range. Discharges may be dispersed further than fifty miles from the NMP area (Gofman 1981).

Sediment

- Bottom and suspended sediment samples should be taken downcurrent (east) and upcurrent (west) of the NMP installation (Eichholz 1976). The scattering, turbulence, and mobility of sediment at Sunset Beach or offshore of Niagara Mohawk's Unit One Reactor would make it impossible to effectively evaluate sediment for accumulations of radioactive isotopes over time. The coarse grained nature of the sediments off of NMP do not readily adsorb radionuclides. It is suggested that suspended sediment traps be utilized to monitor the sediments near NMP. Any sediment used for analysis should be characterized for size distribution and percentage of organic matter.

- In 1985 cesium^{137} sediment activity declined substantially and uranium^{238} bottom sediment activity more than doubled as shown in Figure 8. With no accompanying information, there is no way to explain these variation. Thorium^{232} had a minimum values of 396 and a maximum value of 690000 in table 1G. These large variations should be addressed and explained.

- o Core samples in the deep water area offshore Lake Ontario should be analyzed for radionuclide deposition to provide a history of activities.

Fish

- o Comparison of yearly fish data is not possible because of the lack of sampling consistency and limited information provided on sample characteristics. The annual reports of NYSDEC and NYSDOH do not list the species, size, weight, sex, or condition of fish that are caught for monitoring. The Utilities list the species of fish but not other variables. These data are imperative to understanding the uptake potential of radionuclides.

- o Confusion about split fish sample protocols are due to discrepancies between The NYSDOH and EA Science and Technology, Inc. Koeneke (personal communication) of EA Science and Technology, Inc. stated fish are filleted and chopped into small pieces, mixed thoroughly, and then packaged for split sampling. Whuang (Personal communication) indicated split samples of fish are not subsamples of the same fish. For example, Whuang noted one fish specimen sample is analyzed by the NYSDOH and another fish analyzed (NRC) by the Utilities. Results and comparisons are therefore not possible because the species, size, weight, and therefore exposure may be significantly different. If fish are to be sampled, the same fish must be sampled by laboratories of both the Utilities and the NYSDOH for a true duplicate analysis.

- o Fish habits change from the juvenile to the adult stage and the age of the fish has a direct bearing on the amount of time exposed to radioactive isotopes. When the species selection is made, these factors should be considered and the protocols modified.

- o Lake Ontario salmonoids and other migratory species are a poor choice for monitoring radionuclides and are not a good choice for the bioaccumlation of radioactive isotopes. Other non migratory species should be selected.

- o Benthic organisms should be used for monitoring purposes. Filter feeding invertebrates are stationary and process large quantities of water. Eichholz (1976) noted that large concentrations of radionuclides have been found in seabed silt and sediment which result in higher exposure to the benthic organisms. He notes shellfish have the ability to selectively concentrate a number of radionuclides normally found in reactor effluent. The newly introduced Zebra Mussel may provide a more reasonable sampling option due to its availability and great water filtering capacity. These mollusks are known to filter a liter of water per day. Zebra mussels could be grown on panels suspended from bouys in areas which support their growth (Roberts, personal communication).

- o The Utilities have used the Oswego Harbor as a control area as reported in the FitzPatrick 1988 annual report. However, they do not sample down current from the nuclear plants. Additionally, Oswego Harbor is unsuitable as a control sampling site for taking fish samples because of fish migration and/or movement. Control areas should be located beyond the potential influence of NMP.

- o Fish should not be monitored for the edible potions alone because bone and select organs concentrate specific radionuclides.

Vegetation

- o Inconsistent and unidentified vegetable sampling sites and/or vegetation make it impossible to compare NYSDOH data to previous or subsequent years. The Utilities vegetative data can not be compared to the NYSDEC and the NYSDOH monitoring data. Sampling sites must remain constant for comparison purposes.

- o Wind roses of the Empire State Electric Energy Research Corporation (ESEERCO) for the period 1986-1988, indicate that any one station in New Haven will be down wind 10% - 25% of NMP (see Figure 3). Without the specific location of this sampling site it is difficult to relate or compare data. For example, the greater the distance from the facilities, the greater the wind dispersion, thereby minimizing and lessening crop exposure to radionuclides. The NYSDOH should consider monitoring the New Haven site with additional sites established in the Scriba and/or Mexico area. Selection of additional sites should be made after a careful evaluation of prevailing wind patterns.

- o The preferred produce for the NYSDOH monitoring are cabbage and tomatoes because of the abundance in the NMP area. Abundance should not be the dictating factor, rather crops should be chosen because they present the greatest uptake potential and pathway to humans. Protocols should be modified to assess plant uptake of radionuclides.

- o Although the broad leaf plants serve as a "collection plate", this "plate" will also vary according to the meteorology of the area. The rains of Oswego are steady and varying in intensity. Accumulated radionuclides from the broad leafed plants result in a conservative evaluation of exposure because rainfall would tend to wash off the airborne particulates, thus reducing deposition. If the deposition factor is desired perhaps an instrument could be designed that would collect the rainwater, evaporate the water, and leave the particulates for sampling. This would give a better analysis of the accumulation factor than a vegetable which is subject to the cleansing action of steady rains.

- o Venison should be considered for analysis because the deer are indigenous to the area and are a food source for many area residents.

Accessibility of Information

- Accessing the microfiche for annual radiological reports and/or other documents is not a medium the public readily utilizes. Many of the microfiche and hard copies of semi-annual reports or other document information in the NRC room at Penfield are very blurry and/or illegible. Legible hard copies of all available reports are required for satisfactory public access.

- The NYSDOH has also been contracted to compare the yearly reports of the Utilities to their own reports. These reports are sent out annually to the Nuclear Regulatory Commission office in Washington D.C. These reports are not included in the NRC document room at Penfield Library but may be obtained from J.J. Kottan at the Region I Office, King of Prussia, Pa (NRC). The public may not know comparative reports exist or are obtainable. Therefore it is suggested these reports be included with the reports from the Utilities or from NYSDOH to facilitate public access.

- Sample and numerical data utilized and reported is set up in such a way that it must be rearranged for comparison purposes. Glancing down a row of data doesn't necessarily align the information for quick interpretation. Inconsistent use of scientific notations also makes it difficult to analyze information presented in these reports. Improved and consistent data reporting is required.

- The D/Q value for all sampling sites should be included with monitoring data. Only then can an assessment be made to the suitability of a site. Also a reference table must accompany this information for a clear understanding of what the D/Q value represents.

- A table representing the minimum detection level of radionuclides for pCi/kg should be included in these reports with the minimum detection levels for air, fallout, and water and milk.

Summary

The NYSDEC conducted a radiological environmental surveillance program from pre 1976-1981. The NYSDOH took over the surveillance program from the NYSDEC in a memo of understanding in 1982 and continues the program to the present. The NYSDOH program receives additional funding from the NRC and reports comparison data to the NRC. These surveillance programs of the NYSDEC and the NYSDOH are similar to but not as extensive as the NRC requirements for the Utilities as required from the TS. Monitoring data from the NYSDOH used for comparison purposes to monitoring data from the Utilities at the NMP area is necessary and therefore it is imperative the sampling sites and samples be comparable. Because of numerous inconsistencies, in sample site identification numbers, sampling sites, time of collection, and types of samples it is evident that it is not possible to derive year to year comparisons of the available data. There is a need to revise the sampling protocols to ensure the protection of human health and the environment. Although at no time did any of the monitored radionuclides exceed NRC limits, there are significant differences in all of the samples collected and analyzed during the period 1976-1988. These differences, as large as one to two orders of magnitude, cannot be explained based on the information currently available to the public. We suggest a review of the sampling and monitoring protocols to enable effective comparison of all data collected at and in proximity to the NMP area. Also all information regarding the NMP surveillance programs must be published and made assessable to the pubic in a timely manner.

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TABLE 1

A) NYSDEC and NYSDOH Air Monitoring Sites * 1976-1988
Results in pCi/m3

	Beta	I-131	Cs-137 (x10-3)	Cs-134 (x10-3)	Ru-106 (x10-3)	ZrNb-95 (x10-3)	Be-7 (x10-3)	Sr-90 (x10-3)
minimum	0.002	0.0004	0.35	0.1	2	0.8	29	0.1
maximum	0.2	0.03	9	7	70	53	400	2.2
minimum average	0.009	0.002	0.54	0.49	3	1.2	51	0.13
maximum average	0.067	0.01	7	6.6	12.5	24	92	2.2
total n	968	462	50	49	50	49	48	13

* A376101 (1976, 1977); A376102 (1976-1978) 3767001 (1978-1988); 3767003 (1978-19
Does not include Chernobyl sampling
Sr-90 sampled only during 1979-1980 and Sr-89 only sampled during 1980

B) NYSDEC and NYSDOH Milk Monitoring Sites * 1976 - 1988
Results in pCi/l

	I-131	Cs-137	Sr-90	Sr-89	H-3	K-40	BaLa-140
minimum	0.04	6	0.9	1.3	100	880	9
maximum	19.4	47	16	17	3900	1700	23
minimum average	0.1	8.13	0.97	2.4	185	1054	11
maximum average	7.36	28	10	17	1170	1441	21
total n	446	561	281	19	296	547	17

* Scriba Sites: M376701 (1976); M376702 (1976); M376705 (1976 & 1977)
3767002 (1978-1981); 3767006 (1979-1980); 3767004 (1982-1988)
New Haven Site 3758001 (1981-1988)
Mexico Site 3757002 (1982-1988)

C) NYSDEC and NYSDOH Water Monitoring Sites * 1976 - 1988
Results in pCi/l

	Cs-137	Ru-106	ZrNb-95	Co-60
minimum	6	20	7	1
maximum	81	90	500	7
minimum average	7	26.67	11.75	7
maximum average	9.8	41.11	131.72	7
total n	184	182	182	3

* Oswego City Hall Tap Site 3702001 (1976-1988)
Inlet Site 3767003 (1981, 1987 & 1988) or Outlet Site (1982-1985, 1987 &1988)
Scriba Inlet Site 3767004 (1982 - 1985) or 3702002 (1986)
Steam Station Inlet Site 3702002 (1986 & 1987) & 3767004 (1988)

TABLE 1 (continued)

D) NYSDEC and NYSDOH Water Monitoring Sites * 1976 - 1988
Results in pCi/l

	Beta	H-3	Alpha
minimum	0.9	110	0.7
maximum	14	1300	12
minimum average	2.52	177	1.81
maximum average	6	400	4
total n	593	143	401

* Oswego City Hall Tap Site 3702001 (1976-1988)
Dempster Site 3758002 (1976-1988)

E) NYSDOH Air Monitoring TLD Sites * 1983-1988
Results in Net mR/standard quarter

	Rt.1A	Rt.1A	Met. T.	Vis. C.	Rt.29&M.	Miner	Rt.1A&29
average	14	13	13	14	13	13	13
minimum	12	11	11	12	12	12	11
maximum	17	16	16	17	13	13	14
total n	22	21	23	21	2	2	3

* County Route 1A; County Route 1A across from plant; Meteorological Tower; Visitors Center; County Route 29 and Miner Road; Miner Road; County Route 1A and County Route 29

F) NYSDEC and NYSDOH Fish Monitoring Site * 1976 - 1988
Results in pCi/kg

	Sr-90	Cs-137	Cs-134	Ru-106	K-40	I-131
average	330	50	9	45	2451	30
minimum	8	23	2	5	1700	30
maximum	1800	158	15	80	3000	30
total n	6	24	24	24	24	1

* Offshore Nine Mile Point 3758004

G) NYSDEC and NYSDOH Sediment Monitoring Site * 1981 - 1988
Results in pCi/kg

	Cs-137	Co-60	Ru-106	Zr-95	Cs-134	Th-232	Ra-226	Th-234	K-40	U-235	U-238
average	549	176	136	38	38	43860	586	525	17606	93	960
minimum	11	36	40	6	11	396	50	50	14400	5	90
maximum	1880	377	400	70	64	690000	1040	1000	24900	300	2000
total n	16	7	5	5	6	16	14	2	16	14	13

* Nine Mile Point Site 3767001

H) NYSDEC and NYSDOH Vegetable Monitoring Sites * 1981 - 1988
Results in pCi/kg

	Cs-137	Co-60	Ru-106	Cs-134	K-40
average	11	17	42	13	1933
minimum	8	9	30	6	800
maximum	15	60	50	80	3800
total n	16	14	16	16	16

* New Haven Site 3758005 1981 - 1988 (excluding 1984)
New Haven Site 3758004 1984

TABLE 2

parameters	NYSDOH frequency	NYSDOH # of sites	Utilities frequency	Utilities # of sites
Air	weekly	1	weekly	8
- control	-	-	weekly	1
Milk	monthly	4	monthly	6
- control	-	-	monthly	1
Water - drinking	weekly	1	weekly	1
- surface	monthly	3	monthly	3
- control	-	-	monthly	1
TLD - off-site	quarterly	4	quarterly	45
- control	-	-	quarterly	3
Fish	biannually	1	biannually	2
- control		-	biannually	1
Sediment	annually	1	annually	1
- control	-	-	annually	1
Vegetable	annually	1	annually	1
- control	-	-	annually	1

* Background sampling sites for the NYSDOH are established at various areas in New York State.

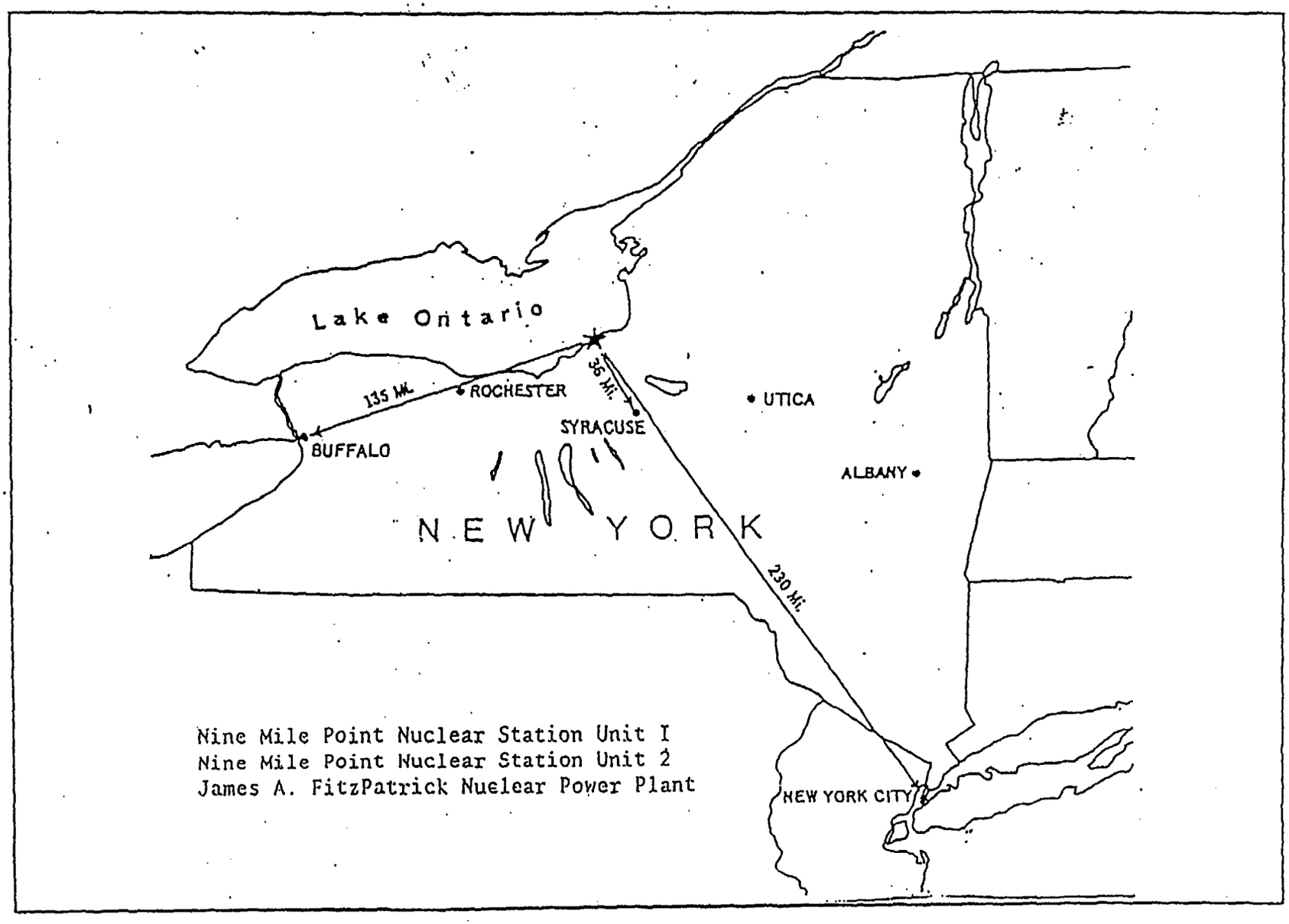

Figure 1. Nine Mile Point location in New York State where three nuclear facilities are operating.. Reprinted from 1988 Radiological Environmental Report, New York Power Authority.

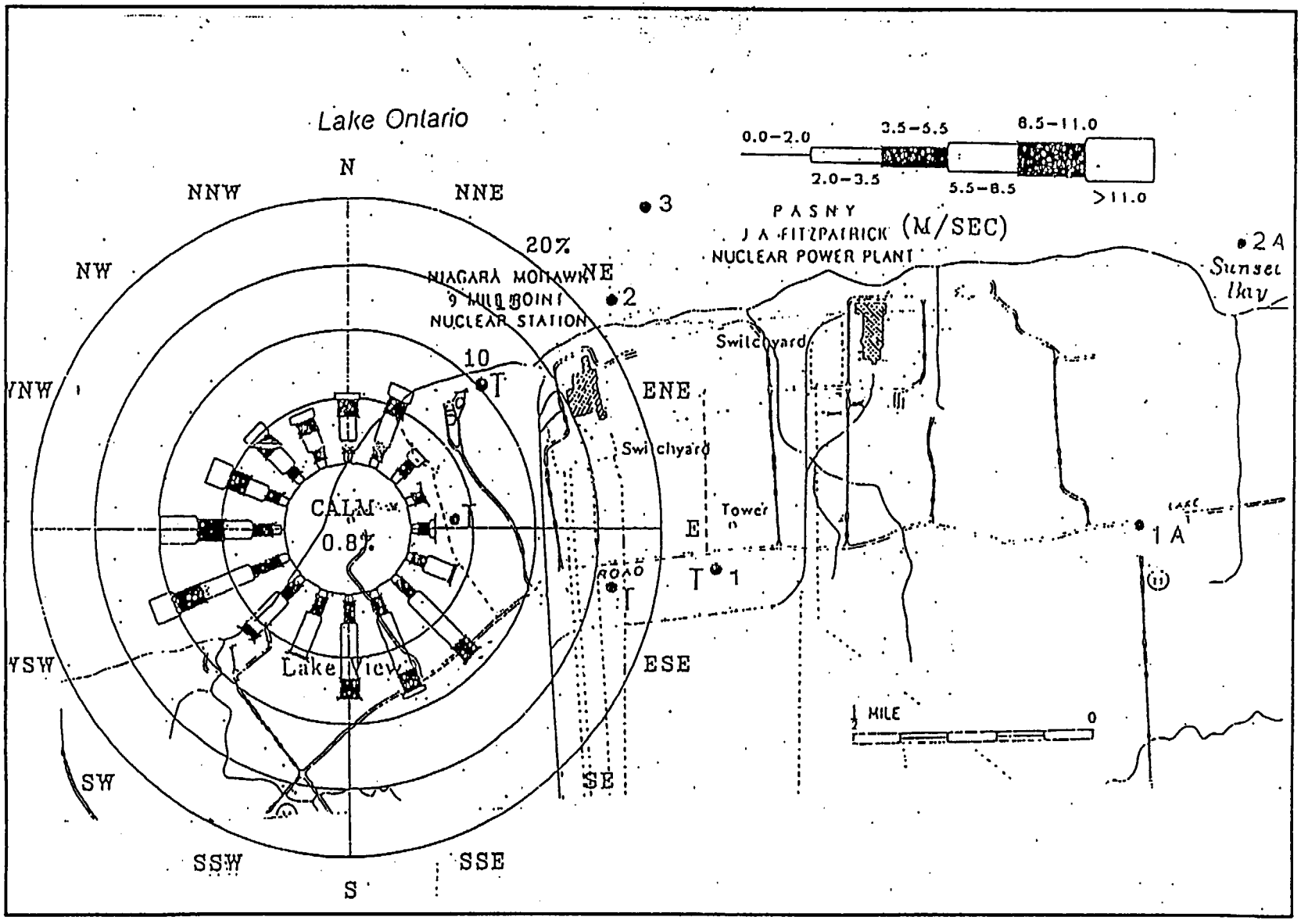

Figure 2. New York State Department of Health sampling locations for air (1, [1A]), sediment (2, [2A]), fish (3), and TLDs (T). A 200 ft. wind rose from ESSERCO has been superimposed. Reprinted from Environmental Radiation in New York State 1988 Annual Report, New York Department of Health.

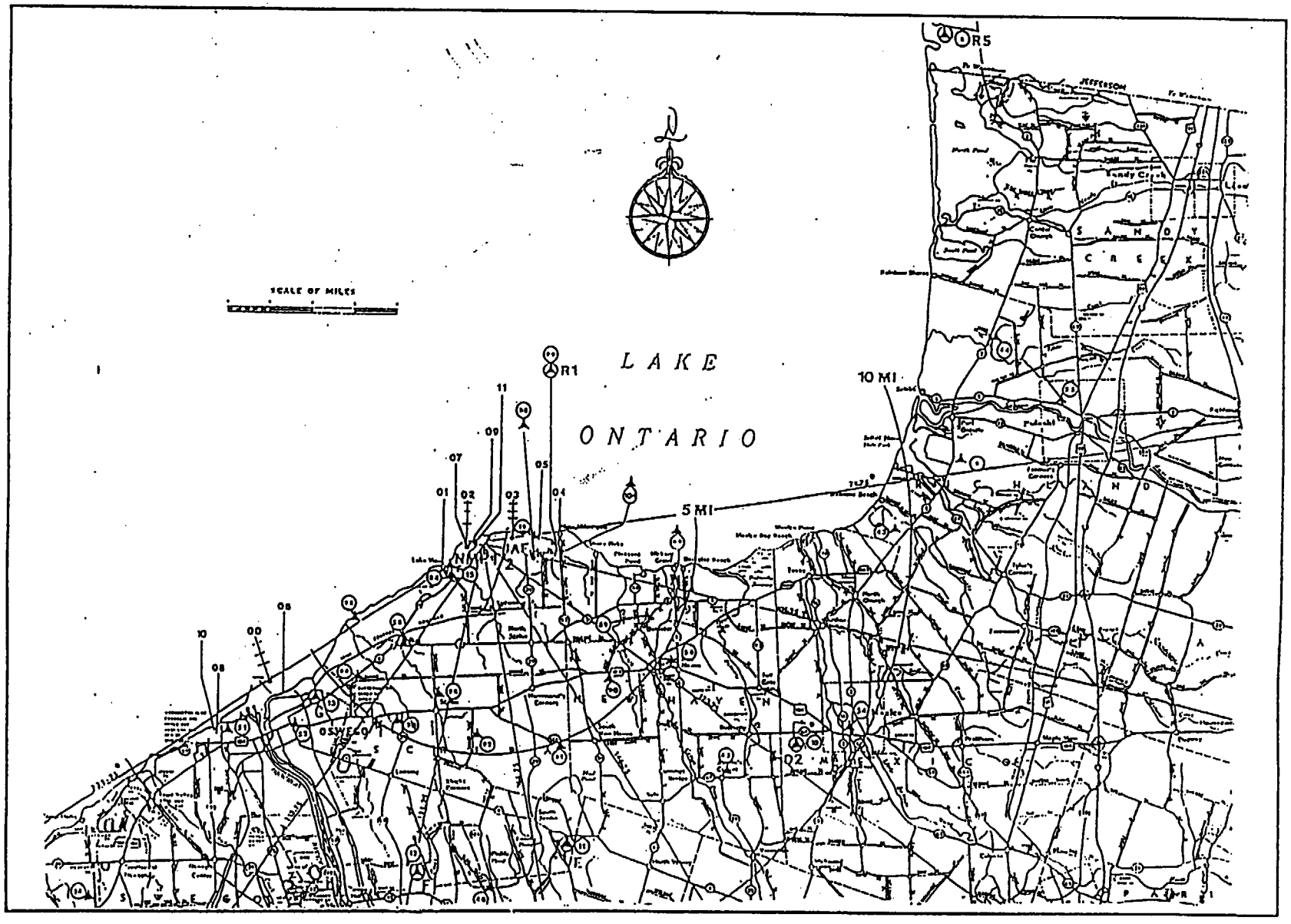

Figure 3. New York Power Authority sampling locations for water (03, 08, 09, 10, 11), Ⓐ environmental stations and ▲ TLD locations. Reprinted from 1988 Radiological Environmental Surveillance Report, New York Power Authority

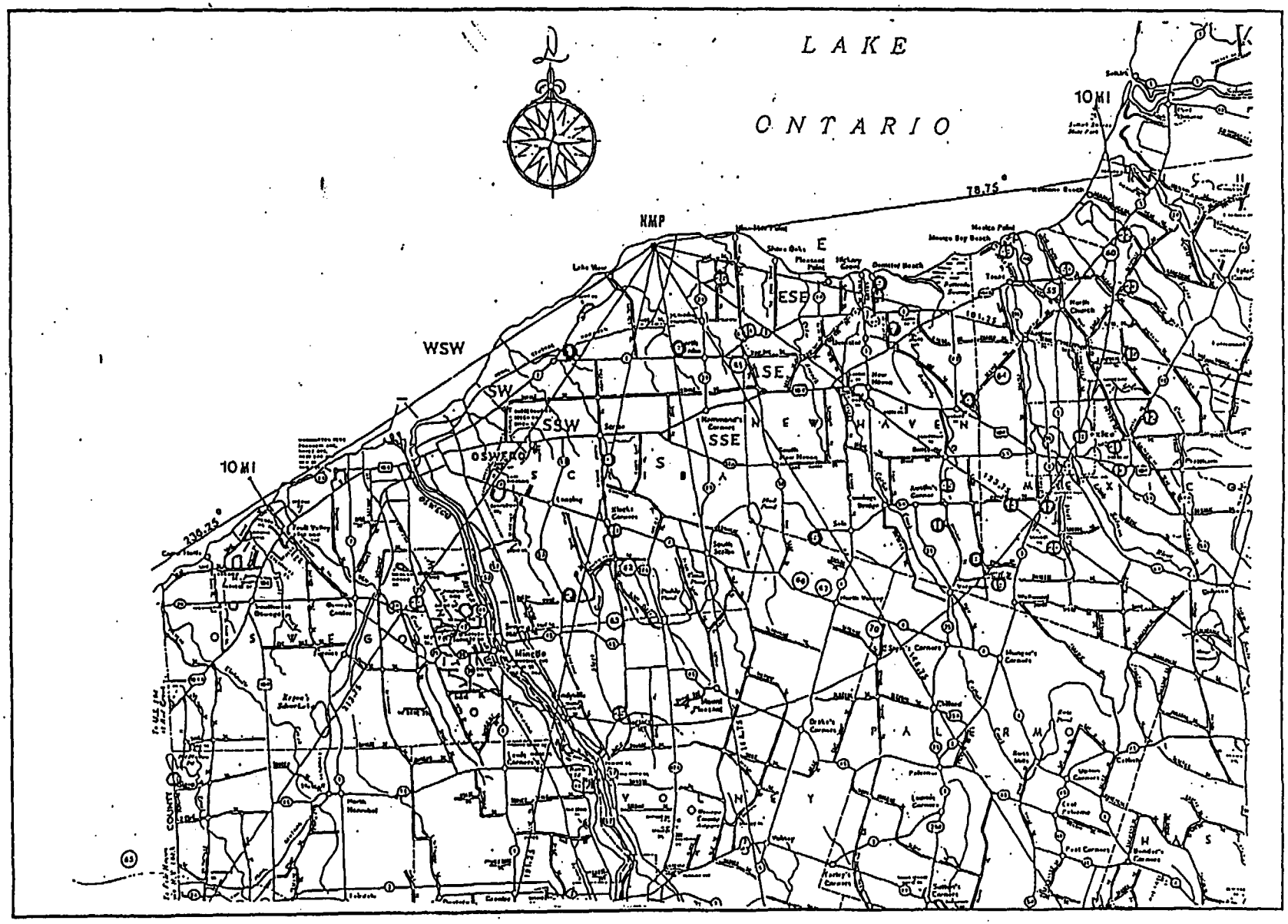

Figure 4. New York Power Authority sampling locations for milk (4, 7, 16, 50, 55, 60, and 65). Other sites illustrated but not used for sampling are milk animal farm sites and previous farms sites. Reprinted from 1988

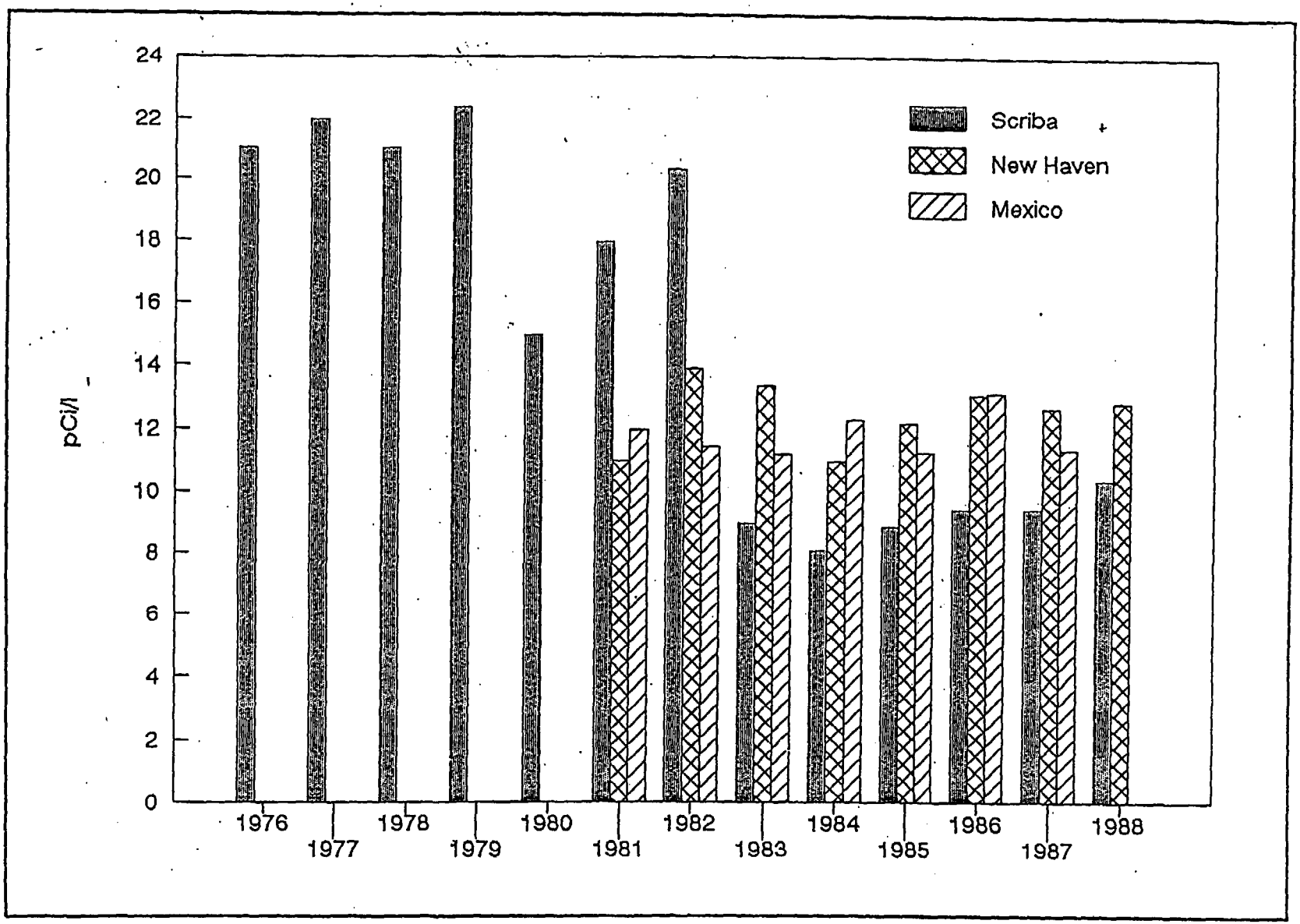

Figure 5. New York State Department of Health for Cesium - 137 milk concentrations for the period 1976 - 1988 from Scriba, New Haven and Mexico sampling sites.

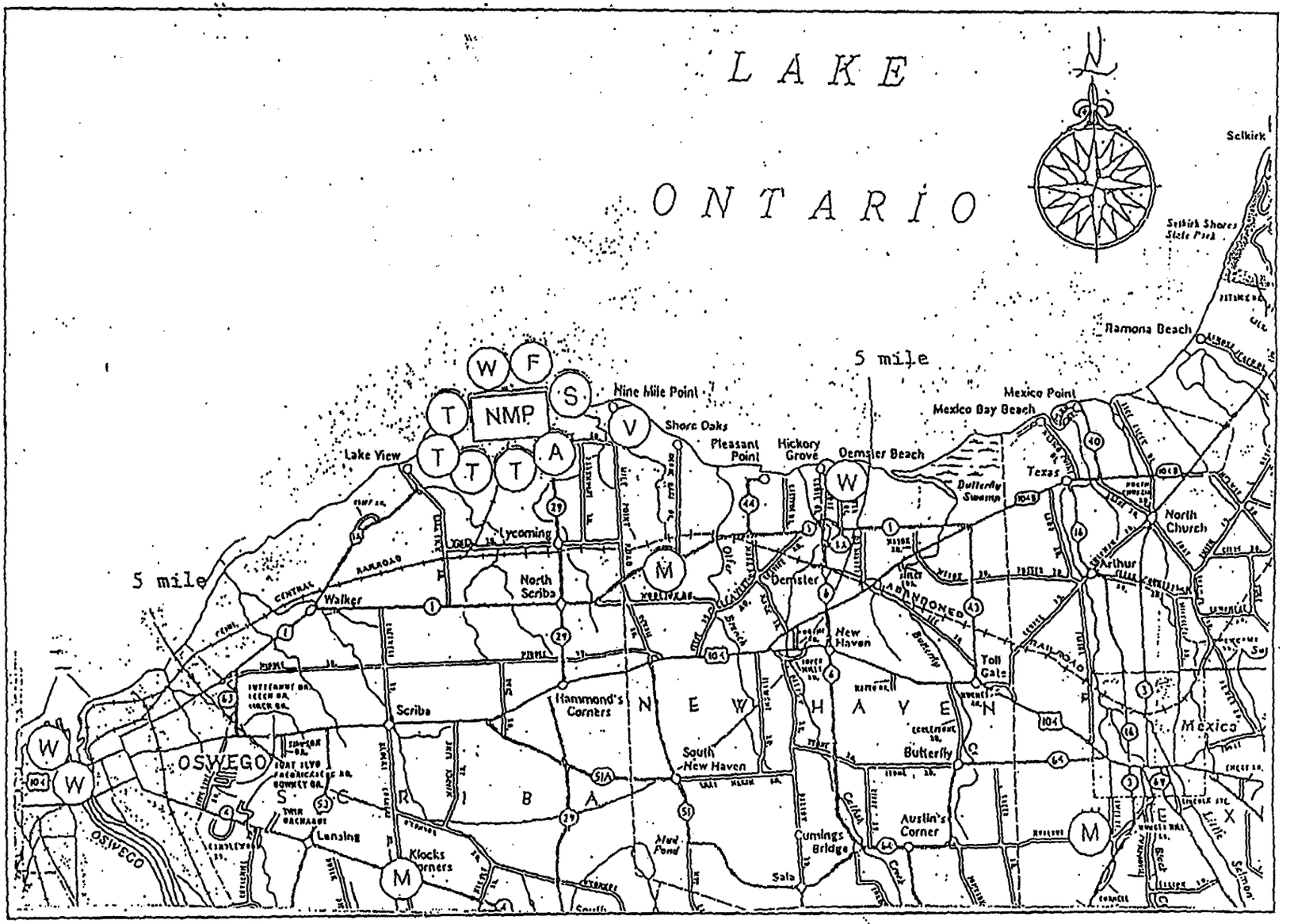

Figure 6. New York State Department of Health sampling locations for air (A), milk (M), water (W), TLD (T), fish (F), sediment (S) and vegetation (V).

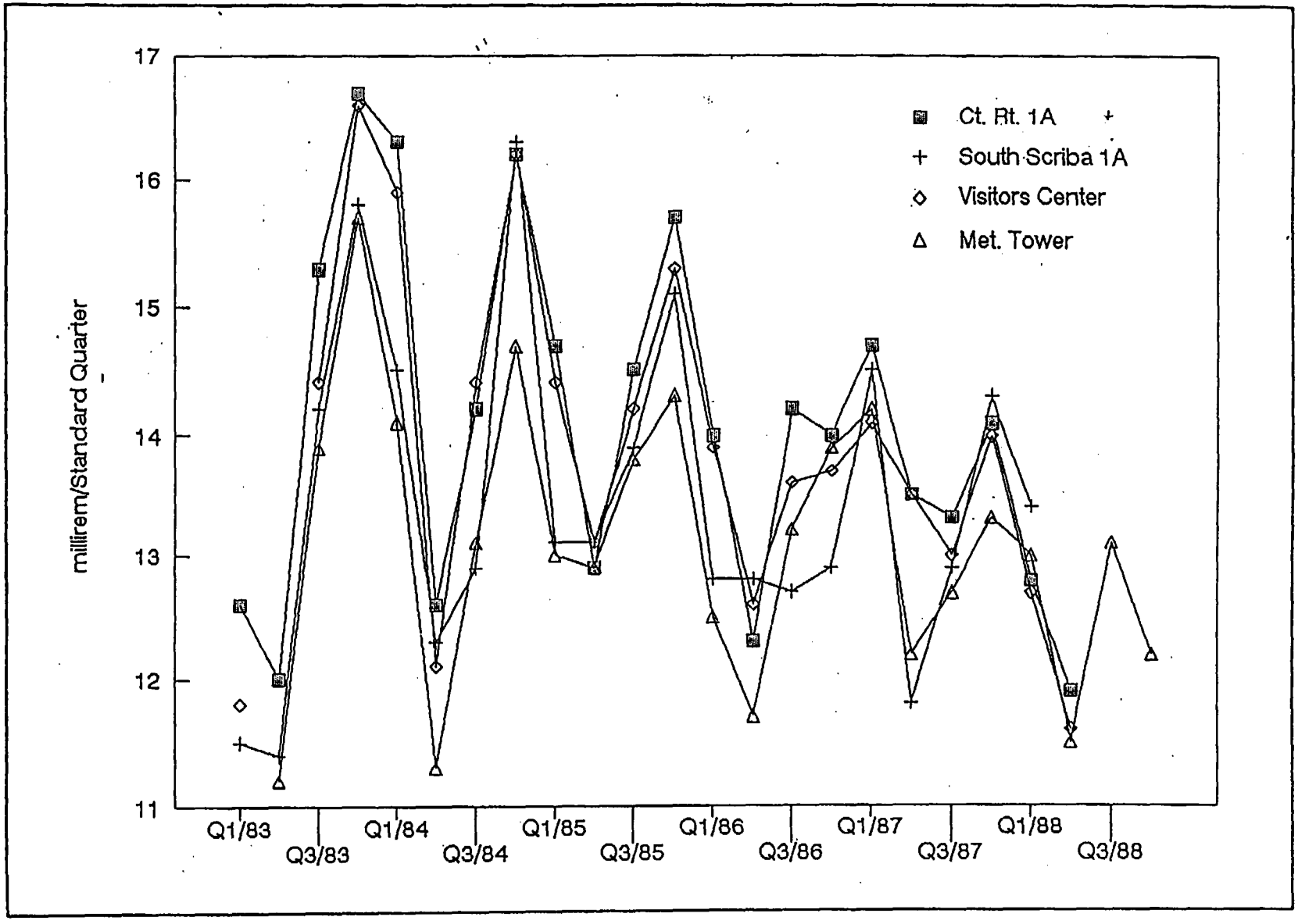

Figure 7. New York State Department of Health for Scriba Air TLD monitoring data from four locations for quarterly sampling for the period 1983 - 1988.

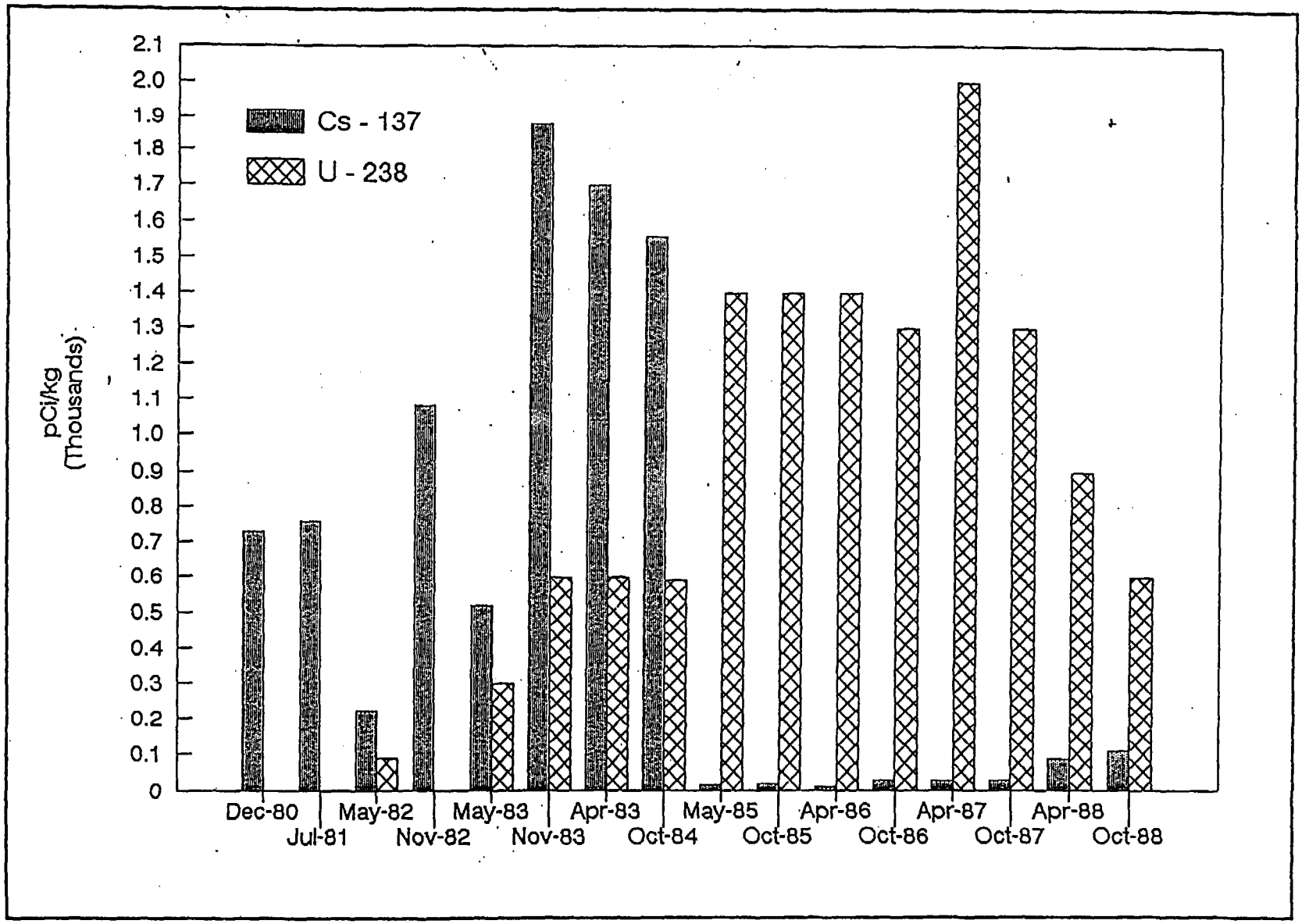

Figure 8. New York State Department of Health for Cesium - 137, Uranium - 238 data from offshore Lake Ontario bottom sediment data for the period 1981 - 1988. Note the large change in Cesium - 137 after 1984.

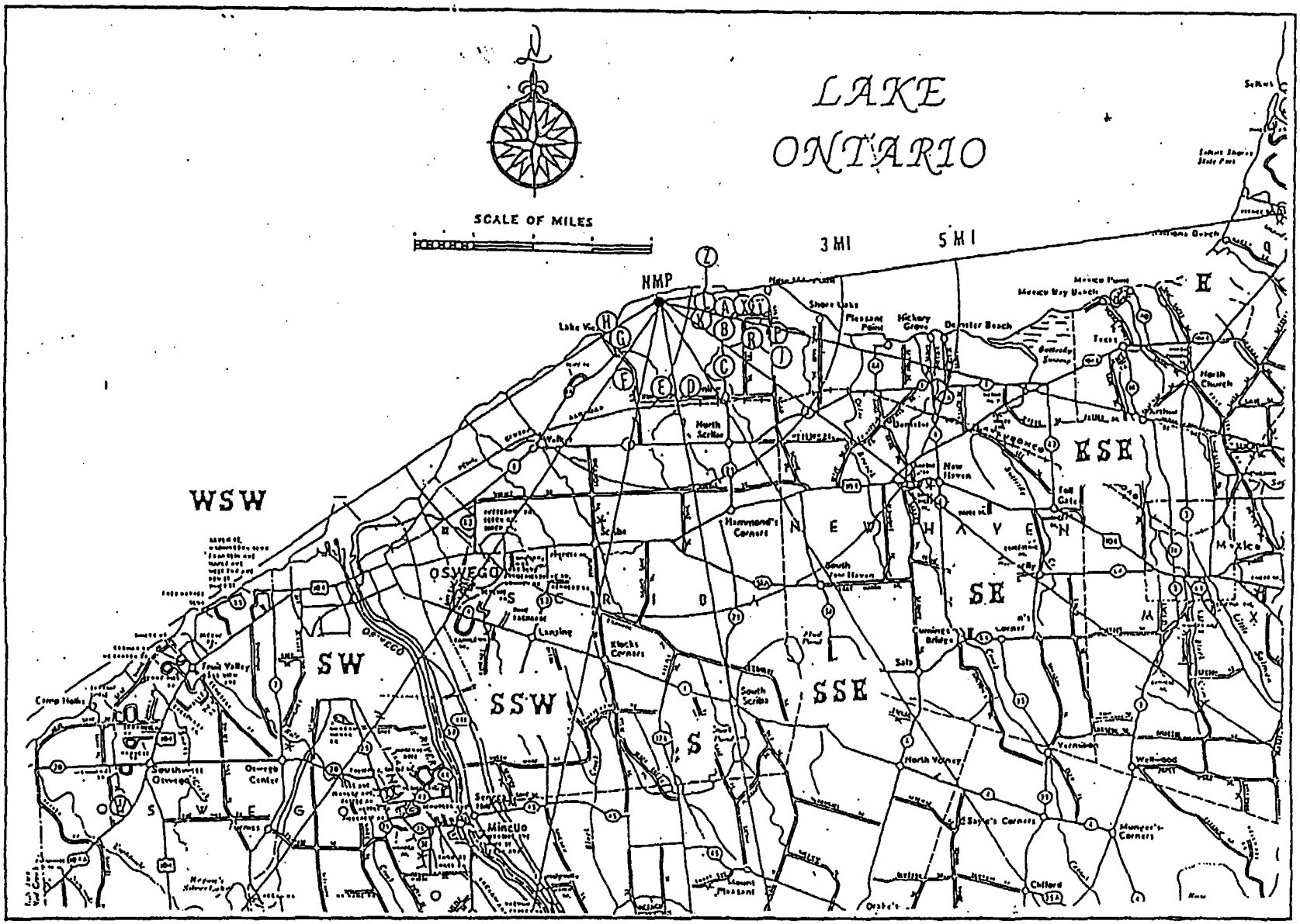

Figure 9. New York Power Authority sampling locations for food product (P, R, J T, X, and W). Other sites illustrate nearest residence locations. The sites in New Haven area are illustrated with the letters P and J. Reprinted from 1988 Radiological Environmental Surveillance Report, New York Power Authority