MAR 5 1984

MEMORANDUM FOR: Robert Jackson
Geosciences Branch

FROM: Cecil O. Thomas, Chief
Standardization and Special Projects Branch
Division of Licensing

SUBJECT: GEOLOGY/SEISMOLOGY REVIEW OF SER FOR UNION CARBIDE SUBSIDIARY CO. LICENSE RENEWAL APPLICATION

In accordance with our agreement, we request the Geosciences Branch review of the geology and seismology sections of the Union Carbide reactor SER. The Docket No. is 50-54 and the PA No. is 1415.

/s/

Cecil O. Thomas, Chief
Standardization and Special
Projects Branch
Division of Licensing

Enclosure: As stated

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

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2 SITE CHARACTERISTICS

2.1 Site Description

The Union Carbide ~~Corporation~~, Medical Products Division, ~~plant~~ is located within the ~~town~~ of Tuxedo, in Orange County, New York. Orange County ~~is~~ in southeastern New York State, is bordered on the south by New Jersey, and is approximately 40 mi northwest of New York City. Tuxedo ~~is~~ in the extreme southeastern corner of Orange County, approximately 4 mi north of the New Jersey State line. The plant site is located on 100 acres of land, owned by Union Carbide, in an area known as Sterling Forest and is about 3-1/4 mi northwest of the village of Tuxedo Park. Features within 10 mi of the site are shown in Figure 2.1. The plant itself, ~~has been~~ constructed along Long Meadow Road on the eastern slope of Hogback Mountain, at an average elevation of 800 ft above mean sea level (MSL). A layout of the UCC complex is shown in Figure 2.2.

There are five principal buildings at the plant site. They are:

Building 1	Reactor
Building 2	Hot laboratory (buildings 1 and 2 are structurally joined)
Building 3	Maintenance
Building 4	Administration
Building 5	Heating plant

There is an additional small concrete block structure at the north end of the plant site used for temporary storage of drummed, miscellaneous low-level radioactive wastes.

2.2 Geography

The UCC, ~~is located in a very thinly populated area—it~~ is within a 22,000-acre woodland area, called Sterling Forest, which is owned by a private development

Figure 2.1 10-mi radius map of site

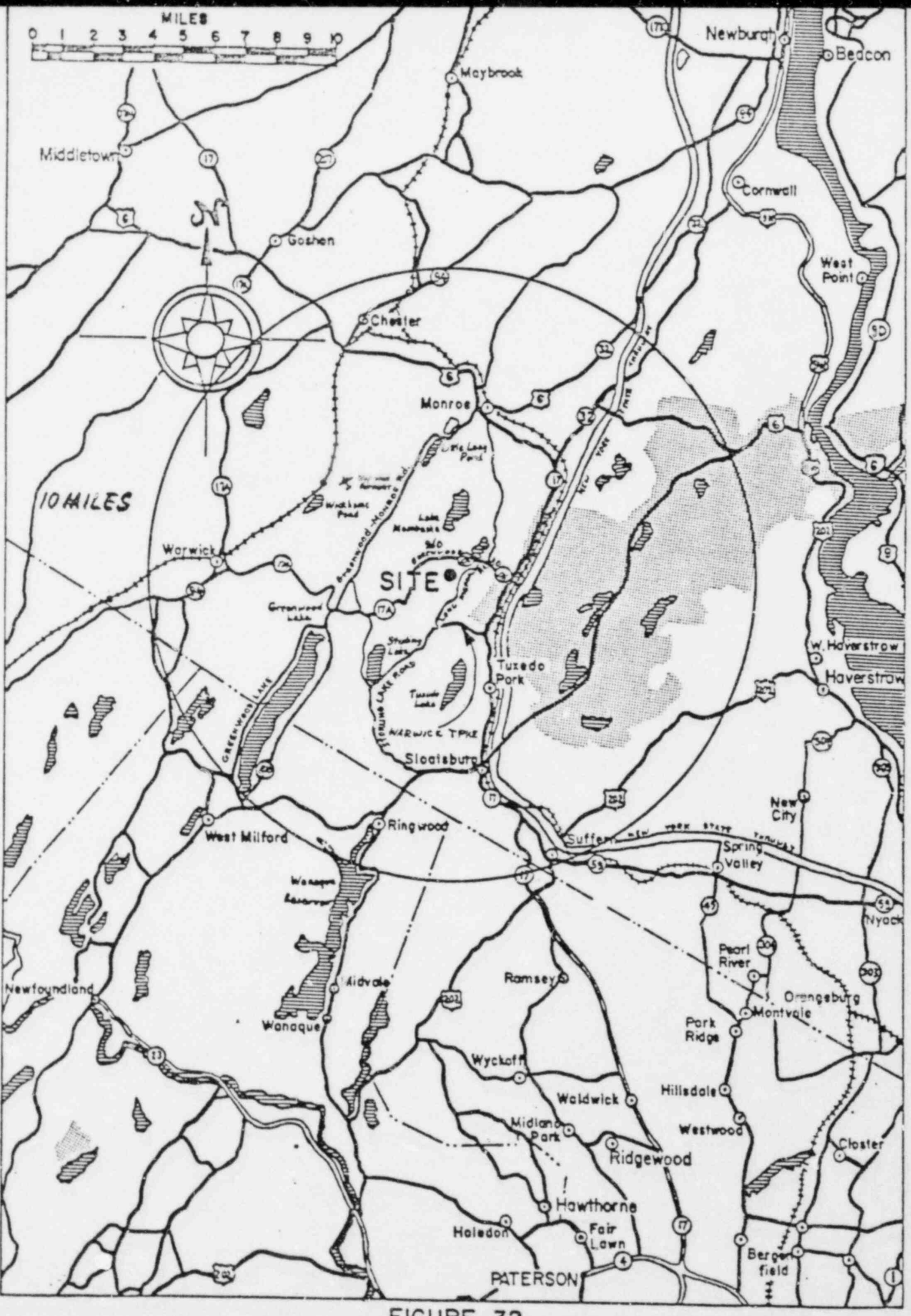
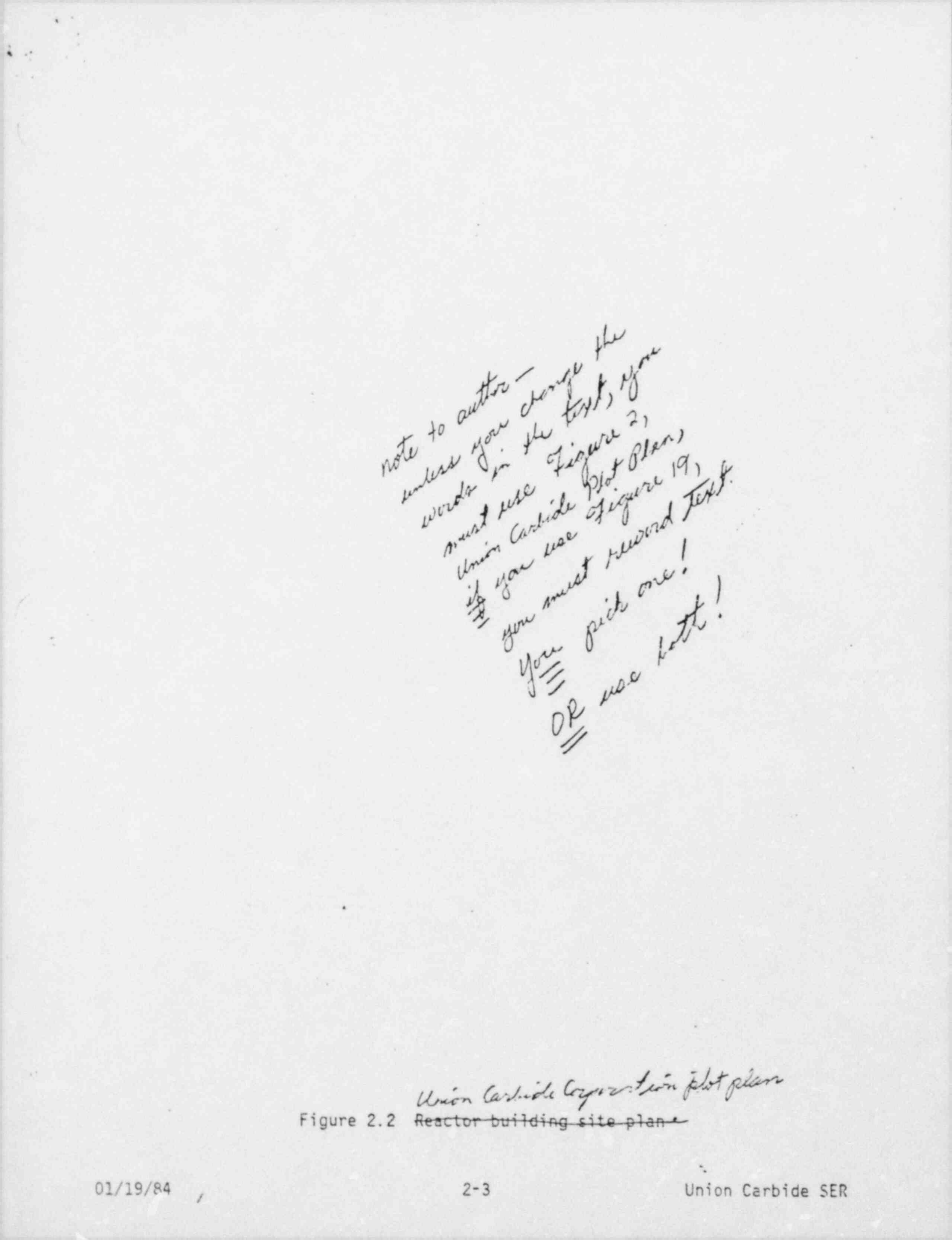


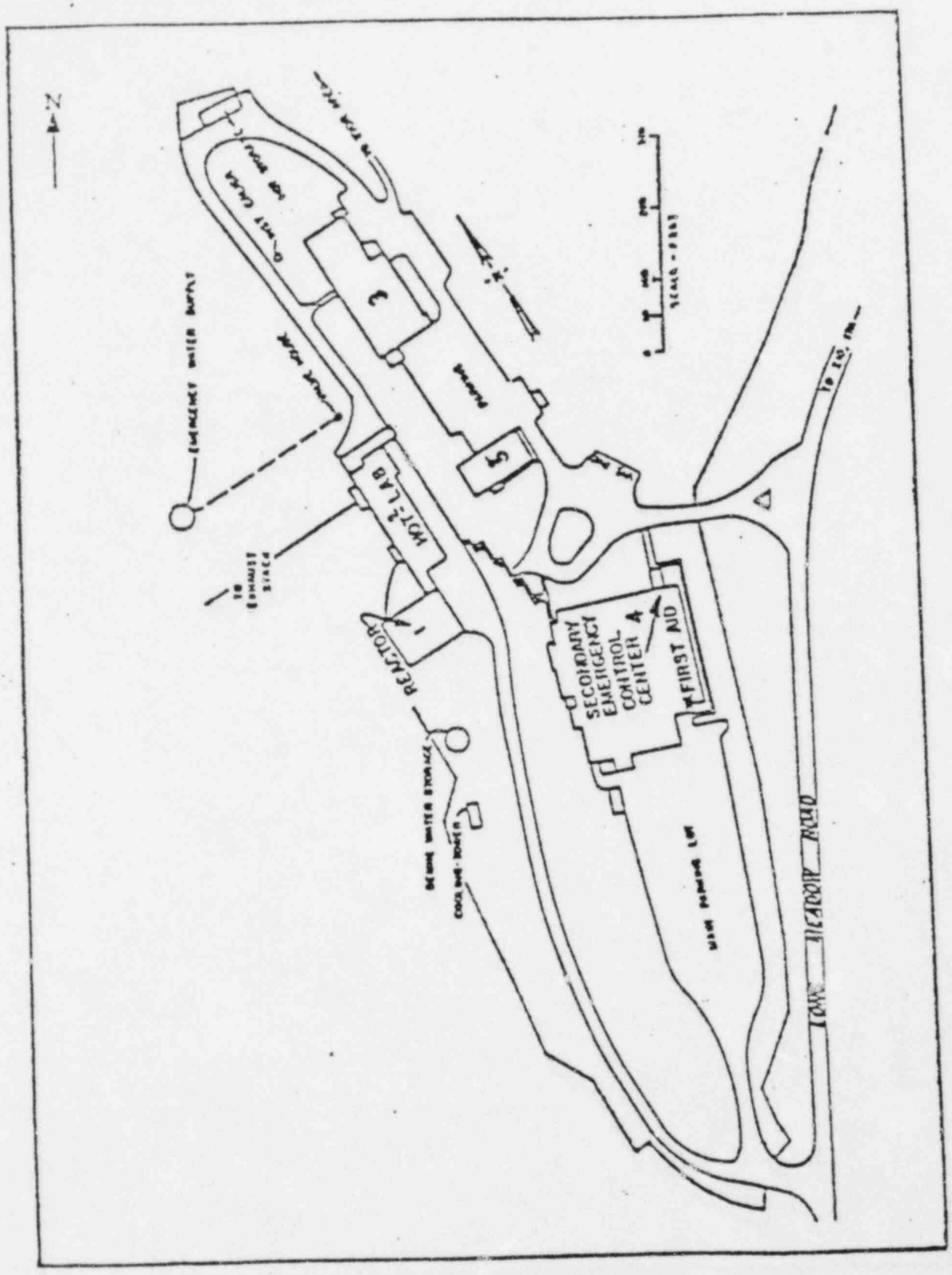
FIGURE 32
TEN MILE RADIUS MAP OF SITE

Note to author —
unless you change the
words in the text, you
must use Figure 2,
Union Carbide Plot Plan;
if you use Figure 19,
you must reword Text.
You pick one!
OR use both!



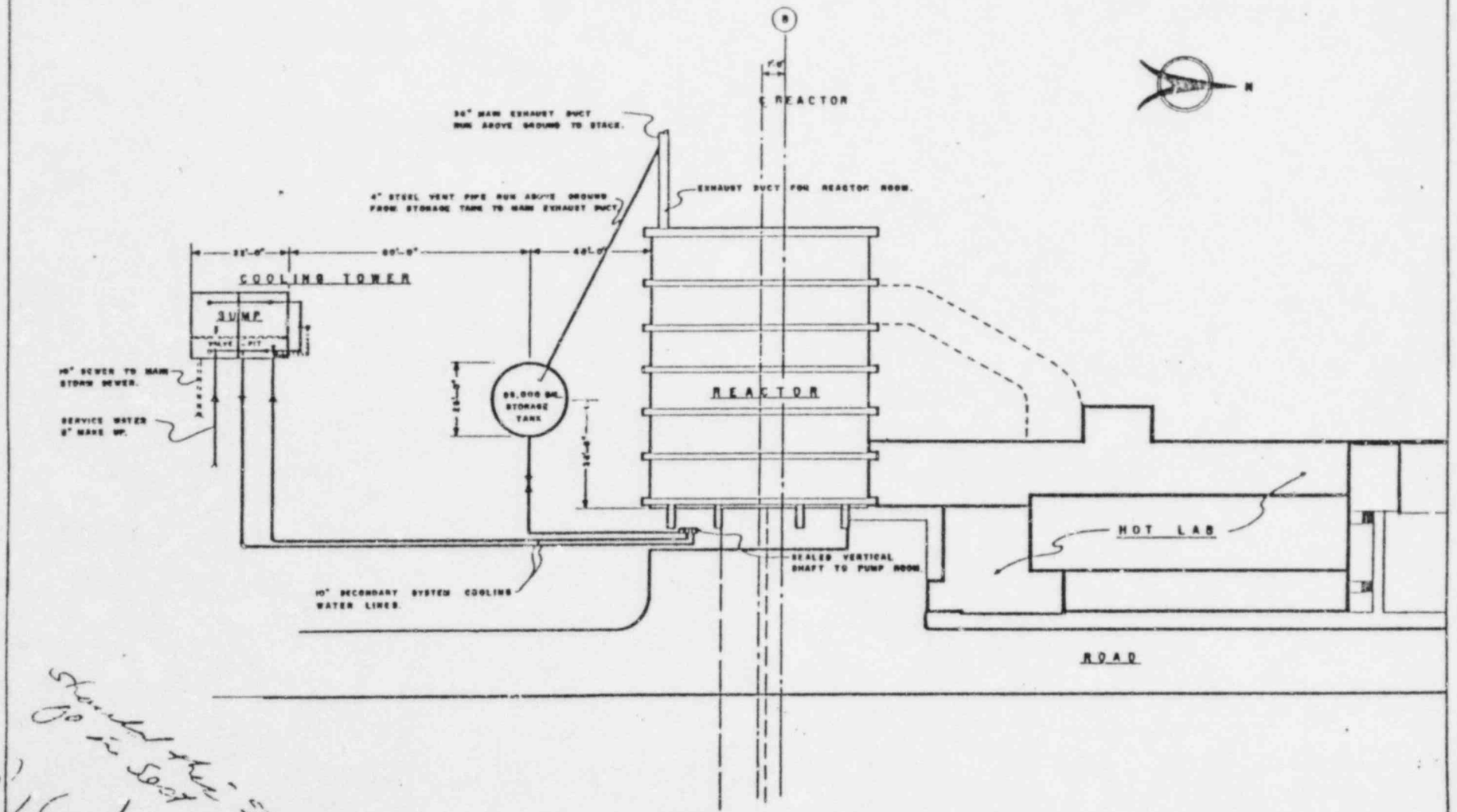
Union Carbide Corporation plot plan

Figure 2.2 ~~Reactor building site plan~~



Union Carbide Plot Plan

Figure 2.2



REACTOR BUILDING - SITE PLAN

FIGURE 19

company. Sterling Forest contains three residential areas, several small research centers, the UCC facility, and a conference center. These developed areas make up a total of less than 1,500 acres. The remainder of the land is undeveloped. Adjoining Sterling Forest to the east is another large undeveloped area ~~which~~ that is a part of the Palisades Interstate Park System. This 75,000 acre woodland contains approximately 31 summer camps but essentially no year-round residency.

The approximately 20,500 acre undeveloped portion of Sterling Forest is managed ecologically by the Sterling Forest Development Corporation. This organization permits regulated (license and bag-limit) hunting in designated, marked portions of the area. ~~The principal game is white-tail deer, rabbit, squirrel, raccoon, grouse, duck, woodcock, and pheasant.~~

Regulated fishing is permitted in designated lakes on the property. The Sterling Forest Development Corporation employs regulated lumbering, the main objective of which is to remove dead and diseased infested trees and promote maintenance of healthy understory. ~~None of the game taken in this area is considered endangered or threatened.~~ [NRC May? 1983]

2.3 Topography and Surface Drainage

The reactor site is ~~in Sterling Forest, 3 1/4 mi north-northwest of Tuxedo Park, Orange County, New York~~, about 1500 ft southwest of Indian Kill Brook, a small stream flowing southeast for a mile and a half to the Ramapo River. The pl_ borders Long Meadow Road at an elevation of approximately 800 ft (see Figure 2.3).

There is a very low north-south topographic divide between Indian Kill Brook drainage and drainage of Warwick Brook to the south, which also flows east to the Ramapo River. These two small streams (Indian Kill Brook and Warwick Brook) drain into the Ramapo River from the vicinity of the site and thus dominate the surface drainage pattern away from the site.

Although the relief in the area is only 400 to 700 ft from valley floors to ridge tops, the hillsides are considered to be steep and rugged. From a past era of

is this correct?
If not, then UCC designation
is incorrect.

Figure 2.3 Union Carbide Nuclear Company Research Center

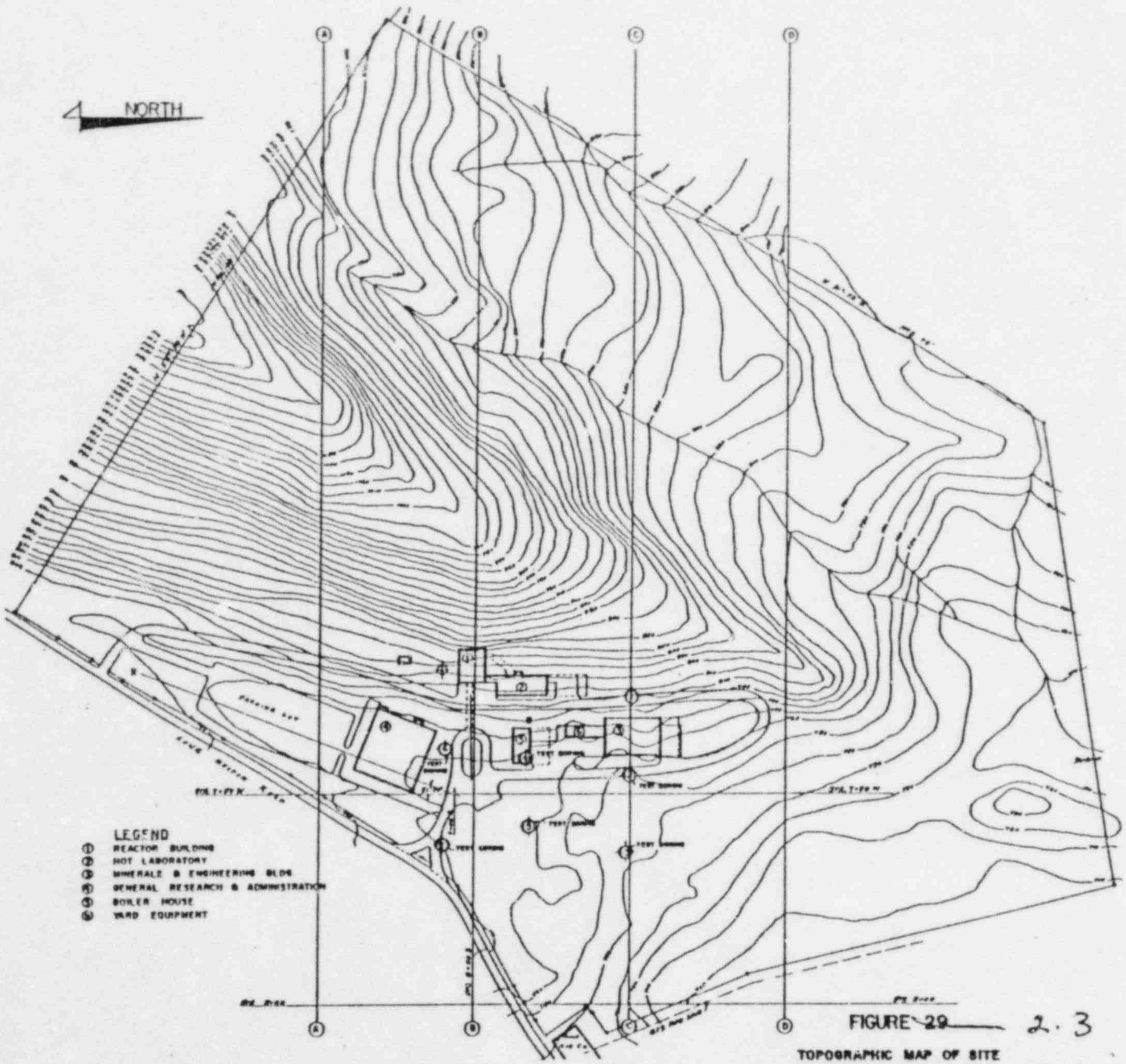


FIGURE ~~29~~ 2.3

TOPOGRAPHIC MAP OF SITE

UNION CARBIDE NUCLEAR COMPANY
RESEARCH CENTER

This figure should have graphics scale to clarify numbering in legend

glaciation, the area features clogged drainage systems such as swamps, ponds and lakes along stream channels. Fill, clay, sand, gravel, and boulders of every size also strew the hillsides. The reactor building is ~~placed~~ located at the eastern toe of a north trending spur of Hogback Mountain, which slopes from an elevation over 1,500-ft down to the level of Indian Kill Lake at an elevation of 700 ft.

As stated above, surface drainage from the site is exclusively by way of Indian Kill. ~~The~~ Indian Kill enters the Ramapo River 1-1/2 mi east of the plant at el 463 ft. Tuxedo Lake stands at el 560 ft. Wee Wah, the adjoining lake to the north, stands lower than Tuxedo Lake to which it is joined by a small stream of high gradient. Wee Wah Lake consists of two segments. The southern, higher segment is separated from the lower northern segment by a stream of steep gradient. This northern segment, in turn, discharges over an earth dam and masonry spillway to a small stream that discharges into Ramapo River. Thus, if the Indian Kill were contaminated ~~due to~~ as a result of some incident, it is not possible to contaminate this chain of three lakes by surface flow from the plant.

2.4 Demography

The UCS plant is located in a thinly populated area. The closest occupied offsite area is the Laurel Ridge housing development which contains 132 houses at a minimum distance of 1,100 ft east of the reactor building. A second development, consisting of 27 houses ~~and~~ in an area called Clinton Woods, is located 3,200 ft to the north. There are no other housing developments within 1.5 mi.

Table 2.2 shows the population distribution in 22.5° compass sectors out to 50 mi. (The north sector is centered on true north but includes 11°15' on either side of true north, a total of 22.5°. Likewise, all other sectors embrace an arc of 22.5°.) The table indicates the most heavily populated areas to be to the southeast, south-southeast, and south of the site within the 20 to 50 mi radii. The high population density of these sections is a result of the large metropolitan centers, i.e., New York City and Newark, and Bayonne, in New Jersey, ~~and~~ as well as others in the area.

Table 2.2 Population density around the Union Carbide ~~Tuxedo Park Plant~~ by sixteen compass sectors out to 50 mi* [NRC May 1983]

Sector	Miles 0 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	614	16,851	36,264	29,237	23,692	19,458
NNE	346	1,903	12,958	53,101	104,808	48,873
NE	108	1,081	14,135	26,503	31,023	26,850
ENE	187	10,489	47,176	43,204	50,442	183,112
E	107	17,330	61,749	30,032	76,475	84,156
ESE	330	7,481	15,506	49,112	275,267	127,105
SE	132	18,868	72,622	476,642	132,749	1,753,651
SSE	3,878	11,829	142,070	454,282	2,296,153	2,334,641
S	91	10,892	96,848	499,486	971,105	2,611,407
SSW	43	10,393	42,750	124,960	133,923	133,281
SW	0	2,951	18,238	60,235	97,985	45,567
WSW	125	2,834	27,381	20,741	30,893	35,991
W	68	23,192	10,754	19,855	13,179	7,900
WNW	878	2,195	8,022	21,651	8,775	7,443
NW	192	2,196	28,510	8,858	6,016	17,724
NNW	190	2,108	18,339	8,964	18,853	7,908

*Population estimates based on 1980 Census of Population and Housing.

2.5 Nearby Industrial, Transportation, and Military Facilities

2.6 Meteorology and Climatology

The climate of the Sterling Forest area is predominantly influenced by air mass movement and prevailing winds from an inland direction. Cold frontal weather moves across the area from west to east at average velocities of 30 to 35 mph in winter and considerably more slowly in summer. This is a part of the normal cyclonic circulation in which high- and low-pressure systems follow paths toward the northeastern United States. About 40% of the low centers pass over or close to southeastern New York so that there is regular change in weather patterns without any consistent periods of stagnation. [NRC May 1983]

Centers of high pressure alternate more or less regularly with the lows. In the winter time, their movement is variable, depending on the strength of cold air outthrusts from the arctic area to the northwest. This movement is slowest

during summer and early fall so that, with the prevailing westerlies aloft reaching their most northerly movement at the same time, high-pressure centers can become stationary for a few days during these seasons.

Cold air masses of the continental arctic or continental polar types dominate the area's weather in the fall, winter, and spring. These are very stable at their northern source, but by the time they have reached southeastern New York, having been heated from below as they moved across the land, their lower layers are generally unstable. During the summer, the continental outbreaks of cold air are weak and maritime tropical air masses migrate northward to exert an effect on the weather of the area. At this time of year, nocturnal cooling, with light or calm wind conditions, result in frequent temperature inversions (about 100 per year), but they are most often short-lived because of the heating that occurs during the day, resulting in turbulence and mixing of the atmosphere. During a 2-year period of inversion observation, only 21 persisted for more than 12 hours and only ~~six~~ 6 persisted longer than 24 hours.

Mean ambient air temperatures vary from 28°F (minus 1°C) in January to 75°F (24°C) in July, with extremes of -19° (-30°C) and 105°F (41°C). The average annual rainfall is about 44 in. Precipitation is fairly uniform throughout the year; however, the fall months of September and October average the least number of rainy days, 7.5 and 7.9, respectively. May has the greatest average number of rainy days (11) of any month. The average annual number of rainy days per month is 9.6.

Thundershowers can accompany fast-moving cold fronts in the spring and occasional air mass thunderstorms will occur during the summer. The area, however, is not normally subjected to severe storms, and tornadoes are virtually unknown.

The prevailing wind is from the southwest generally in the 4-to-12-mph range, but higher velocities are not unusual and do occur during every month of the year. The second most directionally consistent wind is from the west with a slightly slower speed range.

To estimate the annual average X/Q values, STAR data were obtained for Stewart Air Force Base (AFB), located 23 mi north of UCC. A comparison of the annual wind data for the site and Stewart AFB is shown in Figure 2.3. The computer codes XOQDOQ and ISC were used to calculate the average X/Q values for 16 sectors out to 50 miles. The values are presented in Table 2.1. The X/Q values at various atmospheric monitoring points and the reported annual release of I-125 and I-131 were used to compare the predicted concentrations against the measured concentrations of the particular isotopes at the corresponding points. In all cases, the predicted value exceeded the measured value. Additional calculations were performed to investigate the local topographical effects on the X/Q values.

2.7 Geology

The UCC site lies well within (~ 50 mi west of the Atlantic Ocean) the mountainous belt, which roughly parallels the Atlantic Coast, known as the New Jersey-New York Highlands. Though the "Highlands" are rugged, and the hillsides steep, relief is not great, only a matter of some 400 to 700 ft from the valley floors to ridge tops. A striking feature of the area, ~~a feature~~ resulting from a past era of glaciation, is the clearly evident clogged stream drainage system. Swamps and ponds abound along stream channels, as do a multiplicity of lakes, large and small, ~~all bespeaking~~ all signifying the fact that present streams have not, under prevailing gradients and climatic conditions, cleared their overburdened channels of glacial debris: fill, clay, sand, gravel and boulders of every size. These latter, especially, strew the hillsides. The reactor and hot laboratory buildings ~~is~~ are placed in a north trending spur of Hogback Mountain, a spur which slopes northward from something over an elevation of 1,500 ft to the level of Indian Kill Reservoir at an elevation of 700 ft. It is at the eastern foot of this spur, along Long Meadow Road, that the plant is located.

The area is underlain by closely folded sedimentary and igneous gneisses. The folds are generally overturned to the northwest, resulting locally in relatively steep isoclinal dips toward the southeast. The middle section of the eastern spur, where the reactor and hot laboratory buildings sits, is underlain by quartz-oligioclase gneiss. This rock is a highly metamorphosed sediment, parts of which have taken on the aspects of an igneous rock. East of the site are

Figure 2.4 Comparison of wind rose at UCC site and Stewart AFB

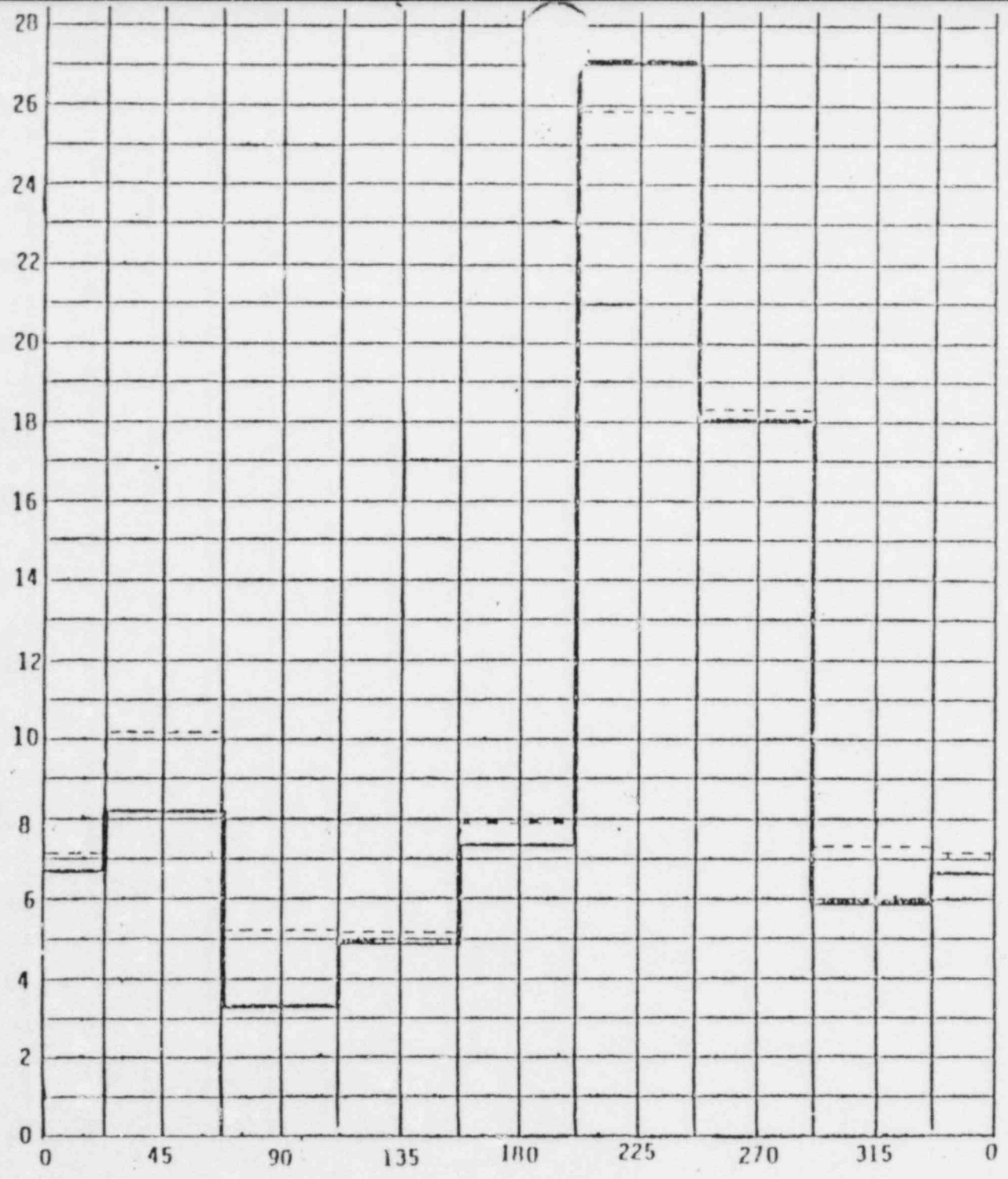


Figure 4 2.4
Comparison of Wind Rose at UCC Site and Stewart Air Base

Table 2.1 Annual Average X/Q values in 10^{-6} sec/m^3

Table

Annual Average X/Q values in 10^{-6} sec/m^3

Sector	Distance in Miles					
	0.5	1	2	3	4	5
NNW	1.562391	0.681988	0.257149	0.141757	0.092676	0.066530
NW	1.402716	0.615194	0.232365	0.128156	0.083799	0.060170
WNW	1.227991	0.509301	0.187594	0.102543	0.066742	0.047833
W	1.571036	0.620389	0.222692	0.120531	0.077981	0.055684
WSW	1.864189	0.762627	0.278423	0.151629	0.098424	0.070377
SW	1.646033	0.707754	0.264636	0.145381	0.094033	0.067900
SSW	1.463370	0.633546	0.237735	0.130811	0.085395	0.061234
S	1.480888	0.656624	0.249416	0.137837	0.090257	0.064878
SSE	1.358792	0.653712	0.256883	0.143596	0.094703	0.068395
SE	1.466552	0.747924	0.300265	0.169036	0.111906	0.080968
ESE	2.122208	1.055397	0.419562	0.235445	0.155595	0.112451
E	3.552957	1.754134	0.695277	0.389739	0.257525	0.186108
ENE	3.938977	1.905551	0.748033	0.418447	0.276045	0.199413
NE	2.871779	1.337522	0.517306	0.287467	0.189025	0.136209
NNE	2.045955	0.938264	0.360839	0.200181	0.131477	0.094730
N	1.591913	0.700646	0.265060	0.146262	0.095730	0.068813

Sector	10	20	30	40	50
NNW	0.023973	0.008944	0.005147	0.003510	0.002611
NW	0.021678	0.008080	0.004646	0.003167	0.002354
WNW	0.017209	0.006415	0.003691	0.002516	0.001871
W	0.019881	0.007384	0.004244	0.002889	0.002147
WSW	0.025153	0.009346	0.005371	0.003657	0.002717
SW	0.024393	0.009076	0.005215	0.003553	0.002641
SSW	0.021975	0.008160	0.004682	0.003186	0.002366
S	0.023447	0.008769	0.005052	0.003449	0.002567
SSE	0.024995	0.009452	0.005478	0.003759	0.002800
SE	0.029666	0.011232	0.006511	0.004470	0.003340
ESE	0.041099	0.015546	0.009009	0.006184	0.004621
E	0.068206	0.025917	0.015063	0.010363	0.007756
ENE	0.072971	0.027787	0.016178	0.011143	0.008348
NE	0.049676	0.018878	0.010983	0.007559	0.005660
NNE	0.034467	0.013031	0.007557	0.005188	0.003877
N	0.024896	0.009346	0.005398	0.003693	0.002753

folded metamorphosed sediments (quartzites) and granitic gneisses. Similar sequences of gneisses extend eastward to the Ramapo River and beyond.

The rock is very dense and tough and relatively free from fractures, though all rocks near the surface are somewhat fractured. Rain water will enter these fractures at the surface and descend to points of escape or to points where fractures give out. Thus, even in fractured hard rocks a water table is built up. In such rocks, water descends to depths where fractures die out, beneath which position such rocks may be essentially dry.

The first drill hole produced nearly 98% of core. A second hole, drilled at an angle of 66° from horizontal, produced 99% of core. In core hole No. 1, water appears to stand at 85 ft below the surface. Thus, there is 155 ft of water in the hole, which suggests that fracturing at depth is slight.

A compression test conducted at the Brooklyn Polytechnical Institute revealed that a cylinder 4-1/4 in. long and 2-1/8 in. in diameter broke only when subjected to a load of approximately 8 tons per square inch, even though the section was cut with planes of schistosity dipping 55° from the axis of the cylinder.

Aa The area in which the UCC is located experiences low intensity earthquakes rather frequently~~, therefore~~, the subject of seismology is addressed separately in ~~a separate~~ section 2.9

2.8 Hydrology

As stated in Section 2.3

The surface water features of significance in connection with the operation of the UCC reactor are the Indian Kill Reservoir, Indian Kill Brook, Warwick Brook, and the Ramapo River. ~~There is a long north-south topographic divide between Indian Kill drainage and the drainage of Warwick Brook so these two small streams dominate the site drainage pattern insofar as it concerns the flow of surface or underground water away from the vicinity.~~

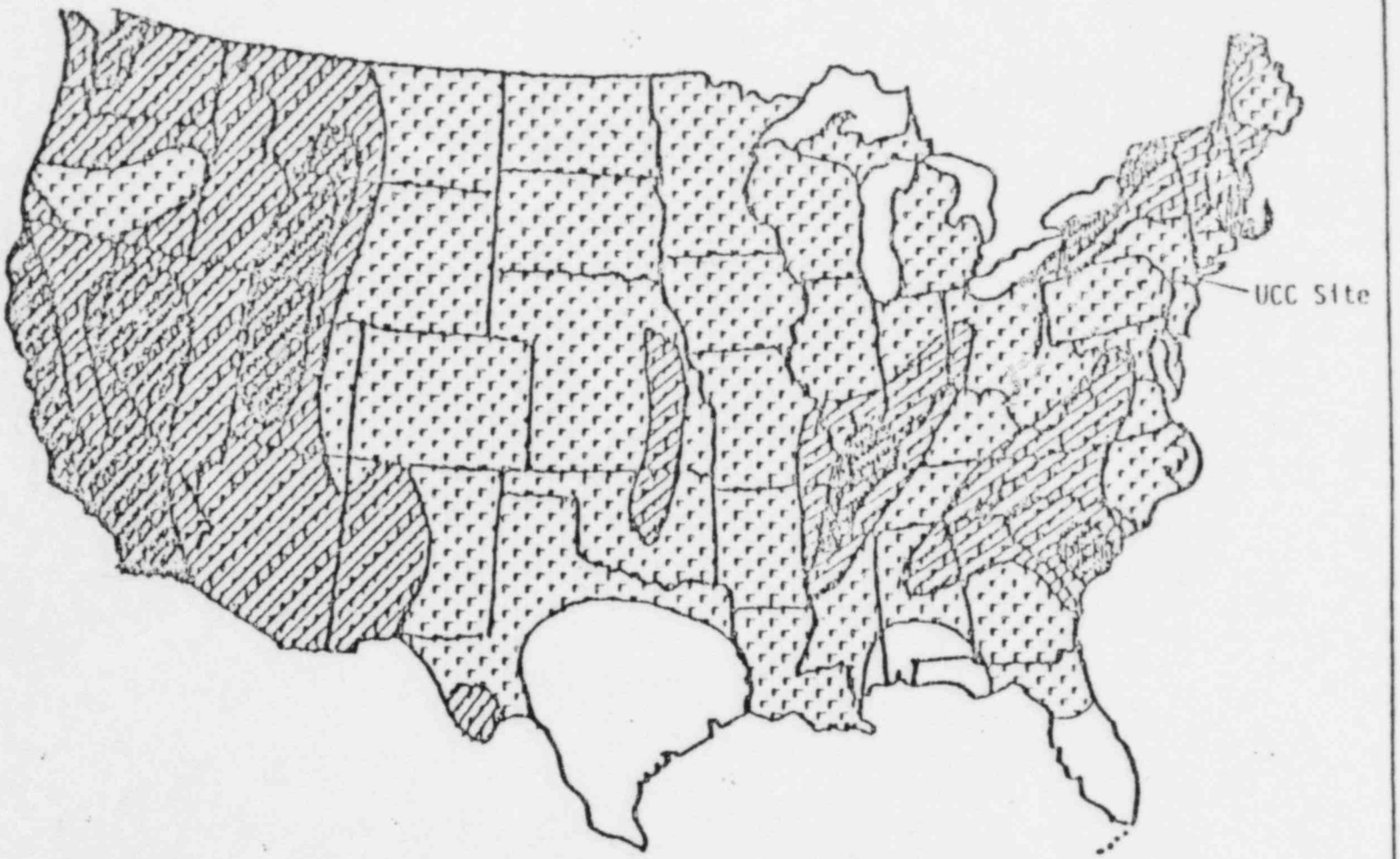
Surface drainage from the site is exclusively by way of Indian Kill, ~~Indian Kill enters Ramapo River 1 1/2-mi east of the plant at el 463 ft. Tuxedo Lake stands at el 560 ft~~ Wee Wah, the adjoining lake to the north, stands lower than Tuxedo Lake to which it is joined by a small stream of high-gradient. Wee Wah Lake consists of two segments. The southern, higher segment is separated from the lower northern segment by a stream of steep gradient. This northern segment, in turn, discharges over an earth dam and masonry spillway to a small ~~stream that discharges into Ramapo River~~. But because of the unique hydrology, ~~Thus, it may be seen that~~ even if the Indian Kill were contaminated, it is not remotely possible to carry such contamination by surface flow to any of this chain of three lakes. [Section 2.3]

Indian Kill presents the only obvious path for contamination by underground flow, that is, through alluvial sand, silts, and gravels that lie beneath the stream channel, resting on the gneissoid bedrock of the region. Water passes downstream easily but slowly through these alluvial deposits. Obviously such waters could not possibly ascend into the chain of Tuxedo Lakes. Further, it does not seem possible that water could ~~Water passing~~ pass underground beneath the mountainous ridges, through the fractures in the hard rocks, ~~does not seem possible.~~ The mountainous tract, which is bounded by Indian Kill, Long Meadow Road, Warwick Brook, and Ramapo River, naturally contains some ground water within fractures in the rocks. But this water drains outward to the nearest and most accessible exists, namely either Indian Kill, Warwick Brook, or Ramapo River. Water cannot pass against this outward flow, across this mountainous tract, and even assuming it could, it could not pass the boundary of Warwick Brook, which flows east to Ramapo River. Therefore, the possibility of contamination of the Tuxedo Lakes chain by water from the vicinity of the plant may be dismissed. The only reasonable route for contamination of liquid effluents that might ~~possibly, but not likely,~~ come from the plant site would be via Indian Kill to the Ramapo and thence to the Passaic River in New Jersey.

2.9 Seismology

According to the seismic risk map of the United States (Figure 2.5) southern New York State and New Jersey lie in Zone 1. This zone is characterized by expectation of only minor damage ~~due to~~ as a result of earthquakes. Possible frequency of

Figure 2.5 Seismic risk map of the United States
Source:



KEY

No hatching - Zone 0, No damage
Light hatching - Zone 1, Minor damage, V and VI, M.M. Scale
Medium hatching - Zone 2, Moderate damage, VII, M.M. Scale
Dark hatching - Zone 3, Major damage, VIII - XII, M.M. Scale

Seismic Risk Map of the United States

Figure ~~2.6~~ 2.5

SET

earthquakes is not indicated on this type map, otherwise considerable activity would have been indicated. During the period 1737 through 1977, a total of 330 earthquakes have been recorded in the State of New York and during the period 1733 through 1977, 51 earthquakes have been recorded in New Jersey. In the local area, i.e., within a 60-mi radius of Tuxedo Park, during the period 1787 through 1977, 77 earthquakes have been recorded. The epicenters of two of those earthquakes (1951 and 1966) were 10 mi northwest and 10 mi east of the UCC site, respectively. Figure 2.5 shows the location of earthquake epicenters within a 60-mi radius of the UCC site, and provides the following additional information: [NRC May 1983]

(1) The triangle indicates the position of the earthquake epicenter.

(2) Roman numeral indicates the greatest intensity of any earthquake at that site on the Modified Mercalli (MM) scale.

(3) Arabic number indicates the number of times an earthquake has occurred at that site.

(4) Data shown is that of the last occurrence.

An Empire State Geogram (Vol. 16, No. 2, 1980) includes a paper, "Earthquake Hazard in New York State" by Walter Mitronovas, in which the author classified significant earthquakes as VI and above on the MM scale. Intensity VI on the MM scale is characterized as follows:

"Felt by all, indoors and outdoors. Frightened many, excitement general, some alarm, many ran outdoors. Awakened all. Persons made to move unsteadily. Trees, bushes shaken slightly to moderately. Liquid set in strong motion. Small bells rang--church, chapel, schools, etc. Damage slight in poorly built buildings. Fall of plaster in small amount. Cracked plaster somewhat, especially fine cracks in chimneys in some instances. Broke dishes, glassware in considerable quantity, also some windows. Fall of knick-knacks, books, pictures. Overturned furniture in many instances. Moved furniture of a moderately heavy kind."

By this standard, nine significant earthquakes have occurred within a 60 mi radius of Tuxedo Park during the periods of record; three in New York state and six in New Jersey. None of these earthquakes, however, were of sufficient intensity to be classified as destructive (IX-XII MM).

The author identifies southeastern New York State and northern New Jersey as presently seismically active areas and notes this has been the case during the last 200 years. He goes on to say:

> "This suggests that, at least in general statistical terms, it is possible to predict the place, if not the time, of the future earthquakes. Ironically, this is to a large extent true for smaller earthquakes for which the need, from the earthquake hazard point of view, is not great but for which the necessary statistical data are available. Unfortunately, direct information on the larger destructive earthquakes, where the need is greatest, is meager and it is not known how reliably such events can be predicted by extrapolating the data from smaller events.
>
> There are several reasons why such extrapolation may not be very reliable for the New York State and Eastern U.S. in general. First, the tectonic forces and motions responsible for the slow build-up of stresses within the crust which periodically rupture in a form of earthquakes are not well understood for the Eastern North America. Because all these earthquakes occur within a plate and not between plates, as postulated by the plate tectonics model, it is not clear what role, if any, the plate motions may have in causing earthquakes here. And second, the exact relationship between earthquakes and tectonic or geologic features also is not known for most of Eastern North America. Within New York, the Ramapo fault (Southeastern area) and Clarendon-Linden fault system (Western area) appear to localize some, but not all, of the earthquakes in those areas. However, the relationship between the known faults and earthquakes in the Northeastern (Adirondack) region and in the rest of the State either does not exist or is

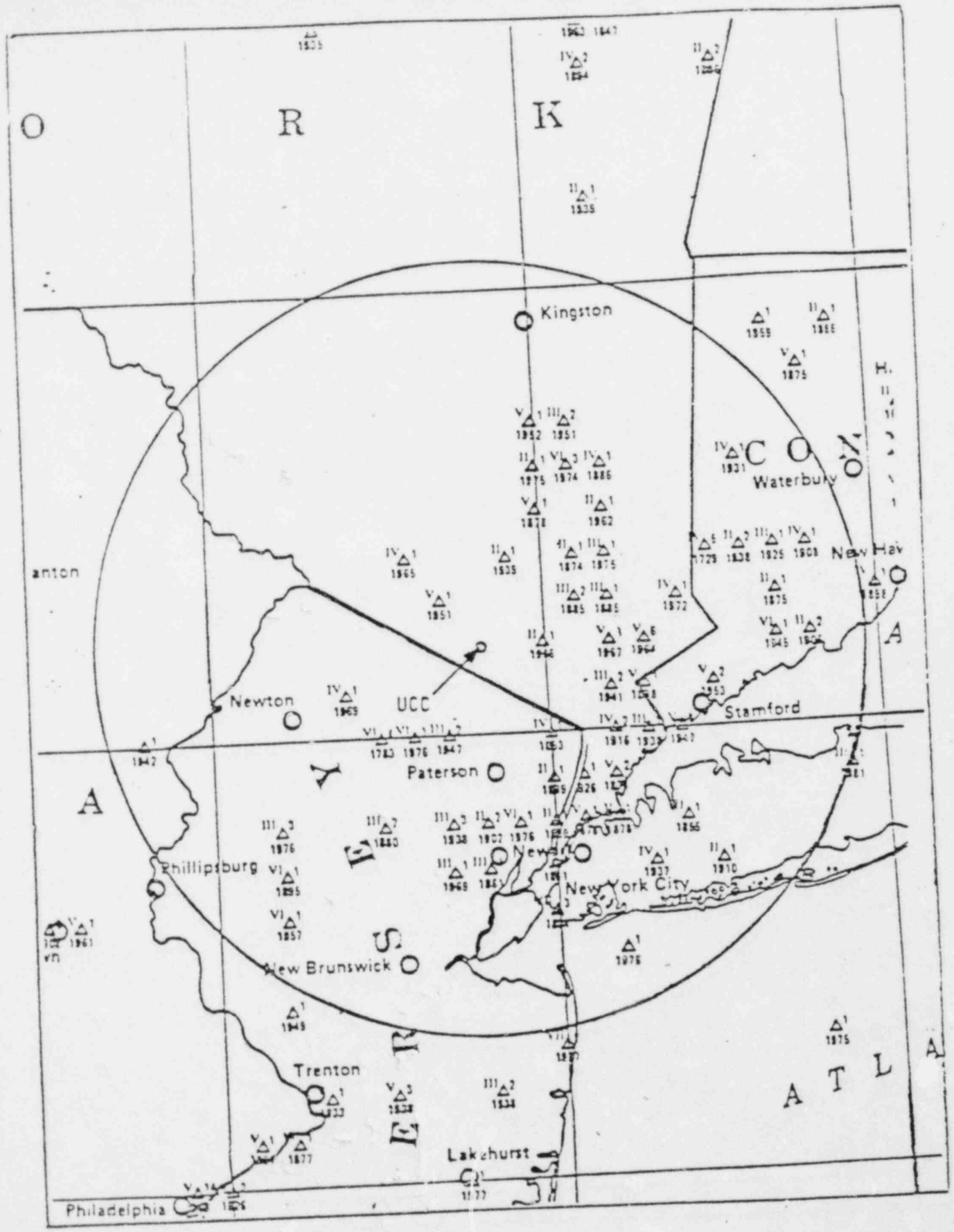
still not understood. Such information would be valuable in trying to extrapolate the location of future large earthquakes from the data for small events. In contrast, the relationship between plate motions, stress build-up, tectonic features and earthquakes are better understood for California and Alaska where, as a result, there is a much better chance of predicting larger earthquakes not only as to location but also as to time.

In conclusion, although New York State is fortunate to be in a region of lower seismic hazard than Alaska or California, it should be realized that seismic risk here is not negligible. Unfortunately, it may be some time before reliable knowledge becomes available to predict the next destructive earthquake within New York."

In the past 20 years, the number of seismic recording stations in the area has increased to the point where detection of events adjacent to New York City of magnitudes greater than 1.8 on the Richter Scale is practically certain. Coupled with interest in the seismic safety of the power reactors located at Buchanan, New York, this seismic work has led to intense study of the seismic activity in the vicinity of the Ramapo Fault and estimates of the probability of occurrence of strong earthquakes at those reactor sites. A detailed discussion of these matters is given in Reference 5. The following is excerpted from this reference.

"Earthquakes tend to occur along major pre-existing faults, with the larger shocks showing a greater tendency than the smaller ones to be located on the major throughgoing fault. A survey of the seismic events in and around this region shows that most of the activity is in the Precambrian Hudson Highlands and that earthquakes in this area occur along pre-existing faults, the large majority of quakes within 1-2 km of the faults. About 50% of all events are roughly collinear to the Ramapo Fault system."

Figure 2.6 Earthquake epicenters within 60 mi. of the UCC site



Earthquake Epicenters within 60 miles of the UCC Site

Figure 2.5

Using data on small shocks obtained in the past 20 years or so, a relation for cumulative frequency of occurrence has been obtained. Extrapolation to larger magnitudes shows excellent agreement with the few historical events of intensity VI and VII. This relation has been used by the authors[5] to predict the probability of intensity VII and VIII shocks at the upper end of the Ramapo Fault. The results are as follows: [NRC May 1983]:

	Recurrence Period (years)		Probability of Occurrence in 20-year period (%)	
	VII	VIII	VII	VIII
(a) Excluding events > 10 Km distant	630	2870	3.2	0.7
(b) Including all events along Ramapo Fault	340	1880	5.9	1.1

The UCC site is about 12 km northwest of the Ramapo Fault; therefore, the predicted probabilities at this site should be less than those given above, that is, less than 3 to 6% for intensity VII, and less than 1% for intensity VIII, for a 20-year period (NRC May 1983).

Other investigations into the seismic characterization of the region indicate a difference of opinion as to whether the seismic activity is associated with the Ramapo Fault. If the micro earthquake activity in the vicinity of the site is assumed not to be associated with the Ramapo Fault, then a conservative approach is to consider an event occurring very near the site vicinity. The largest historical earthquake witnin 100 mi had Modified Mercalli intensity of VII. The s[illegible] equates earthquakes of maximum intensity VII, for the eastern United States, with magnitude (m_b) of approximately 5.3. The corresponding ground acceleration is on the order of 0.1 g. [NRC May 1983]

2.10 Conclusion

The staff has reviewed and evaluated the UCC reactor site and contiguous regions for natural and manmade hazards and concludes that there are no risks associated with the site that make it unacceptable for the continued operation of the reactor at the power level of 5 MW.