Start Historical

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 Specification of Location

The Susquehanna SES is located on the west bank of the Susquehanna River in Salem Township, Luzerne County, Pennsylvania with additional recreational and agricultural lands located on the east bank of the rivers in Conyngham and Hollenback Townships.

It is four miles south of Shickshinny and five miles northeast of Berwick. The nearest village is Beach Haven on the southeast edge of the main station site.

The Universal Transverse Mercator Coordinates for the center point between Susquehanna SES Units 1 and 2 reactors are 4,549,300 meters north and 403,800 meters east, Zone 18. These correspond to 41°05'30" north latitude and 76°08'55" west longitude and are also equivalent to the Pennsylvania Coordinate System (PCS) Coordinates 341,175 feet north and 2,442,025 feet east respectively. The PCS is used throughout this report.

The portion of the site in Salem Township is about 1,574 acres, which includes the property on the flood plain and agricultural land to the west of Confers Lane (Township Road T-438). The main station site area within the security fence is approximately 230 acres. An additional 717 acres of land on the east bank has woodlands, farming, reaction, etc.

Topography in the site vicinity ranges from relatively flat flood plains to gently rolling hills. Elevations range from 500 feet to 1,600 feet above mean sea level (msl). In an east-west direction, the site is essentially flat from the river to U.S. Route 11 and is 530 ft above mean sea level. Elevation increases sharply to the west from U.S. Route 11 to the station site, rising from about 530 feet (mean sea level) to about 700 feet (msl) in the station area (see Figure 2.1-21). Continuing to the westerly edge of the site, the land is relatively flat and at about the same elevation as the main station buildings. In a south-north direction, the site rises gradually from about 650 ft (msl) on the south boundary to about 900 ft (msl) on the north.

The main station buildings are located on a terrace above the flood plain approximately 4000 feet west of the Susquehanna River in Salem Township (see Figure 2.1-22). The land around the main station buildings is relatively open with trees on the steeper slopes. It was formerly under cultivation for farm and orchard crops and is slowly reverting back to woodlands.

2.1.1.2 Site Area Map

A map of the site area including major structures and facilities is provided as (Figure 2.1-22). In addition to the site property in Salem Township the Licensee owns 717 acres of recreational land on the east side of the river in Conyngham and Hollenback Townships.

The exclusion area as defined in 10CFR100 (Ref. 2.1-1), is a circle of radius 1800 feet with the center at the common release point. Radiation dose limits at this location are regulated by

10CFR50.67, Accident Source Term. The coordinates of the common release point are N341,175 and E 2,441,970.5. Aside from transit through the exclusion area, there are no activities permitted within this zone other than those related to station operation. There are no residences within the exclusion area.

Roads that traverse the site are:

a) On the north - Beach Grove Road (T-419) which is approximately 1600 ft. from the center of the exclusion area and approximately 500 ft. from the nearest vital structure. (Salem Township)

b) On the west - Confers Lane (T-438) which is approximately 2000 ft. from the center of the exclusion area and approximately 1400 ft. from the nearest vital structure. (Salem Township)

c) On the south - Bell Bend (T-456) which is approximately 1800 ft. from the center of the exclusion area and approximately 1600 ft. from the nearest vital structure. (Salem Township)

d) On the east - U.S. Route No. 11 which is approximately 2600 ft. from the center of the exclusion area and approximately 2500 ft. from the nearest vital structure. (Salem Township)

e) On the floodplain on the east bank – Route 239 is located approximately 7,100 feet from the center of the exclusion area. (Conyngham Township).

Railways that traverse the site are:

A rail line owned by the Commonwealth of Pennsylvania traverses the flood plain. It is operated by the North Shore Railroad Co. and is located approximately 2,700 feet east of the center of the exclusion area. This line is exclusively used by the Licensee. The section of the line north of the site is not being used at present. An access spur from the main line of the railroad onto the site permits rail service to the station.

The Susquehanna River flows from north to south separating the site from recreational lands on the east side of the river. The river is navigable only by small pleasure and fishing boats because of shallow water and obstructions in the vicinity of the site.

2.1.1.3 Boundaries for Establishing Effluent Release Limits

The exclusion area is the area within a radius of 1,800 feet from the common release point of both reactors, (Figure 2.1-22). The distance from the gaseous effluent release points to the boundary is at least 1,800 feet. The station liquid effluent release point is located at the river approximately 4,000 feet from the common release point. See Section 2.1.2.3 for arrangements for traffic control.

2.1.2 EXCLUSION AREA AUTHORITY AND CONTROL

2.1.2.1 Authority

PP&L owns the entire plant exclusion area (except for Township Route T-419) in fee simple and, therefore, has complete authority to regulate any and all access and activity within that area.

Minimum distance to exclusion area boundary is discussed in Subsection 2.1.1.2.

2.1.2.2 Control of Activities Unrelated to Plant Operation

The only area within the exclusion area in which activities unrelated to plant operation may or will occur is Township Route T-419. See Section 2.1.2.3 for traffic control arrangements.

The location of this area within the exclusion area is shown in Figure 2.1-22. The exclusion area outside the protected area fence will be posted and, with the exception of the township route, will be closed to persons who have not received authorization to enter the property.

PP&L normally will not control passage along Township Route T-419 within the exclusion area although the Emergency Plan provides for execution of control over passage in the event of emergency conditions at the plant.

2.1.2.3 Arrangements for Traffic Control

PP&L has made arrangements with the Salem Township Supervisors and with the Pennsylvania State Police for control of traffic on Township Route T-419 in the event of an emergency. In addition, Pennsylvania, Luzerne County, and Columbia County Emergency Management Agencies have incorporated traffic control in their emergency procedures.

2.1.2.4 Abandonment or Relocation of Roads

Approximately 0.25 mile of Township Road T-419 was relocated approximately 250 feet south to improve the grade and lessen the number of curves. This road was relocated on property owned by PP&L. Access to the plant by a rail spur was also improved through this area.

2.1.3 POPULATION DISTRIBUTION

The population in the vicinity of the Susquehanna SES is sparsely distributed. The steep sloped ridges and the prevailing land use, agriculture, combine to yield a low population density outside of the communities. Table 2.1-33 indicates a decline in total population of counties within 20 miles of the site between the years 1950 and 2000. There was a decrease in population of about 111,000 people or 15.7% (Ref. 2.1-2 and 2.1-3). Between 1990 and 2000 in these counties there was a decrease in population by about 7,800 people or 1.3%. Sullivan County had the greatest percentage increase (7.4%) and Luzerne County had the greatest percentage loss (2.7%) in population (Ref. 2.1-4). The nearest major populated area, the Wilkes-Barre/Scranton corridor, is 15 to 30 miles northeast of the site.

Definitions for urban and rural areas changed in 2000 and, therefore, it is difficult to compare growth trends. For example, in 1990 urban and urbanized areas had population densities as low as 1,000 persons per square mile and in 2000 this definition decreased to 500 persons per *square mile. The changes in urban and rural populations listed in Table 2.1-34 from 1990 to 2000 may only reflect the changes in definition and not major population shifts from urban to rural areas or vice versa (Ref. 2.1-5 and 2.1-6).*

Transient populations were considered in calculating the population distribution in the site vicinity. Variations in the transient population occur from 30 to 50 miles away from the site. This subject is discussed in greater detail in Subsection 2.1.3.3.

Population projections are based upon U.S. Bureau of Census projections for the nation (Ref. 2.1-7). These projections are "stepped-down" to the local level by a ratio technique. The U.S. Census projection series for the nation is based upon fertility assumptions. For the projections used in this report, two basic fertility assumptions are made; one is that the completed cohort fertility is 2.7 children per woman, which is characteristic of a growing population, and the other is 2.1 children per woman, which is characteristic of a replacement population growth. In 1990 the 2.1 completed fertility generates birth rates were comparable to national birth rates experienced in 1970-1974 (Ref. 2.1-8). It is reasonable to assume that the 2.1 completed fertility rate applies to the site area. The U.S. Census projections virtually assume a closed population. That is, on the national level migration of persons into or out of the U.S. is considered negligible. However, such a situation does not exist for the Pennsylvania area. For example, between 1980 and 1990 the U.S. population increased by 9%; however, Pennsylvania's population increased by less than 1% (Ref. 2.1-9). These figures indicate that Pennsylvania experienced out-migration. To include migration in the projections, the trends established in the 1960 to 1970 decade were projected out to the years 2000 to 2020 (Ref. 2.1-10 and 2.1-11). The results of these projections are given in Tables 2.1-35 through 2.1-38 and Figures 2.1-23 through 2.1-26.

2.1.3.1 Population Within 10 Miles

The population within 10 miles of the site was sparsely distributed in 2000, and may be characterized as a declining rural population with a few small communities scattered through the area. As shown in Figure 2.1-27 and Table 2.1-39, the bulk of the population was located in the WSW, NNE, NE, SE, N and SSE sectors (Ref. 2.1-4 and 2.1-12). Seasonal population data were included in this table and figure. These sectors contain all or part of several small communities (Table 2.1-40); however, none of these communities exceeded 25,000 people, and none qualifies as a population center (10CFR100) (Ref. 2.1-1).

The rest of the area is agricultural; however, the number of farms between 1969 and 1997 declined by 26% for Luzerne County and 32% for Columbia County (Ref. 2.1-12). This decline combined with a decline in farmland (24% for Luzerne and 22% for Columbia) indicates a decline in agriculture in the vicinity of the site (Ref. 2.1-13).

Population projections for the area from 0 to 10 miles from the site for 2010 and 2020 are given in Tables 2.1-35, 2.1-37 and Figures 2.1-23, 2.1-25. Between 2010 and 2020 there is a projected decline in population of approximately 2,500 people.

2.1.3.2 Population Between 10 and 50 Miles

As shown in Figure 2.1-28 and Table 2.1-41, the major focus of the population between 10 and 50 miles is in the NE and SE sectors. Seasonal population data were included in this table and *figure. The cities contained in these sectors (Scranton, Wilkes-Barre, and Hazleton) form the nucleus of the Scranton/Wilkes-Barre/Hazleton Metropolitan Area. Between 1990 and 2000 the population decreased from 734,175 to 624,776 in this metropolitan area (Ref. 2.1-14).*

Population projections for the area from 10 to 50 miles from the site for years 2010 and 2020 are given in Tables 2.1-36, 2.1-38, and Figures 2.1-24, 2.1-26. These projections are based on the 1990 Census since new projections are not available. After a slight increase in projected population from 2000 to 2010 there is a moderate but steady decline in population between 2010 and 2020.

2.1.3.3 Transient Population Between 0 and 50 Miles

The transient population around the site are of three types:

- *a. Seasonal*
- *b. Daily*
- *c. Transportation*

A seasonal population is dependent upon the time of year. Examples of seasonal dependency are tourists at resort areas and migrant workers. Commuters, a daily population, for example, may be present in an area 40 hours out of the 168 hours in a week. Another example of a daily population is the visitors to the mountains or beaches for the day. Finally, a transportation population is associated with some mode of transportation. For example, several thousand vehicles pass a particular location on a highway during a day; however, the persons in these vehicles may be in the site vicinity a few minutes only. Furthermore, many of the vehicles counted may be those of local residents going to and from work, or running errands. The seasonal and daily populations are of interest to the location of a nuclear power station and are discussed in more detail below.

2.1.3.3.1 Seasonal Population Between 0 to 50 Miles

Within a 30-mile radius of this site there are all or part of eleven counties (Table 2.1-42). Table 2.1-42 lists current population (2000), seasonal potential population and seasonal population. Luzerne and Columbia Counties have a seasonal population of 8,586 or less than 2.2% of the seasonal potential population in these two counties (Ref. 2.1-14). Within 10 miles of the station assuming seasonal population is 2.2% of the total population then there are approximately 1179 people who are considered seasonal.

From 30 to 50 miles the seasonal population maintains the same general concentration as it does within 30 miles. Table 2.1-42 shows that Pike, Sullivan, Monroe and Wayne counties have rather high concentrations of seasonal population. These counties are NW, NE, and E of the site. The seasonal population for the area defined by a 50 mile radius from the site was weighted and incorporated in the Population Distribution (Tables 2.1-39 and 2.1-41 and Figures 2.1-27 and 2.1-28) and Projections (Tables 2.1-35, 2.1-36, 2.1-37, 2.1-38, and 2 Figures 2.1-23, 2.1-24, 2.1-25, 2.1-26), Ref. 2.1-15.

Other sources of seasonal populations are daily visitors to attractions such as parks, wildlife refuges and national forests. It is difficult to weigh the population due to these attractions since the length of stay is usually unknown. Furthermore, persons who visit a park and hike or swim for the day are often from within the study area. Thus, instead of there being a net increase of *persons in the study area, there may only be a redistribution of persons. The station recreation area is estimated to have a peak daily attendance of 1,000 persons and a daily average of 300 persons according to recreation personnel. The nearest recreational area of a significant size is Ricketts Glen State Park, located approximately 15 miles north-northwest of the site and Nescopeck State Park about 12 miles east both in Luzerne County. (Ref. 2.1.16). Attendance at these parks was not included because of possible counting of local residents who visit the parks.*

2.1.3.3.2 Daily Transient Population

Persons who work at locations which are different than their residences constitute shifts in population during working hours. Especially large employers or urban centers can result in substantial shifts in local population. The Susquehanna site experiences daily shifts in population both into and away from the site area. However, the resident population presents a conservative (high) estimate of the distribution of persons in the vicinity of the station since employment opportunities away from the site area (i.e., further than 5 miles) are greater than those within it. Population shifts into the area occur as workers commute to the 13 industries which occur within 5 miles of the site. These industries employ a total of 1,746 persons some of whom would be expected to reside in the site area (see Table 2.1-43, Ref. 2.1-17). When one weighs the proportion of working hours to total hours in a week (40/160) the residential population increased by only 437 persons.

Daily shifts in population away from the site would be expected to be greater than noted above due to the presence of a number of urban areas located nearby. In Luzerne County, the City of Wilkes-Barre, located 21 miles to the northeast, is a major urban and employment center. Valmont Industrial Park, located near the City of Hazleton 15 miles southeast of the site, is another important employment center. In Columbia County, Berwick Borough, located 5 miles to the southwest, and the Town of Bloomsburg, located approximately 18 miles to the west-southwest, are the major employment and urban centers.

2.1.3.3.3 Low Population Zone

The distance of the Low Population Zone (LPZ), established for the Susquehanna SES in accordance with 10CFR100, is a three-mile radius from the center of exclusion area. Radiation dose limits at LPZ are regulated by 10CFR50.67, Accident Source Term. The estimated population in the LPZ in 2000 was 2,133 (Table 2.1-39). Projected and existing population distribution data for distances up to 50 miles from the plant are on Tables 2.1-36, 2.1-38, and 2.1-41, and Figures 2.1-24, 2.1-26 and 2.1-28.

No schools, hospitals, state or municipal parks are located within the LPZ. The plant recreation area is within the LPZ. Five industrial plants, Leggett and Platt, Castek, PMC Lifestyle, and MP Metals and Tech Packaging are located within the LPZ. These plants employ a total of 254 persons who would contribute to the peak daily transient population. Seasonal population and daily transient populations are discussed in Subsection 2.1.3.3.1.

Some of the facilities and institutions beyond the low population zone within five miles of the station which because of their nature, may require special consideration when evaluating emergency plans include: campgrounds, at state gamelands, public schools, municipal buildings, swimming and boating operations, a miniature golf course, and a number of *industries. Industries within five miles are identified in Table 2.1-43. The State and county emergency management agencies have plans for notification of facilities and institutions within the 10-mile Emergency Planning Zone (EPZ) in the event of an emergency. Also, State and local police departments will direct traffic in the event of an emergency. It should be noted that portions of communities outside this 10-mile EPZ are included in emergency planning evacuation plans.*

2.1.3.4 Population Center

The nearest population center as defined in 10CFR100 is the City of Wilkes-Barre, located about 21 miles northeast, which had a 1980 population of 55,551 and a 1990 population of 47,523 and a 2000 population of 43,123 (Ref. 2.1-4). It is part of the Scranton/Wilkes-Barre/Hazleton Metropolitan Area. See Section 2.1.3.2 for additional information.

Subsection 2.1.3.3 discusses transient population.

Tables 2.1-35, 2.1-36, 2.1-37, 2.1-38 and Figures 2.1-23, 2.1-24, 2.1-25, and 2.1-26 show population projections for the population around the Susquehanna site.

Berwick, Pennsylvania is not likely to exceed 25,000 people and become the population center within the next 40 years. Using population figures provided by the Columbia County Planning Commission (Ref. 2.1-18), Berwick's population is projected to decrease by 1,071 persons between 2000 and 2020 (Table 2.1-44). The 2000 projection of 10,395 was within 379 people according to the 2000 census.

2.1.3.5 Population Density

Tables 2.1-45 and 2.1-46 show the comparison of cumulative population for the initial year of operation and final year of operation versus a cumulative population from a uniform population density of 500 people/sq. mile and 1000 people/sq. mile respectively.

2.1.4 REFERENCES

2.1-1 *Code of Federal Regulations, 10 Energy Part-100. The Office of Federal Register National Archives and Records Administration, January 1, 1990.*

2.1-2 *Pennsylvania State Data Center. Historical Population Counts for Pennsylvania Counties, 1790-1980. October 24, 1997. Web Site: http://www.mnsfld.edu/depts/lib/ref/stats/pa-demog.txt*

2.1-3 *Pennsylvania State Data Center. Pennsylvania County Profiles. October 24, 1997.*

2.1-4 *Pennsylvania State Data Center. Pennsylvania County Profiles. U.S. Census Bureau, Census 2000.*

2.1-5 *The Center for Rural Pennsylvania. A legislative Agency of the Pennsylvania General Assembly, Harrisburg, PA. U.S. Census Bureau, 2002. Web site: http://www.ruralpa.org/rural def/*

2.1-6 *Johnson, Jonathan, The Center for Rural Pennsylvania. Personal Communications with J. S. Fields, PPL Susquehanna, LLC. October 30 and November 6, 2002.*

2.1-7 *U.S. Bureau of the Census. 1970 Census of Population Numbers of Inhabitants, Pennsylvania, PC (1)A-40, U. S. Government Printing Office, Washington, D.C. 1971.*

2.1-8 *Projections of the Population of the United States, by Age and Sex, 1975 to 2000, with Extensions of Total Population to 2025, Population Estimates and Projects, Current Population Reports No 541. U.S. Department of Commerce, February, 1975..*

2.1-9 *U.S. Bureau of the Census. U.S. and Pennsylvania Population Data, 1980 and 1990 (Fax). Philadelphia, PA.*

2.1-10 *Vital Statistics Report, Annual Summary for United States 1974, Volume 23. U.S. Department of Health, Education, and Welfare, Rockville, MD.*

2.1-11 *Regulatory Standard Review Plan, Section 2.1.3 Population Distribution, Directorate of Licensing, U.S. Atomic Energy Commission, October 1974.*

2.1-12 *Census 2000 including seasonal population. AccuData America, 2003. Fort Myers, Florida.*

2.1-13 *Census of Agriculture, National Agricultural Statistics Service. The Center for Rural Pennsylvania, Harrisburg, PA. 2002. Web site: http://www.ruralpa.org/2002profiles/luzerne.html (or columbia).*

2.1-14 *Pennsylvania State Data Center. Profile of General Demographic Characteristics: 2000, Table DP-1. US. Census Bureau, Census 2000.*

2.1-15 *U.S. Bureau of the Census. Census of Population and Housing 1990, 1980: Summary Tape File 1 and 3, The Pennsylvania State Data Center, Penn State, Harrisburg, 1990.*

2.1-16 *Fridman, John, PPL Services. Personal Communication with J. S. Fields, PPL Susquehanna, LLC. November 11, 2002.*

2.1-17 *Berwick Area Chamber of Commerce, 2000 Report and Personal Communication with T. V. Jacobsen, Ecology III on October 16, 2002.*

2.1-18 *Columbia County Planning Commission. Personal Communication with J.R. Schinner, Tetra Tech NUS, Inc., Gaithersburg, MD, June 12, 1998.*

End Historical

Table 2.1-1

This Table Has Been Deleted

Table 2.1-2

This Table Has Been Deleted

Table 2.1-3

This Table Has Been Deleted

Table 2.1-4

This Table Has Been Deleted

Table 2.1-5

This Table Has Been Deleted

Table 2.1-6

This Table Has Been Deleted

Table 2.1-7

This Table Has Been Deleted

Table 2.1-8

This Table Has Been Deleted

Table 2.1-9

This Table Has Been Deleted

Table 2.1-10

This Table Has Been Deleted

Table 2.1-11

This Table Has Been Deleted

Table 2.1-12

This Table Has Been Deleted

Table 2.1-13

This Table Has Been Deleted

Table 2.1-14

This Table Has Been Deleted

Table 2.1-15

This Table Has Been Deleted

Table 2.1-16

This Table Has Been Deleted

Table 2.1-17

This Table Has Been Renumbered to 2.1-33

Table 2.1-18

This Table Has Been Renumbered to 2.1-34

Table 2.1-19

This Table Has Been Renumbered to 2.1-39

Table 2.1-20

This Table Has Been Renumbered to 2.1-41

Table 2.1-21

This Table Has Been Renumbered to 2.1-35

Table 2.1-22

This Table Has Been Renumbered to 2.1-36

Table 2.1-23

This Table Has Been Renumbered to 2.1-37

Table 2.1-24

This Table Has Been Renumbered to 2.1-38

Table 2.1-25

This Table Has Been Deleted

Table 2.1-26

This Table Has Been Renumbered to 2.1-40

Table 2.1-27

This Table Has Been Deleted

Table 2.1-28

This Table Has Been Deleted

Table 2.1-29

This Table Has Been Renumbered to 2.1-43

Table 2.1-30

This Table Has Been Renumbered to 2.1-44

Table 2.1-31

This Table Has Been Renumbered to 2.1-45

Table 2.1-32

This Table Has Been Renumbered to 2.1-46

TABLE 2.1-33

PAST POPULATION CHANGES OF COUNTIES WITHIN 20 MILES OF THE SITE*

County	1950	1960	1970	1980	1990	2000	% Change 1990 to 2000
Luzerne	392,241	346,972	341,956	343,079	328,149	319,250	-2.7
Columbia	53,460	53,489	55,114	61,967	63,202	64,151	1.5
Sullivan	6,745	6,251	5,961	6,349	6,104	6,556	7.4
Schuylkill	200,577	173,027	160,089	160,630	152,585	150,336	-1.5
Carbon	57,558	52,889	50,573	53,285	56,846	58,802	3.4
Total	710,581	632,628	613,693	625,310	606,886	599,095	-1.3

Source: Refs. 2.1-2 and 2.1-3 and 2.1-4

* Population includes entire county even area outside 20 mile radius from site.

TABLE 2.1-34

POPULATION BY RESIDENCE FOR COUNTIES WITHIN 20 MILES OF THE SITE
1980 TO 2000

County	1980		1990		2000	
	Urban	Rural	Urban	Rural	Urban	Rural
Luzerne	253,336	89,743	239,215	88,834	254,164	65,086
Columbia	23,576	38,391	23,418	39,784	35,730	28,421
Sullivan	0	6,349	0	6,104	0	6,556
Schuylkill	76,995	83,675	63,560	89,025	95,497	54,839
Carbon	30,665	22,620	29,795	27,051	29,109	29,693

Source: Ref. 2.1-5 and 2.1-6

TABLE 2.1-35

POPULATION DISTRIBUTION
2010
0-10 Miles
Distance (Miles)

Sector	0-1	1-2	2-3	3-4	4-5	5-10	10 Mile Total
N	40	15	48	1,112	2,157	1,200	4,572
NNE	0	75	29	0	0	1,600	1,704
NE	0	0	162	191	369	9,000	9,722
ENE	0	15	37	67	94	1,600	1,813
E	0	56	22	41	72	1,200	1,391
ESE	24	26	63	175	172	2,300	2,760
SE	44	245	147	143	13	3,000	3,592
SSE	40	154	37	89	46	3,700	4,066
S	36	147	29	137	10	1,900	2,259
SSW	4	245	44	83	120	1,000	1,496
SW	4	15	335	89	1,520	2,000	3,963
WSW	4	60	331	111	4,073	12,700	17,279
W	4	30	59	92	182	1,500	1,867
WNW	12	41	44	99	260	700	1,156
NW	16	72	92	0	94	800	1,074
NNW	70	19	15	0	23	1,000	1,127
TOTAL	298	1,215	1,494	2,429	9,205	45,200	59,841
CUMULATIVE TOTAL	298	1,513	3,007	5,436	14,641	59,841	

Source: Refs. 2.1-8 and 2.1-10

Table Rev. 0

TABLE 2.1-36

POPULATION DISTRIBUTION
2010
0-50 Miles
Distance (Miles)

Sector	10 Mile Total	10-20	20-30	30-40	40-50	50 Mile Total
N	4,572	3,700	1,800	7,700	4,800	22,572
NNE	1,704	17,200	17,100	20,100	8,900	65,004
NE	9,722	75,200	101,000	164,800	40,900	391,622
ENE	1,813	30,200	34,800	12,000	9,600	88,413
E	1,391	12,500	1,400	7,900	33,700	56,891
ESE	2,760	11,600	3,100	7,900	32,600	57,960
SE	3,592	37,200	26,500	34,600	211,500	313,392
SSE	4,066	10,700	23,400	11,500	57,400	107,066
S	2,259	9,000	28,300	38,200	31,100	108,859
SSW	1,496	5,200	42,200	12,600	21,500	82,996
SW	3,963	1,700	18,400	23,700	14,700	62,463
WSW	17,279	21,000	23,200	27,700	40,900	130,079
W	1,867	4,400	4,700	20,500	16,300	47,767
WNW	1,156	4,000	2,300	8,900	43,600	59,956
NW	1,074	1,600	1,500	2,000	1,900	8,074
NNW	1,127	1,500	800	3,000	7,500	13,927
TOTAL	59,841	246,700	330,500	403,100	576,900	1,617,041
CUMULATIVE TOTAL	59,841	306,541	637,041	1,040,141	1,617,041	

Source: Refs. 2.1-8 and 2.1-10

Table Rev. 0

TABLE 2.1-37

POPULATION DISTRIBUTION
2020
0-10 Miles
Distance (Miles)

Sector	0-1	1-2	2-3	3-4	4-5	5-10	10 Mile Total
N	41	15	47	1,056	2,010	1,200	4,369
NNE	0	76	29	0	0	1,400	1,505
NE	0	0	160	181	359	7,400	8,100
ENE	0	15	36	63	92	1,600	1,806
E	0	57	22	39	70	1,200	1,388
ESE	24	26	62	166	168	2,400	2,846
SE	45	246	145	136	13	3,100	3,685
SSE	41	155	36	84	44	4,000	4,360
S	37	147	29	130	10	1,800	2,153
SSW	4	246	44	78	117	1,000	1,489
SW	4	15	330	84	1,480	2,000	3,913
WSW	4	60	327	106	3,966	12,100	16,563
W	4	30	58	88	177	1,500	1,857
WNW	12	42	44	94	254	700	1,146
NW	16	72	91	0	92	800	1,071
NNW	20	19	15	0	22	1,000	1,076
TOTAL	252	1,221	1,475	2,305	8,874	43,200	57,327
CUMULATIVE TOTAL	252	1,473	2,948	5,253	14,127	57,327	

Source: Refs. 2.1-8 and 2.1-10

Table Rev. 0

TABLE 2.1-38

POPULATION DISTRIBUTION
2020
0-50 Miles
Distance (Miles)

Sector	10 Mile Total	10-20	20-30	30-40	40-50	50 Mile Total
N	4,369	3,600	2,000	8,200	4,500	22,669
NNE	1,505	18,300	18,800	21,400	9,900	69,905
NE	8,100	65,600	91,200	151,700	37,400	354,000
ENE	1,806	29,200	31,700	13,600	9,800	86,106
E	1,388	14,800	1,500	8,900	35,600	62,188
ESE	2,846	11,000	3,100	8,300	33,700	58,946
SE	3,685	32,500	23,600	34,700	225,600	320,085
SSE	4,360	9,600	21,200	12,000	62,700	109,860
S	2,153	7,900	25,200	38,600	33,700	107,553
SSW	1,489	4,800	37,800	11,800	21,600	77,489
SW	3,913	1,600	17,000	20,700	13,900	57,113
WSW	16,563	21,400	22,800	25,900	43,600	130,263
W	1,857	4,400	4,700	19,200	16,600	46,757
WNW	1,146	4,000	2,100	8,700	42,100	58,046
NW	1,071	1,500	1,400	1,900	1,800	7,671
NNW	1,076	1,500	700	2,700	7,500	13,476
TOTAL	57,327	231,700	304,800	388,300	600,000	1,582,127
CUMULATIVE TOTAL	57,327	289,027	593,827	982,127	1,582,127	

Source: Refs. 2.1-8 and 2.1-10

TABLE 2.1-39

POPULATION DISTRIBUTION
2000
0-10 MILES
DISTANCE (MILES)

Sector	0-1 Miles	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	5-10 Miles	10 Mile Total
N	12	29	49	711	937	1,575	3,313
NNE	13	28	46	176	83	3,460	3,806
NE	17	28	46	64	126	3,347	3,628
ENE	16	28	46	67	133	1,840	2.130
E	14	27	66	109	139	1,552	1,907
ESE	16	35	79	111	142	2,288	2,671
SE	22	34	77	111	144	3.873	4.261
SSE	29	48	61	90	161	2,505	2,894
S	30	70	61	85	122	1,076	1,444
SSW	30	88	69	85	110	1,015	1,397
SW	30	89	120	418	1,043	771	2,471
WSW	30	89	143	403	3,583	12,590	16,838
W	29	54	63	137	167	2.019	2.469
WNW	16	29	48	67	105	822	1,087
NW	13	29	48	67	86	1,077	1,320
NNW	12	29	48	67	91	1.384	1.631
TOTAL	329	734	1.070	2.768	7.172	41.194	53.267
53,267	329	1,063	2,133	4,901	12,073	53,267	

Ref. 2.1-4 and 2.1-12

TABLE 2.1-40

COMMUNITIES WITHIN 10 MILES OF THE SITE, 2000

COMMUNITIES[(1)]	POPULATION 1990	POPULATION 2000	DIRECTIONAL SECTOR	RADIAL DISTANCE	% CHANGE
Shickshinny	1,108	959	N	5 to 10	-13.45
Briar Creek	616	651	WSW	5 to 10	5.68
Berwick	10,976	10,774	WSW	5 to 10	-1.84
Nescopeck	1,651	1,528	SW	5 to 10	-7.45
Conyngham	2,060	1,958	SE	5 to 10	-4.95

Source: Ref. 2.1-3, 2,1-4, and 2.1-12

NOTES: [(1)]Boroughs

TABLE 2.1-41

POPULATION DISTRIBUTION
2000
0-50 MILES
DISTANCE (MILES)

Sector	0-10 Miles	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	50 Mile Total
N	3,314	4,953	2,440	5,990	8,071	24,768
NNE	3,806	18,285	13,505	18,818	11,110	65,524
NE	3,629	119,400	78,944	147,035	40,712	389,720
ENE	2,130	13,926	5,178	21,330	35,341	77,905
E	1,909	8,346	7,131	35,232	52,694	105,312
ESE	2,671	13,938	17,073	27,333	56,689	117,704
SE	4,260	36,774	27,237	36,858	230,006	335,135
SSE	2,895	7,229	14,821	14,120	62,753	101,818
S	1,444	14,507	43,974	27,178	24,875	111,978
SSW	1,396	4,018	28,353	15,335	16,925	66,027
SW	2,470	3,511	21,747	18,465	15,064	61,257
WSW	16,839	25,498	18,138	34,811	38,435	133,721
W	2,470	5,868	6,089	27,774	23,573	65,774
WNW	1,086	4,040	4,437	16,797	57,231	83,591
NW	1,318	3,510	2,156	3,354	3,888	14,226
NNW	1,630	3,843	2,524	5,352	10,376	23,725
TOTAL	53,267	287,646	293,747	455,782	687,743	1,778,185
CUMULATIVE TOTAL	53,267	340,913	634,660	1,090,442	1,778,185	

Ref. 2.1-4 and 2.1-12

TABLE 2.1-42

SEASONAL POPULATION OF COUNTIES IN STUDY AREA, 2000

Counties Within 30 Miles of Site	Current Population	Seasonal Potential Population	Seasonal Population	% Seasonal
Wyoming	28,080	30,892	2,812	9.1
Sullivan	6,556	12,672	6,116	48.3
Monroe	138,687	176,579	37,892	21.5
Lackawanna	213,295	217,984	4,689	2.2
Carbon	58,802	70,044	11,242	16
Schuylkill	150,336	152,745	2,409	1.6
Luzerne	319,250	325,270	6,020	1.9
Columbia	64,151	66,717	2,566	3.8
Montour	18,236	18,464	228	1.2
Northumberland	94,556	95,175	619	0.7
Lycoming	120,044	124,865	4,821	3.9
SUBTOTAL	**1,211,993**	**1,291,407**	**79,414**	
Counties Within 50 Miles of Site				
Susquehanna	42,238	51,108	8,870	17.4
Bradford	62,761	68,602	5,841	8.5
Wayne	47,722	72,509	24,787	34.2
Pike	46,302	80,804	34,502	42.7
Northampton	267,066	268,478	1,412	0.5
Lehigh	312,090	313,040	950	0.3
Berks	373,638	375,326	1,688	0.4
Lebanon	120,327	121,253	926	0.8
Dauphin	251,798	253,278	1,480	0.6
Snyder	37,546	38,617	1,071	2.8
Union	41,624	43,763	2,139	4.9
SUBTOTAL	**1,603,112**	**1,686,778**	**83,666**	
TOTAL FOR ALL COUNTIES	**2,815,105**	**2,978,185**	**163,080**	

Source: Ref. 2.1-4, 2.1-12 and 2.1-15

Table Rev. 0

TABLE 2.1-43

INDUSTRIES WITHIN 5 MILES OF THE SITE
2000

Industry	Distance (miles) and Direction from the Site		Number of Employees	Products
Riverview Vibrated Block Co.	4.0	WSW	5	Concrete Block and Brick
Crispin Multiplex Mfg. Co. Inc.	4.75	WSW	45	Valve
Tech Packaging	1.5	WSW	130	Packaging Material
RAD Woodwork Co., Inc.	4.5	SW	60	Lumber Mill
Zeiser Vault Co.	4.25	SW	15	Concrete Products
Cooks Wholesale Food, Inc.	5.0	WSW	8	Package Food Products
Leggett & Platt	1.25	NNE	57	Carpet Underlay
Berwick Industries, Inc.	3.9	WSW	1300	Decorative bows and ribbons
Castek, Inc.	1.5	WSW	10	Plastic/Cement
PMC Lifestyle	1.5	SSW	55	Foam Products
MP Metals	2.5	SW	2	Metal Scrap
Dyco	4.5	SW	59	Packaging Machines
Audimation	3.2	S	4	Stereo Amplifiers

Source: Ref. 2.1-17

TABLE 2.1-44

POPULATION PROJECTIONS FOR BERWICK, PENNSYLVANIA

Year	Historical Trend[1]
1970	12,274
1980	11,850
1990	10,976
2000	10,395
2010	9,845
2020	9,324

[1] Calculated by TtNUS based on 1970-1990 population data supplied by the Columbia County Planning Commission (Ref. 2.1-8). Extrapolation based on 1970 to 1990 trend.

TABLE 2.1-45

CUMULATIVE POPULATIONS FOR 1990 AND 2000

Distance (mi)	1990	2000	500#/mile(sq)*
1	124	329	1,570
2	820	1,063	6,280
3	2,243	2,133	14,135
4	4,573	4,901	25,130
5	12,006	12,073	39,265
10	51,528	53,267	157,079
20	341,058	340,913	628,515
30	610,710	634,660	1,413,715
40	1,020,502	1,090,442	2,513,270
50	1,616,658	1,778,185	3,926,990

* This is the population that would occur if 500 persons per square mile were uniformly distributed over the study area.

Source: Refs. 2.1-12, 2.1-14 and 2.1-16

TABLE 2.1-46

CUMULATIVE POPULATIONS FOR 1990, 2000, 2010 AND 2020

Distance (miles)	1990	2000	2010	2020	1000/mi²*
1	124	329	289	252	3,140
2	820	1,063	1,513	1,473	12,560
3	2,243	2,133	3,007	2,948	28,270
4	4,573	4,901	5,436	5,253	50,260
5	12,006	12,073	14,641	14,127	78,530
10	51,528	53,267	59,841	57,327	314,159
20	341,058	340,913	306,541	289,029	1,256,630
30	610,710	634,660	637,041	593,827	2,827,430
40	1,020,502	1,090,442	1,040,141	982,127	5,026,540
50	1,616,658	1,778,185	1,617,041	1,581,127	7,853,980

*This is the population that would occur if 1000 persons per square mile were uniformly distributed over the study area.

Source: Refs. 2.1-12, and 2.1-14 and 2.1-16

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-11

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure renumbered from 2.1-1 to 2.1-11

FIGURE 2.1-1, Rev. 55

AutoCAD Figure 2_1_1.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-12

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-2 to 2.1-12 FIGURE 2.1-2, Rev. 55

AutoCAD Figure 2_1_2.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-13

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-3 to 2.1-13 FIGURE 2.1-3, Rev. 55

AutoCAD Figure 2_1_3.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-14

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-4 to 2.1-14 FIGURE 2.1-4, Rev. 55

AutoCAD Figure 2_1_4.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-15

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-5 to 2.1-15 FIGURE 2.1-5, Rev. 55

AutoCAD Figure 2_1_5.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-16

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-6 to 2.1-16 FIGURE 2.1-6, Rev. 55

AutoCAD Figure 2_1_6.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-17

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-7 to 2.1-17
FIGURE 2.1-7, Rev. 55

AutoCAD Figure 2_1_7.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-18

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-8 to 2.1-18 FIGURE 2.1-8, Rev. 55

AutoCAD Figure 2_1_8.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-19

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-9 to 2.1-19 FIGURE 2.1-9, Rev. 55

AutoCAD Figure 2_1_9.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-20

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure renumbered from 2.1-10 to 2.1-20

FIGURE 2.1-10, Rev. 55

AutoCAD Figure 2_1_10.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-21

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure renumbered from 2.1-11 to 2.1-21

FIGURE 2.1-11, Rev. 56

AutoCAD Figure 2_1_11.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-22

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-12 to 2.1-22 FIGURE 2.1-12, Rev. 57

AutoCAD Figure 2_1_12.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-27

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure renumbered from 2.1-13 to 2.1-27

FIGURE 2.1-13, Rev. 56

AutoCAD Figure 2_1_13.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-28

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-14 to 2.1-28 FIGURE 2.1-14, Rev. 56

AutoCAD Figure 2_1_14.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-23

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure renumbered from 2.1-15 to 2.1-23

FIGURE 2.1-15, Rev. 56

AutoCAD Figure 2_1_15.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-24

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-16 to 2.1-24
FIGURE 2.1-16, Rev. 56

AutoCAD Figure 2_1_16.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-25

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-17 to 2.1-25 FIGURE 2.1-17, Rev. 56

AutoCAD Figure 2_1_17.doc

THIS FIGURE HAS BEEN
RENUMBERED TO 2.1-26

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
Figure renumbered from 2.1-18 to 2.1-26
FIGURE 2.1-18, Rev. 56

AutoCAD Figure 2_1_18.doc

THIS FIGURE HAS BEEN
DELETED

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure Deleted

FIGURE 2.1-19, Rev. 56

AutoCAD Figure 2_1_19.doc

THIS FIGURE HAS BEEN
DELETED

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Figure Deleted

FIGURE 2.1-20, Rev. 56

AutoCAD Figure 2_1_20.doc

Security-Related Information
Figure Withheld Under 10 CFR 2.390

FSAR REV. 65

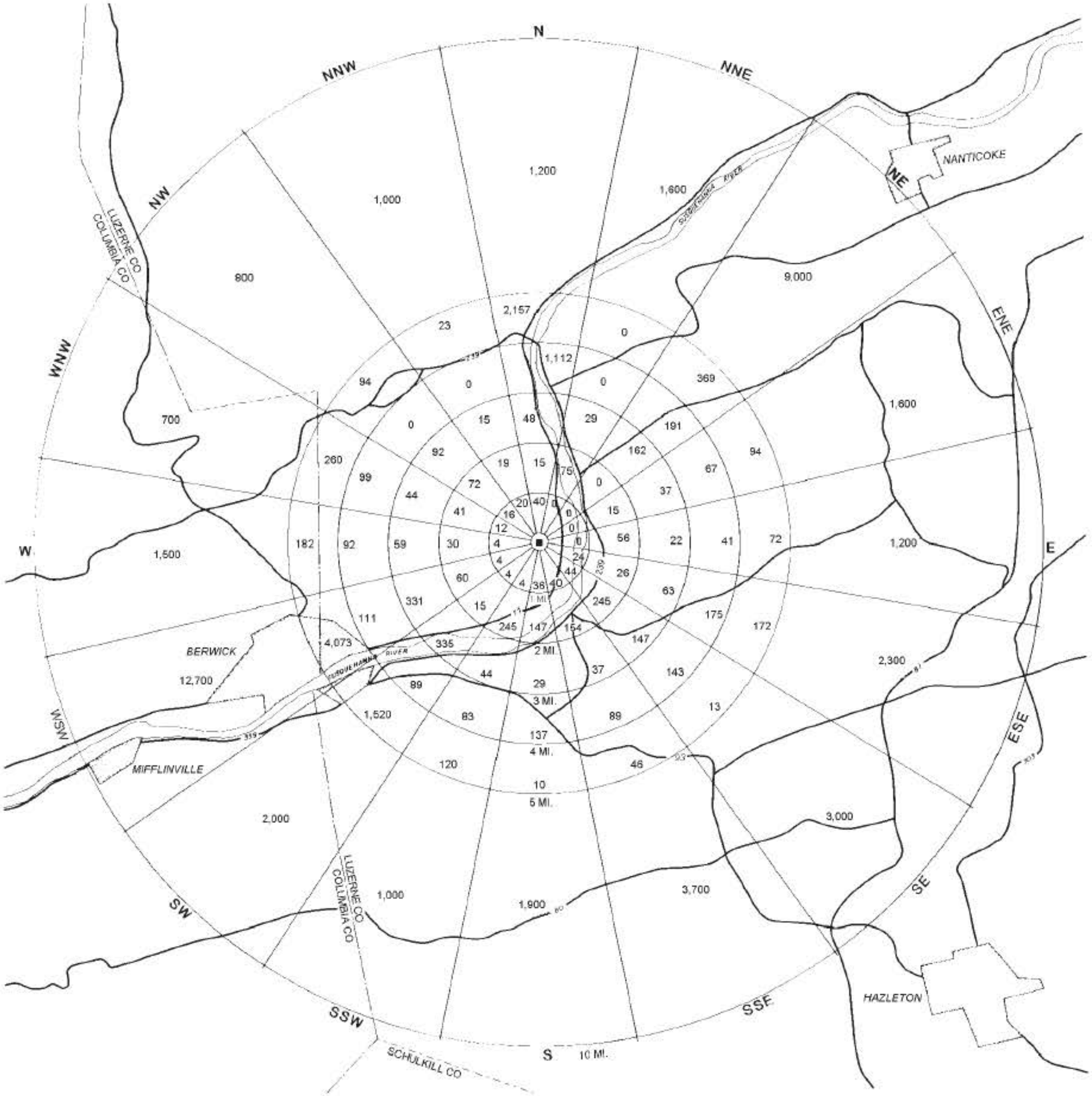
SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
SITE VICINITY MAP FIGURE 2.1-21, Rev 1

AutoCAD: Figure Fsar 2_1_21.dwg

Security-Related Information
Figure Withheld Under 10 CFR 2.390

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
SITE AREA MAP FIGURE 2.1-22, Rev 3

AutoCAD: Figure Fsar 2_1_22.dwg



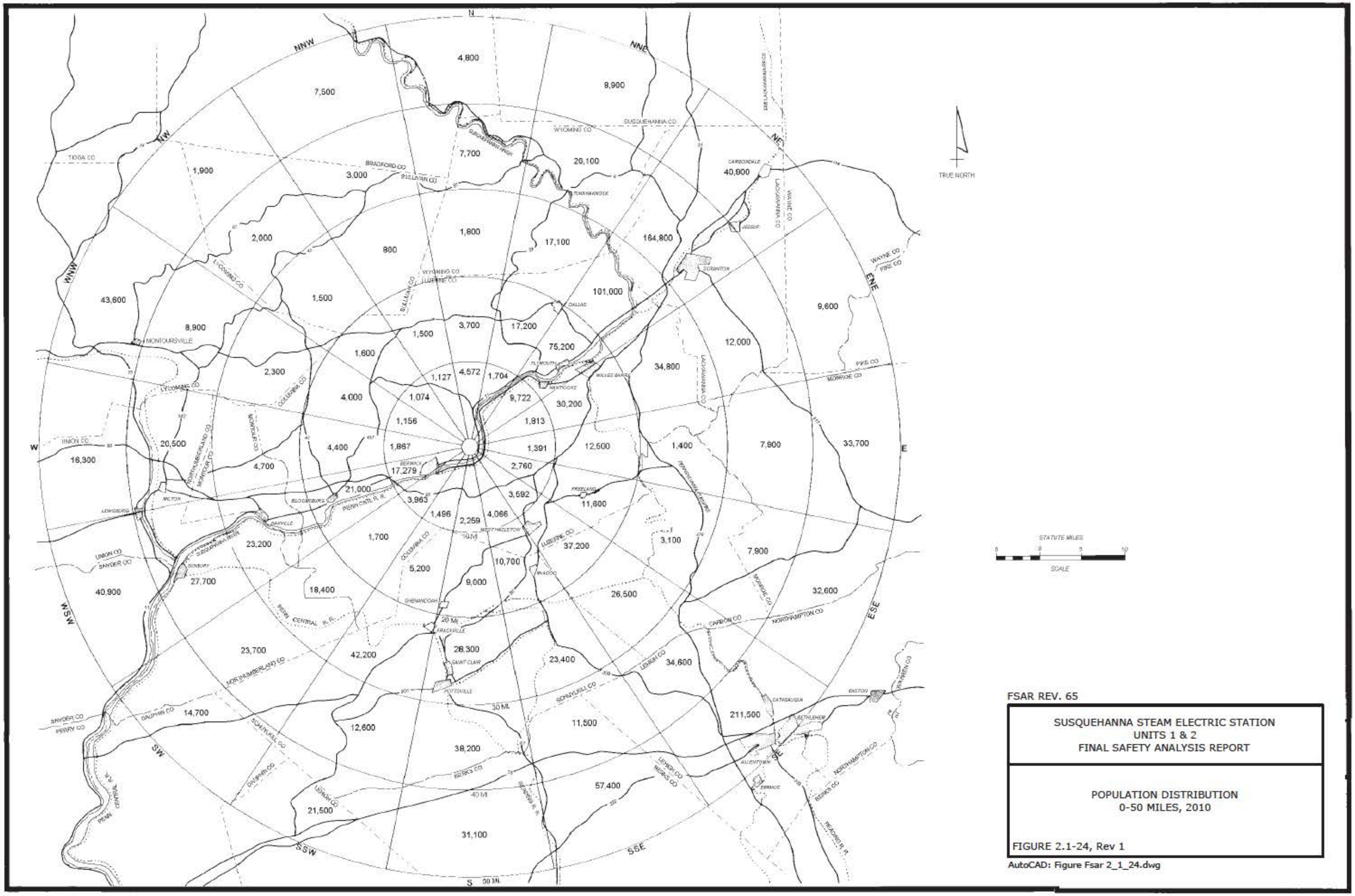
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

POPULATION DISTRIBUTION
0-10 MILES, 2010

FIGURE 2.1-23, Rev 1

AutoCAD: Figure Fsar 2_1_23.dwg



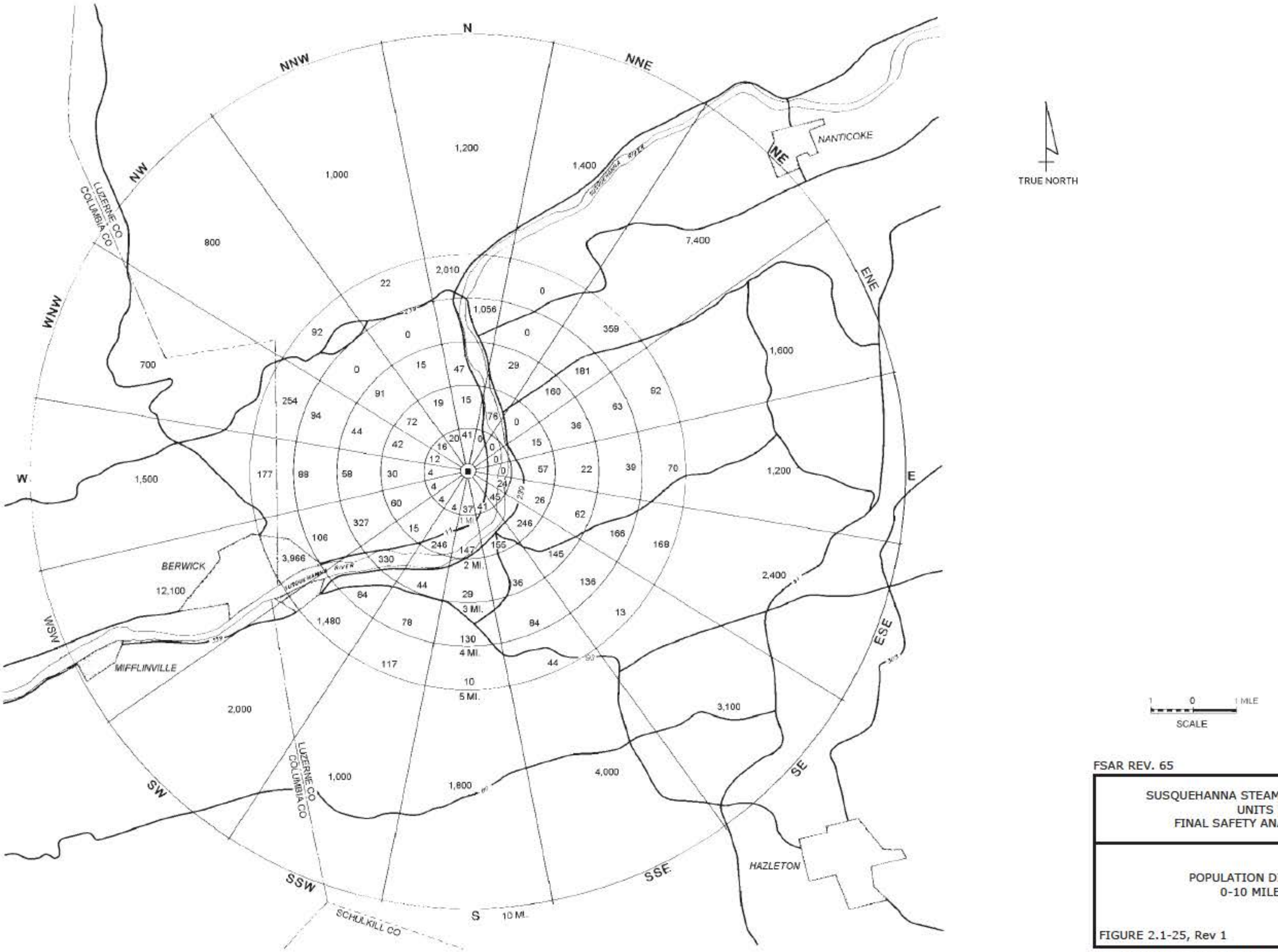
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

POPULATION DISTRIBUTION
0-50 MILES, 2010

FIGURE 2.1-24, Rev 1

AutoCAD: Figure Fsar 2_1_24.dwg



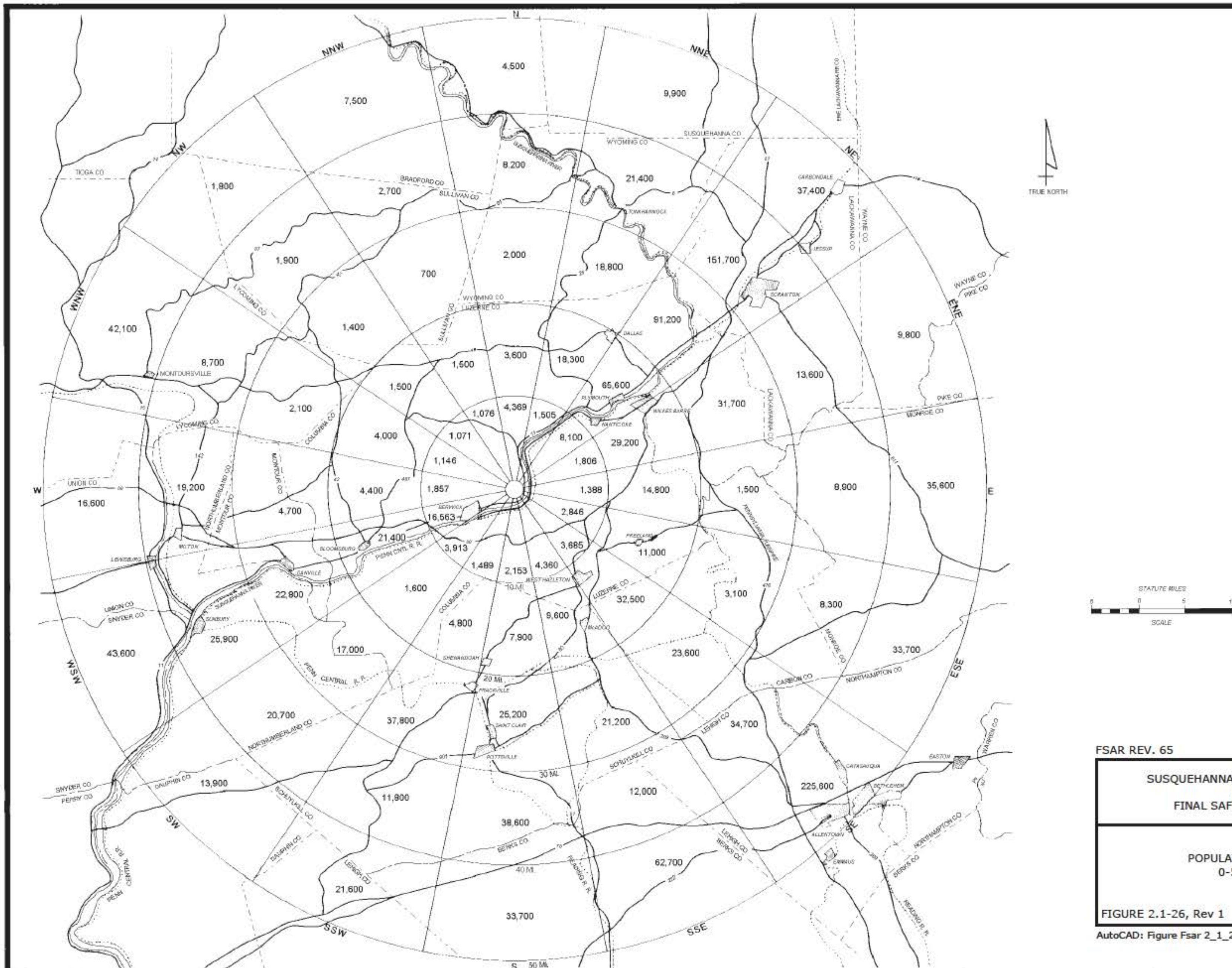
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

POPULATION DISTRIBUTION
0-10 MILES, 2020

FIGURE 2.1-25, Rev 1

AutoCAD: Figure Fsar 2_1_25 dwg



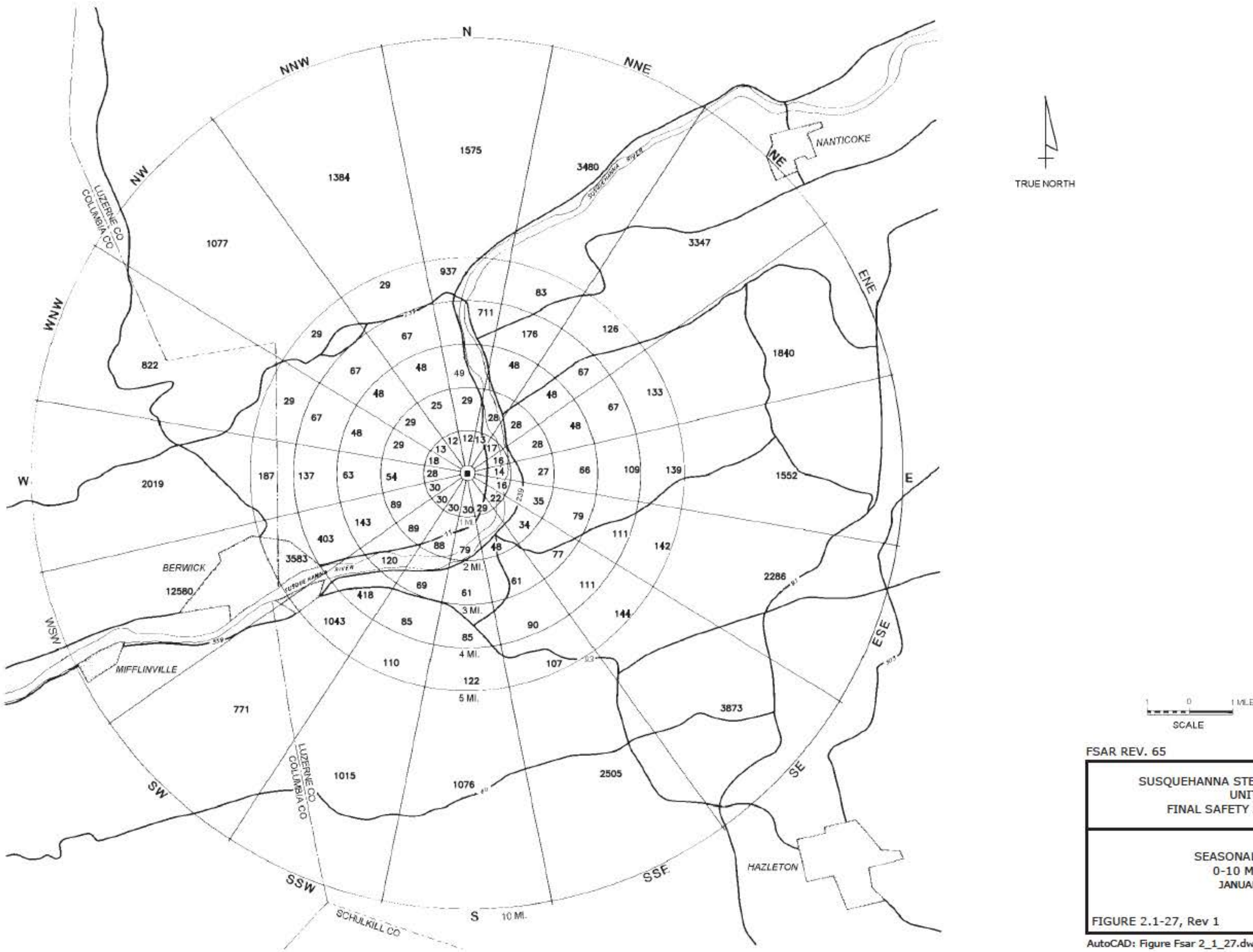
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

POPULATION DISTRIBUTION
0-50 MILES, 2020

FIGURE 2.1-26, Rev 1

AutoCAD: Figure Fsar 2_1_26 dwg



FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

SEASONAL POPULATION
0-10 MILES, 2000
JANUARY 15, 2003

FIGURE 2.1-27, Rev 1

AutoCAD: Figure Fsar 2_1_27.dwg

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

SEASONAL POPULATION
0-50 MILES, 2000
JANUARY 15, 2003

FIGURE 2.1-28, Rev 1

AutoCAD: Figure Fsar 2_1_28 dwg

Start Historical

2.2 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

2.2.1 LOCATIONS AND ROUTES (See pages 2.2-2 and 2.2-16 for changes)

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.2.2 DESCRIPTIONS

2.2.2.1 Description of Facilities

Thirteen industries located within five miles of the Susquehanna SES are listed on Table 2.1-43 along with their products and number of employees (Ref. 2.1.17). None of these manufacturers stores any explosives or hazardous materials.

The nearest industry to the site is Leggett and Plat *(formerly Dura Bond) which is located 1.25 miles northeast of the site. The company does not use any explosive material. It has a water well field one mile north of the site. The Company employs 74 employees at this location (Ref. 2.2-3).*

There are approximately 25 industries located in Berwick Borough beyond the five mile limit, but within a distance of seven miles from the site. The two largest employers are Wise Potato Chip Company with 800 employees, and Deluxe Homes with 250 employees. The remaining industries are mainly manufacturers of apparel and other finished products. None of these industries located beyond five miles uses or stores any explosive or hazardous materials.

2.2.2.2 Descriptions of Products and Materials

End Historical

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.2.2.3 Pipelines

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Start Historical

2.2.2.4 Waterways

Navigation, except for recreational boating, is negligible on the Susquehanna River. Therefore, no commercial traffic occurs in the vicinity of the Susquehanna SES. Only recreational boating and sports fishing occur in the vicinity of the Susquehanna SES (Ref. 2.2-4).

2.2.2.5 Airports

The Hazleton Municipal Airport is located 12 miles southeast of the site is the closest airport. The airport serves private and corporate airplanes. The airport has one paved runway with a length of 4,988 feet with an east-west orientation. The flying pattern is a normal left hand pattern. The number of operations over the last 10 years have significantly decreased from earlier estimates because commercial flights were discontinued (Ref. 2.2-5).

The Wilkes-Barre Scranton Airport located 28 miles northeast of the site handles single wheel, dual wheel and dual tandem wheel airplanes. The types of commercial aircraft using the airport are Boeing 727s, BAC-111s and DC-9s. The airport has three asphalt paved runways. The length of the longest runway (Runway 4-22) is 7,500 feet. The restricted maximum weight is 110,000 pounds for single wheel loads, 169,000 pounds for dual wheel loads, and 300,000 pounds for dual tandem wheels. The lengths of the two remaining runways are 4,497 and 3,699 feet. The orientation of the runways are as follows: 4-22-SSW to NNE; 10-28-E to W; 16-34-NNW to SSE. The airport is so distant from the site that approach and holding patterns do not pose a hazard to the plant.

The number of operations conducted at the airport in 1990 was 67,200. Operations in 1990 were approximately 11,000 below the 1973 number and significantly below the 1975 airport forecast for 1995 total operations of 167,400 (Ref. 2.2-6).

Federal Vortac airways passing near the site are:

V-499 3.0 miles	*(West) – Lancaster, Pa./ Binghampton, NY*
V-106 3.5 miles	*(Southeast) – Wilkes-Barre-Scranton, Johnston, PA*
V-164 6.7 miles	*(Southwest) – Allentown/Williamsport, PA*
V-232 9 miles	*(South) – Newark, NJ/Cleveland, OH*
V-188/226 13 miles	*(North) – Wilkes-Barre-Scranton/ Williamsport, PA*

The distances to the site are measured from the map centerline of the route, as given in the standard aeronautical map (New York Sectional).

2.2.2.6 Projections of Industrial Growth

Commonwealth employment forecasts for textile and apparel manufacturing for the Bloomsburg - Berwick and Wilkes-Barre - Hazleton Labor Market Areas indicate negligible industrial expansion. Employment is projected to increase 5.1% in textile manufacturing and 14% in apparel manufacturing from 1970-1990 in the Berwick - Bloomsburg Labor Market Area. For the same period of time in the Wilkes-Barre - Hazleton Labor Market Area, employment is projected to decrease by 40% in textile manufacturing and to increase 6.2% in apparel manufacturing (Ref. 2.2-7).

2.2.3 EVALUATION OF POTENTIAL ACCIDENTS

Potential accidents in nearby transportation, industrial, and military activities are reviewed in this section to evaluate whether their effects at the site might be of serious consequence to nuclear safety, with an annual probability of occurrence exceeding 10^7. For events such as truck accidents where a probability has not been estimated, it is shown that should the event occur no consequence of critical magnitude with respect to nuclear safety would be induced at the plant.

End Historical

2.2.3.1 Determination of Design Basis Events

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Start Historical

2.2.3.1.4 Fires

Fires which could result in smoke clouds at the site may arise from brush and forest fires, oil spills from adjacent pipelines, and transportation accidents. A fire from a natural gas pipeline could result in a transient radiant heat flux of very short duration (a few seconds) if the flame front were as close as 1,500 feet. However, the condition is not sustainable and would become limited to about 2,000-3,000 feet from the point of pipeline rupture.

An oil fire from a pipeline rupture at the river, followed by ignition of a pool of floating oil could produce 1.5 Kg/second of particulates for each 1,000 barrels per hour of fuel consumed in open area burning. For pool or choked burning, i.e., sooting conditions, the particulate generation could reach 10 Kg/second. Maximum smoke concentration at the site could reach 250 milligrams/cubic meter. No radiant heat problem at the site would be expected, since firefighting equipment would normally be able to use the road between the site and river bank. However, the on-site fire brigade would respond to any fire at the intake location. The fire hydrant and hose located at the intake would be used to mitigate the effects of the potential radiant heat associated with an oil fire at the river.

The usual failure mode of oil pipelines, the distances to structures containing safety related equipment, and the nature of oil spills on rivers minimize the potential of an oil fire impacting Susquehanna SES. However, as a worst case, it could be assumed that the pipeline will continue to flow for one half hour after the rupture. Since the maximum flow rate in the Sun Pipeline (the closest oil pipeline to the site) is 800 barrels per hour, this would produce a spill of 400 barrels plus the amount remaining in the pipeline up to the points of shutoff in each direction. This distance would be about 3/4 of a mile in the near direction and about 8 miles in the far direction, if it is assumed that pipeline rupture occurs at the shutoff point closest to the site. For 6.625 inside diameter line, this gives a volume of approximately 1970 barrels. When added to the 400 barrels for the amount spilled before shutoff, we have a total worst case spill of 2370 barrels.

The fire would basically burn until the spill was shutoff, 1/2 hour under the worst case conditions. However, it may be that the spill, if it reaches the Susquehanna River, might spread out on the surface of the river and continue to burn until the spill thickness passes below some minimum which will no longer sustain combustion. Under the worst case circumstances, the thickness of the slick by the area over which the spill will spread can be estimated. A well-recognized formula for this spreading is:

$$A = 10^5 \, x \, v^{3/4} \qquad \text{(Ref. 2.2-14)}$$

where A is the spill area in square meters and V is the spill volume in cubic meters. The thickness is then estimated by dividing the volume by the spill area. For the aforementioned worst case 2370-barrel spill, the formula gives a thickness (at maximum spread) of only 4.2 x

10^{-3} centimeters. At a typical burning rate of one inch per hour, this thickness would be consumed in less than 10 seconds. Therefore, it would appear that a spill from the Sun Pipeline would not be able to burn for much longer than the 1/2 hour maximum flow time until shutoff. This evaluation assumes the oil is spilled on a calm lake. The postulated exposure and the chance for ignition would be minimized by the river flow.

The gas line would not create any smoke problem, but could ignite brush or forest areas. Combustible cover to the northwest of the plant is heavy along Lee Mountain, 3,200 acres at about three miles distance, and over a low ridge north of the plant boundary, 250 acres at one mile. The smoke particulate load estimated from a fire consuming 40 acres per hour (low wind condition, associated with atmospheric stagnation) would be at 210 Kg total particulates per hectare (EPA-42, Factors for Atmospheric Emissions), 160 and 22 milligrams/cubic meter for fires at one and three miles, respectively.

2.2.3.1.5 Collisions with Intake Structure

The Susquehanna River is not used as a navigable waterway for other than small recreational boats, which do not constitute any hazard potential to the intake structure.

2.2.3.1.6 Liquid Spills

Petroleum spills could occur from a pipeline rupture near the Susquehanna River and float on the river surface at the river water makeup line intake. The intake is underwater, so oil would be excluded from entry into the intake line. The most severe condition would occur at the design low water condition with water surface at 483.5 feet MSL. The water intake would still be submerged one foot. Intake flow velocity would be between 0.5 and 0.7 foot/second, remaining below the value of about 1.0 foot/second, at which the surface layer in flow stagnation against the debris lip might begin to be drawn down into the intake. In Subsection 2.4.11, a more severe condition was considered; namely, the low flow level with strong wind blowing away from the intake. Under this latter hypothesis, however, floating oil would also be blown away from the intake.

2.2.3.1.7 Subsurface Gas and Waste Storage

The unconsolidated Quaternary deposits in the vicinity of the Susquehanna SES are unsuitable for storage or disposal. While storage in unconsolidated strata is feasible, the thickness and extent of the Quaternary strata in the site area is insufficient. For example, with regard to aquifer storage of natural gas, the minimum depth of overburden necessary to maintain adequate deliverability at the well head is about 500 ft., while depths in excess of 1500 ft. are desirable for an efficient operation.

As discussed in Subsection 2.4.13, none of the bedrock formations in the site vicinity have a high primary transmissivity. Both the primary porosity and permeability of these well consolidated rocks are generally low. Ground water utilization is dependent upon secondary permeability developed through tectonic fracturing and jointing or solution processes. Thus, while the anticlinal structure in the site vicinity may provide geometry suitable for aquifer storage or disposal, no suitable reservoir strata are known to be present.

Deep well injection into fracture porosity zones in impermeable rock might be considered as a potentially feasible method of waste disposal in the site vicinity. However, based on existing literature and considering current technology, this method of disposal is the least desirable. Reservoir strata with some degree of primary permeability are preferred (Ref. 2.2-15).

It is believed that the Precambrian basement, at depths in excess of 30,000 feet in the vicinity of the Susquehanna SES, does not contain the Fold and Thrust Belt Fracture System (Subsection 2.5.1.1.3). The nature and extent of any fracturing in these rocks is known. Recent advances in drilling technology suggest that the technical capability to construct a disposal well at depths in excess of 30,000 feet may be available in the near future. In the U.S. there has been at least one instance of disposal of chemical waste into Precambrian age crystalline rock (Ref. 2.2-16). However, rocks of this type with transmissibilities dependent solely on fracture porosity are not generally considered to be suitable storage or disposal reservoirs (Refs. 2.2-17, 2.2-18 and 2.2 19).

A discussion of the potential hazard resulting from a subsurface storage facility would be dependent upon the type of facility and the type of material being stored. In view of the low potential for the development of such a facility in the near vicinity of the Susquehanna SES, a discussion of potential hazard is unwarranted.

2.2.3.2 Effects of Design Basis Events

No offsite accidental conditions were identified as constituting a design basis event. The plant is sufficiently removed from local transportation to avoid critical problems with explosions, toxic gases, flammable vapors, and fire. The water intake is designed to exclude floating oil. There are no identifiable nearby industrial or military activities which constitute design basis hazards.

Potential hazard associated with onsite storage and usage of industrial gases has been considered in the control room ventilation design.

2.2.4 REFERENCES

2.2-1 *Telephone conversation with Mr. Ken Bradshaw, Penn Dot, District 4, September 4, 1991.*

2.2-2 *Telephone conversation with Mr. Vince Herman, Manager of Traffic and Expediting, Pennsylvania Power & Light Company, October 11, 1991.*

2.2-3 Leggett and Platt, Personal communication with T. V. Jacobsen, Ecology III on November 14, 2002

2.2-4 *Susquehanna River Basin Study, Appendix C, p. G XI-3.*

2.2-5 *Communications with Mr. R. Schriebmier, Airport Manager, Hazleton Municipal Airport, October 25, 1991.*

2.2-6 *Communication with D. A. Yurgosky, Administrative Assistant, Wilkes-Barre/Scranton International Airport, September 11, 1991.*

2.2-7 *Pennsylvania Projection Series, Employment by Industry for 48 Labor Market Areas, Office of State Planning and Development, Harrisburg, Pennsylvania, January 1973.*

2.2-8 *Briggs, G. A., "Plume Rise," TID-25075, November 1969.*

2.2-9 *Briggs, G. A., "Plume Rise Predictions," a TDL Contribution File No. 75115.*

2.2-10 *Briggs, G. A., "Plume Rise and Buoyancy Effects," a TDL Contribution File No. 7916.*

2.2-11 *Simmons, J. A. Erdman, B.N., and Naft, B. N., "The Risk of Catastrophic Spills of Toxic Chemicals," UCLA-ENG-7425, University of California, Los Angeles, California, May 1974.*

2.2-12 *Dames & Moore, Responses Prepared for NRC in Re: Puget Sound Power and Light Company, Preliminary Safety Analysis Report for Skagit Nuclear Power Plant Project, 1975, Seattle, Washington, 1977.*

2.2-13 *Not Used*

2.2-14 *Fay, J. A., "Physical Processes in the Spread of Oil on a Water Surface," American Petroleum Institute, Proceedings of the Joint Conference on Prevention and Control of Oil Spills, Washington D.C., June 1971, pp. 463-467.*

2.2-15 *Donaldson, E. C., 1972, Injection Wells and Operations Today; Cook, T. D., (Ed.) Underground Waste Management and Environmental Implications, A.A.P.G. Mem. 18, pp. 24-26.*

2.2-16 *Healy, J. H., Rubey, W. W., Griggs, D. T., and Raleign, C. B., 1968, The Denver Earthquake, Science, V. 161, N. 3848, pp. 1301-1310.*

2.2-17 *Galley, J. E., 1968, Economic and Industrial Potential of Geologic Basins and Reservoir Strata; Galley, J. E., (Ed.), Subsurface Disposal in Geologic Basins - A Study Of Reservoir Strata, A.A.P.G. Mem. 10, pp. 1-10.*

2.2-18 *Galley, J. E., 1972, Geologic Framework for Successful Underground Waste Management; Cook, T.D., (Ed.) Underground Management and Environmental Implications, A.A.P.G. Me. 18, pp. 119-125*

2.2-19 *Warner, D. L., 1968, Subsurface Disposal of Liquid Industrial Wastes by Deep Well Injection; Galley, J. E., (Ed.), Subsurface Disposal in Geologic Basins - A Study of Reservoir Strata, A.A.P.G. Mem. 10, pp. 11-20.*

2.2-20 *Greater Berwick Chamber of Business and Industry, "Industrial List."*

End Historical

TABLE 2.2-1

Security-Related Information Text
Withheld Under 10 CFR 2.390

TABLE 2.2-1

Security-Related Information Text
Withheld Under 10 CFR 2.390

TABLE 2.2-2
Not Used

Security-Related Information
Text Withheld Under 10 CFR 2.390

TABLE 2.2-3
Not Used

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Figure Withheld Under 10 CFR 2.390

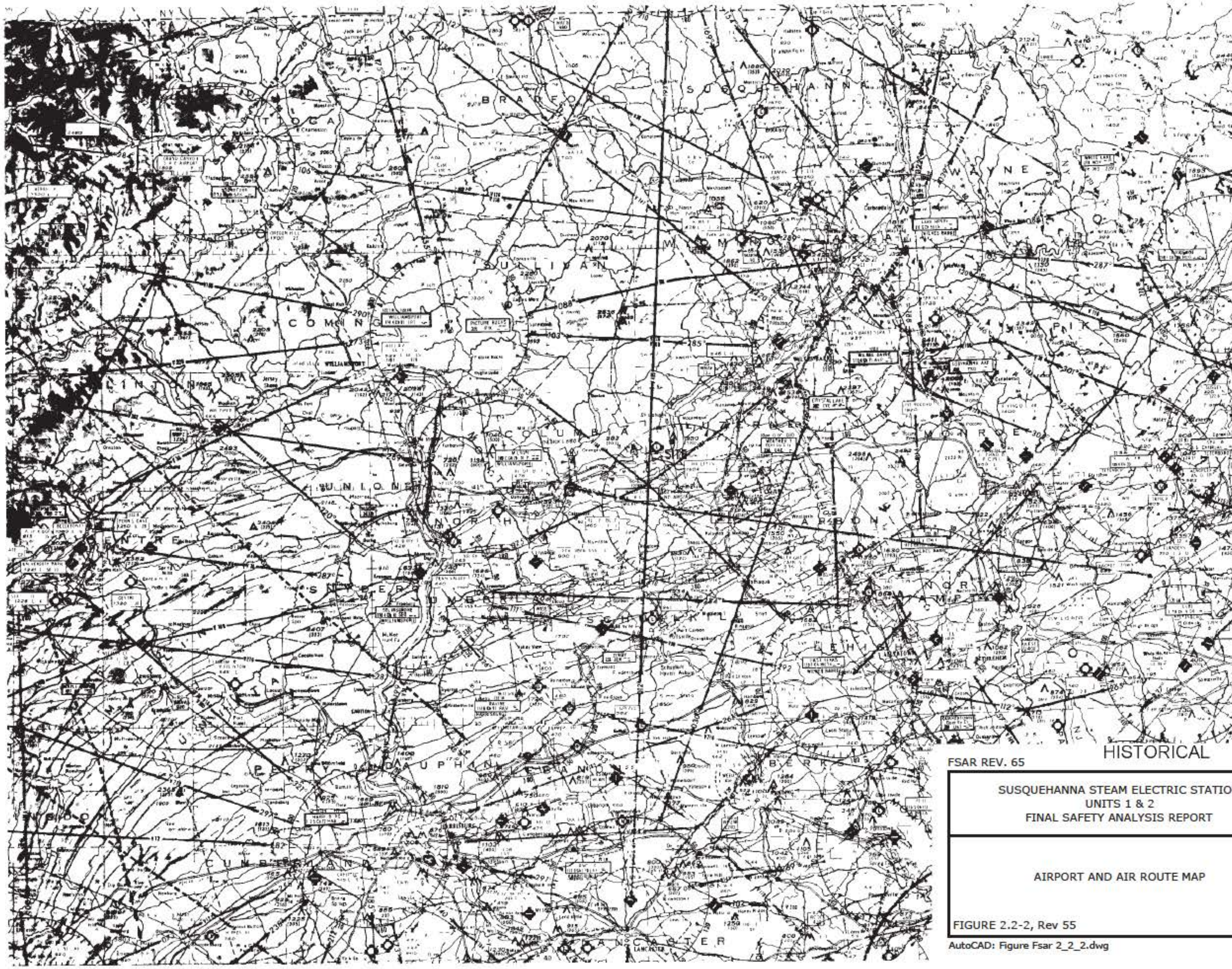
FSAR REV. 67

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAJOR TRANSPORTATION
ROUTES AND PIPELINES

FIGURE 2.2-1, Rev 57

AutoCAD: Figure Fsar 2_2_1.dwg



HISTORICAL

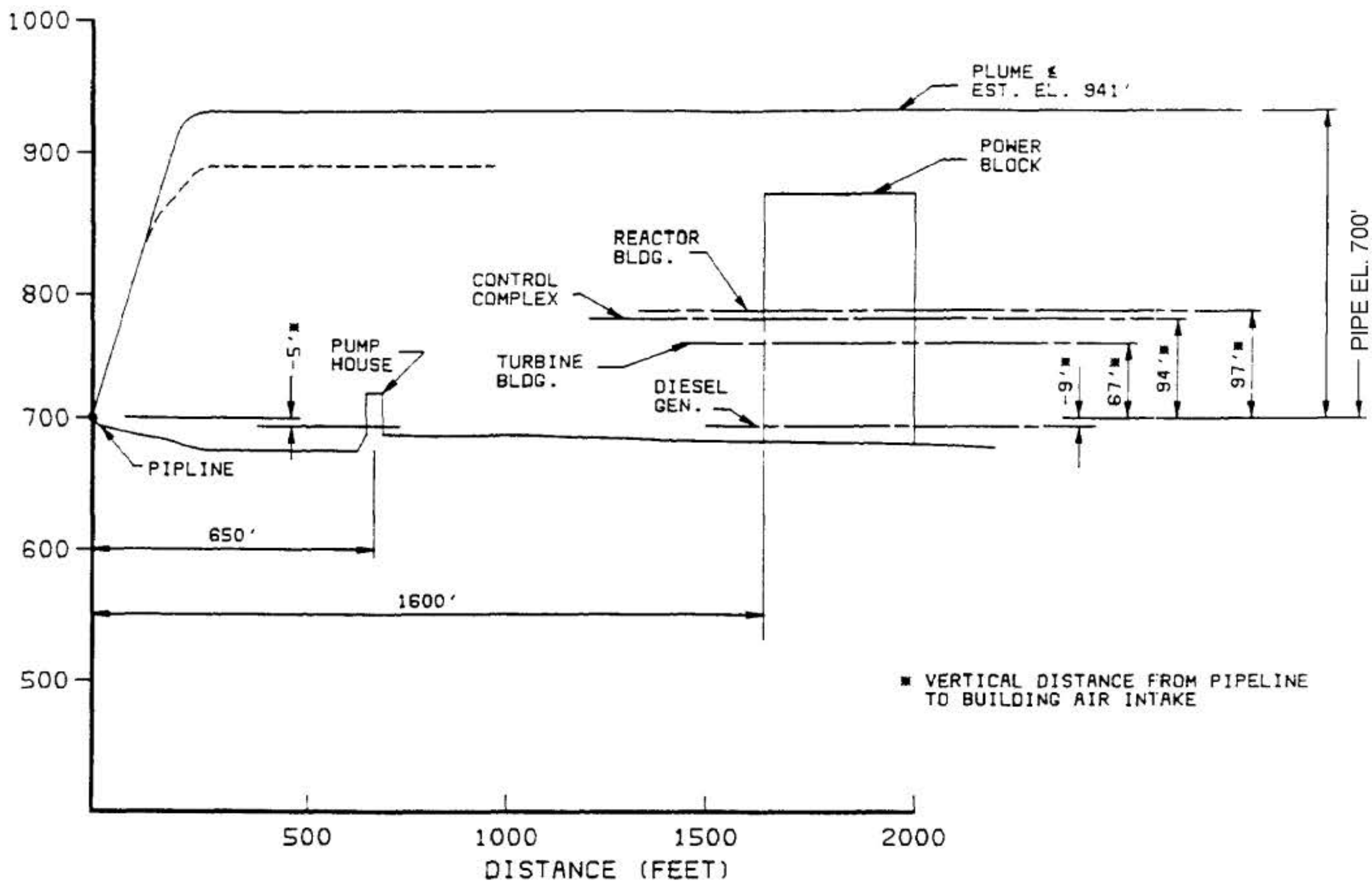
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

AIRPORT AND AIR ROUTE MAP

FIGURE 2.2-2, Rev 55

AutoCAD: Figure Fsar 2_2_2.dwg



HISTORICAL

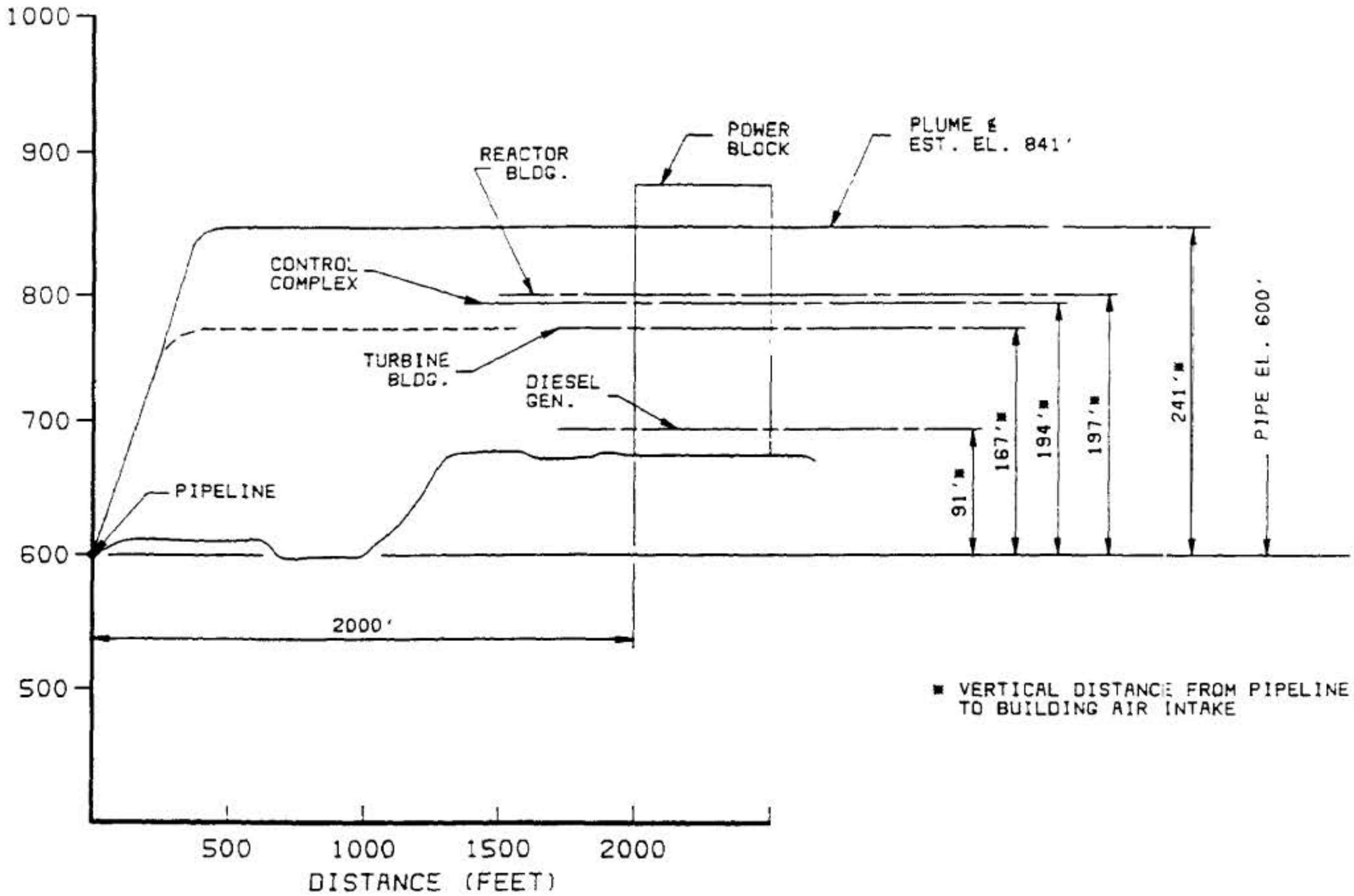
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

PIPELINE BREAK AT EL. 700'
(NEAREST PUMPHOUSE)
STEADY STATE BREAK FLOW

FIGURE 2.2-3, Rev 55

AutoCAD: Figure Fsar 2_2_3.dwg



HISTORICAL

FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

PIPELINE BREAK
AT ELEVATION 600'
STEADY STATE BREAK FLOW

FIGURE 2.2-4, Rev 55

AutoCAD: Figure Fsar 2_2_4.dwg

2.3 METEOROLOGY

2.3.1 REGIONAL CLIMATOLOGY

2.3.1.1 General Climate

The climate of east central Pennsylvania is on the border of Koeppens' "snow forest" and temperate rainy climate (Ref. 2.3-1). There is considerable snow during the winter and relatively hot humid summers with precipitation distributed evenly throughout the year.

This region is repeatedly affected by interactions between warm, moist maritime tropical air masses and cool, dry continental polar air masses. The polar air masses are the dominant influence in the winter while tropical air masses predominate in the summer. Maritime polar air masses are also common in a highly modified form from the Pacific or directly from the North Atlantic. The North Atlantic air masses which are cool and humid are usually associated with approaching warm fronts and "back door" cold fronts.

The weather systems which affect east central Pennsylvania are generally of non-tropical origin. The storm tracks of less than 7% of all North Atlantic tropical cyclones enter Pennsylvania (Ref. 2.3-2). Systems which produce precipitation are divided into 3 groups. Cold fronts, trailing from cyclones passing to the north, occurring throughout the year, are the primary source of summer precipitation in the region. A second type of disturbance that produces precipitation in this area is the coastal low, originating in the Gulf of Mexico or in the Cape Hatteras region, which moves NNE along the coast. The greatest snowfalls in east central Pennsylvania are associated with this type of system. Major extra-tropical cyclones originating in the Gulf of Mexico, Texas Panhandle, or the lee of the Rockies which move northeast or east frequently give the region light or moderate snowfalls and rain. Tropical cyclones occasionally affect the region but very rarely retain hurricane force so far inland. Record rainfalls are often associated with decaying tropical cyclones.

Tornadoes seldom occur in Pennsylvania and those which cause severe damage or loss of life are rare.

The monthly average winds are westerly (Ref. 2.3-3). The wind in the region is constrained by the general direction (ENE-WSW) of the ridge and valley topography. Wind speeds in the region are light to moderate with monthly averages less than 10 mph.

Average temperatures range between 72^{o}F in the summer and 25^{o}F in the winter with extremes of 101^{o}F and -21^{o}F. Relative humidity is usually greater than 50%, often greater than 85% (Ref. 2.3-3a).

The Wilkes-Barre Scranton Airport at Avoca, Pennsylvania approximately 45 km northeast of the site, is the nearest National Weather Service Station. Based upon "STAR" summaries for the years 1971-1975 neutral stability conditions predominate at Avoca with Class C, D, and E occurring approximately 9, 59, and 13 percent of the time, respectively (Ref. 2.3-4).

The diffusion climatology of the region is generally good due to the prevalence of moderate wind speeds at most times. Occasional stagnant situations occur during the late summer and autumn when anticyclones stall over the northeastern U.S. It should also be noted that the plant's location in the Susquehanna Valley can cause different stability conditions than those found concurrently at the top of the surrounding mountains or plateaus.

2.3.1.2 Regional Meteorological Conditions for Design and Operating Bases

2.3.1.2.1 Hurricanes

Hurricane winds seldom affect the area because of the rough terrain and the distance of the region from the ocean. Recently, Hurricane Agnes (June 1972) resulted in the worst natural disaster to hit the region because of the excessive precipitation it produced. Record flooding was recorded along the Susquehanna River. At Wilkes-Barre, 25 miles upstream from the site, the river crested on June 24 at a height of 40.91 feet, almost 8 feet above the previous record. Rainfall at Avoca, Pennsylvania for the period of Hurricane Agnes (June 21-22) was 3.10 inches. On August 18-19, 1955 the rainfall associated with Hurricane Diane was 4.58 inches (Ref. 2.3-3).

A tabulation of North Atlantic tropical cyclones with centers passing within 75 and 150 nautical miles of the Susquehanna site is presented in Table 2.3-1. The significance of these two distances is that points that lie within 75 to 150 nautical miles from the center of a hurricane may receive some heavy rainfall whereas points that lie between 0 and 75 nautical miles from the center of a hurricane are very likely to receive heavy rainfall. The frequency and recurrence interval of hurricane centers passing within 75 and 150 nautical miles is, respectively, 0.08 per year with an interval of 12 years, and 0.20 per year with an interval of 5 years (Ref. 2.3-2).

2.3.1.2.2 Tornadoes

The incidence of tornadoes in the site area is very low. Between the years 1950 and 1973 only 38 tornadoes were reported within 50 miles of the site. Tornado activity is at a maximum during the summer months with most tornadoes occurring in the late afternoon or evening. Figure 2.3-1 is a histogram for the years 1953-1962 showing tornado frequency by month, hour, and intensity within a 3° by 3° square which is centered on the site. The intensity categories are based on the Fujita tornado intensity classification (Ref. 2.3-5). From Figure 2.3-1 it can be seen that maximum tornado occurrence is in the summer. Diurnally, tornado frequency reaches a maximum during late afternoon, shortly after the period of greatest instability. For the period from 1950-1997, there were 5 tornadoes officially reported in Columbia County and 13 tornadoes officially reported in Luzerne County (Ref. 2.3-5a).

2.3.1.2.3 Thunderstorms

Thunderstorms in the area are usually of brief duration and concentrated in the warm months. They are responsible for most of the summertime rainfall which normally averages around 3.7 inches per month at Avoca, Pennsylvania. Based on a 19 year average at Avoca the mean number of "days with thunder heard" is 30 (Ref. 2.3-3). A monthly breakdown of the mean number of thunderstorm days that is representative of the site is shown in Table 2.3-2.

2.3.1.2.4 Lightning

There is neither documentation nor direct measurement of the occurrence of lightning other than the observation of associated thunder. Local climatological data tabulated by the National Weather Service (Ref. 2.3-3) does not provide information regarding the incidence, severity, or frequency of lightning occurrences. A thunderstorm can usually be heard unless the lightning causing the thunder is more than 15 miles away; therefore, thunder incidence can presumably be used to confirm the presence of some lightning.

The number of lightning strikes per square mile per year has been established by Uman (Ref. 2.3-6). The combined results of several studies summarized by Uman indicate that the number of flashes to the ground per square mile per year is between .05 and .80 times the number of thunderstorm days per year. The mean number of days with thunderstorms probably overestimates the actual occurrence of cloud-to-ground lightning since some thunderstorms probably contain only cloud-to-cloud lightning. Therefore, if the annual thunderstorm frequency at Avoca is used (30 days), the number of ground lightning strikes is between 2 and 24.

2.3.1.2.5 Hail

Hail in the site region sometimes falls from severe thunderstorms. Because hail falls in narrow swaths, only a small fraction of occurrences is recorded at regular reporting stations. The average annual number of days with hail at a point in the area is 23 (Ref. 2.3-7). The occurrence of large hail (greater than 3/4 inch diameter) averages 1 or 2 occurrences annually. According to Pautz (Ref. 2.3-7) the number of hailstorms with hail 3/4 inch and greater by 1-degree longitude-latitude squares was about 5 in the vicinity of the site for the period 1955-1967. For Avoca, Pennsylvania from 1973-75 there was one hailstorm each June, and one each in July of 1973 and 1974. In 1975 there was also one hailstorm in August and one in October. There were no occurrences of hail recorded in 1976 at Avoca (Ref. 2.3-3).

2.3.1.2.6 Extreme Winds

Strong winds occur in Pennsylvania as a result of the remnants or outer fringes of tropical systems, occasional hurricanes, thunderstorms, and tornadoes. The following is the fastest mile of wind and its associated direction, by month, at Avoca, Pennsylvania (1955-1976) (Ref. 2.3-3).

FASTEST MILE OF WIND

Month	mph	Direction	Month	mph	Direction
January	43	SE	July	42	NW
February	60	W	August	50	NE
March	49	S	September	38	SW
April	47	NW	October	38	E
May	40	NW	November	45	S
June	43	W	December	47	SW

The 50-year and 100-year mean fastest mile wind speeds for the site area are 75 miles per hour and 80 miles per hour, respectively (Ref. 2.3-8). According to Pautz, there were 8 windstorms 50 knots and greater for the 1 degree latitude-longitude square that includes the Susquehanna site for the period 1955-1967 (Ref. 2.3-7).

The gust factor was calculated as 1.3 from the following equation (Ref. 2.3-9).

$$G_F = \frac{G_f}{K_z(.00256V^2)}$$

Where

G_F is the gust factor to be applied to the fastest mile wind speed at 10 m above the ground.

K_Z is the velocity pressure coefficient at 10 m (.52).

V is the speed of the 100 year return period fastest mile wind (80 mph).

G_f is the velocity pressure (11.5).

2.3.1.2.7 Freezing Rain

Freezing rain can occur in the late fall, winter, and early spring. During the 50 years from 1919-1969 there were 4 occurrences of ice accumulation of 1 inch. The probability of an ice storm accumulating at least 1 inch in any year in the Northeast region of the U.S. is .24 (Ref. 2.3-10). At Avoca, Pennsylvania from 1973-1976 there were 57 days with freezing rain, 21 in January and 18 in February. There were nine occurrences each in March and December during that period. The duration of these phenomenon never exceeded 12 hours and was usually less than 3 hours (Ref. 2.3-11).

2.3.1.2.8 Duststorms

Because the soil in Pennsylvania is usually moist all year the likelihood of a duststorm is small (Ref. 2.3-12). There were no recorded duststorms for the period 1972-1976 at Avoca, Pennsylvania (Ref. 2.3-11).

2.3.1.2.9 High Air Pollution Potential

The meteorological conditions that are generally conducive to high air pollution potential are light winds, stable boundary layers, and near surface based inversions. Holzworth (Ref. 2.3-13) studied the episodic occurrence of several limited dispersion conditions at each of 62 upper air stations in the United States. He considered episode durations of at least 2 days and at least 5 days. Twelve different limited dispersion conditions were used to define each episode. Each condition was defined by a different combination of mixing height and wind speed. Intermediate limiting conditions of mixing heights less than or equal to 1500 m and wind speeds 4.0 m sec^{-1} or less with no significant precipitation during episodes lasting at least 2 days are of interest because such criteria have been used as criteria by the National Pollution Potential Forecasting Program (Ref. 2.3-13). The approximate number of episode-days at the site area is 25 in 5 years. This is much less than in the western half of the country and less than most of the East. Table 2.3-3 presents a summary of the data at stations presented by Holzworth which are closest to the site. Days with high air pollution correlate to days with minimum low level atmospheric mixing and dispersion.

2.3.1.2.10 Snowpacks

Severe snowstorms are not frequent in the area. Snowfall averages between 40 and 50 inches a year in the site region. At Avoca, Pennsylvania the extreme 24-hour snowfall was 20.5 inches in November, 1971 but the greatest snowfall of record was 21.1 inches over a 29 hour period in January, 1964. The extreme seasonal snowfall was 76.8 inches in 1969-1970 (Ref. 2.3-3).

The 100 year mean recurrence interval snow load on the ground is 122.02 kgm^{-2} (25 lbs ft^{-2}) (Ref. 2.3-9). The 100 year mean recurrence snow depth for Avoca, Pennsylvania is 28.6 inches (Ref. 2.3-15).

Assuming the maximum probable winter precipitation falls on top of the 100 year mean recurrence interval snowload yields a conservative estimate of the maximum probable combined snowload.

Assuming that the 100 year mean recurrence interval snowload occurs during January, which has the lowest average monthly temperature and the greatest snowfall of record, the weight of the 48 hour probable maximum winter precipitation for January must be added to it. The weight of the 48 hour probable maximum winter precipitation for January is 287.0 kg m^{-2} (59 lbs ft^{-2}) (Ref. 2.3-14). Thus, the weight of the probable maximum combined snowload at ground level is 409.02 kg m^{-2} (84 lbs ft^{-2}).

2.3.1.2.11 Design Basis Tornado

The development of a Design Basis Tornado (DBT) follows the premise that the probability of occurrence of a tornado exceeding the DBT should be on the order of 10^{-7} per year (Ref. 2.3-16). The 10^{-7} per year design tornado was determined for a 3° latitude by 3° longitude area encompassing the site. The tornado path lengths and widths in the area of interest were used in the probable calculation.

The first step in the procedure is the computation of the geometric probability which is given by the following equation:

$$P_s = \overline{n}(a / A) \qquad \text{(Eq. 2.3-1)}$$

where P_s is the mean annual probability of a tornado striking a point, $\bar{n}$ is the mean number of tornadoes occurring within the area A per year, and "a" is the mean path area determined from the log-normal distribution.

The design basis wind speed is one which satisfies the condition $P_sP_i < 10^{-7}$ yr^{-1} where P_i is the acceptable intensity probability and is determined from the plot of cumulative F-scale intensity frequencies on log-probability paper. The F-scale is an estimate of tornadic wind speed range based upon damage inspection and has been compiled for the years of 1971 and 1972 (Ref. 2.3-17).

The average rate of pressure drop within the radius of maximum winds is determined by: (Ref. 2.3-19)

$$\frac{dp}{dt} = \frac{\Delta pT}{2r_m} \qquad \text{(Eq. 2.3-2)}$$

Where:

Δp	=	pressure change
t	=	time
T	=	translational speed
r_m	=	radius rotational wind speed = 150'

The total pressure drop, p, is determined by the application of the cyclostrophic wind equation:

$$\int_o^r \frac{\partial \rho}{\partial r} dr = \int_o^r 2\rho A \frac{V^2 m}{r_m} dr \qquad \text{(Eq. 2.3-3)}$$

where V_m is maximum rotational wind speed and is the density of air (1×10^{-3} gm/cm^3).

The region from which tornado path length and width statistics were selected was between 75^o to 78^o longitude and 40^o to 43^o latitude; approximately centered on the site location. Of the 63 tornadic events thirty four values of path length and width were found for the period 1950-1973 based upon the National Severe Storms Forecast Center's tornado tape.

The geometric probability is calculated by substituting the following parameters into Equation 2.3-1:

Where,

	a	=	0.388 mi^2
	A	=	32,265 mi^2
	$\bar{n}$	=	63/24yr = 2.625 yr^{-1}
	P_s	=	3.157×10^{-5} yr^{-1}
and	Pi	=	3.168×10^{-3} yr^{-1}

This results in a design wind speed of 260 mph for a probability of 10^{-7} yr^{-1} (Ref. 2.3-19). The value of "a" is conservative in comparison with a value of .26 mi^2 for the combined states of Pennsylvania and West Virginia and .37 mi^2 for New York state for the period 1953-1972 (Ref. 2.3-18). Although the value of "a" was based on only 34 of the 63 tornadoes it was conservatively assumed that all 63 tornadoes had a mean path area of 0.388 mi^2. In this region, the highest tornadic intensity was F 2 or 157 mph. Thus, the 260 mph design wind speed is conservative with respect to the local historical record.

The rate of pressure drop and the total pressure drop are determined directly from Equations 2.3-2 and 2.3-3, respectively. The maximum translational wind speed was interpolated from the Region

II and Region III values (Ref. 2.3-16). The design basis parameters calculated for the Susquehanna Steam Electric Station are (Ref. 2.3-19):

Total Maximum Wind Speed	Rotational Wind Speed	Maximum Translational Speed
260	205	55

Minimum Translational Speed	Total Pressure Drop	Rate of Pressure Drop
5 mph	1.9 psi	0.9 psi/sec

The actual design basis parameters that were used for the Susquehanna design are presented in Section 3.3.

2.3.1.2.12 Ultimate Heat Sink

An analysis of the ultimate heat sink is presented in Section 9.2 of the FSAR.

This analysis is based on 11 years of meteorological data collected on site as well as 34 years of meteorological data collected at Avoca Airport near Scranton, Pennsylvania.

A computer-aided search was done for both data bases to determine two periods of time for use as the Ultimate Heat Sink design meteorology. One was chosen such that the ability to cool sprayed water is minimized (minimum heat transfer case). The other was chosen such that the potential for water loss is maximized (maximum water loss case). The selection of this meteorology is discussed further in Subsections 9.2.7.3.5 and 9.2.7.3.7.

2.3.2 LOCAL METEOROLOGY

2.3.2.1 Normal and Extreme Values of Meteorological Parameters

2.3.2.1.1 Wind

The following data sources were used as the basis of this section: long-term data from Wilkes-Barre Scranton Airport at Avoca, Pennsylvania (Ref. 2.3-3), four years of data (1973-1976) collected at the 31.5 and 300 feet levels and five years of data (1999-2003) collected at the 10 m and 60 m levels of the Susquehanna meteorological tower located at the site.

The Avoca station is located about 30 miles northeast of the Susquehanna site. It is reasonably representative of the site due to their close proximity to one another and similar topography.

Table 2.3-6 is a summary of long-term wind data for Avoca (Ref. 2.3-3). It shows the annual average speed is 8.4 miles per hour and the prevailing direction is southwest. The monthly average wind speeds are greatest in the spring (9.6 mph in April) and lowest in the late summer (7.2 mph in August). The prevailing wind direction is SW or WSW for every month except March when it is NW. Table 2.3-7 is a similar summary for the on-site data.

Lower level (31.5 feet) data from the Susquehanna site for the 4 year period show an average wind speed of 4.45 mph (1.99 m/sec). The prevalent direction over the 4 years was the WSW closely followed by W. The ENE direction presents a secondary maximum in frequency of occurrence.

Tables 2.3-8 through 2.3-16 provide wind persistence data for the Susquehanna site on an annual basis, at the lower level, for each stability class, all classes combined, and all stable classes.

The joint frequencies of wind speed, direction, and stability at both the lower and upper levels were updated in 2005 to use the 5 year period (1999 – 2003) are found in Tables 2.3-75 through 2.3-91.

The overall southwest to northeast orientation of topographic ridge lines in the SSES vicinity has a profound influence on the low level winds. At Avoca, PA, the mean annual wind direction is from the southwest. At the SSES site, the predominant wind directions measured at the 10-meter level are from the east-northeast and from the southwest. The Susquehanna River Valley orientation effectively funnels a localized, low level wind flow up or down the valley. The river valley environment is also favorable for stable meteorological conditions in the lowermost portion of the atmosphere characterized by little to no wind and the presence of fog. This is most prevalent during the overnight hours. The river valley influence on atmospheric stability at the SSES site makes stability conditions unique and often quite different when compared to stability conditions at Aroca.

2.3.2.1.2 Temperature and Atmospheric Water Vapor

Table 2.3-17 presents the long-term monthly average and extreme temperatures for Avoca, Pennsylvania. July is the warmest month with a long-term average maximum temperature of 82.2°F, an average minimum temperature of 61.8°F, and a mean of 72.0°F. The coolest month is January, having an average temperature range of 32.3°F to 17.7°F and a mean temperature of 25.0°F. The average annual diurnal variation is 18.1°F (Ref. 2.3-3a).

East Central Pennsylvania experiences the temperature extremes associated with mid-latitude traveling low pressure disturbances. The temperature extremes at Avoca, Pennsylvania are 101°F in July of 1966 and -21°F in January, 1994. Average Avoca, Pennsylvania dewpoint and relative humidity data are contained in Table 2.3-18 (Ref. 2.3-3a).

At the Susquehanna site during the period 1973-1976 dry bulb temperatures ranged from a high of 34.3°C (94°F) to a low of -20.9°C (-6°F). The average temperature was 9.3°C (49°F). July had the highest average temperature 20.3°C (69°F) while January had the lowest with -2.1°C (28°F). The average wet bulb temperature was 6.9°C (44°F) with the months of July and August averaging 17.7°C (64°F). The average relative humidity was 70% with the month of August averaging 82%. A summary of the site data is presented in Tables 2.3-19 through 2.3-32.

For the period of 1981-1996, the maximum SSES average hourly temperature of 37.8°C (100°F) occurred on July 16, 1996. The minimum average hourly temperature at SSES for this period was –30.8°C (-23.1°F) on January 21, 1994.

2.3.2.1.3 Precipitation

The region surrounding the Susquehanna site has a moderately moist climate averaging just over 36 inches of rainfall per year spread quite evenly over all months of the year. There is a slight maximum during the summer when there is a greater effect of tropical air masses and thunderstorms. The average monthly and maximum 24-hour precipitation for Avoca, Pennsylvania are given in Table 2.3-33. The greatest 24-hour rainfall amount reported at Avoca, Pennsylvania was 6.52 inches in September 1985, associated with the remnants of Hurricane Gloria. The greatest 24-hour snowfall, 20.5 inches occurred with the Thanksgiving Day storm of November 24-25, 1971, but the greatest snowfall of record was 21.1 inches over a 29 hour period on January 12-13, 1964 (Ref. 2.3-3).

Table 2.3-34 presents the expected rainfall by duration and recurrence intervals for the area around the Susquehanna site as compiled by the National Weather Service (Ref. 2.3-20). The probable maximum precipitation for various rainfall duration in East Central Pennsylvania by area size is presented in Table 2.3-35. Assuming 10 square miles is most representative of the power plant site, the probable maximum rainfall ranges from 25 1/2 inches in 6 hours to 36 1/2 inches in 72 hours (Ref. 2.3-21). The rainfall rate distribution curves are presented for Scranton, Pennsylvania in Figure 2.3-2. The 100 year return period rainfall rate is 2.5 inches for a 1 hour period.

Table 2.3-36 presents the summary of on-site precipitation data for the 4 year period. The site averaged a total of 47.83 inches annually with the greatest occurring in September (7.54 inches) and the minimum in December (2.21 inches). Data on the rainfall frequency, and duration of precipitation for the Susquehanna site are presented in Tables 2.3-37 through 2.3-49 by month and for the 4 year period. Precipitation wind roses are presented by month and for the total period in Tables 2.3-50 through 2.3-62.

2.3.2.1.4 Fog and Smog

At Avoca, Pennsylvania between the years of 1973-1976 there was an average of 86 days of haze and smoke reported. Most of the days were in the summer months. Over the same period, the three hourly observations of fog averaged 250 for a year. Fog was usually observed with rain or snow and most often in the early fall months. The average number of days with heavy fog for the period was 21. Table 2.3-63 presents the heavy fog occurrences at Avoca, Pennsylvania for recent years. Based on National Weather Service data from Avoca, Pennsylvania from a 22 year period, heavy fog (visibility 1/4 mile or less) occurs 24 times per year. No on-site data on fog, or haze, is available.

2.3.2.1.5 Stability

Atmospheric stability at the Wilkes-Barre Scranton airport based on STAR data for the period 1971-1975. The STAR data for the period 1971-1975 were selected because they represented the most recent five year period which was available at the time and the fact that a five year period of record is generally regarded as being representative of long-term meteorological conditions. The 1971-1975 period also shows the prevailing direction to be from the SW at an average speed of 8.5 mph. STAR data for the fire year period 1960-1964 also show that the prevailing wind direction is from the SW at an average speed of 6.7 mph. For a 22 year period of record the prevailing wind direction was SW at an average speed of 8.4 mph. The relative stability distribution of these two five year periods are:

Pasquill Stability Class	1960-64	1971-75
A	0.41	0.32
B	5.27	4.84
C	10.04	8.92
D	54.27	58.64
E	12.36	13.09
F	13.05	11.16
G	4.60	3.01

The seasonal occurrence of E and F stabilities are given below for the 1971-75 period:

SEASONAL OCCURRENCE (%) OF E AND F STABILITIES

	Winter	Spring	Summer	Autumn
E	12.3	12.0	14.9	12.9
F	8.5	8.9	14.0	13.0

Tables 2.3-64 to 2.3-71 are annual stability summaries by wind speed and direction from Avoca, Pennsylvania data for the years 1971 through 1975 (Ref. 2.3-4). The analytical technique for classifying stability is based upon three hourly observations and is dependent primarily upon net solar radiation and wind speed. For the entire period neutral and sightly stable most often occur. The on-site stability summaries by wind speed and direction are presented in Tables 2.3-75 through 2.3-91.

Studies by Holzworth (Ref. 2.3-33) indicate that for Northeastern Pennsylvania unstable conditions (A, B, C) occur 16-25 percent of the time while neutral (D) conditions prevail 46-55 percent of the time and stable conditions (E, F, G) occur 26-35 percent of the time. For the 4 year period 1973-1976 the on-site data showed the following stability frequencies: Pasquill class A-16 percent, B-7.6 percent, C-4.2 percent, D-30.8 percent, E-26.2 percent, F-10.5 percent, G-4.5 percent. This indicates that the site is prone toward stable conditions (41.2%) rather than neutral conditions (30.8%).

Representative mixing heights on a seasonal and diurnal basis obtained by averaging data from Albany, and New York, New York; Pittsburgh, Pennsylvania; and Washington, D.C. (Ref. 2.3-13) are presented in Table 2.3-72.

Low level atmospheric stability is influenced by insolation. The relatively high latitude of the SSES site (approximately 41° North) has a profound impact on the length of daylight. At the winter solstice (around December 21), the time elapsed between sunrise and sunset is 9 hours, 11minutes. At the summer solstice (around June 21), the time elapsed between sunrise and sunset is 15 hours, 10 minutes, or a difference of 6 hours (Ref. 2.3-13a).

2.3.2.2 Potential Influence of the Plant and its Facilities on Local Meteorology

The expected characteristics and effects of water vapor plumes entering the atmosphere arising from the operation of two natural draft cooling towers have been evaluated.

The characteristics and effects associated with cooling tower operation were determined in terms of:

a) Monthly and annual frequency distributions of plume length with respect to distance and direction out to 20,000 ft.

b) Monthly and annual frequency distributions of ground level plumes (fogging) with respect to distance and direction.

c) Monthly and annual frequency distributions of ground level plumes accompanied by subfreezing temperatures (icing) by distance and direction.

d) Monthly and annual frequency distribution of increases in relative humidity and temperature with respect to distance and direction.

Simulations were obtained from a computerized diffusion model that simulates vapor plume length and the occurrence of ground level fogging or icing. The Gaussian plume theory distribution is assumed with buoyancy approximated by a dry plume rise equation. The computer program utilizes cooling tower performance data and on-site meteorological observations for 1976 (ambient temperature, dew point, wet bulb temperature, wind velocity, and atmospheric stability) to determine the downwind dispersion of water vapor at plume centerline and ground level.

The year 1976 was selected because it was the most conservative year with respect to atmospheric dispersion conditions of the four years of on-site data. It is also conservative with respect to long-term atmospheric conditions.

The model used was developed by Dames & Moore and has been used in previous submittals to NRC. The model was presented by Bowman, W. Alan and Biggs, W. Gale in their paper entitled "Meteorological Aspects of Large Cooling Towers" presented at a APCA Conference in Miami, Florida in June, 1972. The height at which each meteorological measurement input to the model was taken is given below:

Wind Speed..300 ft.
Wind Direction......................................300 ft.
Temperature...31.5 ft.
Relative Humidity ....31.5 ft.
Stability ....300 ft. - 31.5 ft.

Generally, the longer plume lengths occur more frequently in the winter months in the early morning hours when the relative humidities are high. The visible plumes were computed to extend laterally beyond 20,000 feet (4 miles) approximately 30 percent of the time in the sectors of maximum occurrence (NE and ENE) and 70 percent for all sectors. Visible plumes occurred least frequently in the WNW through NNW sectors with computed plume lengths beyond 4 miles occurring with a frequency of 2.1 percent to 2.5 percent annually. There were no computed occurrences of ground fogging. Relative humidity increases of 2.5 percent above ambient did not occur.

No occurrences of icing were computed. Likewise, no computed increases in surface temperature of 0.5^{o}C or greater were projected in the study sample.

In conclusion, the frequent (70%) long visible plumes are the primary meteorological effects to be experienced from the operation of the Susquehanna cooling towers. There is no fogging or icing expected. The inducement of other weather modification effects such as rainfall augmentation is unlikely due to the small percentage increase in atmospheric moisture introduced into the already moisture laden environment.

Further details of this analysis are provided in Subsection 5.1.4 of the Environmental Report.

The topography surrounding the site consists of ridges and valleys. Figure 2.1-11 shows the topography within a 5 mile radius of the site. The cross-sections of elevation centered on the plant along the 16 cardinal directions to a distance of 50 miles are shown in Figures 2.3-4-1, 2.3-4-2, 2.3-4-3, 2.3-4-4, 2.3-4-5, 2.3-4-6, 2.3-4-7, and 2.3-4-8.

2.3.2.3 Local Meteorological Conditions for Design and Operating Bases

All local meteorological and air quality conditions used for design and operating basis considerations and their bases, except for those conditions referred to in Subsections 2.3.4 and 2.3.5, are provided in Subsections 2.3.1.2.1 through 2.3.1.2.11. Current site meteorological information is documented on a regular basis in the SSES Annual Effluent and Waste Disposal report.

2.3.3 ON-SITE METEOROLOGICAL MEASUREMENTS PROGRAM

The on-site meteorological program is designed to provide a complete climatology of the site area, but most importantly to provide dispersion climatology for use in safety planning of radioactive effluent releases and as a means of determining the appropriately conservative meteorological parameters to be used in estimating the potential consequences of hypothetical accidents. Analysis of collected meteorological data permits an assessment of the diffusion parameters characteristic of the site.

2.3.3.1 Location and Description of the Tower Site

The site is about 8 km (5 mi.) ENE of Berwick, Pennsylvania. The primary meteorological tower, commonly referred to as the Primary Meteorological Tower, a 200 foot steel framed tower, is located about 340 m to the southeast of the cooling towers. The area is generally level, increasing slightly in elevation to the north and west. South and east of the tower the topography slopes down towards the Susquehanna River. Vegetation in the immediate vicinity is low weeds with some deciduous trees in a gully to the south. The deciduous trees are approximately 40 feet in height and are approximately 100 feet from the tower. In 1994, an ash facility was placed approximately 185 feet north of the Primary Meteorological Tower. The maximum height of this structure is approximately 30 feet.

In November 1972 three meteorological instrumentation platforms were constructed. The primary tower was erected on the Susquehanna nuclear power station site at the same altitude as the station (approximately 650' msl) between the station and the Susquehanna River. The purpose of the primary tower is to estimate the stability and movement of the air layer into which the effluent from the facility could be released as required by NRC Regulatory Guide 1.23 (Ref. 2.3-22). In addition to the primary tower, 75 foot and 10 foot instrumented poles were erected at site vicinity.

The 75 foot tower was at 1115' msl on a hill to the NW of the station and the 10 foot tower was below the station towards the river at 500' msl. The purpose of the 75 foot pole was to provide sensing of wind, temperature, and humidity parameters at an elevation comparable to the elevations of the cooling tower plumes. The 75 foot tower was removed on January 14, 1974 due to construction requirements. The data from the primary meteorological tower provides sufficient information for the cooling tower analysis. The 10 foot tower in the valley below the station, was removed on November 14, 1975, after three years of data had been collected. Figure 2.3-5 presents a schematic of the sites and the instrumentation.

In compliance with the requirements of NUREG-0654 a backup meteorological tower was erected in 1982. This tower is commonly referred to as the Backup Tower. The tower is a 30-foot instrumented utility pole located northeast of the station and across from the Training Center. The purpose of the backup tower is to provide sensing of wind parameters at the 10-meter level. Additionally, in 1985 two supplemental towers were installed in the river valley near the station to provide additional data to more accurately model the effects of surrounding terrain on atmospheric dispersion and transport. One tower is located UPRIVER approximately 1.2 miles NNE of the station off Route 11 towards Shickshinny; the second tower is located DOWNRIVER approximately 3.6 miles SW of the station off Route 93 just east of Nescopeck. Meteorological validation of the UPRIVER supplemental tower data was terminated on October 1, 1994 and the UPRIVER supplemental tower equipment was abandoned in place at that time .

Both The DOWNRIVER tower measures wind speed, wind direction and sigma theta at the 10 meter level. The DOWNRIVER tower also measures temperature at a height of approximately 6.6 feet.

The meteorological data collected from the DOWNRIVER tower continues to be validated and is used only to support assessment and restoration efforts in the event there is an accidental release of radioactive material from SSES.

2.3.3.2 Types of Measurements Made

The parameters which are monitored for conformance to NRC Regulatory Guide 1.23 (Ref. 2.3-22) commitments are wind speed, wind direction, temperature, delta temperature, dewpoint temperature and precipitation. Delta temperature accuracy criteria is monitored for conformance to AEC Safety Guide 123 (Ref. 2.3-22a). The parameter, heights, and number of sensors installed at the Susquehanna site are listed in Table 2.3-73.

2.3.3.3 Description of Instruments

The wind sensor consists of a 3 cup anemometer and coupled drive shaft that responds to wind and rotates a multi-section light beam chopper. Rotation of the chopper alternately masks and exposes a phototransistor to a miniature light source. The phototransistor responds to the light passing through the chopper wheel and generates an electrical output which has a frequency proportional to wind velocity. This signal is then sent to a translator for further conversion. The accuracy required for the wind speed measurement is ±0.5 mph for speeds less than 5 mph and ±10% for speeds above 5 mph. This requirement is met by the instrumentation used on the primary tower.

The wind direction sensor is comprised of a counterbalanced lightweight vane coupled to a precision potentiometer assembly by the drive shaft, causing the potentiometer wiper to directly follow movements of the wind vane. The position of the vane is sensed by the potentiometer and is sent to a translator as a DC voltage. The accuracy requirement for the wind direction measurement is ±5° of azimuth with a starting threshold of less than 1 mph. This requirement is met by the instrumentation used on the primary tower.

On the primary tower the temperature measuring system consists of multiple thermistor composite sensors. Two sensors are mounted in motor aspirated radiation shields at each of the 10 meter and 60 meter levels. The thermistor sensors are connected in a resistive network and powered by a D.C. voltage to produce a voltage that varies approximately linearly with temperature as a translator output. Each translator produces two channels of output; one channel of one translator provides the ambient temperature output for 10 meters and a second, comparator channel provides differential temperature output derived from one 10 meter sensor input and one 60 meter sensor input. The two separate sets of 10 meter and 60 meter sensors provide one 10 meter ambient temperature measurement and two difference temperature measurements between the 10 meter and 60 meter levels.

Accuracy required for the ambient temperature measurement is ±0.5°C. This requirement is met by the instrumentation used at the primary tower.

Accuracy required for the temperature difference measurement is ±0.1°C/50m. This requirement is met by the instrumentation used on the primary tower.

The dewpoint temperature is measured on the primary tower with bifilar wire electrodes wound on a cloth sleeve which covers a hollow tube or bobbin. The bifilar electrodes are not interconnected, but depend on conductivity of the atmospherically moistened lithium chloride treated bobbin for current flow. As the moisture content in the air increases, the lithium chloride absorbs water vapor and becomes conductive. Current then begins to flow between the electrodes energized by low AC voltage, and heats the bobbin. Some of the moisture is thereby evaporated until an equilibrium temperature is reached on the bobbin. The equilibrium temperature is related to the dewpoint temperature of the air. A thermistor sensor is mounted inside the bobbin to measure the cavity temperature which is converted in analog outputs, representing dewpoint temperature by a electronic temperature translator. The accuracy required for the dewpoint temperature measurement is ±1.5°C. This requirement is met by the instrumentation used on the primary tower.

On the 10 meter level of the primary tower a motor aspirated temperature and dewpoint shield houses two thermistor sensors, and the dewpoint sensor. At the 60 meter level two motor aspirated temperature shields each houses a thermistor sensor.

Precipitation is measured in a Tipping Bucket Rain Gauge at the primary tower site. This is a remote reading gauge which produces a signal proportional to total rainfall. Precipitation is collected in a collection opening and is funneled to the two buckets of the tipping mechanism. As one bucket fills with water, the weight causes it to lower, tip, and empty while the bucket on the opposite side is simultaneously raised to receive additional water. Each tipping phase causes a momentary switch closure. This closure actuates a digital counter directly proportional to accumulated rainfall. The required accuracy for the rainfall measurement is ±10% of the total accumulated catch for amounts in excess of 0.2 in. This requirement is met by the instrumentation used on the primary tower.

Vertical diffusion coefficients are computed from the vertical temperature differences. Wind sigma standard deviation of wind direction is measured at the 10 and 60 meter levels and used to compute horizontal diffusion coefficients. Sigma theta calculations based on wind direction measurements are used as a backup to temperature readings to monitor atmospheric stability.

The outputs of all sensors are handled by a modular translator system designed to convert the sensor outputs into a standardized voltage/current output. Each input channel is allotted one circuit designed for a particular sensor, such as wind speed, wind direction, or temperature, etc. The necessary signal processing and scaling is contained in each circuit to provide an electrical output of uniform range. There are two outputs from each circuit. One low voltage output is directed to a data logger accessible via telephone modem and a second low voltage output to a telemetry transmitting system which directs a specific frequency/parameter signal to telemetry receiving device in the control room which converts this signal to a 4 to 20 ma output which then inputs to an appropriate recorder in the main control room.

Each translator circuit has internal zero and full scale calibration facilities. Each calibrator switch has a "normal" position which allows normal recording of data. When depressed the calibrator switch provides a signal to the individual translator circuit producing a zero or full scale signal to the recorders. The indicated output in meteorological units for each position of the calibrator is given below.

Parameter	Zero	Full Scale	Type of Calibration
Wind Speed	0 mph	100 mph	Calibrated Voltage
Wind Direction	0°	540°	Calibrated Voltage
Temperature	-20°F	+100°F	Precision Resistance
Dewpoint	-40°F	+100°F	Precision Resistance
Delta temp	-5°F	+5°F	Calibrated Voltage
Precipitation	0 in	1 in.	Calibrated Voltage

2.3.3.4 Data Recording Systems

The primary data recording system used for the Susquehanna site’s primary tower is a digital data acquisition system. The system is an integrated data conversion and recording station which scans up to 16 analog signal outputs, converts each 0 to 1 V DC input to a digital code which is stored and retrieved via modem interface.

The secondary recording system is the Control Room recorders.

It is estimated that approximately 10% of the data used at the Susquehanna site was obtained from strip chard records.

Spot checks were made to compare the strip chart and digital data. Although no formal records of these comparisons were prepared, it is estimated that the average differences between strip chart and digital data were as follows:

Temperature	1°F
Wind Speed	1 mph
Wind Direction	5 degrees
Dewpoint	1°F
Temperature	0.5°F
Precipitation	.05 inches

All telemetry transmitters, translators, and the data logger are housed in a weatherproof cinderblock building. This building has thermostatically controlled heating and air conditioning.

2.3.3.5 Calibration and Maintenance of the System

All calibration and maintenance is performed at least semi-annually in accordance with the frequencies and procedures prescribed in the manufacturer's operating and maintenance manual.

2.3.3.6 Data Analysis

The analog recording system provides a back-up in case of digital system failure, so that a high data recovery rate can be maintained. Table 2.3-74 gives the recovery rates for each year. The SSES Annual Meteorological Summary Report also provides an ongoing summary of data recovery rates for each year since the 1970's.

An hourly average for each parameter is computed. Data validity, range of hourly averages, and the number of valid observations contributing to the averages are tabulated to assist in the determination of data reliability. Comparisons between the analog and digital data are performed when the review of the digital data reveals questionable or invalid data.

Temperature and dewpoint hourly averages are computed using the following scalar equation:

where:

$$\overline{B}_j = \frac{1}{n}\sum_{i=1}^{n} r_j B_{ji}$$

$\overline{B}_j$ = the average hourly value for the variable (in physical units)

n = the total number of minute observations during the hour (normally 60), but if n is less than 15 for that hour, data are considered to be missing;

B_{ji} = the i^{th} minute observation on the j^{th} variable (millivolts);

r = the conversion factor to change the jth variable from millivolts into physical units.

After wind speed (WS) and wind direction (WD) are converted from millivolts they are related in the following manner:

If WS is invalid (999) then WD is marked invalid (999) and vice versa

If WS > threshold (non-calm) and WD = 0 (implying calm) then WD is set to 360° (North)

If WS < threshold (calm) and WD > 0 (implying non-calm) then WD is set to 0° (calm)

Hourly averages are computed as scalars for wind speed. Wind direction averages are determined by vector analysis for all non-calm wind distribution of the lowest non-calm wind speed class by stability class.

If the associated average WS is less than .36 mps then average WD is set to 0° (calm) and average WS is set to 0 mps (calm).

NRC Regulatory Guide 1.23 (Ref. 2.3-22) suggests that data be averaged over a period of at least 15 minutes once each hour. Hours containing less than 15 minutes of valid data are invalidated. The hourly averaged data are reviewed for validity, completeness, and reliability. Periods containing problems are then replaced by analog data.

Data analysis for diffusion characteristics for the site requires three basic atmospheric variables. These three variables, together with the primary and secondary (back-up) measurements for each, are as follow:

Horizontal wind speed	primary-10 m wind speed; secondary-60 m wind speed
Horizontal wind direction	primary-10 m wind direction; secondary-60 m wind direction
Temperature difference (ΔT)	primary-delta T's from 10 m to 60 m; secondary-ΔT from 10 m to 60 m

If the 10 m wind speed is unavailable the 60 m wind speed is reduced to the equivalent 10 m value as follows:

$$V_{10} = V_j \left(\frac{10}{H_j} \right)^S$$

where:

H_j = sensor height, meters

V_{10} = the equivalent 10 m wind speed

V_j = the 60 m wind speed

S = 0.25 for Pasquill classes A, B, C, and D

0.50 for Pasquill classes E, F, and G

The percentage of data recovery for the 10 m wind sensor indicates the extent of this substitution for the data period.

Temperature difference values are used to determine Pasquill stability classes. Atmospheric dispersion coefficients are assigned according to stability class and downwind travel distance.

The hourly values of the meteorological parameters are then processed to obtain the following:

a. joint frequency distributions of wind speed and stability for lower and upper levels (Tables 2.3-75 through 2.3-91)

b. wind direction persistence summaries by stability class

c. maximum, minimum and diurnal variation of temperature, and humidity

d. annual average values of relative concentration with direction and distance

e. frequency distribution of concentrations for the 0-2 hour, 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods.

This data is presented each year in the SSES Annual Meteorological Summary Report.

2.3.4 SHORT-TERM (ACCIDENT) DIFFUSION ESTIMATES

Atmospheric diffusion conditions (expressed as values of χ/Q) developed for use in evaluating accidents hypothesized in Chapter 15 are discussed in this section for various periods after an accident. This includes χ/Q estimates based on the methods described in Regulatory Guide 1.145. (Reference 2.3-34) All estimates use vertical temperature difference to determine stability classification. Tables 2.3-75 through 2.3-82 and 2.3-84 through 2.3-91 give the joint frequency distribution of temperature difference categories used to summarize 5 years of SSES data into Pasquill groups for use in computing σ_y and σ_z in the diffusion equations. Results are based on evaluation of a recent 5-year period of onsite meteorological data (1999-2003). A description of the site meteorological program is given in Section 2.3.3.

Methods used to estimate diffusion conditions for evaluating short-term accident releases are discussed in Section 2.3.4.1, and methods for assessing the consequences of longer term accident releases (up to 30 days) are discussed in Section 2.3.4.2.

2.3.4.1 Short-Term (0-2 hours) Releases

The methodology for determining the atmospheric dispersion that exists for short-term releases involves direction-dependent and direction-independent calculations as described in Regulatory Guide 1.145. Both methods include the effects of plume meander as discussed below.

2.3.4.1 1 Direction-Independent Calculations

The direction-independent approach involves computing χ/Q values for each hour of the period of SSES records used and then counting all of the hours that had χ/Q values equal to or greater than a selected value regardless of direction. The number of hours so obtained was then divided by the number of hours in the total period of record to obtain the probability that the selected χ/Q value would be equaled or exceeded. The resulting probabilities are independent of wind direction. A plot of cumulative centerline χ/Q values as a function of probability of occurrence was constructed using the SSES hourly data for all 5 years combined as shown in Figure 2.3-6. Equations 2.3-4, 2.3-5 and 2.3-6 in Section 2.3.4.4 were used to compute values of χ/Q. The distance to the site boundary (exclusion area boundary referred to as the EAB) was assumed to be a circle with a radius of 0.34 miles (549 meters).

2.3.4.1 2 Direction-Dependent Calculations

The direction-dependent calculations outlined in Regulatory Guide 1.145 require the χ/Q values to be calculated using the equations given in Section 2.3.4.4; however, the results are treated separately for each direction. A 5-year composite direction-dependent probability distribution was plotted by combining the frequency of occurrence of selected χ/Q values for each direction at the EAB as shown in Figure 2.3-7.

2.3.4.1 3 Determining Appropriate Short-Term Dispersion

In accordance with Regulatory Guide 1.145, the two cumulative probability distributions shown in Figures 2.3-6 and 2.3-7 are used to determine the appropriate χ/Q value at the EAB distance. The peak 5% value read from Figure 2.3-6 is 6.5E-4 s/m^3. For the direction-dependent case, the 0.5% χ/Q is determined from Figure 2.3-7 to be 8.3e-4 s/m^3. The highest of the two (χ/Q = 8.3E-4 s/m^3) is to be used in accident dose calculations and is shown in Table 2.3-92 for the 1-hour case at the EAB. Tables 2.3-93 through 2.3-98 show the direction dependent results for each of the separate years plus the total for all five years at the EAB. For “realistic” dose calculations the 50% direction independent value is also shown in Table 2.3-92.

Similar calculations for short-term dispersion were made at the LPZ distance of 3 miles (4827 meters). Tables 2.3-99 through 2.3-104 give the direction-dependent χ/Q probability distributions for 1 hour for each of the 5 years and the weighted 5 year average at the LPZ.

2.3.4.2 Long-Term Releases

For releases that occur over a longer period, it is appropriate to incorporate wind direction changes in the model used to estimate concentration at any given point. Using the same 5-year period of data from SSES, the probability that any particular average diffusion condition (or poorer one) would exist during a selected interval of time (greater than 1 hour) was determined.

The procedure for determining longer term-χ/Q values is also taken from Regulatory Guide 1.145. The calculation is made using the 5-year data set. The highest 0.5% direction-dependent short-term (1 hour) χ/Q value was used because it is greater than the 5% direction-independent at the LPZ. These χ/Q values are plotted on Figures 2.3-8 and 2.3-9 as a function of averaging time. Only the 1-hour values are used in the Reg. Guide 1.145 interpolation method. The long-term 0.5% χ/Q values for defined averaging times are determined by a log-

log interpolation between the maximum direction dependent annual average and the maximum 0.5% direction dependent 1 hour value used at the 2 hour averaging time. The long term 50% values are determined by interpolating (log-log) between the 50% direction independent 1 hour value at the 2 hour averaging time and the direction independent annual average (see Figure 2.3-10). The interpolated values are summarized in Table 2.3-105. For the 50% probable case the direction independent values were used because they are higher than the direction dependent values.

2.3.4.3 Analytical Methods for Dispersion Computations

During neutral (D) or stable (E, F, or G) atmospheric stability conditions when the wind speed at the 10 meter level is less than 6 meters per second, horizontal plume meander is taken into account. χ/Q values are determined through selective use of the following set of equations for ground level relative concentrations at the plume centerline:

$$\chi/Q = \frac{1}{\overline{U}_{10}\left(\pi\sigma_y\sigma_z + A/2\right)} \qquad 2.3\text{-}4$$

$$\chi/Q = \frac{1}{\overline{U}_{10}\left(3\pi\sigma_y\sigma_z\right)} \qquad 2.3\text{-}5$$

$$\chi/Q = \frac{1}{\overline{U}_{10}\pi\Sigma_y\sigma_z} \qquad 2.3\text{-}6$$

Where

χ/Q is relative concentration, in sec/m^3

π is 3.14159

$\overline{U}_{10}$ is wind speed at 10 meters above plant grade, in m/sec

σ_y is lateral plume spread, in m, a function of atmospheric stability and distance

σ_z is vertical plume spread, in m, a function of atmospheric stability and distance

Σ_y is lateral spread with meander and building wake effects, in m, a function of atmospheric stability, wind speed $\overline{U}_{10}$, and distance [for distances of 800 meters or less, $\Sigma_y = M\sigma_y$, where M is a function of the atmospheric stability and wind speed; for distances greater than 800 meters, $\Sigma_y = (M - 1)\ \sigma_{y800m} + \sigma_y$].

A is the smallest vertical-plane cross-sectional area of the reactor building in m^2.

χ/Q values are calculated using Equations 2.3-4, 2.3-5 and 2.3-6. The values from Equations 2.3-4 and 2.3-5 are compared and the higher values selected. This value is compared with the value from Equations 2.3-6 and the lower value of these two is selected as the appropriate χ/Q value.

The χ/Q value used in accident consequence analysis is selected from the maximum sector χ/Q values which is exceeded 0.5% of the time[gp1].

2.3.5 LONG-TERM (ROUTINE) DIFFUSION ESTIMATES[gp2]

The long-term diffusion characteristics for the Susquehanna SSES were estimated in accordance with the criteria set forth in NRC Regulatory Guide 1.111 (1977). The analysis was performed using the onsite meteorological data recorded at the primary tower for January 1999 through December 2003.

2.3.5.1 Atmospheric Diffusion Models

2.3.5.1.1 Straight Line Airflow Model

A ground level release model based on meteorological data and plant parameters was used to calculate the annual average atmospheric relative concentration (χ/Q) values. Depletion factors are computed directly from depletion curves as the relative deposition rates. For long-term, ground level relative concentrations, the plume is assumed to diffuse evenly over a 22.5-degree sector.

The hourly relative concentration values are calculated in the sector defined by the wind direction using the following equation:

$$\chi/Q = \frac{2.032}{\sigma_z \bar{u} x} \qquad (5)$$

Where

χ/Q = ground level relative concentration (sec/m^3)

σ_z = vertical standard deviation of the plume (m)

$\bar{u}$ = average wind speed (m/sec)

x = distance from the source (m)

However, with consideration of the turbulent wake effect, Equation 5 is revised as follows:

$$\chi/Q = \frac{2.032}{\bar{u} x \sqrt{\sigma_z^2 + cV^2/\pi}} \qquad (6)$$

Where

c = building shape factor

V = vertical height of the highest adjacent building

The wake factor (cV^2/π) is limited, close to the source, to a factor of $2\sigma_z^2$.

If $\sqrt{3} < \sigma_z < \sqrt{\sigma_z^{\ 2} + c\frac{V^2}{\pi}}$, the equation is

$$\chi/Q = \frac{2.032}{\sqrt{3}\sigma_z \bar{u} x} \qquad (7)$$

(i.e., χ/Q is calculated to be the larger of Equations 6 and 7). The total relative concentration at each sector and distance is then divided by the total number of hours in the database.

2.3.5.1.2 Terrain/Recirculation Correction Factors

The straight-line trajectory, Gaussian diffusion model assumes that a constant mean wind transports and diffuses plume effluents in the direction of airflow at the release point within the entire region of interest. In other words, the wind speed and atmospheric stability at the release point are assumed to determine the atmospheric dispersion characteristics in the direction of the mean wind at all distances. In areas of more complex terrain recirculation of the plume over longer time periods may occur. To account for this effect the results of a comparison of the PAM (Puff Advection Model) with the straight line model was made from which adjustment factors for the site region were determined. These correction factors were applied to the results of the straight line model by multiplying the χ/Q values by the correction factors found in Table 2.3-106.

2.3.5.1.3 Deposition and Depleted X/Q's

As radioactive effluent in a plume travels downwind, it is subject to several removal mechanisms, including radioactive decay, dry deposition, and wet deposition (during precipitation). Corrections for radioactive decay of 2.26 days for undepleted χ/Q and 8 days of depleted χ/Q are shown in the dispersion estimates reported in this subsection.

Dry deposition, which results in depletion of halogen and particulate isotopes from the plume, is calculated using Figures 2 through 5 in Regulatory Guide 1.111. Depletion factors in these curves are a function of release height and distance. All releases at the SSES are at ground level. Therefore, elevated curves were not used. Each χ/Q is multiplied by the depletion correction factor to estimate the depleted χ/Q value.

To determine relative deposition rate as a function of distance and stability, the curves given in Regulatory Guide 1.111 are used in a computerized table look-up routine. Values from the curves are divided by the sector cross-width (arc) at the point of calculation to give units m^{-2}.

2.3.5.1.4 Results of Long-Term Diffusion Estimates

Tables 2.3-107 through 2.3-118 present the annual and five year average χ/Q, decayed and depleted χ/Q and deposition values at the site boundary and exclusion area boundary for each of the 16 cardinal directions. Tables 2.3-119 through 2.3-136 show similar information for the nearest residence, vegetable garden, meat and dairy animal location and selected special receptor locations around the plant. Tables 2.3-137 through 2.3-140 present the five year average χ/Q, decayed and depleted χ/Q and deposition values for the sixteen directions out to a distance of 80.5 kilometers (50 miles) from the plant.

2.3.6 REFERENCES

2.3-1 Critchfield, Howard J., General Climatoloy, England Cliffs, New Jersey: Prentice Hall Inc., (1966) p.446.

2.3-2 U.S. Department of Commerce, Tropical Cyclones of the North Atlantic Ocean, Technical Report 55, (1965).

2.3-3 U.S. Department of Commerce, Local Climatological Data; Annual Summary with Comparative Data; Wilkes-Barre/Scranton Airport, Avoca, Pennsylvania (1993).

2.3-3a National Oceanic and Atmospheric Administration, Cooperative Institute for Research in Environmental Sciences, Climate Diagnostic Center, World Wide Web Internet Site, United States Climate Page, Monthly Values for 1961-1996, URL address http://www.cdc.noaa.gov/

2.3-4 U.S. Department of Commerce, Monthly and Annual Wind Distribution of Pasquill Stability Classes (7) Star Program, Wilkes-Barre Scranton, Pennsylvania Period 1/71-12/75. Environmental Data Service, National Climatic Center: Asheville, N.C. (May, 1976).

2.3-5 Fujita, T.T. Characterization of Hurricanes and Tornadoes by Area and Intensity SMRP No. 92 (1971).

2.3-5a Knight, Paul, Pennsylvania State Climatologist, World Wide Web internet Site, State Data Miscellaneous Information Page, Tornado Data. URL address http://www.ems.psu.edu/PA-Climatologist/

2.3-6 Uman, M., Understanding Lightning; Carnegie, Pennsylvania: Beek Technical Publications, (1971).

2.3-7 Pautz, M.E. Severe Local Storm Occurrences, 1955-1967.

2.3-8 Thom, C.S., New Distributions of Extreme Winds in the United States, Journal of Structural Division Proceedings of the American Society of Civil Engineers, (July 1968) pp. 787-1801.

2.3-9 American National Standards Institute, Inc., Building Code Requirements for Minimum Design Loads In Buildings and Other Structures, A581-1972 , (1972).

2.3-10 Tattelman, Paul and Gringorten, Irving I., Estimated Glaze Ice and Wind Loads at the Earth's Surface for the Contiguous United States. Air Force Cambridge Research Laboratories, Bedford, Mass., (1973).

2.3-11 U.S. Dept of Commerce, Local Climatological Data; Monthly summaries; Avoca, Pennsylvania, Wilkes-Barre Scranton Airport, (1973-1976).

2.3-12 Ohman, Howard L., Viletto, John, Jr., Ackerson, Kenneth T., and Miller, Le Forrest, Potential Sand and Dust Source Area, Report ETL-SR-771-1, (August, 1972).

2.3-13 Holzworth, G., "Mixing Heights, Wind Speeds and Potential for Urban Air Pollution Throughout the Contiguous United States," Preliminary Document, Environmental Protection Agency, (1971).

2.3-13a U.S. Naval Observatory, Astronomical Applications Department, World Wide Web Internet Site, DATA SERVICES, COMPLETE SUN AND MOON DATA FOR ONE DAY, URL address http://aa.usno.navy.mil/AA/

2.3-14 U.S. Dept. of Commerce, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1000 Square Miles and Duration of 6, 12, 24, and 48 hours. U.S. Dept. of Army Corps of Engineers; Hydrometeorological Report No. 33. Wash., D.C.(April, 1956).

2.3-15 Dunlap, D.V., Probabilities of Extreme Snowfalls and Snow Depths; Bulletin 821; New Jersey Agricultural Experiment Station; Rutgers University, New Brunswick, New Jersey (1970).

2.3-16 U.S. Nuclear Regulatory Commission Regulatory Guide 1.76. Design Basis Tornado for Nuclear Power Plants. Directorate of Regulatory Standards (April, 1974).

2.3-17 Thom, H.C.S., "Tornado Probabilities," Monthly Weather Review, (October-December, 1963) pp.730-736.

2.3-18 Howe, G.M., "Tornado Path Sizes," Journal of Applied Meteorology, (3) pp.343-347, (April, 1974).

2.3-19 Dames & Moore, Tornado Evaluation for the Susquehanna Steam Electric Station, (1974).

2.3-20 Hershfield, David M., Technical Paper #40, Rainfall Frequency Atlas of the United States for Duration from 30 minutes to 24 Hours and Return Periods From 1 to 100 Years; U.S. Department of Commerce, Washington, D.C., (1974).

2.3-21 Riedel, John T., Personal communication NOAA Office of Hydrology about soon to be released revision of Hydromet. Report #33 (February, 1977).

2.3-22 -U.S. Nuclear Regulatory Commission, Second Proposed Revision 1 to Regulatory Guide 1.23, Meteorological Measurement Program for Nuclear Power Plants, April 1986.

2.3-22a Atomic Energy Commission, Safety Guide 23 (Regulatory Guide 1.23 Rev. 0), Onsite Meteorological Programs. Office of Standards Development, February 1972.

2.3-23 Not Used

2.3-24 Not Used

2.3-25 Not Used

2.3-26 U.S. Nuclear Regulatory Commission, Regulatory Guide 1.111. Methods for estimating atmospheric transport and dispersion of gaseous effluents in routine release from light-water-cooled reactors. Office of Standards Development, (July, 1977).

2.3-27 Not Used

2.3-28 Not Used

2.3-29 Not Used

2.3-30 Not Used

2.3-31 Not Used

2.3-32 Not Used

2.3-33 Doty, Stephen R, Wallace, Brian L., Holzworth, George C. A Climatological Analysis of Pasquill Stability Categories Based On "Star" Summaries National Climatic Center (April, 1976), p.51.

2.3-34 U. S. Nuclear Regulatory Commission, Regulatory Guide 1.145. Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, Reissued February, 1983.

TABLE 2.3-1

HURRICANES WITHIN 75 AND 150 NAUTICAL MILES
OF THE SUSQUEHANNA SITE
PERIOD OF RECORD 1871 to 1969

	TRACKS WITHIN 75 NM*	TRACKS WITHIN 150 NM*	TOTAL NORTH ATLANTIC STORMS
TIME PERIOD			
Prior to 1900	8	18	
After 1900	0	2	
1871 TO 1969	8	20	489
Occurrence by Month			
June	0	1	
July	0	0	
August	2	3	
September	4	10	
October	2	6	
Totals	8	20	

*NM represents nautical miles.

TABLE 2.3-2

THUNDERSTORM DAYS FOR AVOCA, PENNSYLVANIA

WILKES-BARRE SCRANTON AIRPORT

PERIOD OF RECORD 1956 TO 1974

VALUES ARE EXPRESSED IN DAYS (Ref. 2.3-3)

MONTH	THUNDERSTORM DAYS (to the nearest whole day)
January	*
February	*
March	1
April	2
May	4
June	6
July	8
August	5
September	3
October	1
November	*
December	*
Annual Average	30

*Less than one-half

TABLE 2.3-3

TOTAL NUMBER OF DAYS IN 5 YEARS

MIXING HEIGHTS < 1500m

WIND SPEEDS < 4.0 sec^{-1} and

NO SIGNIFICANT PRECIPITATION

FOR EPISODES LASTING AT LEAST 2 DAYS

Station	Episodes	Episode-days	Season of Greatest # of Episode Days
Pittsburgh, PA	16	39	Autumn
New York, N.Y.	4	9	Autumn
Albany, N.Y.	7	23	Autumn

TABLE 2.3-4

This Table Intentionally Left Blank

TABLE 2.3-5

MEAN MONTHLY VALUES: SUSQUEHANNA SITE (1973-1976)

Month	Wind Speed (m/sec)	Dry Bulb (C)	Wet Bulb (C)
January	2.3	-2.1	-3.6
February	2.0	-1.4	-3.4
March	2.7	3.6	1.1
April	2.8	8.8	5.2
May	2.0	13.8	10.6
June	1.7	18.8	16.1
July	1.5	20.3	17.7
August	1.4	20.0	17.7
September	1.6	15.0	12.9
October	1.9	9.9	7.6
November	2.1	4.9	2.6
December	2.1	-0.9	-2.6
Annual	2.0	9.3	6.9

TABLE 2.3-6

LONG-TERM AVERAGE WIND SPEED AND PREVAILING DIRECTION AT WILKES-BARRE SCRANTON AIRPORT

Period of Record: 1956-1974

Month	Average Speed (mph)	Prevailing Direction
January	8.9	SW
February	9.3	SW
March	9.3	NW
April	9.6	SW
May	8.8	WSW
June	7.9	SW
July	7.4	WSW
August	7.2	SW
September	7.4	SW
October	7.9	WSW
November	8.7	WSW
December	8.9	SW
Annual	8.4	SW

TABLE 2.3-7
AVERAGE WIND SPEED AND PREVAILING
DIRECTION AT THE SUSQUEHANNA SITE

Period of Record (1973-1976)

Month	Average Speed (mph)	Prevailing Direction
January	5.1	WSW
February	4.5	SSW
March	6.0	W
April	6.3	W
May	4.5	W and E
June	3.8	WSW
July	3.4	WSW
August	3.1	ENE
September	3.6	ENE
October	4.3	E
November	4.7	W
December	4.7	W
Annual	4.5	WSW

TABLE 2.3-8

WIND DIRECTION PERSISTENCE - PASQUILL A (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	33	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	34	12	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	17	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	19	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	11	5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	12	6	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	46	12	8	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	49	15	11	4	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	80	26	10	9	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	123	55	20	13	4	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	102	69	29	17	10	3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	33	16	8	4	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	17	6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	16	9	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	16	5	7	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.64	3.15	2.56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.38	2.58	2.87	3.09	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	2.41	2.86	2.88	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	2.51	1.85	3.62	0.	0.	3.44	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.29	2.65	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.60	2.29	0.	2.09	2.98	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	2.28	2.02	3.28	1.80	2.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	2.73	2.94	3.44	4.88	3.75	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	2.66	2.71	3.84	4.02	5.01	0.	6.76	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	2.37	2.65	2.58	2.89	3.29	2.00	3.64	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.94	2.97	3.20	3.12	3.94	4.22	2.31	0.	2.45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	3.51	3.61	3.87	4.34	3.63	5.20	3.68	6.33	3.04	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	4.33	4.83	4.80	5.43	4.81	0.	0.	4.99	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	3.23	4.59	4.38	5.62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	3.59	4.37	2.53	4.68	6.45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	3.28	3.64	3.26	3.12	3.66	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-9

WIND DIRECTION PERSISTENCE - PASQUILL B (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	12	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	14	6	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	7	4	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	12	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	7	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	21	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	20	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	21	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	33	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	36	12	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	11	5	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	15	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	14	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	8	3	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.51	2.81	1.30	3.58	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.72	2.20	2.19	3.54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	1.65	2.34	3.29	0.	0.	3.28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	2.69	1.16	0.	2.06	0.	6.58	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.05	2.50	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.68	2.17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	2.06	1.16	1.48	1.74	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	2.47	2.91	1.97	3.59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	2.82	7.00	0.	6.52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	3.27	3.06	4.70	6.69	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	3.47	3.64	1.78	5.78	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	4.53	5.09	3.62	2.27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	3.90	4.70	4.43	5.96	0.	5.14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	3.70	2.63	4.25	1.79	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	3.23	3.14	3.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	2.89	2.55	3.35	2.40	0.	3.61	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-10

WIND DIRECTION PERSISTENCE - PASQUILL C (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	14	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	10	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	13	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	15	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	11	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	7	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	10	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.05	2.49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.62	0.	3.81	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	3.38	2.44	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	3.05	7.30	0.	0.	4.93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.54	1.03	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	1.39	1.48	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	3.75	3.83	0.	0.	5.95	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	3.63	0.	2.75	0.	0.	0.	0.	4.63	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	3.35	5.17	0.	3.67	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	3.75	4.05	4.02	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	4.09	4.89	1.60	5.59	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	2.23	5.45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	3.46	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	3.45	1.85	4.69	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	3.14	4.26	3.11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-11

WIND DIRECTION PERSISTENCE - PASQUILL D (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	79	25	4	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	90	27	17	4	2	2	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	60	17	5	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	53	10	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	33	10	6	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	24	4	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	33	16	4	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	62	24	7	7	4	4	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	74	30	4	2	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	101	32	8	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	134	60	23	9	7	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	102	41	26	21	13	2	1	1	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
WNW	68	26	15	8	3	4	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	63	29	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	45	21	5	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
N	47	22	6	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	1.98	2.77	2.37	3.15	4.38	0.	2.81	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	1.98	2.32	2.13	2.65	2.66	3.45	0.	2.73	2.32	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	2.10	2.33	1.62	2.66	0.	4.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.79	1.82	2.28	2.52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	1.55	2.30	1.81	0.	2.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.81	1.48	0.	3.75	2.27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	1.48	1.98	2.62	1.98	1.85	0.	0.	2.67	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	2.10	2.40	2.57	1.89	2.08	2.39	3.03	0.	3.79	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	2.05	1.75	1.22	5.27	0.	2.43	0.	4.54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	1.79	2.37	1.77	1.15	0.	2.35	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.49	2.73	3.03	2.92	2.82	2.17	4.08	3.75	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	3.19	3.56	3.96	4.20	3.11	4.58	5.59	5.50	4.71	0.	0.	4.25	0.	3.29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	3.71	3.60	4.01	3.87	5.39	5.41	4.64	0.	5.20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	3.06	3.05	3.83	3.66	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	2.77	2.92	3.93	3.40	6.47	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.73	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	2.33	3.22	2.87	1.98	3.84	0.	0.	6.83	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-12

WIND DIRECTION PERSISTENCE - PASQUILL E (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	47	20	4	2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	98	21	4	4	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ENE	103	31	21	7	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
E	89	33	8	11	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	38	5	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	23	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	19	9	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	34	13	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	44	8	8	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	61	28	10	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	64	33	12	10	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	61	22	11	2	1	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WNW	32	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	22	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	25	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	37	19	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	1.55	1.56	2.39	1.59	2.13	1.95	0.	1.70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	1.47	1.39	1.62	2.26	1.57	0.	0.	0.	0.	0.	0.	0.	1.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	1.34	1.03	1.46	1.12	0.	0.	.81	0.	1.02	0.	0.	0.	0.	.98	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.11	1.12	1.30	1.00	1.12	3.47	0.	1.04	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	1.13	.83	1.52	1.45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.77	.91	.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	1.72	2.05	2.97	1.86	2.38	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	1.58	1.63	2.37	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	1.28	1.40	1.52	1.11	2.21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	1.47	1.35	1.70	1.31	0.	2.09	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	1.93	2.29	2.47	2.37	2.71	2.69	3.65	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	2.59	2.57	3.59	3.59	3.40	2.50	0.	5.62	0.	0.	0.	0.	0.	5.11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	2.22	2.06	2.76	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	2.37	1.80	2.74	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	1.59	2.66	2.34	3.03	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	1.72	1.49	1.62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-13

WIND DIRECTION PERSISTENCE - PASQUILL F (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	14	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	36	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	89	28	13	11	7	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
E	85	31	14	4	6	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	20	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	6	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	9	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	12	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	.88	.97	1.01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	.91	.72	.54	.98	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	.97	1.13	1.20	1.40	1.05	1.97	1.56	0.	0.	0.	0.	1.34	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.06	1.25	1.00	1.24	1.17	1.25	.60	.92	1.62	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	.92	1.18	1.13	.93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	.71	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	.86	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	1.38	.70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	1.12	.53	0.	0.	0.	2.01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	1.98	.69	.93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	.87	.64	.76	.84	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	.79	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	.85	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	.95	.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	1.14	1.53	.89	1.14	1.36	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-14

WIND DIRECTION PERSISTENCE - PASQUILL G (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	28	4	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	50	18	12	1	4	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	36	20	13	7	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	6	3	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	.98	1.07	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	1.04	1.05	1.15	.73	0.	0.	1.01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	1.03	1.02	1.22	1.47	1.33	1.67	1.55	1.76	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.02	1.01	1.22	1.23	0.	2.50	1.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	.99	.81	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	.69	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	0.	.63	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	.69	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	.76	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	1.08	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	.85	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	.92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	1.47	.95	0.	1.48	1.40	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SNRS - FSAR

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-15

WIND DIRECTION PERSISTENCE - PASQUILL ALL (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	211	81	26	15	4	3	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
NE	315	107	60	22	11	7	4	1	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
ENE	328	128	79	34	15	9	9	4	5	1	1	0	2	2	0	0	0	0	0	0	0	0	0	0
E	271	99	63	35	21	17	9	9	4	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0
ESE	140	44	15	9	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	90	17	7	4	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	90	38	13	11	7	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
S	158	66	29	14	14	6	3	5	1	4	1	1	0	1	1	0	0	0	0	1	0	0	0	0
SSW	184	87	33	11	9	7	3	1	3	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0
SW	305	114	54	20	14	12	7	1	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
WSW	373	166	93	56	23	13	16	3	7	1	1	1	2	0	0	0	1	0	0	0	0	0	0	0
W	309	129	93	63	24	25	20	9	5	4	4	2	0	2	0	0	1	0	0	0	1	0	0	0
WNW	163	65	34	14	11	7	8	2	3	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
NW	128	58	20	8	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	123	46	21	13	10	0	2	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0
N	155	68	30	16	8	5	2	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	1.77	1.99	2.29	2.31	3.79	3.05	2.06	1.48	0.	0.	0.	4.45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	1.54	1.80	2.01	2.25	1.99	2.34	1.80	2.73	2.74	0.	4.11	0.	1.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	1.40	1.34	1.54	1.43	1.18	2.13	1.50	1.05	1.48	1.01	1.61	0.	1.44	1.08	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.37	1.21	1.26	1.17	1.32	1.47	1.94	2.06	1.27	2.72	3.15	0.	1.49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	1.43	1.56	1.37	1.57	2.61	1.26	0.	0.	2.90	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.63	1.55	1.88	3.20	1.67	1.85	0.	0.	2.67	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	1.63	1.68	1.84	2.00	2.06	0.	1.46	2.67	2.68	3.95	0.	0.	1.95	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	1.71	2.13	2.64	2.27	2.74	2.10	2.61	2.91	6.24	3.32	4.65	3.99	0.	5.26	4.06	0.	0.	0.	0.	4.89	0.	0.	0.	0.
SSW	1.93	2.11	2.51	2.45	3.18	4.02	1.91	4.54	5.16	4.05	4.09	0.	0.	4.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	1.91	1.99	1.94	2.26	2.48	3.23	1.72	3.41	2.22	8.48	0.	0.	0.	0.	5.11	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.43	2.47	2.77	2.86	3.19	3.21	3.68	3.76	3.29	4.03	3.36	2.35	2.81	0.	0.	0.	3.69	0.	0.	0.	0.	0.	0.	0.
W	2.79	3.06	3.45	3.65	3.84	3.57	3.78	4.97	4.94	5.18	4.50	5.23	0.	4.20	0.	0.	4.44	0.	0.	0.	5.58	0.	0.	0.
WNW	2.90	3.51	3.67	3.97	4.34	5.51	4.59	5.10	5.20	0.	0.	0.	0.	5.78	5.45	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	2.70	3.08	3.51	4.07	3.05	0.	0.	0.	3.77	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	2.41	3.07	3.22	3.41	3.93	0.	2.62	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.86	4.72	0.	.24	0.	0.	0.	0.
N	1.97	2.28	2.82	2.38	2.60	2.42	1.73	1.28	4.24	0.	4.21	0.	0.	0.	0.	6.24	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-16

WIND DIRECTION PERSISTENCE - PASQUILL E, F, & G (1973 - 1976)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	77	29	7	4	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	183	46	17	7	4	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ENE	235	94	54	21	15	6	10	2	6	0	1	0	2	2	0	0	0	0	0	0	0	0	0	0
E	177	78	46	30	17	14	7	6	4	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ESE	74	16	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	35	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	26	13	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	44	12	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	48	13	9	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	80	31	11	5	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	81	39	17	16	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	86	29	12	2	1	2	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WNW	49	12	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	38	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	41	6	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	63	30	8	1	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)
CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	1.26	1.45	2.03	1.60	0.	2.02	0.	1.70	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	1.26	1.17	1.48	1.69	1.44	1.06	.99	0.	0.	0.	0.	0.	1.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	1.13	1.04	1.21	1.10	1.12	1.06	1.43	.99	1.40	0.	1.61	0.	1.44	1.08	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	1.05	1.06	1.03	1.06	1.21	1.33	1.26	1.07	1.99	1.28	0.	0.	1.49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	1.06	.89	1.52	1.17	.92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	1.57	.90	.89	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSE	1.55	2.02	1.63	1.86	2.38	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	1.39	1.73	1.46	2.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	1.22	1.23	1.61	1.11	2.21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	1.46	1.35	1.63	1.46	0.	2.09	.92	2.03	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	1.93	2.10	2.27	2.33	2.71	3.20	3.65	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	2.22	2.38	3.53	3.59	3.40	2.50	.77	5.62	0.	0.	0.	0.	0.	5.11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	1.80	2.06	2.81	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	1.94	1.80	2.74	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	1.57	1.45	2.34	3.03	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	1.53	1.47	1.73	1.31	1.36	1.19	0.	1.28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 35064

TABLE 2.3-17

LONG TERM TEMPERATURE (°F) AT WILKES-BARRE SCRANTON AIRPORT

1	2	3	4	5	6
	Averages			Extreme	
Month	Daily Max.	Daily Min.	Mean	Highest	Lowest
January	32.3	17.7	25.0	67	-21
February	34.7	19.0	26.9	71	-16
March	45.4	28.1	36.8	83	-4
April	58.1	38.1	48.1	92	+14
May	69.6	48.3	58.9	91	+27
June	77.8	56.8	67.3	97	+34
July	82.2	61.8	72.0	101	+43
August	80.1	60.2	70.1	95	+38
September	72.2	52.6	62.4	95	+30
October	61.1	41.9	51.5	83	+19
November	48.8	33.8	41.3	80	+9
December	36.8	23.5	30.2	67	-9
Annual	58.3	40.2	49.2	101	-21

Temperature averages are based on a 36-year climatological period from 1961-1996.
Temperature extremes are for the 43 year period from 1954-1995.

Sources: Pennsylvania State Climatologist (Ref. 2.3-5a)
National Oceanic and Atmospheric Administration Cooperative Institute for Research in Environmental Sciences, Climate Diagnostic Center (Ref. 2.3-3a) (NOAA/CIRES/CDC)

TABLE 2.3-18

MEAN MONTHLY TEMPERATURE, DEW POINT*
TEMPERATURE, AND RELATIVE HUMIDITY
WILKES-BARRE SCRANTON AIRPORT (Ref. 2.3-3)

Period of Records: 1956-1974

Month	Temperature °F	Dew Point °F	RH (%)
January	26	18	70
February	27	18	69
March	36	26	67
April	49	37	62
May	59	47	64
June	68	58	70
July	72	62	70
August	70	61	73
September	63	55	76
October	53	44	72
November	41	33	72
December	29	21	73
Annual	49	40	70

*Dew point temperatures computed from temperature and relative humidity measurements.

TABLE 2.3-19

TEMPERATURE AND MOISTURE DATA
FOR THE SUSQUEHANNA SITE

Period of Record: 1973-1976

Month	Dry Bulb (°C)			Average Wet Bulb (°C)	R.H. %
	Average	Max	Min		
January	-2.1	18.5	-20.9	-3.6	66
February	-1.4	18.7	-18.5	-3.4	61
March	3.6	22.2	-11.2	1.1	62
April	8.8	32.5	-6.1	5.2	60
May	13.8	30.6	-1.9	10.6	70
June	18.8	31.9	5.6	16.1	76
July	20.3	31.7	7.8	17.7	79
August	20.0	34.3	4.8	17.7	82
September	15.0	31.8	-0.8	12.9	81
October	9.9	27.8	-6.4	7.6	72
November	4.9	23.1	-14.0	2.6	67
December	-0.9	17.8	-19.0	-2.6	66
Annual	9.3	34.3	-20.9	6.9	70

TABLE 2.3-20
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JANUARY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	67.9	-4.2	-2.8
2	68.5	-4.4	-3.1
3	68.8	-4.5	-3.2
4	68.9	-4.7	-3.4
5	68.7	-4.8	-3.6
6	68.4	-5.1	-3.8
7	68.8	-5.3	-4.1
8	69.2	-5.4	-4.2
9	69.6	-5.1	-4.0
10	68.8	-4.3	-3.0
11	66.3	-3.5	-2.0
12	63.6	-2.8	-1.1
13	61.7	-2.3	-.4
14	60.6	-1.9	.1
15	60.0	-1.6	.5
16	59.6	-1.6	.6
17	60.1	-1.9	.2
18	61.7	-2.3	-.4
19	63.6	-2.7	-1.0
20	64.8	-3.1	-1.5
21	65.5	-3.4	-1.9
22	65.7	-3.8	-2.2
23	65.9	-4.0	-2.6
24	66.6	-4.3	-2.9

TABLE 2.3-20
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JANUARY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	98.5	16.4	18.5
AVG DAILY MAX	78.3	-.2	1.9
MEAN	65.6	-3.6	-2.1
CLIMATIC MEAN	65.1	-3.7	-2.2
AVG DAILY MIN	52.0	-7.3	-6.2
ABSOLUTE MIN	3.2	-21.6	-20.9
STANDARD DEV	17.9	6.0	6.2
VALID OBS	2975	2975	2975
INVALID OBS	1	1	1
TOTAL OBS	2976	2976	2976
DATA RECOVERY	100.0	100.0	100.0

TABLE 2.3-21
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: FEBRUARY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	64.8	-4.4	-2.9
2	65.2	-4.6	-3.1
3	65.4	-4.9	-3.4
4	66.3	-5.1	-3.7
5	66.5	-5.4	-4.0
6	66.8	-5.5	-4.2
7	66.8	-5.7	-4.4
8	67.4	-5.6	-4.4
9	67.3	-5.0	-3.6
10	64.0	-4.0	-2.4
11	60.0	-3.0	-1.0
12	57.4	-2.2	.2
13	54.7	-1.7	1.0
14	53.2	-1.2	1.7
15	53.1	-.9	2.1
16	52.6	-.8	2.2
17	53.0	-.9	2.0
18	54.4	-1.4	1.4
19	56.7	-2.0	.5
20	59.2	-2.5	-.3
21	61.2	-2.9	-.9
22	62.8	-3.2	-1.4
23	64.1	-3.6	-1.9
24	65.1	-3.9	-2.4

TABLE 2.3-21
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: FEBRUARY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	14.2	18.7
AVG DAILY MAX	76.9	.3	3.2
MEAN	61.2	-3.4	-1.4
CLIMATIC MEAN	61.5	-3.6	-1.5
AVG DAILY MIN	46.0	-7.4	-6.2
ABSOLUTE MIN	13.7	-18.9	-18.5
STANDARD DEV	17.0	5.9	6.5
VALID OBS	2712	2712	2712
INVALID OBS	0	0	0
TOTAL OBS	2712	2712	2712
DATA RECOVERY	100.0	100.0	100.0

TABLE 2.3-22
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: MARCH 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	66.1	-.1	1.9
2	66.7	-.3	1.6
3	67.4	-.5	1.3
4	67.9	-.7	1.1
5	68.3	-.9	.9
6	68.6	-1.0	.7
7	69.2	-1.0	.6
8	69.3	-.7	.9
9	66.9	-.1	1.8
10	63.4	.8	3.0
11	60.5	1.5	4.1
12	57.8	2.2	5.2
13	55.9	2.7	6.0
14	54.7	3.1	6.6
15	54.2	3.5	7.2
16	54.3	3.6	7.3
17	54.0	3.5	7.2
18	54.8	3.1	6.6
19	56.7	2.5	5.8
20	59.1	1.9	4.8
21	60.9	1.4	4.0
22	62.3	.9	3.3
23	63.9	.5	2.8
24	65.1	.2	2.3

TABLE 2.3-22
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: MARCH 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	20.8	22.2
AVG DAILY MAX	77.7	4.6	8.3
MEAN	62.0	1.1	3.6
CLIMATIC MEAN	62.3	1.0	3.6
AVG DAILY MIN	47.0	-2.6	-1.0
ABSOLUTE MIN	18.8	-12.2	-11.2
STANDARD DEV	18.1	5.2	5.8
VALID OBS	2925	2925	2925
INVALID OBS	51	51	51
TOTAL OBS	2976	2976	2976
DATA RECOVERY	98.3	98.3	98.3

TABLE 2.3-23
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: APRIL 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	66.7	3.7	6.1
2	68.1	3.3	5.6
3	69.5	3.0	5.1
4	70.8	2.7	4.7
5	71.9	2.4	4.2
6	72.8	2.2	4.0
7	72.5	2.5	4.4
8	69.6	3.6	5.8
9	63.9	4.7	7.5
10	58.7	5.4	9.0
11	55.6	6.2	10.3
12	52.9	6.7	11.3
13	51.4	7.2	12.1
14	49.9	7.6	12.7
15	49.4	7.8	13.1
16	49.0	7.9	13.3
17	49.1	7.8	13.2
18	49.5	7.5	12.7
19	50.9	7.0	11.8
20	53.9	6.4	10.7
21	56.8	5.8	9.6
22	59.8	5.2	8.5
23	62.2	4.7	7.7
24	64.7	4.2	6.9

TABLE 2.3-23
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: APRIL 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	97.9	20.0	32.5
AVG DAILY MAX	77.9	8.7	14.2
MEAN	60.0	5.2	8.8
CLIMATIC MEAN	60.7	4.9	8.6
AVG DAILY MIN	43.6	1.0	2.9
ABSOLUTE MIN	10.0	-7.8	-6.1
STANDARD DEV	18.6	5.8	7.1
VALID OBS	2878	2878	2878
INVALID OBS	2	2	2
TOTAL OBS	2880	2880	2880
DATA RECOVERY	99.9	99.9	99.9

TABLE 2.3-24
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: MAY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	76.5	9.1	11.2
2	77.6	8.7	10.6
3	78.4	8.3	10.2
4	79.4	8.1	9.8
5	80.0	7.8	9.5
6	81.1	7.7	9.3
7	81.0	8.1	9.7
8	78.4	9.1	11.0
9	73.4	10.2	12.7
10	69.3	11.0	14.1
11	65.7	11.7	15.3
12	63.3	12.2	16.2
13	60.6	12.6	17.1
14	58.9	13.0	17.8
15	57.6	13.2	18.2
16	57.5	13.2	18.2
17	58.2	13.0	17.9
18	59.5	12.7	17.4
19	61.3	12.4	16.7
20	63.7	11.8	15.7
21	67.2	11.3	14.6
22	70.7	10.7	13.5
23	73.4	10.1	12.6
24	75.2	9.7	11.9

TABLE 2.3-24
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: MAY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

ABSOLUTE MAX	100.0	30.6	30.6
AVG DAILY MAX	85.8	14.0	19.2
MEAN	69.5	10.6	13.8
CLIMATIC MEAN	69.0	10.3	13.7
AVG DAILY MIN	52.1	6.6	8.1
ABSOLUTE MIN	20.7	-3.3	-1.9
STANDARD DEV	18.1	5.1	5.9
VALID OBS	2964	2964	2964
INVALID OBS	12	12	12
TOTAL OBS	2976	2976	2976
DATA RECOVERY	99.6	99.6	99.6

TABLE 2.3-25
STATISTICAL AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JUNE 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	85.1	14.4	15.8
2	85.9	14.0	15.4
3	86.5	13.8	15.1
4	86.8	13.5	14.8
5	87.1	13.3	14.6
6	88.0	13.4	14.6
7	87.6	14.0	15.2
8	85.4	15.0	16.4
9	80.8	15.9	18.0
10	75.4	16.7	19.5
11	70.9	17.4	20.9
12	67.7	17.8	21.8
13	64.9	18.0	22.6
14	64.0	18.2	22.9
15	63.6	18.4	23.2
16	63.2	18.4	23.3
17	63.4	18.3	23.2
18	64.8	18.0	22.6
19	67.5	17.6	21.7
20	71.3	17.0	20.5
21	76.6	16.4	19.0
22	80.4	15.7	17.9
23	83.0	15.3	17.0
24	84.0	14.8	16.4

TABLE 2.3-25
STATISTICAL AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JUNE 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	27.2	31.9
AVG DAILY MAX	90.5	19.0	24.0
MEAN	76.4	16.1	18.8
CLIMATIC MEAN	74.7	15.8	18.9
AVG DAILY MIN	58.8	12.6	13.9
ABSOLUTE MIN	17.3	3.9	5.6
STANDARD DEV	15.8	4.0	4.7
VALID OBS	2876	2876	2876
INVALID OBS	4	4	4
TOTAL OBS	2880	2880	2880
DATA RECOVERY	99.9	99.9	99.9

TABLE 2.3-26
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JULY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	88.9	15.9	17.1
2	89.5	15.6	16.6
3	89.6	15.3	16.3
4	89.7	15.0	16.0
5	90.2	14.7	15.7
6	90.8	14.7	15.7
7	90.8	15.3	16.2
8	88.6	16.3	17.5
9	84.0	17.4	19.2
10	77.6	18.4	21.0
11	72.9	19.0	22.4
12	69.4	19.5	23.4
13	66.7	19.8	24.2
14	64.3	20.0	24.8
15	63.3	20.1	25.2
16	63.2	20.2	25.3
17	64.0	20.1	25.0
18	66.1	19.9	24.5
19	69.6	19.7	23.7
20	74.9	19.0	22.1
21	81.0	18.1	20.3
22	84.4	17.5	19.2
23	86.3	16.9	18.4
24	87.6	16.4	17.7

TABLE 2.3-26
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JULY 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	25.7	31.7
AVG DAILY MAX	94.0	20.8	26.0
MEAN	78.9	17.7	20.3
CLIMATIC MEAN	76.9	17.5	20.5
AVG DAILY MIN	59.9	14.1	15.1
ABSOLUTE MIN	30.9	6.9	7.8
STANDARD DEV	14.9	3.5	4.5
VALID OBS	2970	2970	2975
INVALID OBS	6	6	1
TOTAL OBS	2976	2976	2976
DATA RECOVERY	99.8	99.8	100.0

TABLE 2.3-27
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: AUGUST 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	91.4	16.2	17.1
2	91.7	15.8	16.7
3	92.0	15.5	16.3
4	92.5	15.3	16.1
5	92.5	15.1	15.9
6	92.9	15.0	15.7
7	93.2	15.2	15.9
8	92.4	16.1	16.8
9	88.2	17.2	18.5
10	81.6	18.3	20.4
11	75.6	19.2	22.1
12	70.5	19.7	23.5
13	67.3	20.0	24.4
14	65.5	20.3	24.9
15	65.0	20.3	25.0
16	65.2	20.2	24.9
17	66.3	20.0	24.6
18	68.9	19.8	23.9
19	73.6	19.4	22.7
20	80.5	18.7	20.9
21	85.3	17.9	19.6
22	87.8	17.4	18.7
23	89.5	16.8	17.9
24	90.7	16.5	17.4

TABLE 2.3-27
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: AUGUST 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	26.8	34.3
AVG DAILY MAX	95.0	20.8	25.8
MEAN	81.7	17.7	20.0
CLIMATIC MEAN	78.2	17.6	20.4
AVG DAILY MIN	61.4	14.3	15.1
ABSOLUTE MIN	28.1	3.9	4.8
STANDARD DEV	14.6	3.7	4.7
VALID OBS	2970	2970	2972
INVALID OBS	6	6	4
TOTAL OBS	2976	2976	2976
DATA RECOVERY	99.8	99.8	99.9

TABLE 2.3-28
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: SEPTEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	88.6	11.4	12.5
2	88.9	11.2	12.1
3	89.5	10.9	11.8
4	89.5	10.7	11.6
5	89.6	10.5	11.4
6	90.0	10.4	11.3
7	90.6	10.4	11.2
8	90.6	11.0	11.8
9	88.2	12.0	13.1
10	82.7	13.1	14.8
11	76.3	14.1	16.6
12	70.9	14.8	18.1
13	67.2	15.2	19.0
14	65.3	15.4	19.6
15	64.2	15.5	19.8
16	64.4	15.5	19.8
17	65.7	15.3	19.4
18	69.2	14.9	18.5
19	75.2	14.3	16.9
20	80.5	13.6	15.5
21	84.2	13.0	14.5
22	85.6	12.4	13.8
23	87.1	12.0	13.2
24	88.1	11.6	12.7

TABLE 2.3-28
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: SEPTEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	99.0	25.7	31.8
AVG DAILY MAX	93.3	16.3	20.5
MEAN	80.5	12.9	15.0
CLIMATIC MEAN	77.3	12.6	15.2
AVG DAILY MIN	61.3	9.0	9.8
ABSOLUTE MIN	28.4	-1.2	-.8
STANDARD DEV	14.9	4.6	5.3
VALID OBS	2875	2875	2875
INVALID OBS	5	5	5
TOTAL OBS	2880	2880	2880
DATA RECOVERY	99.8	99.8	99.8

TABLE 2.3-29
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: OCTOBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	79.6	6.2	7.7
2	80.2	5.9	7.2
3	80.5	5.6	6.9
4	80.9	5.3	6.5
5	80.9	5.1	6.3
6	81.3	4.9	6.1
7	82.0	4.8	5.8
8	82.6	5.2	6.3
9	80.5	6.3	7.7
10	75.0	7.7	9.6
11	69.1	8.7	11.4
12	64.7	9.5	12.9
13	61.9	9.9	13.8
14	59.7	10.4	14.6
15	58.5	10.5	14.9
16	58.3	10.5	15.0
17	59.5	10.2	14.4
18	62.3	9.6	13.3
19	66.5	8.9	11.9
20	70.8	8.2	10.7
21	73.9	7.7	9.8
22	75.7	7.2	9.0
23	76.9	6.8	8.6
24	78.6	6.4	8.0

TABLE 2.3-29
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: OCTOBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	20.7	27.8
AVG DAILY MAX	86.2	11.3	15.5
MEAN	72.4	7.6	9.9
CLIMATIC MEAN	70.8	7.5	10.1
AVG DAILY MIN	55.4	3.6	4.7
ABSOLUTE MIN	22.9	-7.9	-6.4
STANDARD DEV	17.4	5.6	6.0
VALID OBS	2706	2706	2975
INVALID OBS	270	270	1
TOTAL OBS	2976	2976	2976
DATA RECOVERY	90.9	90.9	100.0

TABLE 2.3-30
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: NOVEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	70.2	1.6	3.5
2	71.0	1.4	3.2
3	71.2	1.2	2.9
4	71.6	1.0	2.6
5	72.0	.8	2.4
6	72.2	.6	2.2
7	72.6	.5	2.0
8	73.4	.5	2.0
9	73.2	1.2	2.8
10	71.0	2.3	4.2
11	67.0	3.4	5.8
12	63.5	4.2	7.0
13	60.5	4.7	7.9
14	58.9	5.0	8.4
15	57.7	5.1	8.7
16	57.4	5.1	8.6
17	58.4	4.7	8.0
18	59.9	4.1	7.1
19	62.3	3.5	6.3
20	64.6	3.0	5.4
21	66.1	2.5	4.8
22	67.1	2.2	4.3
23	68.0	1.9	4.0
24	68.8	1.7	3.6

TABLE 2.3-30
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: NOVEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	19.4	23.1
AVG DAILY MAX	79.0	6.1	9.4
MEAN	66.6	2.6	4.9
CLIMATIC MEAN	65.9	2.5	4.9
AVG DAILY MIN	52.8	-1.1	.5
ABSOLUTE MIN	21.1	-15.4	-14.0
STANDARD DEV	17.7	6.0	6.3
VALID OBS	2873	2873	2880
INVALID OBS	7	7	7
TOTAL OBS	2880	2880	2880
DATA RECOVERY	99.8	99.8	100.0

TABLE 2.3-31
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: DECEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	68.4	-3.2	-1.8
2	68.8	-3.3	-1.9
3	68.9	-3.4	-2.1
4	68.8	-3.5	-2.2
5	68.7	-3.6	-2.3
6	68.8	-3.7	-2.4
7	68.9	-3.9	-2.6
8	68.5	-4.0	-2.7
9	68.5	-3.9	-2.5
10	68.3	-3.1	-1.6
11	66.3	-2.2	-.6
12	63.9	-1.6	.3
13	62.5	-1.1	1.0
14	60.7	-.9	1.4
15	59.6	-.6	1.8
16	59.4	-.8	1.6
17	59.7	-1.2	1.1
18	61.2	-1.6	.4
19	63.0	-2.0	-.1
20	64.9	-2.3	-.6
21	66.1	-2.6	-1.0
22	66.9	-2.8	-1.3
23	67.6	-3.0	-1.5
24	68.2	-3.2	-1.8

TABLE 2.3-31
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: DECEMBER 1973-1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	16.4	17.8
AVG DAILY MAX	79.2	.8	2.9
MEAN	65,7	-2.6	-.9
CLIMATIC MEAN	66.1	-2.7	-1.0
AVG DAILY MIN	52.9	-6.1	-4.8
ABSOLUTE MIN	7.9	-20.2	-19.0
STANDARD DEV	18.8	5.4	5.4
VALID OBS	2849	2849	2853
INVALID OBS	127	127	123
TOTAL OBS	2976	2976	2976
DATA RECOVERY	95.7	95.7	95.9

TABLE 2.3-32
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JANUARY 1973 - DECEMBER 1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
	9.61	9.61	9.61
HOUR	PCT	DEG C	DEG C
1	76.3	5.6	7.2
2	76.9	5.4	6.8
3	77.4	5.1	6.5
4	77.8	4.9	6.2
5	78.1	4.7	6.0
6	78.5	4.5	5.8
7	78.7	4.7	5.9
8	78.0	5.2	6.5
9	75.4	6.0	7.7
10	71.3	6.9	9.2
11	67.2	7.8	10.5
12	63.8	8.4	11.6
13	61.3	8.9	12.5
14	59.7	9.2	13.1
15	58.9	9.4	13.4
16	58.7	9.4	13.4
17	59.3	9.2	13.1
18	61.1	8.8	12.4
19	64.0	8.3	11.5
20	67.4	7.7	10.4
21	70.5	7.2	9.5
22	72.5	6.7	8.7
23	74.1	6.3	8.1
24	75.3	5.9	7.6

TABLE 2.3-32
STATISTICS AND DIURNAL VARIATION OF METEOROLOGICAL PARAMETERS
DATA PERIOD: JANUARY 1973 - DECEMBER 1976
METEOROLOGICAL PARAMETERS (HEIGHTS IN METERS)

	REL HUMID	WET BULB	DRY BULB
ABSOLUTE MAX	100.0	30.6	34.3
AVG DAILY MAX	84.5	10.3	14.3
MEAN	70.1	6.9	9.3
CLIMATIC MEAN	69.1	6.7	9.4
AVG DAILY MIN	53.6	3.1	4.4
ABSOLUTE MIN	3.2	-21.6	-20.9
STANDARD DEV	18.6	9.4	9.9
VALID OBS	34573	34573	34860
INVALID OBS	491	491	204
TOTAL OBS	35064	35064	35064
DATA RECOVERY	98.6	98.6	99.4

TABLE 2.3-33

LONG TERM MONTHLY PRECIPITATION DATA (LIQUID EQUIVALENT, IN INCHES)
FOR THE WILKES-BARRE SCRANTON AIRPORT AT AVOCA, PA.

MONTH	MEAN	GREATEST 24-HOUR
January	2.23	1.89
February	2.01	3.11
March	2.60	3.02
April	3.15	3.80
May	3.50	2.58
June	3.70	3.61
July	3.70	2.45
August	3.27	3.18
September	3.40	6.52
October	2.89	3.27
November	3.20	2.91
December	2.58	2.86
Annual	36.23	

Precipitation means are based on a 36 year climatological period from 1961-1996. Greatest 24-hour rainfall amounts are for a 38 year period from 1953-1990.

Sources: National Oceanic Atmospheric Administration, Cooperative Institute for Research in Environmental Science, Climate Diagnostic Center (NO44/CIRES/CDC) Ref. 2.3-3a
National Oceanic and Atmospheric Administration, Local Climatological Data, Annual Summary with Comparitive Data, Avoca, PA (Ref. 2.3-3)

TABLE 2.3-34

EXPECTED RAINFALL BY DURATION AND RECURRENCE

INTERVAL FOR VICINITY OF SUSQUEHANNA SITE (Ref. 2.3-20) (INCHES)

RECURRENCE INTERVAL

DURATION	1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
1 Hour	1.1	1.4	1.6	2.0	2.2	2.5	2.8
2 Hour	1.4	1.6	2.1	2.5	2.8	3.2	3.5
3 Hour	1.4	1.8	2.3	2.7	3.1	3.5	3.8
6 Hour	1.8	2.2	2.8	3.3	3.9	4.2	4.8
12 Hour	2.2	2.7	3.4	4.0	4.7	5.0	5.8
24 Hour	2.5	3.0	4.0	4.7	5.3	6.0	6.8

TABLE 2.3-35

PROBABLE MAXIMUM PRECIPITATION FOR VARYING
RAINFALL DURATIONS AND AREAS (Ref. 2.3-21) (INCHES)

AREA	DURATION (HOURS)				
(Mi^2)	6	12	24	48	72
10	25.5	29.5	31.0	35.0	36.5
200	17.0	20.5	23.0	26.0	27.0

TABLE 2.3-36

PRECIPITATION DATA FOR THE SUSQUEHANNA SITE

(Inches of Water) (1973-1976)

MONTH	TOTAL
January	3.68
February	2.53
March	3.67
April	3.73
May	4.19
June	4.82
July	4.73
August	3.59
September	7.54
October	4.40
November	2.76
December	2.21
Annual	47.83

TABLE 2.3-37

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: JANUARY 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
.0 TO .1	190	89.20	34	45.95	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	15	7.04	33	44.59	28	75.68	0	0.00	0	0.00	0	0.00
.2 TO .3	3	1.41	2	2.70	5	13.51	3	27.27	0	0.00	0	0.00
3 TO .4	2	.94	2	2.70	2	5.41	6	54.55	0	0.00	0	0.00
.4 TO .5	1	.47	0	0.00	1	2.70	0	0.00	0	0.00	0	0.00
.5 TO .6	0	0.00	1	1.35	1	2.70	1	9.09	0	0.00	0	0.00
.6 TO .7	1	.47	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.7 TO .8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	1	.47	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	1	1.35	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00
1.2 TO 1.3	0	0.00	1	1.35	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	213	100.00	74	100.00	37	100.00	11	100.00	2	100.00	0	0.00
MAXIMUM AMT.	.91		1.30		.60		.76		1.12		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 14.71 INCHES

	NO.	PCT.		NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2763	92.84	VALID OBSERVATIONS	2976	100.00
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	213	7.16	INVALID OBSERVATIONS	0	0.00
TOTAL VALID OBSERVATIONS	2976	100.00	TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-38

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: FEBRUARY 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	155	88.07	37	60.66	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	19	10.80	19	31.15	24	82.76	0	0.00	0	0.00	0	0.00
.2 TO .3	2	1.14	2	3.28	1	3.45	0	0.00	0	0.00	0	0.00
.3 TO .4	0	0.00	3	4.92	3	10.34	3	60.00	0	0.00	0	0.00
.4 TO .5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.5 TO .6	0	0.00	0	0.00	1	3.45	1	20.00	0	0.00	0	0.00
.6 TO .7	0	0.00	0	0.00	0	0.00	1	20.00	0	0.00	0	0.00
.7 TO .8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	176	100.00	61	100.00	29	100.00	5	100.00	1	100.00	0	0.00
MAXIMUM AMT.	.28		.40		.52		.64		1.16		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 10.12 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2536	93.51
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	176	6.49
TOTAL VALID OBSERVATIONS	2712	100.00

	NO.	PCT.
VALID OBSERVATIONS	2712	100.00
INVALID OBSERVATIONS	0	0.00
TOTAL OBSERVATIONS	2712	100.00

TABLE 2.3-39

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: MARCH 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	187	84.23	32	46.38	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	33	14.86	25	36.23	11	40.74	0	0.00	0	0.00	0	0.00
.2 TO .3	1	.45	8	11.59	8	29.63	0	0.00	0	0.00	0	0.00
.3 TO .4	0	0.00	4	5.80	5	18.52	0	0.00	0	0.00	0	0.00
.4 TO .5	0	0.00	0	0.00	2	7.41	2	40.00	0	0.00	0	0.00
.5 TO .6	0	0.00	0	0.00	1	3.70	1	20.00	0	0.00	0	0.00
.6 TO .7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.7 TO .8	0	0.00	0	0.00	0	0.00	2	40.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	1	.45	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	222	100.00	69	100.00	27	100.00	5	100.00	0	0.00	0	0.00
MAXIMUM AMT.	1.18		.32		.52		.72		0.00		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 14.66 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2752	92.54
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	222	7.46
TOTAL VALID OBSERVATIONS	2974	100.00

	NO.	PCT.
VALID OBSERVATIONS	2974	99.93
INVALID OBSERVATIONS	2	.07
TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-40

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: APRIL 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	198	88.39	37	46.25	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	16	7.14	31	38.75	24	66.67	0	0.00	0	0.00	0	0.00
.2 TO .3	6	2.68	4	5.00	4	11.11	3	37.50	0	0.00	0	0.00
.3 TO .4	3	1.34	3	3.75	3	8.33	1	12.50	0	0.00	0	0.00
.4 TO .5	0	0.00	2	2.50	0	0.00	2	25.00	0	0.00	0	0.00
.5 TO .6	0	0.00	2	2.50	3	8.33	0	0.00	1	100.00	0	0.00
.6 TO .7	0	0.00	0	0.00	2	5.56	0	0.00	0	0.00	0	0.00
.7 TO .8	1	.45	1	1.25	0	0.00	2	25.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	224	100.00	80	100.00	36	100.00	8	100.00	1	100.00	0	0.00
MAXIMUM AMT.	.71		.79		.64		.72		.52		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 14.92 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2607	92.09
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	224	7.91
TOTAL VALID OBSERVATIONS	2831	100.00

	NO.	PCT.
VALID OBSERVATIONS	2831	98.30
INVALID OBSERVATIONS	49	1.70
TOTAL OBSERVATIONS	2880	100.00

TABLE 2.3-41

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATE PERIOD: MAY 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	182	81.98	37	50.00	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	29	13.06	24	32.43	19	55.88	0	0.00	0	0.00	0	0.00
.2 TO .3	3	1.35	3	4.05	10	29.41	1	20.00	0	0.00	0	0.00
.3 TO .4	4	1.80	2	2.70	0	0.00	1	20.00	0	0.00	0	0.00
.4 TO .5	2	.90	1	1.35	1	2.94	0	0.00	0	0.00	0	0.00
.5 TO .6	1	.45	5	6.76	0	0.00	1	20.00	0	0.00	0	0.00
.6 TO .7	0	0.00	0	0.00	1	2.94	0	0.00	0	0.00	0	0.00
.7 TO .8	0	0.00	1	1.35	1	2.94	0	0.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	1	2.94	1	20.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	1	20.00	0	0.00	0	0.00
1.0 TO 1.1	1	.45	1	1.35	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	1	2.94	0	0.00	0	0.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	222	100.00	74	100.00	34	100.00	5	100.00	0	0.00	0	0.00
MAXIMUM AMT.	1.06		1.10		1.14		.99		0.00		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 16.75 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2754	92.54
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	222	7.46
TOTAL VALID OBSERVATIONS	2976	100.00

	NO.	PCT.
VALID OBSERVATIONS	2976	100.00
INVALID OBSERVATIONS	0	0.00
TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-42

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: JUNE 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)			FREQUENCY DISTRIBITION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 24 HOUR DURATION	
.0	TO	.1	180	78.60	44	58.67	0	0.00	0	0.00	0	0.00	0	0.00
.1	TO	.2	33	14.41	16	21.33	22	68.75	0	0.00	0	0.00	0	0.00
.2	TO	.3	5	2.18	5	6.67	5	15.63	4	57.14	0	0.00	0	0.00
3	TO	.4	4	1.75	4	5.33	1	3.13	1	14.29	0	0.00	0	0.00
.4	TO	.5	2	.87	2	2.67	1	3.13	0	0.00	0	0.00	0	0.00
.5	TO	.6	3	1.31	2	2.67	0	0.00	2	28.57	0	0.00	0	0.00
.6	TO	.7	2	.87	1	1.33	2	6.25	0	0.00	0	0.00	0	0.00
.7	TO	.8	0	0.00	1	1.33	1	2.94	0	0.00	0	0.00	0	0.00
.8	TO	.9	0	0.00	0	0.00	1	2.94	1	20.00	0	0.00	0	0.00
.9	TO	1.0	0	0.00	0	0.00	0	0.00	1	20.00	0	0.00	0	0.00
1.0	TO	1.1	1	.45	1	1.35	0	0.00	0	0.00	0	0.00	0	0.00
1.1	TO	1.2	0	0.00	0	0.00	1	2.94	0	0.00	0	0.00	0	0.00
1.2	TO	1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3	TO	1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4	TO	1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5	TO	1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6	TO	1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7	TO	1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8	TO	1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9	TO	2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0	TO	2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2	TO	2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4	TO	2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6	TO	2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8	TO	3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0	TO	3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2	TO	3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4	TO	3.6	0	0.00	0	0.00	.0	0.00	0	0.00	0	0.00	0	0.00
3.6	TO	3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8	TO	4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0	TO	4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5	TO	5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0	TO	5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5	TO	6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0	TO	6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5	TO	7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0	TO	7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
7.5	TO	8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0	TO	9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0	TO	10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0	TO	11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0	TO	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	GT	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL			229	100.00	75	100.00	32	100.00	7	100.00	1	0.00	0	0.00
MAXIMUM AMT.			.67		.71		.99		.60		.48		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 19.29 INCHES

	NO.	PCT.		NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2651	92.05	VALID OBSERVATIONS	2880	100.00
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	229	7.95	INVALID OBSERVATIONS	0	0.00
TOTAL VALID OBSERVATIONS	2880	100.00	TOTAL OBSERVATIONS	2880	100.00

TABLE 2.3-43

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: JULY 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)			FREQUENCY DISTRIBITION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 24 HOUR DURATION	
.0	TO	.1	128	72.73	14	33.33	0	0.00	0	0.00	0	0.00	0	0.00
.1	TO	.2	34	19.32	15	35.71	8	40.00	0	0.00	0	0.00	0	0.00
.2	TO	.3	3	1.70	3	7.14	4	20.00	1	33.33	0	0.00	0	0.00
3	TO	.4	3	1.70	6	14.29	4	20.00	1	14.29	0	0.00	0	0.00
.4	TO	.5	1	.57	0	0.00	1	5.00	0	0.00	0	0.00	0	0.00
.5	TO	.6	2	1.14	0	0.00	0	0.00	1	33.33	0	0.00	0	0.00
.6	TO	.7	1	.57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.7	TO	.8	1	.57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.8	TO	.9	1	.57	1	2.38	0	0.00	0	0.00	0	0.00	0	0.00
.9	TO	1.0	0	0.00	1	2.38	0	0.00	0	0.00	0	0.00	0	0.00
1.0	TO	1.1	1	.57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1	TO	1.2	0	0.00	1	2.38	2	10.00	0	0.00	0	0.00	0	0.00
1.2	TO	1.3	0	0.00	1	2.38	0	0.00	0	0.00	0	0.00	0	0.00
1.3	TO	1.4	0	0.00	0	0.00	1	5.00	0	0.00	0	0.00	0	0.00
1.4	TO	1.5	0	0.00	0	0.00	0	0.00	1	33.33	0	0.00	0	0.00
1.5	TO	1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6	TO	1.7	1	.57	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7	TO	1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8	TO	1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9	TO	2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0	TO	2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2	TO	2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4	TO	2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6	TO	2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8	TO	3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0	TO	3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2	TO	3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4	TO	3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6	TO	3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8	TO	4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0	TO	4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5	T0	5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0	TO	5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5	TO	6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0	TO	6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5	TO	7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0	TO	7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
7.5	TO	8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0	TO	9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0	TO	10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0	TO	11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0	TO	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	GT	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL			176	100.00	42	100.00	20	100.00	3	100.00	0	0.00	0	0.00
MAXIMUM AMT.			1.61		1.22		1.38		1.46		0.00		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 18.90 INCHES

	NO.	PCT.		NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2799	94.08	VALID OBSERVATIONS	2975	99.97
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	176	5.92	INVALID OBSERVATIONS	1	.03
TOTAL VALID OBSERVATIONS	2975	100.00	TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-44

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: AUGUST 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	152	83.06	29	58.00	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	19	10.38	7	14.00	12	50.00	0	0.00	0	0.00	0	0.00
.2 TO .3	6	3.28	4	8.00	4	16.67	2	50.00	0	0.00	0	0.00
.3 TO .4	3	1.64	5	10.00	4	16.67	0	0.00	0	0.00	0	0.00
.4 TO .5	1	.55	1	2.00	0	0.00	0	0.00	0	0.00	0	0.00
.5 TO .6	0	0.00	2	4.00	0	0.00	1	25.00	0	0.00	0	0.00
.6 TO .7	1	.55	0	0.00	0	0.00	1	25.00	0	0.00	0	0.00
.7 TO .8	0	0.00	0	0.00	2	8.33	0	0.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	1	2.00	1	4.17	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	1	.55	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	1	2.00	0	0.00	0	0.00	0	0.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	1	4.17	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	183	100.00	50	100.00	24	100.00	4	100.00	0	0.00	0	0.00
MAXIMUM AMT.	1.06		1.14		1.30		.68		0.00		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 14.37 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2793	93.85
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	183	6.15
TOTAL VALID OBSERVATIONS	2976	100.00

	NO.	PCT.
VALID OBSERVATIONS	2976	100.00
INVALID OBSERVATIONS	0	0.00
TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-45

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: SEPTEMBER 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)			FREQUENCY DISTRIBITION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 24 HOUR DURATION	
.0	TO	.1	225	76.01	47	41.59	0	0.00	0	0.00	0	0.00	0	0.00
.1	TO	.2	37	12.50	31	27.43	27	49.09	0	0.00	0	0.00	0	0.00
.2	TO	.3	14	4.73	7	6.19	4	12.73	1	6.25	0	0.00	0	0.00
3	TO	.4	8	2.70	10	8.85	4	7.27	3	18.75	0	0.00	0	0.00
.4	TO	.5	6	2.03	5	4.42	0	1.82	1	6.25	0	0.00	0	0.00
.5	TO	.6	4	1.35	5	4.42	0	10.91	1	6.25	1	33.33	0	0.00
.6	TO	.7	0	0.00	2	1.77	0	3.64	2	12.50	0	0.00	0	0.00
.7	TO	.8	1	.34	3	2.65	2	7.27	1	6.25	0	0.00	0	0.00
.8	TO	.9	0	0.00	1	.88	0	5.45	1	6.25	0	0.00	0	0.00
.9	TO	1.0	0	0.00	0	0.00	1	0.00	1	25.00	0	0.00	0	0.00
1.0	TO	1.1	0	.34	1	.88	0	0.00	4	6.25	0	0.00	0	0.00
1.1	TO	1.2	0	0.00	0	0.00	0	0.00	1	0.00	0	0.00	0	0.00
1.2	TO	1.3	0	0.00	0	0.00	1	1.82	0	0.00	0	0.00	0	0.00
1.3	TO	1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4	TO	1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5	TO	1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6	TO	1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7	TO	1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8	TO	1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9	TO	2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0	TO	2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2	TO	2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4	TO	2.6	1	.34	1	.88	0	0.00	0	0.00	0	0.00	0	0.00
2.6	TO	2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8	TO	3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0	TO	3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2	TO	3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4	TO	3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6	TO	3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8	TO	4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0	TO	4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5	T0	5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0	TO	5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5	TO	6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0	TO	6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5	TO	7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0	TO	7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
7.5	TO	8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0	TO	9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0	TO	10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0	TO	11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0	TO	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	GT	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL			296	100.00	113	100.00	55	100.00	16	100.00	3	0.00	0	0.00
MAXIMUM AMT.			2.56		2.60		1.27		1.11		2.19		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 30.17 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2578	89.70
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	296	10.30
TOTAL VALID OBSERVATIONS	2874	100.00

	NO.	PCT.
VALID OBSERVATIONS	2874	99.79
INVALID OBSERVATIONS	6	.21
TOTAL OBSERVATIONS	2880	100.00

TABLE 2.3-46

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: OCTOBER 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
.0 TO .1	187	82.02	37	47.44	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	29	12.72	27	34.62	21	56.76	0	0.00	0	0.00	0	0.00
.2 TO .3	3	1.32	3	3.85	4	10.81	1	11.11	0	0.00	0	0.00
.3 TO .4	4	1.75	4	5.13	6	16.22	2	22.22	0	0.00	0	0.00
.4 TO .5	2	.88	3	3.85	2	5.41	1	11.11	0	0.00	0	0.00
.5 TO .6	2	.88	3	3.85	1	2.70	0	0.00	0	0.00	0	0.00
.6 TO .7	0	0.00	0	0.00	1	2.70	1	11.11	0	0.00	0	0.00
.7 TO .8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.8 TO .9	1	.44	0	0.00	1	2.70	2	22.22	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	1	11.11	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.2 TO 1.3	0	0.00	1	1.28	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	1	2.70	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	1	11.11	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	228	100.00	78	100.00	37	100.00	9	100.00	2	100.00	0	0.00
MAXIMUM AMT.	.83		1.26		1.50		1.90		2.74		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 17.59 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2748	92.34
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	228	7.66
TOTAL VALID OBSERVATIONS	2976	100.00

	NO.	PCT.
VALID OBSERVATIONS	2976	100.00
INVALID OBSERVATIONS	0	0.00
TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-47

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: NOVEMBER 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)			FREQUENCY DISTRIBITION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBITION OF PRECIPITATION 24 HOUR DURATION	
.0	TO	.1	156	86.67	34	58.62	0	0.00	0	0.00	0	0.00	0	0.00
.1	TO	.2	19	10.56	15	25.86	18	75.00	0	0.00	0	0.00	0	0.00
.2	TO	.3	4	2.22	6	10.34	0	0.00	3	42.86	0	0.00	0	0.00
3	TO	.4	1	.56	3	5.17	5	20.83	1	14.29	0	0.00	0	0.00
.4	TO	.5	0	0.00	0	0.00	1	4.17	0	0.00	0	0.00	0	0.00
.5	TO	.6	0	0.00	0	0.00	0	0.00	1	14.29	0	50.0	0	0.00
.6	TO	.7	0	0.00	0	0.00	0	0.00	1	14.29	0	0.00	0	0.00
.7	TO	.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.8	TO	.9	0	0.00	0	0.00	0	0.00	1	14.29	0	0.00	0	0.00
.9	TO	1.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0	TO	1.1	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00
1.1	TO	1.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.2	TO	1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3	TO	1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4	TO	1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5	TO	1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6	TO	1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7	TO	1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8	TO	1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9	TO	2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0	TO	2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2	TO	2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4	TO	2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6	TO	2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8	TO	3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0	TO	3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2	TO	3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4	TO	3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6	TO	3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8	TO	4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0	TO	4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5	T0	5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0	TO	5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5	TO	6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0	TO	6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5	TO	7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0	TO	7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5	TO	8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0	TO	9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0	TO	10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0	TO	11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0	TO	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	GT	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL			180	100.00	58	100.00	24	100.00	7	100.00	2	0.00	0	0.00
MAXIMUM AMT.			.35		.40		.48		.84		0.00		0.00	
TOTAL PRECIPITATION FOR DATA PERIOD							11.03 INCHES							

	NO.	PCT.		NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	2700	93.75	VALID OBSERVATIONS	2880	100.00
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	180	6.25	INVALID OBSERVATIONS	0	0.00
TOTAL VALID OBSERVATIONS	2880	100.00	TOTAL OBSERVATIONS	2880	100.00

TABLE 2.3-48

FREQUENCY DISTRIBUTION OF PRECIPITATION
DATA PERIOD: DECEMBER 1973-1976

PRECIPITATION CLASS INTERVAL (INCHES)	FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION NO.	PCT.	FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION NO.	PCT.	FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION NO.	PCT.	FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION NO.	PCT.	FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION NO.	PCT.	FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION NO.	PCT.
.0 TO .1	53	68.83	3	12.50	0	0.00	0	0.00	0	0.00	0	0.00
.1 TO .2	15	19.48	12	50.00	5	50.00	0	0.00	0	0.00	0	0.00
.2 TO .3	3	3.90	6	25.00	1	10.00	0	0.00	0	0.00	0	0.00
.3 TO .4	1	1.30	1	4.17	3	30.00	0	0.00	0	0.00	0	0.00
.4 TO .5	2	2.60	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.5 TO .6	0	0.00	0	0.00	0	0.00	3	100.00	0	0.00	0	0.00
.6 TO .7	1	1.30	1	4.17	0	0.00	0	0.00	0	0.00	0	0.00
.7 TO .8	2	2.60	1	4.17	0	0.00	0	0.00	0	0.00	0	0.00
.8 TO .9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
.9 TO 1.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.0 TO 1.1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.1 TO 1.2	0	0.00	0	0.00	1	10.00	0	0.00	1	100.00	0	0.00
1.2 TO 1.3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.3 TO 1.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.4 TO 1.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.5 TO 1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6 TO 1.7	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.7 TO 1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8 TO 1.9	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.9 TO 2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0 TO 2.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.2 TO 2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4 TO 2.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.6 TO 2.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.8 TO 3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0 TO 3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2 TO 3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4 TO 3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6 TO 3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8 TO 4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0 TO 4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5 TO 5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0 TO 5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5 TO 6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0 TO 6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5 TO 7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0 TO 7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5 TO 8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0 TO 9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0 TO 10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0 TO 11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0 TO 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
GT 12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	77	100.00	24	100.00	10	100.00	3	100.00	1	100.00	0	0.00
MAXIMUM AMT.		.75		.79		1.18		.60		1.12		0.00

TOTAL PRECIPITATION FOR DATA PERIOD 8.82 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	1645	95.53
OBSERVATIONS WITH PRECIPITATION GE 0.01 INCH	77	4.47
TOTAL VALID OBSERVATIONS	1722	100.00

	NO.	PCT.
VALID OBSERVATIONS	1722	57.86
INVALID OBSERVATIONS	1254	42.14
TOTAL OBSERVATIONS	2976	100.00

TABLE 2.3-49

FREQUENCY DISTRIBUTION OF PRECEIPITATION
DATA PERIOD: JANUARY 1973 - DECEMBER 1976

PRECIPITATION CLASS INTERVAL (INCHES)			FREQUENCY DISTRIBUTION OF PRECIPITATION 1 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 2 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 3 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 6 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 12 HOUR DURATION		FREQUENCY DISTRIBUTION OF PRECIPITATION 24 HOUR DURATION	
.0	TO	.1	1993	82.15	385	48.25	0	0.00	0	0.00	0	0.00	0	0.00
.1	TO	.2	298	12.28	255	31.95	220	60.11	0	0.00	0	0.00	0	0.00
.2	TO	.3	53	2.18	53	6.64	54	14.75	19	22.89	0	0.00	0	0.00
3	TO	.4	33	1.36	47	5.89	38	10.38	18	21.69	0	0.00	0	0.00
.4	TO	.5	17	.70	14	1.75	11	3.01	6	7.23	1	7.69	0	0.00
.5	TO	.6	12	.49	20	2.51	13	3.55	13	15.66	3	23.08	0	0.00
.6	TO	.7	6	.25	4	.50	8	2.19	7	8.43	0	0.00	0	0.00
.7	TO	.8	5	.21	7	.88	7	1.91	5	6.02	1	7.69	0	0.00
.8	TO	.9	2	.08	2	.25	5	1.37	5	6.02	0	0.00	0	0.00
.9	TO	1.0	1	.04	2	.25	2	.55	3	3.61	0	0.00	0	0.00
1.0	TO	1.1	3	.12	3	.38	0	0.00	4	4.82	0	0.00	0	0.00
1.1	TO	1.2	1	.04	2	.25	4	1.09	1	1.20	4	30.77	0	0.00
1.2	TO	1.3	0	0.00	3.	.38	2	.55	0	0.00	0	0.00	0	0.00
1.3	TO	1.4	0	0.00	0	0.00	1	.27	0	0.00	0	0.00	0	0.00
1.4	TO	1.5	0	0.00	0	0.00	1	.27	1	1.20	0	0.00	0	0.00
1.5	TO	1.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.6	TO	1.7	1	.04	0	0.00	0	0.00	0	0.00	1	7.69	0	0.00
1.7	TO	1.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1.8	TO	1.9	0	0.00	0	0.00	0	0.00	1	1.20	0	0.00	0	0.00
1.9	TO	2.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.0	TO	2.2	0	0.00	0	0.00	0	0.00	0	0.00	1	7.69	0	0.00
2.2	TO	2.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2.4	TO	2.6	1	.04	1	.13	0	0.00	0	0.00	0	0.00	0	0.00
2.6	TO	2.8	0	0.00	0	0.00	0	0.00	0	0.00	1	7.69	0	0.00
2.8	TO	3.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.0	TO	3.2	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.2	TO	3.4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.4	TO	3.6	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.6	TO	3.8	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
3.8	TO	4.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.0	TO	4.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
4.5	TO	5.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.0	TO	5.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5.5	TO	6.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.0	TO	6.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
6.5	TO	7.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.0	TO	7.5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
7.5	TO	8.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
8.0	TO	9.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
9.0	TO	10.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10.0	TO	11.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11.0	TO	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	GT	12.0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL			2426	100.00	798	100.00	366	100.00	83	100.00	13	100.00	0	0.00
MAXIMUM AMT.			2.56		2.60		1.50		1.90		2.74		0.00	

TOTAL PRECIPITATION FOR DATA PERIOD 191.33 INCHES

	NO.	PCT.
OBSERVATIONS WITH NO PRECIPITATION	31326	92.81
OBSERVATIONS WITH PRECIPITATION GE 0.01NCH	2426	7.19
TOTAL VALID OBSERVATIONS	33752	100.00

	NO.	PCT.
VALID OBSERVATIONS	33752	96.26
INVALLID OBSERVATIONS	1312	3.74
TOTAL OBSERVATIONS	35064	100.00

TABLE 2.3-50

PRECIPITATION WIND ROSE
JANUARY 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	8 3.88	8 3.88	0 0.00	0 0.00	0 0.00	0 0.00	16 7.77	1.53
NE	7 3.40	6 2.91	0 0.00	0 0.00	0 0.00	0 0.00	13 6.31	1.56
ENE	6 2.91	4 1.94	0 0.00	0 0.00	0 0.00	0 0.00	10 4.85	1.44
E	3 1.46	6 2.91	0 0.00	0 0.00	0 0.00	0 0.00	9 4.37	2.09
ESE	10 4.85	8 3.88	2 .97	0 0.00	0 0.00	0 0.00	20 9.71	1.70
SE	4 1.94	4 1.94	0 0.00	2 .97	0 0.00	0 0.00	10 4.85	2.38
SSE	7 3.40	5 2.43	1 .49	1 .49	0 0.00	0 0.00	14 6.80	1.89
S	7 3.40	5 2.43	3 1.46	0 0.00	0 0.00	0 0.00	15 7.28	2.03
SSW	4 1.94	2 .97	5 2.43	4 1.94	0 0.00	0 0.00	15 7.28	3.69
SW	4 1.94	4 1.94	3 1.46	0 0.00	0 0.00	0 0.00	11 5.34	2.05
	3 1.46	4 1.94	4 1.94	2 .97	0 0.00	0 0.00	13 6.31	3.29
W	9 4.37	0 0.00	4 1.94	3 1.46	0 0.00	0 0.00	16 7.77	2.70
WNW	6 2.91	2 .97	0 0.00	1 .49	0 0.00	0 0.00	9 4.37	1.83
NW	10 4.85	1 .49	0 0.00	0 0.00	0 0.00	0 0.00	11 5.34	1.25
NNW	7 3.40	0 0.00	1 .49	0 0.00	0 0.00	0 0.00	8 3.88	1.32
N	7 3.40	7 3.40	0 0.00	0 0.00	0 0.00	0 0.00	14 6.80	1.51
CALM	2 .97						2 .97	CALM
TOTAL	104 50.49	66 32.04	23 11.17	13 6.31	0 0.00	0 0.00	206 100.00	2.03

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	206	6.92	PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2112	70.97	PCT.
NUMBER OF INVALID OBSERVATIONS	658	22.11	PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00	PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		14.08	INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-51

PRECIPITATION WIND ROSE
FEBRUARY 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES (METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	12 7.50	5 3.12	0 0.00	0 0.00	0 0.00	0 0.00	17 10.62	1.32
NE	2 1.25	4 2.50	0 0.00	0 0.00	0 0.00	0 0.00	6 3.75	1.87
ENE	6 3.75	5 3.12	2 1.25	0 0.00	0 0.00	0 0.00	13 8.12	1.96
E	4 2.50	2 1.25	3 1.87	0 0.00	0 0.00	0 0.00	9 5.62	2.10
ESE	5 3.12	2 1.25	0 0.00	0 0.00	0 0.00	0 0.00	7 4.37	1.26
SE	5 3.12	6 3.75	1 .62	1 .62	0 0.00	0 0.00	13 8.12	2.05
SSE	7 4.37	2 1.25	4 2.50	0 0.00	0 0.00	0 0.00	13 8.12	2.05
S	2 1.25	4 2.50	1 .62	6 3.75	2 1.25	0 0.00	15 9.37	4.55
SSW	3 1.87	1 .62	4 2.50	6 3.75	0 0.00	0 0.00	14 8.75	4.37
SW	3 1.87	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	3 1.87	.83
WSW	4 2.50	2 1.25	2 1.25	0 0.00	0 0.00	0 0.00	8 5.00	2.06
W	1 .62	0 0.00	2 1.25	1 .62	0 0.00	0 0.00	4 2.50	3.87
WNW	3 1.87	6 3.75	1 .62	0 0.00	0 0.00	0 0.00	10 6.25	1.95
NW	2 1.25	9 5.62	1 .62	0 0.00	0 0.00	0 0.00	12 7.50	2.13
NNW	1 .62	2 1.25	1 .62	0 0.00	0 0.00	0 0.00	4 2.50	2.17
N	9 5.62	3 1.87	0 0.00	0 0.00	0 0.00	0 0.00	12 7.50	1.21
CALM	0 0.00						0 0.00	CALM
TOTAL	69 43.12	53 33.12	22 13.75	14 8.75	2 1.25	0 0.00	160 100.00	2.33

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	160	5.90 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	1951	71.94 PCT.
NUMBER OF INVALID OBSERVATIONS	601	22.16 PCT.
TOTAL NUMBER OF OBSERVATIONS	2712	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		8.92 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-52

PRECIPITATION WIND ROSE
FEBRUARY 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES (METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	3 1.36	6 2.71	0 0.00	0 0.00	0 0.00	0 0.00	9 4.07	1.92
NE	2 2.26	12 5.43	2 .90	3 1.36	0 0.00	0 0.00	22 9.95	2.71
ENE	3 1.36	11 4.98	6 2.71	1 .45	0 0.00	0 0.00	21 9.50	2.70
E	7 3.17	8 3.62	9 4.07	2 .90	0 0.00	0 0.00	26 11.76	2.92
ESE	3 1.36	4 1.81	4 1.81	0 0.00	0 0.00	0 0.00	11 4.98	2.41
SE	3 1.36	6 2.71	3 1.36	0 0.00	0 0.00	0 0.00	12 5.43	2.14
SSE	3 1.36	2 .90	0 0.00	1 .45	0 0.00	0 0.00	6 2.71	1.97
S	5 2.26	4 1.81	2 .90	2 .90	0 0.00	0 0.00	13 5.88	2.53
SSW	7 3.17	2 .90	3 1.36	1 .45	0 0.00	0 0.00	13 5.88	2.23
SW	5 2.26	4 1.81	0 0.00	1 .45	0 0.00	0 0.00	10 4.52	1.92
WSW	3 1.36	5 2.26	2 .90	5 2.26	0 0.00	0 0.00	15 6.79	3.21
W	8 3.62	2 .90	7 3.17	7 3.17	0 0.00	0 0.00	24 10.86	3.43
WNW	4 1.81	0 0.00	1 .45	4 1.81	1 .45	0 0.00	10 4.52	4.20
NW	5 2.26	0 0.00	2 .90	0 0.00	0 0.00	0 0.00	7 3.17	1.60
NNW	2 .90	6 2.71	1 .45	1 .45	0 0.00	0 0.00	10 4.52	2.62
N	2 .90	3 1.36	1 .45	4 1.81	0 0.00	0 0.00	10 4.52	3.73
CALM	2 .90						2 .90	CALM
TOTAL	70 31.67	75 33.94	43 19.46	32 14.48	1 .45	0 0.00	221 100.00	2.72

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	221	7.43 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2730	91.73 PCT
NUMBER OF INVALID OBSERVATIONS	25	.84 PCT.
TOTAL NUMBER OF OBSERVATIONS	2979	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		14.62 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-53

PRECIPITATION WIND ROSE
APRIL 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES (METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	4 1.79	14 6.25	8 3.57	0 0.00	0 0.00	0 0.00	26 11.161	2.53
NE	4 1.79	10 4.46	32 14.29	0 0.00	0 0.00	0 0.00	46 20.54	3.25
ENE	3 1.34	5 2.23	4 1.79	3 1.34	0 0.00	0 0.00	15 6.70	3.23
E	4 1.79	4 1.79	4 1.79	0 0.00	0 0.00	0 0.00	12 5.36	2.26
ESE	4 1.79	1 .45	1 .45	0 0.00	0 0.00	0 0.00	6 2.68	1.83
SE	2 .89	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 .89	.80
SSE	6 2.68	2 .89	0 0.00	1 .45	0 0.00	0 0.00	9 4.02	1.81
S	7 3.12	1 ..45	3 1.34	1 .45	0 0.00	0 0.00	12 5.36	2.29
SSW	5 2.23	1 .45	2 .89	0 0.00	0 0.00	0 0.00	8 3.57	1.85
SW	7 3.12	4 1.79	1 .45	0 0.00	0 0.00	0 0.00	12 5.36	1.51
WSW	4 1.79	16 7.14	5 2.23	2 .89	0 0.00	0 0.00	27 12.05	2.70
W	4 1.79	4 1.79	8 3.57	1 .45	0 0.00	0 0.00	17 7.59	3.02
WNW	0 0.00	2 .89	7 3.12	3 1.34	0 0.00	0 0.00	12 5.36	4.34
NW	1 .45	0 0.00	4 1.79	1 .45	0 0.00	0 0.00	6 2.68	3.42
NNW	1 .45	2 .89	3 1.34	2 .89	0 0.00	0 0.00	8 3.57	3.69
N	2 .89	2 .89	1 .45	0 0.00	0 0.00	0 0.00	5 2.23	1.98
CALM	1 .45						1 .45	CALM
TOTAL	59 26.34	68 30.36	83 37.05	14 6.25	0 0.00	0 0.00	224 100.00	2.75

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	224	7.78 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2604	90.42 PCT.
NUMBER OF INVALID OBSERVATIONS	52	1.81 PCT.
TOTAL NUMBER OF OBSERVATIONS	2880	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		14.92 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-54

PRECIPITATION WIND ROSE
MAY 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	4 1.80	5 2.25	0 0.00	0 0.00	0 0.00	0 0.00	9 4.05	1.58
NE	5 2.25	10 4.50	1 .45	0 0.00	0 0.00	0 0.00	16 7.21	1.90
ENE	10 4.50	7 3.15	0 0.00	0 0.00	0 0.00	0 0.00	17 7.66	1.52
E	7 3.15	5 2.25	0 0.00	0 0.00	0 0.00	0 0.00	12 5.41	1.44
ESE	5 2.25	3 1.35	0 0.00	0 0.00	0 0.00	0 0.00	8 3.60	1.36
SE	5 2.25	1 .45	0 0.00	0 0.00	0 0.00	0 0.00	6 2.70	1.17
SSE	9 4.05	10 4.50	4 1.80	0 0.00	0 0.00	0 0.00	23 10.36	2.00
S	8 3.60	4 1.80	4 1.80	0 0.00	0 0.00	0 0.00	16 7.21	2.08
SSW	8 3.60	2 .90	2 .90	0 0.00	0 0.00	0 0.00	12 5.41	1.66
SW	8 3.60	10 4.50	0 0.00	0 0.00	0 0.00	0 0.00	18 8.11	1.67
WSW	4 1.80	8 3.60	3 1.35	0 0.00	0 0.00	0 0.00	15 6.76	2.46
W	8 3.60	13 5.86	6 2.70	5 2.25	0 0.00	0 0.00	32 14.41	2.82
WNW	6 2.70	3 1.35	2 .90	0 0.00	0 0.00	0 0.00	11 4.95	1.94
NW	3 1.35	4 1.80	0 0.00	0 0.00	0 0.00	0 0.00	7 3.15	2.06
NNW	5 2.25	3 1.35	1 .45	1 .45	0 0.00	0 0.00	10 4.50	2.06
N	5 2.25	4 1.80	0 0.00	0 0.00	0 0.00	0 0.00	9 4.05	1.54
CALM	1 .45						1 .45	CALM
TOTAL	101 45.50	92 41.44	23 10.36	6 2.70	0 0.00	0 0.00	222 100.00	1.95

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	222	7.46 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2705	90.89 PCT.
NUMBER OF INVALID OBSERVATIONS	49	1.65 PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		16.75 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-55

PRECIPITATION WIND ROSE
JUNE 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	7 3.18	4 1.82	0 0.00	0 0.00	0 0.00	0 0.00	11 5.00	1.43
NE	19 8.64	9 4.09	3 1.36	0 0.00	0 0.00	0 0.00	31 14.09	1.62
ENE	11 5.00	12 5.45	1 .45	0 0.00	0 0.00	0 0.00	24 10.91	1.77
E	17 7.73	10 4.55	1 .45	0 0.00	0 0.00	0 0.00	28 12.73	1.47
ESE	4 1.82	4 1.82	1 .45	0 0.00	0 0.00	0 0.00	9 4.09	1.89
SE	1 .45	8 3.64	0 0.00	0 0.00	0 0.00	0 0.00	9 4.09	1.81
SSE	7 3.18	4 1.82	0 0.00	0 0.00	0 0.00	0 0.00	11 5.00	1.30
S	8 3.64	2 .91	2 .91	0 0.00	0 0.00	0 0.00	12 5.45	1.55
SSW	4 1.82	3 1.36	0 0.00	0 0.00	0 0.00	0 0.00	7 3.18	1.59
SW	11 5.00	5 2.27	0 0.00	0 0.00	0 0.00	0 0.00	16 7.27	1.48
WSW	8 3.64	8 3.64	2 .91	0 0.00	0 0.00	0 0.00	18 8.18	1.68
W	9 4.09	9 4.09	3 1.36	0 0.00	0 0.00	0 0.00	21 9.55	1.95
WNW	4 1.82	2 .91	1 .45	0 0.00	0 0.00	0 0.00	7 3.18	1.86
NW	3 1.36	1 .45	0 0.00	0 0.00	0 0.00	0 0.00	4 1.82	1.15
NNW	5 2.27	2 .91	0 0.00	0 0.00	0 0.00	0 0.00	7 3.18	1.29
N	2 .91	1 .45	1 .45	0 0.00	0 0.00	0 0.00	4 1.82	1.97
CALM	1 .45						1 .45	CALM
TOTAL	121 55.00	84 38.18	15 6.82	0 0.00	0 0.00	0 0.00	220 100.00	1.62

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	220	7.64 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2452	85.14 PCT.
NUMBER OF INVALID OBSERVATIONS	208	7.22 PCT.
TOTAL NUMBER OF OBSERVATIONS	2880	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		18.49 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-56

PRECIPITATION WIND ROSE
JULY 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	6 3.41	1 .57	1 .57	0 0.00	0 0.00	0 0.00	8 4.55	1.35
NE	11 6.25	6 3.41	1 .57	0 0.00	0 0.00	0 0.00	18 10.23	1.48
ENE	8 4.55	4 2.27	0 0.00	0 0.00	0 0.00	0 0.00	12 6.82	1.19
E	11 6.25	2 1.14	0 0.00	0 0.00	0 0.00	0 0.00	13 7.39	1.10
ESE	2 1.14	3 1.70	0 0.00	0 0.00	0 0.00	0 0.00	5 2.84	1.54
SE	2 1.14	1 .57	0 0.00	0 0.00	0 0.00	0 0.00	3 1.70	1.23
SSE	1 .57	1 .57	1 .57	0 0.00	0 0.00	0 0.00	3 1.70	2.07
S	3 1.70	4 2.27	0 0.00	0 0.00	0 0.00	0 0.00	7 3.98	1.83
SSW	9 5.11	5 2.84	0 0.00	0 0.00	0 0.00	0 0.00	14 7.95	1.36
SW	9 5.11	3 1.70	0 0.00	0 0.00	0 0.00	0 0.00	12 6.82	1.37
WSW	7 3.98	4 2.27	4 2.27	0 0.00	0 0.00	0 0.00	15 8.52	2.13
W	6 3.41	5 2.84	9 5.11	1 .57	0 0.00	0 0.00	21 11.93	2.86
WNW	11 6.25	0 0.00	4 2.27	0 0.00	0 0.00	0 0.00	15 8.52	1.63
NW	3 1.70	1 .57	4 2.27	0 0.00	0 0.00	0 0.00	8 4.55	2.42
NNW	5 2.84	3 1.70	3 1.70	1 .57	0 0.00	0 0.00	12 6.82	2.43
N	3 1.70	6 3.41	0 0.00	0 0.00	0 0.00	0 0.00	9 5.11	1.91
CALM	1 .57						1 .57	CALM
TOTAL	98 55.68	49 27.84	27 15.34	2 1.14	0 0.00	0 0.00	176 100.00	1.79

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	176	5.91 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2798	94.02 PCT.
NUMBER OF INVALID OBSERVATIONS	2	.07 PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		18.90 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-57

PRECIPITATION WIND ROSE
AUGUST 1973 - 1976

WIND SECTOR	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
	WIND SPEED CATEGORIES(METERS PER SECOND)							
NNE	7	10	1	0	0	0	18	1.79
	3.83	5.46	.55	0.00	0.00	0.00	9.84	
NE	8	12	4	0	0	0	24	1.98
	4.37	6.56	2.19	0.00	0.00	0.00	13.11	
ENE	9	2	2	0	0	0	13	1.51
	4.92	1.09	1.09	0.00	0.00	0.00	7.10	
E	8	3	0	0	0	0	11	1.17
	4.37	1.64	0.00	0.00	0.00	0.00	6.01	
ESE	15	3	0	0	0	0	18	1.11
	8.20	1.64	0.00	0.00	0.00	0.00	9.84	
SE	4	0	0	0	0	0	4	.92
	2.19	0.00	0.00	0.00	0.00	0.00	2.19	
SSE	0	0	0	0	0	0	0	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
S	3	0	0	0	0	0	3	.70
	1.64	0.00	0.00	0.00	0.00	0.00	1.64	
SSW	7	1	0	0	0	0	8	1.10
	3.83	.55	0.00	0.00	0.00	0.00	4.37	
SW	12	11	0	0	0	0	23	1.55
	6.56	6.01	0.00	0.00	0.00	0.00	12.57	
WSW	2	11	2	0	0	0	15	2.17
	1.09	6.01	1.09	0.00	0.00	0.00	8.20	
W	7	10	3	0	0	0	20	2.12
	3.83	5.46	1.64	0.00	0.00	0.00	10.93	
WNW	7	1	1	0	0	0	9	1.20
	3.83	.55	.55	0.00	0.00	0.00	4.92	
NW	1	2	0	0	0	0	3	1.63
	.55	1.09	0.00	0.00	0.00	0.00	1.64	
NNW	2	2	0	0	0	0	4	1.37
	1.09	1.09	0.00	0.00	0.00	0.00	2.19	
N	7	1	1	0	0	0	9	1.49
	3.83	.55	.55	0.00	0.00	0.00	4.92	
CALM	1						1	CALM
	.55						.55	
TOTAL	100	69	14	0	0	0	183	1.60
	54.64	37.70	7.65	0.00	0.00	0.00	100.00	

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	183	6.15	PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2791	93.78	PCT.
NUMBER OF INVALID OBSERVATIONS	2	.07	PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00	PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		14.37	INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-58

PRECIPITATION WIND ROSE
SEPTEMBER 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES (METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	18	18	2	1	0	0	39	1.77
	6.08	6.08	.68	.34	0.00	0.00	13.18	
NE	22	30	8	0	0	0	60	1.98
	7.43	10.14	2.70	0.00	0.00	0.00	20.27	
ENE	16	15	11	0	0	0	42	2.13
	5.41	5.07	3.72	0.00	0.00	0.00	14.19	
E	13	9	5	1	0	0	28	1.93
	4.39	3.04	1.69	.34	0.00	0.00	9.46	
ESE	6	3	0	0	0	0	9	1.38
	2.03	1.01	0.00	0.00	0.00	0.00	3.04	
SE	4	1	0	0	0	0	5	1.00
	1.35	.34	0.00	0.00	0.00	0.00	1.69	
SSE	8	0	0	0	0	0	8	.96
	2.70	0.00	0.00	0.00	0.00	0.00	2.70	
S	5	1	0	0	0	0	6	.88
	1.69	.34	0.00	0.00	0.00	0.00	2.03	
SSW	11	3	1	0	0	0	15	1.13
	3.72	1.01	.34	0.00	0.00	0.00	5.07	
SW	8	10	2	0	0	0	20	1.82
	2.70	3.38	.68	0.00	0.00	0.00	6.76	
WSW	3	10	2	0	0	0	15	2.05
	1.10	3.38	.68	0.00	0.00	0.00	5.07	
W	4	8	3	0	0	0	15	2.15
	1.35	2.70	1.01	0.00	0.00	0.00	5.07	
WNW	3	3	0	0	0	0	6	1.68
	1.01	1.01	0.00	0.00	0.00	0.00	2.03	
NW	4	2	0	0.	0	0	6	1.17
	1.35	.68	0.00	0.00	0.00	0.00	2.03	
NNW	5	0	0	0	0	0	5	1.12
	1.69	0.00	0.00	0.00	0.00	0.00	1.69	
N	5	5	0	0	0	0	10	1.48
	1.69	1.69	0.00	0.00	0.00	0.00	3.38	
CALM	7						7	CALM
	2.36						2.36	
TOTAL	142	118	34	2	0	0	296	1.74
	47.97	39.86	11.49	.68	0.00	0.00	100.00	

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	296	10.28 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2574	89.28 PCT.
NUMBER OF INVALID OBSERVATIONS	10	.35 PCT.
TOTAL NUMBER OF OBSERVATIONS	2880	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		30.17 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-59

PRECIPITATION WIND ROSE
OCTOBER 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	8 3.52	19 8.37	4 1.76	0 0.00	0 0.00	0 0.00	31 13.66	2.18
NE	12 5.29	26 11.45	14 6.17	0 0.00	0 0.00	0 0.00	52 22.91	2.31
ENE	10 4.41	15 6.61	3 1.32	1 .44	0 0.00	0 0.00	29 12.78	2.08
E	13 5.73	4 1.76	0 0.00	6 2.64	0 0.00	0 0.00	23 10.13	2.64
ESE	4 1.76	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	4 1.76	.87
SE	2 .88	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 .88	1.05
SSE	2 .88	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 .88	.80
S	5 2.20	1 .44	0 0.00	0 0.00	0 0.00	0 0.00	6 2.64	1.03
SSW	7 3.08	2 .88	0 0.00	0 0.00	0 0.00	0 0.00	9 3.96	1.36
SW	3 1.32	3 1.32	0 0.00	0 0.00	0 0.00	0 0.00	6 2.64	1.63
WSW	7 3.08	4 1.76	7 3.08	3 1.32	0 0.00	0 0.00	21 9.25	2.97
W	2 .88	1 .44	2 .88	2 .88	0 0.00	0 0.00	7 3.08	3.16
WNW	5 2.20	3 1.32	0 0.00	2 .88	0 0.00	0 0.00	10 4.41	2.20
NW	0 0.00	3 1.32	1 .44	0 0.00	0 0.00	0 0.00	4 1.76	2.62
NNW	4 1.76	1 .44	1 .44	0 0.00	0 0.00	0 0.00	6 2.64	1.57
N	7 3.08	3 1.32	4 1.76	0 0.00	0 0.00	0 0.00	14 6.17	2.11
CALM	1 .44						1 .44	CALM
TOTAL	92 40.53	85 37.44	36 15.86	14 6.17	0 0.00	0 0.00	227 100.00	2.20

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	227	7.63	PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2732	91.80	PCT.
NUMBER OF INVALID OBSERVATIONS	17	.57	PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00	PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		17.55	INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-60

PRECIPITATION WIND ROSE
NOVEMBER 1973 - 1976

WIND SECTOR	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
	WIND SPEED CATEGORIES(METERS PER SECOND)							
NNE	5 (2.91)	4 (2.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	9 (5.23)	1.64
NE	4 (2.33)	4 (2.33)	1 (.58)	0 (0.00)	0 (0.00)	0 (0.00)	9 (5.23)	1.74
ENE	8 (4.65)	4 (2.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	12 (6.98)	1.27
E	4 (2.33)	1 (.58)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	5 (2.91)	.96
ESE	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0.00
SE	3 (1.74)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.74)	.73
SSE	6 (3.49)	2 (1.16)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	8 (4.65)	1.22
S	7 (4.07)	12 (6.98)	2 (1.16)	2 (1.16)	0 (0.00)	0 (0.00)	23 (13.37)	2.33
SSW	5 (2.91)	5 (2.91)	2 (1.16)	0 (0.00)	0 (0.00)	0 (0.00)	12 (6.98)	1.91
SW	9 (5.23)	4 (2.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	13 (7.56)	1.44
WSW	8 (4.65)	8 (4.65)	14 (8.14)	7 (4.07)	0 (0.00)	0 (0.00)	37 (21.51)	3.33
W	7 (4.07)	3 (1.74)	10 (5.81)	0 (0.00)	0 (0.00)	0 (0.00)	20 (11.63)	2.46
WNW	1 (.58)	0 (0.00)	2 (1.16)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.74)	3.53
NW	0 (0.00)	0 (0.00)	1 (.58)	0 (0.00)	0 (0.00)	0 (0.00)	1 (.58)	3.80
NNW	1 (.58)	2 (1.16)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.74)	1.93
N	9 (5.23)	2 (1.16)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	11 (6.40)	1.20
CALM	3 (1.74)						3 (1.74)	CALM
TOTAL	80 (46.51)	51 (29.65)	32 (18.60)	9 (5.23)	0 (0.00)	0 (0.00)	172 (100.00)	2.11

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	172	5.97 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	2552	88.61 PCT.
NUMBER OF INVALID OBSERVATIONS	156	5.42 PCT.
TOTAL NUMBER OF OBSERVATIONS	2880	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		10.63 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-61

PRECIPITATION WIND ROSE
DECEMBER 1973 - 1976

WIND SECTOR	WIND SPEED CATEGORIES (METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	1 1.30	3 3.90	1 1.30	0 0.00	0 0.00	0 0.00	5 6.49	1.96
NE	0 0.00	14 18.18	2 2.60	0 0.00	0 0.00	0 0.00	16 20.78	2.37
ENE	0 0.00	2 2.60	1 1.30	0 0.00	0 0.00	0 0.00	3 3.90	2.43
E	1 1.30	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 1.30	1.10
ESE	2 2.60	0 0.00	0 0.00	1 1.30	0 0.00	0 0.00	3 3.90	2.40
SE	1 1.30	0 0.00	1 1.30	0 0.00	0 0.00	0 0.00	2 2.60	2.95
SSE	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0.00
S	4 5.19	6 7.79	0 0.00	0 0.00	0 0.00	0 0.00	10 12.99	1.88
SSW	4 5.19	5 6.49	1 1.30	0 0.00	0 0.00	0 0.00	10 12.99	1.85
SW	6 7.79	3 3.90	1 1.30	0 0.00	0 0.00	0 0.00	10 12.99	1.51
WSW	1 1.30	2 2.60	1 1.30	0 0.00	0 0.00	0 0.00	4 5.19	1.85
W	0 0.00	1 1.30	0 0.00	3 3.90	0 0.00	0 0.00	4 5.19	5.60
WNW	2 2.60	1 1.30	0 0.00	2 2.60	0 0.00	0 0.00	5 6.49	2.72
NW	0 0.00	1 1.30	0 0.00	0 0.00	0 0.00	0 0.00	1 1.30	1.80
NNW	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0.00
N	0 0.00	1 1.30	0 0.00	2 2.60	0 0.00	0 0.00	3 3.90	4.83
CALM	0 0.00						0 0.00	CALM
TOTAL	22 28.57	39 50.65	8 10.39	8 10.39	0 0.00	0 0.00	77 100.00	2.35

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	77	2.59 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	1522	51.14 PCT.
NUMBER OF INVALID OBSERVATIONS	1377	46.27 PCT.
TOTAL NUMBER OF OBSERVATIONS	2976	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		8.62 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-62

PRECIPITATION WIND ROSE
JANUARY 1973 - DECEMBER 1976

WIND SECTOR	WIND SPEED CATEGORIES(METERS PER SECOND) 0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL	MEAN SPEED
NNE	83 3.48	97 4.07	17 .71	1 .04	0 0.00	0 0.00	198 8.31	1.84
NE	99 4.15	143 6.00	68 2.85	3 .13	0 0.00	0 0.00	313 13.13	2.20
ENE	90 3.78	86 3.61	30 1.26	5 .21	0 0.00	0 0.00	211 8.85	1.99
E	92 3.86	54 2.27	22 .92	9 .38	0 0.00	0 0.00	177 7.42	1.96
ESE	60 2.52	31 1.30	8 .34	1 .04	0 0.00	0 0.00	100 4.19	1.59
SE	36 1.51	27 1.13	5 .21	3 .13	0 0.00	0 0.00	71 2.98	1.74
SSE	56 2.35	28 1.17	10 .42	3 .13	0 0.00	0 0.00	97 4.07	1.72
S	64 2.68	44 1.85	17 .71	11 .46	2 .08	0 0.00	138 5.79	2.24
SSW	74 3.10	32 1.34	20 .84	11 .46	0 0.00	0 0.00	137 5.75	2.11
SW	85 3.57	61 2.56	7 .29	1 .04	0 0.00	0 0.00	154 6.46	1.61
WSW	54 2.27	82 3.44	48 2.01	19 .80	0 0.00	0 0.00	203 8.52	2.64
W	65 2.73	56 2.35	57 2.39	23 .96	0 0.00	0 0.00	201 8.43	2.75
WNW	52 2.18	23 .96	19 .80	12 .50	1 .04	0 0.00	107 4.49	2.39
NW	32 1.34	24 1.01	13 .55	1 .04	0 0.00	0 0.00	70 2.94	1.96
NNW	38 1.59	23 .96	11 .46	5 .21	0 0.00	0 0.00	77 3.23	2.08
N	58 2.43	38 1.59	8 .34	6 .25	0 0.00	0 0.00	110 4.61	1.88
CALM	20 .84						20 .84	CALM
TOTAL	1058 44.38	849 35.61	360 15.10	114 4.78	3 .13	0 0.00	2384 100.00	2.08

NUMBER OF VALID OBSERVATIONS WITH PRECIPITATION	2384	6.80 PCT.
NUMBER OF VALID OBSERVATIONS WITHOUT PRECIPITATION	29523	84.20 PCT.
NUMBER OF INVALID OBSERVATIONS	3157	9.00 PCT.
TOTAL NUMBER OF OBSERVATIONS	35064	100.00 PCT.
TOTAL AMOUNT OF PRECIPITATION FOR DATA PERIOD		188.22 INCHES

KEY XXX NUMBER OF OCCURRENCES
XXX PERCENT OCCURRENCES

TABLE 2.3-63

HEAVY FOG (VISIBILITY 1/4 MILE OR LESS) AT AVOCA, PA. (Rev. 2.3-11)

Month	YEAR			
	1972	1973	1974	1975
January	3	3	0	3
February	0	0	1	3
March	1	3	1	2
April	2	2	0	1
May	3	3	0	0
June	2	0	1	2
July	5	2	0	0
August	0	1	2	4
September	1	2	7	3
October	3	4	2	0
November	0	1	2	3
December	8	2	0	3
Annual	28	23	16	24

TABLE 2.3-64

JOINT FREQUENTY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (Ref. 2.3-4)

Stability Class A

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.0139	.0205	0	0	0	0	.0345
NNE	.0046	.0068	0	0	0	0	.0115
NE	.0230	.0000	0	0	0	0	.0230
ENE	.0046	.0068	0	0	0	0	.0115
E	.0000	0	0	0	0	0	0
ESE	.0046	.0068	0	0	0	0	.0115
SE	.0000	0	0	0	0	0	0
SSE	.0046	.0068	0	0	0	0	.0115
S	.0254	.0205	0	0	0	0	.0460
SSW	.0093	.0137	0	0	0	0	.0230
SW	.0046	.0068	0	0	0	0	.0115
WSW	.0139	.0205	0	0	0	0	.0345
W	.0186	.0274	0	0	0	0	.0460
SNW	.0093	.0137	0	0	0	0	.0230
NW	.0046	.0068	0	0	0	0	.0115
NNW	.0093	.0137	0	0	0	0	.0230
Total	.1507	.1712	0	0	0	0	

Relative frequency of occurrences of A Stability = .3219
Relative frequency of calms distributed with A Stability = .1301

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-65

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (Ref. 2.3-4)

Stability Class B

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	.2871
N	898	.1507	.1164	0	0	0	.3569
NNE	975	.0548	.0548	0	0	0	.2071
NE	654	.0548	.0616	0	0	0	.1819
ENE	1112	.0411	.0137	0	0	0	.1660
E	768	.0274	.0342	0	0	0	.1385
ESE	516	.0205	0	0	0	0	.0721
SE	528	.0274	.0068	0	0	0	.0870
SSE	424	.0137	.0137	0	0	0	.0698
S	1675	.0890	.0205	0	0	0	.2771
SSW	898	.1507	.0959	0	0	0	.3364
SW	991	.2055	.1507	0	0	0	.4553
WSW	1773	.2877	.2123	0	0	0	.6773
W	2118	.2493	.1301	0	0	0	.6913
WNW	1449	.1918	.1164	0	0	0	.4531
NW	1449	.1986	.0890	0	0	0	.3856
NNW	748	.1096	.1027	0	0	0	.2871
Total	6507	1.9726	1.2192				

Relative frequency of occurrences of B Stability = 4.8425
Relative frequency of calms distributed with B Stability = .5274

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-66

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (Ref. 2.3-4)

Stability Class C

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.0707	.2808	.3014	.0274	0	0	.6803
NNE	.0631	.1164	.0822	.0137	0	0	.2754
NE	.0488	.2055	.0959	.0137	0	0	.3639
ENE	.1069	.2671	.0685	0	0	0	.4425
E	.0712	.1233	.1233	.0068	0	0	.3246
ESE	.0132	.0616	.0411	0	0	0	.1159
SE	.0175	.0274	.0479	0	0	0	.0928
SSE	.0480	.0342	.0411	.0068	0	0	.1302
S	.0556	.1164	.1781	.0753	.0068	0	.1302
SSW	.0326	.1918	.5000	.1096	.00137	0	.8340
SW	.0413	.2055	.7877	.1507	0	0	1.1989
WSW	.0415	.3699	.6164	.1027	0	0	1.1306
W	.0714	.2877	.3630	.0342	0	0	.7563
WNW	.0681	.1712	.3493	.0959	0	0	.6846
NW	.0613	.1781	.3836	.0890	.0068	0	.7188
NNW	.0313	.1781	.4178	.1096	.0068	0	.7347
Total	.8425	2.8151	4.3973	.8356	.0342	0	

Relative frequency of occurrence of C Stability = 8.9247
Relative frequency of calms distributed with C Stability = .3082

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-67

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (Ref. 2.3-4)

Stability Class D

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.4311	1.2808	1.6027	.7671	.0137	0	4.0955
NNE	.2648	.9041	1.0342	.1918	.068	0	2.4018
NE	.2677	1.0068	.8425	.3562	.0205	0	2.4937
ENE	.4100	1.4452	.9863	.4726	.0274	.0137	3.3552
E	.2648	.9041	1.0959	.3973	.0479	0	2.7100
ESE	.1397	.5616	.5616	.1233	.0205	0	1.4068
SE	.1684	.3973	.3493	.1644	.0274	.0068	1.1136
SSE	.1610	.5479	.5205	.4932	.0342	0	1.7568
S	.4506	1.5479	1.8288	1.2945	.1027	.0068	5.2314
SSW	.2837	1.2397	2.7123	1.4658	.0685	.0068	5.7768
SW	.2740	1.2192	3.3082	2.8699	.1507	.0205	7.8425
WSW	.3542	1.1164	1.2945	1.2192	.1164	.0205	4.1213
W	.2210	.9178	.7808	.8562	.1514	.0274	2.9607
WNW	.1836	.5479	1.0753	1.7740	.2949	.0411	3.9165
NW	.1995	.7055	1.8767	2.5822	.2123	.0205	5.5968
NNW	.2344	.6027	1.4589	1.5068	.0616	0	3.8645
Total	4.3082	14.9452	21.3288	16.5342	1.3630	.1644	

Relative frequency occurrence of D Stability = 58.6438
Relative frequency of calms distributed with D Stability = 1.7671

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-68

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (2.3-4)

Stability Class E

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	0	.3904	.4521	0	0	0	.8425
NNE	0	.2329	.0781	0	0	0	.3110
NE	0	.2534	.0479	0	0	0	.3014
ENE	0	.6574	.2945	0	0	0	.9521
E	0	.7055	.6849	0	0	0	1.3904
ESE	0	.3836	.6918	0	0	0	1.0753
SE	0	.2603	.1096	0	0	0	.3699
SSE	0	.4726	.1096	0	0	0	.5822
S	0	1.0753	.5685	0	0	0	1.6438
SSW	0	.6906	.6507	0	0	0	1.2603
SW	0	.3973	.8288	0	0	0	1.2260
WSW	0	.3836	.3014	0	0	0	.6849
W	0	.2123	.2534	0	0	0	.4658
WNW	0	.1575	.3151	0	0	0	.4726
NW	0	.2740	.5137	0	0	0	.7877
NNW	0	.2055	.4178	0	0	0	.6233
Total	0	6.6712	6.4178	0	0	0	

Relative frequency of occurrence of E Stability = 13.0890
Relative frequency of calms distributed with E Stability = 0

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-69

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (2.3-4)

Stability Class F

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.0986	.4247	0	0	0	0	.5232
NNE	.0335	.2466	0	0	0	0	.2800
NE	.0813	.2945	0	0	0	0	.3758
ENE	.2463	1.1096	0	0	0	0	1.3559
E	.2782	1.3356	0	0	0	0	1.6139
ESE	.1387	.8562	0	0	0	0	.9948
SE	.1323	.3836	0	0	0	0	.5158
SSE	.1647	.6164	0	0	0	0	.7811
S	.2420	1.2466	0	0	0	0	1.4886
SSW	.1241	.6644	0	0	0	0	.7885
SW	.0875	.4726	0	0	0	0	.5601
WSW	.1028	.3836	0	0	0	0	.4864
W	.0809	.1918	0	0	0	0	.2727
WNW	.0440	.1918	0	0	0	0	.2358
NW	.0581	.3767	0	0	0	0	.4348
NNW	.0939	.3630	0	0	0	0	.4569
Total	2.0068	9.1575	0	0	0	0	

Relative frequency of occurrence of F Stability = 11.1644
Relative frequency of calms distributed with F Stability = .7877

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observation

TABLE 2.3-70

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (2.3-4)

Stability Class G

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.0976	0	0	0	0	0	.0976
NNE	.0366	0	0	0	0	0	.0366
NE	.1464	0	0	0	0	0	.1464
ENE	.3416	0	0	0	0	0	.3416
E	.6467	0	0	0	0	0	.6467
ESE	.2684	0	0	0	0	0	.2884
SE	.1342	0	0	0	0	0	.1342
SSE	.2562	0	0	0	0	0	.2562
S	.3782	0	0	0	0	0	.3782
SSW	.1586	0	0	0	0	0	.1586
SW	.0732	0	0	0	0	0	.0732
WSW	.1342	0	0	0	0	0	.1342
W	.0732	0	0	0	0	0	.0732
WNW	.0732	0	0	0	0	0	.0732
NW	.0732	0	0	0	0	0	.0732
NWN	.1220	0	0	0	0	0	.1220
Total	3.0137	0	0	0	0	0	

Relative frequency of occurrence of G Stabiity = 3.0137
Relative frequency of calms distributed with G Stability = 1.3219

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-71

JOINT FREQUENCY (%) OF WIND
DIRECTION, WIND SPEED AND STABILITY (2.3-4)

All Stability Classes

Wind Speed (kts)

Sector	0-3	4-6	7-10	11-16	17-21	>21	Total
N	.8291	2.5479	2.4726	.7945	.0137	0	6.6579
NNE	.5271	1.5616	1.3493	.2055	.0068	0	3.6504
NE	.6243	1.8151	1.0479	.3699	.0205	0	3.8778
ENE	1.2294	3.5274	1.3630	.4726	.0274	.0137	6.335
E	1.2417	3.0959	1.9384	.4041	.0479	0	6.7280
ESE	.5947	1.8904	1.2945	.1233	.0205	0	3.9235
SE	.5050	1.0959	.5137	.1644	.0274	.0068	2.3132
SSE	.6638	1.6918	.6840	.5000	.0342	0	3.5747
S	1.3470	4.0959	2.5959	1.3699	.1092	.0068	9.5251
SSW	.7359	2.8699	3.9589	1.5753	.0685	.0068	9.2153
SW	.6186	2.5068	5.0753	3.0205	.1644	.0205	11.4063
WSW	.8230	2.5616	2.4247	1.3219	.1164	.0205	7.2682
W	.6589	1.9863	1.5274	.8904	.1574	.0274	5.2480
WNW	.5098	1.2740	1.8562	1.8699	.2945	.0411	5.8455
NW	.5091	1.7397	2.8630	2.6712	.2192	.0205	8.0228
NNW	.5551	1.4726	2.3973	1.6164	.0685	0	6.1099
Total	11.9726	35.7328	33.3630	17.3699	1.3973	.1644	

Relative frequency of occurrence of observations = 100
Relative frequency of calms distributed above = 4.8425

Wilkes-Barre/Scranton Airport
1971-1975
Three Hourly Observations

TABLE 2.3-72

MIXING HEIGHTS (meters)

Time	Spring	Summer	Autumn	Winter
4 AM-9 PM	706	510	562	774
4 PM-9 PM	1750	1816	1306	979
Other Times	1228	1163	934	877

TABLE 2.3-73

Heights of Meteorological Sensors

200 Foot Primary Tower				
Parameter	60M (849.8' MSL)	10M (685.8' MSL)	SFC (653.21' MSL)	10 Meter Nescopeck[1] Tower 10 Meters
Wind Speed	1	1		1
Wind Direction	1	1		1
Ambient Temperature		1		1[2]
Dew Point Temperature		1		
Temperature Difference (using the 10 m temperature as reference)	2	2		
Precipitation			1	
10 Meter Backup Tower				
Parameter	10 Meters (622.8' MSL)			
Wind Speed	1			
Wind Direction	1			

1. Nescopeck supplemental tower added per PLA-2467.
2. Measurements made at 8' height of tower.

TABLE 2.3-74
METEOROLOGICAL DATA RECOVERY RATES
1998 THROUGH 2003

	1999	2000	2001	2002	2003	5 YR AVG
Wind Speed 10m Primary	99.7	99.8	100.0	99.5	99.6	99.7
Wind Speed 60m Primary	99.7	99.4	99.4	99.5	99.2	99.4
Wind Direction 10m Primary	99.7	100.0	100.0	99.4	99.7	99.8
Wind Direction 60m Primary	99.6	100.0	99.3	99.5	99.7	99.6
Delta Temperature 60-10m A Primary	99.6	99.8	99.3	99.0	99.1	99.4
Temperature 10m Primary	99.6	99.7	99.9	99.6	99.0	99.6
Dew Point 10m Primary	99.3	87.2	98.8	98.6	98.8	96.5
Precipitation	99.7	100.0	100.0	100.0	100.0	99.9
<u>Composite</u>						
Wind Speed 10m, Wind Direction 10m, Delta Temperature 60-10m	99.5	99.7	99.3	99.0	99.0	99.3
Wind Speed 60m, Wind Direction 60m Delta Temperature 60-10m	99.5	99.3	99.2	99.0	98.6	99.1

TABLE 2.3-75

Joint Frequency Distribution

Hours at Each Wind Speed and Direction
Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class A Delta Temperature Extremely Unstable

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	1	0	0	2	3	11	28	4	0	0	0	0	49
NNE	0	0	0	3	1	28	58	4	0	0	0	0	94
NE	0	0	0	7	15	45	23	0	0	0	0	0	90
ENE	0	0	1	8	17	11	4	0	0	0	0	0	41
E	0	0	4	26	8	4	1	0	0	0	0	0	43
ESE	0	1	7	12	7	8	6	0	0	0	0	0	41
SE	0	0	2	6	14	33	20	0	0	0	0	0	75
SSE	0	0	2	6	19	36	14	1	0	0	0	0	78
S	0	0	2	10	28	62	63	1	0	0	0	0	166
SSW	0	0	0	12	38	105	88	4	0	0	0	0	247
SW	0	0	1	10	38	177	261	28	1	0	0	0	516
WSW	0	0	0	4	7	29	125	35	2	0	0	0	202
W	0	0	0	1	2	4	48	5	0	0	0	0	60
WNW	0	0	0	1	2	6	12	0	0	0	0	0	21
NW	0	0	0	0	1	0	6	3	0	0	0	0	10
NNW	0	0	0	1	0	1	12	4	0	0	0	0	18
Totals	1	1	19	109	200	560	769	89	3	0	0	0	1751

Wind Speed (m/s)

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	1751
Total Hours for the Period	43823

TABLE 2.3-76

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	1	0	1	5	9	42	8	0	0	0	0	66
NNE	0	0	0	3	20	47	34	3	0	0	0	0	107
NE	0	0	0	12	16	46	24	0	0	0	0	0	98
ENE	0	0	1	24	13	10	2	0	0	0	0	0	50
E	0	0	9	15	7	10	3	0	0	0	0	0	44
ESE	0	0	4	11	14	5	5	0	0	0	0	0	39
SE	0	0	2	10	11	16	11	0	0	0	0	0	50
SSE	0	0	0	4	11	11	6	0	0	0	0	0	32
S	0	0	2	11	14	38	21	0	0	0	0	0	86
SSW	0	0	1	11	39	55	28	3	0	0	0	0	137
SW	0	0	0	4	36	105	175	31	4	0	0	0	355
WSW	0	0	1	1	7	23	100	43	2	0	0	0	177
W	0	0	0	0	1	8	34	4	0	0	0	0	47
WNW	0	0	0	0	1	1	18	1	0	0	0	0	21
NW	0	0	0	0	1	5	10	2	0	0	0	0	18
NNW	0	0	0	0	4	8	19	3	2	0	0	0	36
Totals	0	1	20	107	200	397	532	98	8	0	0	0	1363

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	1363
Total Hours for the Period	43823

TABLE 2.3-77

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	0	0	3	7	23	73	6	0	0	0	0	112
NNE	0	0	1	8	21	52	59	6	0	0	0	0	147
NE	0	0	0	12	24	45	20	0	0	0	0	0	101
ENE	0	0	2	25	20	14	4	0	0	0	0	0	65
E	0	1	7	19	8	8	3	0	0	0	0	0	46
ESE	0	1	6	15	16	10	3	0	0	0	0	0	51
SE	1	0	7	9	17	13	11	0	0	0	0	0	58
SSE	0	1	4	12	18	21	12	0	0	0	0	0	68
S	0	0	4	26	28	50	28	0	0	0	0	0	136
SSW	0	0	1	24	35	76	17	2	0	0	0	0	155
SW	0	0	1	18	43	146	186	37	1	0	0	0	432
WSW	0	0	1	3	11	38	139	61	7	0	0	0	260
W	0	0	0	8	7	7	51	21	1	0	0	0	95
WNW	0	0	0	0	2	14	31	1	0	0	0	0	48
NW	0	0	1	0	3	9	30	4	0	0	0	0	47
NNW	0	0	0	1	1	19	31	16	2	0	0	0	70
Totals	1	3	35	183	261	545	698	154	11	0	0	0	1891

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	1891
Total Hours for the Period	43823

TABLE 2.3-78

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	2	7	23	74	119	433	716	98	0	0	0	0	1472
NNE	1	16	64	214	267	519	324	15	0	0	0	0	1420
NE	9	33	119	276	281	418	164	6	0	0	0	0	1306
ENE	8	51	130	219	153	158	54	3	0	0	0	0	776
E	10	85	158	202	124	119	32	5	0	0	0	0	735
ESE	15	67	144	144	117	146	58	7	3	1	0	0	702
SE	7	53	110	219	169	200	121	14	1	0	0	0	894
SSE	10	38	74	163	158	179	89	9	1	0	0	0	721
S	3	26	84	210	204	257	106	7	0	0	0	0	897
SSW	0	15	54	220	242	368	139	2	0	0	0	0	1040
SW	1	8	29	193	242	594	864	170	7	0	0	0	2108
WSW	0	3	15	87	132	254	627	425	90	1	0	0	1634
W	0	1	6	38	80	196	396	172	35	0	0	0	924
WNW	0	2	4	23	49	157	314	108	19	0	0	0	676
NW	1	2	11	31	45	225	632	178	6	0	0	0	1131
NNW	0	4	8	33	52	268	752	280	8	0	0	0	1405
Totals	67	411	1033	2346	2434	4491	5388	1499	170	2	0	0	17841

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	17841
Total Hours for the Period	43823

TABLE 2.3-79

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period

Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	1	14	28	90	138	144	53	2	0	0	0	0	470
NNE	3	33	112	324	269	254	79	1	0	0	0	0	1075
NE	13	124	289	551	197	159	54	0	0	0	0	0	1387
ENE	20	279	467	493	87	29	7	3	0	0	0	0	1385
E	41	378	361	154	33	29	5	0	0	0	0	0	1001
ESE	45	265	207	99	30	24	8	5	0	0	0	0	683
SE	37	201	229	152	48	50	23	10	4	0	0	0	754
SSE	19	109	183	213	95	63	40	6	0	0	0	0	728
S	10	75	216	413	193	151	49	18	0	0	0	0	1125
SSW	3	42	126	397	334	309	84	4	0	0	0	0	1299
SW	2	14	39	188	209	343	210	10	1	0	0	0	1016
WSW	0	4	12	64	80	83	61	14	3	0	0	0	321
W	2	1	9	36	33	37	19	4	0	0	0	0	141
WNW	0	2	7	16	23	34	13	0	0	0	0	0	95
NW	1	2	4	19	42	87	24	2	0	0	0	0	181
NNW	0	5	6	21	41	116	35	2	0	0	0	0	226
Totals	197	1548	2295	3230	1852	1912	764	81	8	0	0	0	11887

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	11887
Total Hours for the Period	43823

TABLE 2.3-80

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	1	5	6	25	11	5	2	0	0	0	0	0	55
NNE	5	21	34	66	32	9	1	0	0	0	0	0	168
NE	13	92	198	257	50	1	1	0	0	0	0	0	612
ENE	21	361	806	994	149	6	0	0	0	0	0	0	2337
E	44	371	356	149	9	0	0	0	0	0	0	0	929
ESE	23	160	122	15	0	0	0	0	0	0	0	0	320
SE	14	82	82	25	2	0	0	0	0	0	0	0	205
SSE	8	32	78	49	6	1	0	0	0	0	0	0	174
S	2	29	78	121	14	1	1	0	0	0	0	0	246
SSW	1	16	24	81	37	4	1	0	0	0	0	0	164
SW	1	4	15	38	21	19	2	0	0	0	0	0	100
WSW	0	0	5	6	4	3	1	0	0	0	0	0	19
W	2	2	3	5	0	1	0	0	0	0	0	0	13
WNW	1	0	0	2	2	1	0	0	0	0	0	0	6
NW	0	0	2	1	1	2	1	0	0	0	0	0	7
NNW	1	0	3	2	5	2	2	0	0	0	0	0	15
Totals	137	1175	1812	1836	343	55	12	0	0	0	0	0	5370

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	5370
Total Hours for the Period	43823

TABLE 2.3-81

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Stability Class G Delta Temperature Extremely Stable

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	1	2	2	3	1	0	0	0	0	0	0	0	9
NNE	1	16	17	17	3	1	0	0	0	0	0	0	55
NE	2	71	168	162	19	1	0	0	0	0	0	0	423
ENE	8	167	690	1065	186	4	0	0	0	0	0	0	2120
E	13	120	219	102	3	0	0	0	0	0	0	0	457
ESE	4	63	55	9	0	0	0	0	0	0	0	0	131
SE	3	31	35	12	2	1	0	0	0	0	0	0	84
SSE	0	14	23	15	3	0	0	0	0	0	0	0	55
S	0	5	12	17	0	0	0	0	0	0	0	0	34
SSW	1	2	8	7	5	1	0	0	0	0	0	0	24
SW	0	2	3	1	0	1	0	0	0	0	0	0	7
WSW	0	1	0	0	0	0	0	0	0	0	0	0	1
W	0	0	0	0	0	1	0	0	0	0	0	0	1
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	1	0	0	0	0	0	0	0	0	0	0	1
NNW	0	2	0	1	0	0	0	0	0	0	0	0	3
Totals	33	497	1232	1411	222	10	0	0	0	0	0	0	3405

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	3405
Total Hours for the Period	43823

Table 2.3-82

Joint Frequency Distribution

Hours at Each Wind Speed and Direction
Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 10M SPD Direction: 10M WD Lapse: DT60-10

Summary of All Stability Classes Delta Temperature

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	6	29	59	198	284	625	914	118	0	0	0	0	2233
NNE	10	86	228	635	613	910	555	29	0	0	0	0	3066
NE	37	320	774	1277	602	715	286	60	0	0	0	0	4017
ENE	57	858	2097	2828	625	232	71	6	0	0	0	0	6774
E	108	955	1114	667	192	170	44	5	0	0	0	0	3255
ESE	87	557	545	305	184	193	80	12	3	1	0	0	1967
SE	62	367	467	433	263	313	186	24	5	0	0	0	2120
SSE	37	194	364	462	310	311	161	16	1	0	0	0	1856
S	15	135	398	808	481	559	268	26	0	0	0	0	2690
SSW	5	75	214	752	730	918	357	1	0	0	0	0	3066
SW	4	28	88	452	589	1385	1698	276	14	0	0	0	4534
WSW	0	8	34	165	241	430	1053	578	104	1	0	0	2614
W	4	4	18	88	123	254	548	206	36	0	0	0	1281
WNW	1	4	11	42	79	213	388	110	19	0	0	0	867
NW	2	5	18	51	93	328	703	189	6	0	0	0	1395
NNW	1	11	17	59	103	414	851	305	12	0	0	0	1773
Totals	436	3636	6446	9222	5512	7970	8163	1921	200	2	0	0	43508

Number of Calm Hours for this Table	18
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	297
Number of Valid Hours for this Table	1751
Total Hours for the Period	43823

Table 2.3-83

This Table Intentionally Left Blank

TABLE 2.3-84

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00- 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse:DT60-10

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	0	0	0	1	2	30	12	4	0	0	0	49
NNE	0	0	0	0	1	14	45	32	7	0	0	0	99
NE	1	0	1	11	16	23	47	11	3	0	0	0	113
ENE	0	2	2	11	12	9	3	0	1	0	0	0	40
E	0	0	2	5	9	5	1	0	1	0	0	0	23
ESE	0	0	2	6	4	8	5	5	0	0	0	0	30
SE	0	0	1	3	4	7	27	18	1	0	0	0	61
SSE	0	0	0	2	3	11	33	17	1	0	0	0	67
S	0	1	3	5	6	24	46	55	10	1	0	0	151
SSW	0	0	0	6	13	49	85	62	22	0	0	0	237
SW	0	0	0	8	12	49	239	169	28	1	0	0	506
WSW	0	0	0	2	2	13	85	121	34	3	0	0	260
W	0	0	0	1	2	0	26	40	3	0	0	0	72
WNW	0	0	0	0	1	1	5	9	0	0	0	0	16
NW	0	0	1	0	0	0	1	6	0	0	0	0	8
NNW	0	0	0	0	0	1	7	9	0	0	0	0	17
Totals	1	3	12	60	86	216	685	566	115	5	0	0	1749

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	1749
Total Hours for the Period	43823

TABLE 2.3-85

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00- 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
					Wind Speed (m/s)								
N	0	0	0	1	3	8	27	27	3	0	0	0	69
NNE	0	0	0	4	10	22	57	19	5	0	0	0	117
NE	0	0	4	11	22	30	33	12	1	0	0	0	113
ENE	0	0	2	9	8	15	5	1	0	0	0	0	40
E	0	0	3	7	4	9	4	2	1	0	0	0	30
ESE	0	0	2	4	8	5	11	2	0	0	0	0	32
SE	0	0	1	6	0	10	12	10	2	0	0	0	41
SSE	0	0	0	0	1	4	20	5	0	0	0	0	30
S	0	0	0	3	6	10	28	22	3	0	0	0	72
SSW	0	0	2	2	11	31	47	25	13	1	0	0	132
SW	0	0	0	2	10	51	145	101	28	4	0	0	341
WSW	0	0	0	0	2	6	67	86	55	1	0	0	217
W	0	0	0	0	0	3	21	28	6	0	0	0	58
WNW	0	0	0	0	0	2	8	7	0	0	0	0	17
NW	0	0	0	0	3	2	13	5	1	0	0	0	24
NNW	0	0	0	0	1	3	10	12	1	1	0	0	28
Totals	0	0	14	49	89	211	508	364	119	7	0	0	1361

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	1361
Total Hours for the Period	43823

TABLE 2.3-86

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00- 12/31/03 23:00 Total Period

Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	0	0	2	6	9	45	43	1	0	0	0	106
NNE	0	0	0	9	18	30	74	37	5	0	0	0	173
NE	0	0	4	10	8	31	32	11	1	0	0	0	97
ENE	0	2	6	13	11	21	7	4	0	0	0	0	64
E	0	1	3	13	9	5	5	1	0	0	0	0	37
ESE	0	1	1	1	4	10	11	3	0	0	0	0	31
SE	0	0	3	6	7	14	16	8	2	0	0	0	56
SSE	0	1	1	3	7	10	15	7	3	0	0	0	47
S	0	0	5	9	11	23	37	23	6	0	0	0	114
SSW	0	0	0	15	18	52	57	27	9	0	0	0	178
SW	0	0	0	3	15	69	187	77	31	1	0	0	383
WSW	0	0	0	1	7	18	88	140	78	7	0	0	339
W	0	0	0	1	2	4	24	51	20	1	0	0	103
WNW	0	1	0	1	0	5	28	12	1	0	0	0	48
NW	0	0	0	0	0	3	26	12	2	0	0	0	43
NNW	0	0	0	87	124	310	683	480	165	9	0	0	68
Totals	0	6	23	87	124	310	683	480	165	9	0	0	1887

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	1887
Total Hours for the Period	43823

TABLE 2.3-87

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class D Delta Temperature Neutral

	Wind Speed (m/s)												
Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	6	5	45	52	159	578	343	50	0	0	0	1238
NNE	4	6	33	124	154	289	584	283	46	2	0	0	1525
NE	1	25	82	183	131	288	455	139	16	1	0	0	1321
ENE	3	26	60	106	83	169	143	35	3	3	0	0	631
E	4	28	50	71	60	146	156	26	14	1	0	0	556
ESE	1	26	39	52	51	107	170	54	12	1	3	0	516
SE	2	20	45	75	53	130	241	82	22	8	0	0	678
SSE	2	13	41	88	59	115	258	88	26	7	0	0	697
S	1	15	39	115	76	105	221	122	44	5	0	0	743
SSW	1	9	32	131	156	202	255	192	66	4	0	0	1048
SW	1	2	23	112	187	405	625	403	110	5	0	0	1873
WSW	0	2	9	26	70	177	583	849	678	99	9	0	2502
W	2	5	2	7	23	77	361	423	230	34	5	0	1169
WNW	0	1	3	8	13	75	329	238	107	7	0	0	781
NW	1	2	3	5	9	81	531	482	98	1	0	0	1213
NNW	0	2	3	23	18	86	550	506	133	0	0	0	1321
Totals	23	188	469	1171	1195	2611	6040	4265	1655	178	17	0	17812

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	17812
Total Hours for the Period	43823

TABLE 2.3-88

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	16	28	57	93	197	190	25	1	0	0	0	607
NNE	2	19	66	254	364	482	331	101	12	0	0	0	1631
NE	4	51	139	373	200	277	277	82	6	0	0	0	1409
ENE	9	50	112	139	84	140	73	7	1	3	0	0	618
E	9	54	87	107	61	71	76	10	2	1	0	0	478
ESE	5	48	70	78	36	62	63	11	7	2	0	0	382
SE	6	33	61	103	63	68	85	30	16	7	0	0	472
SSE	4	37	71	130	61	132	163	38	22	5	0	0	663
S	5	24	75	141	108	154	242	81	42	14	1	0	887
SSW	5	8	47	126	136	183	434	190	59	2	1	0	1191
SW	1	14	33	108	136	324	579	213	29	1	1	0	1439
WSW	0	6	17	42	85	157	419	384	57	3	0	0	1170
W	0	3	11	22	26	57	81	29	8	1	0	0	238
WNW	0	2	2	6	11	68	77	6	0	0	0	0	172
NW	0	3	5	15	13	49	168	35	3	0	0	0	291
NNW	1	6	10	14	14	54	118	15	0	1	0	0	233
Totals	51	374	834	1715	1491	2475	3376	1257	265	40	3	0	11881

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	11881
Total Hours for the Period	43823

TABLE 2.3-89

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class F Delta Temperature Moderately Stable

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	2	3	13	47	82	176	37	3	0	0	0	0	363
NNE	0	16	33	269	503	677	100	0	0	0	0	0	1598
NE	7	28	97	340	243	154	34	0	0	0	0	0	903
ENE	8	28	87	132	47	20	3	0	0	0	0	0	325
E	7	20	65	101	36	15	4	1	0	0	0	0	249
ESE	3	26	55	64	23	9	2	0	0	0	0	0	182
SE	1	20	45	90	24	13	5	0	0	0	0	0	198
SSE	1	8	29	87	30	22	12	1	0	0	0	0	190
S	1	8	17	82	53	57	33	1	0	0	0	0	252
SSW	1	4	16	41	72	97	80	8	1	0	0	0	320
SW	0	4	3	31	44	128	142	16	1	0	0	0	369
WSW	0	2	5	8	14	22	124	65	2	0	0	0	242
W	0	3	3	6	5	11	6	0	0	0	0	0	34
WNW	0	2	2	2	7	8	5	0	0	0	0	0	26
NW	0	1	2	5	7	20	11	2	0	0	0	0	48
NNW	0	1	4	10	11	14	10	1	0	0	0	0	51
Totals	31	174	476	1315	1201	1443	608	98	4	0	0	0	5350

Wind Speed (m/s)

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	5350
Total Hours for the Period	43823

TABLE 2.3-90

Joint Frequency Distribution

Hours at Each Wind Speed and Direction
Period of Record = 01/01/99 1:00 - 12/31/03 23:00 Total Period
Elevation:Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	0	3	6	29	62	163	42	0	0	0	0	0	305
NNE	1	6	21	169	418	365	39	0	0	0	0	0	1019
NE	3	11	53	226	208	108	12	0	0	0	0	0	621
ENE	0	10	53	105	45	20	3	0	0	0	0	0	236
E	1	8	50	84	10	10	1	0	0	0	0	0	164
ESE	2	14	31	68	19	5	3	0	0	0	0	0	142
SE	0	4	26	66	16	12	1	0	0	0	0	0	125
SSE	1	5	19	47	32	10	1	1	0	0	0	0	116
S	0	3	11	41	47	60	18	2	0	0	0	0	182
SSW	0	1	4	23	31	72	49	6	0	0	0	0	186
SW	0	0	5	16	24	70	48	5	0	0	0	0	168
WSW	0	0	3	4	8	9	25	13	1	0	0	0	63
W	0	0	1	3	1	1	1	0	0	0	0	0	7
WNW	0	0	1	3	0	6	3	0	0	0	0	0	13
NW	1	1	0	4	3	8	6	0	0	0	0	0	23
NNW	0	0	0	4	0	14	7	0	0	0	0	0	25
Totals	9	66	284	892	924	933	259	27	1	0	0	0	3395

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	3395
Total Hours for the Period	43823

TABLE 2.3-91

Joint Frequency Distribution

Hours at Each Wind Speed and Direction
Period of Record = 01/01/99 1:00- 12/31/03 23:00 Total Period
Elevation: Speed: 60M SPD Direction: 60M WD Lapse: DT60-10

Summary of All Stability Classes Delta Temperature

Wind Direction From	0.23 0.50	0.51- 0.75	0.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	> 18.0	Total
N	2	28	52	181	299	714	949	453	59	0	0	0	2737
NNE	7	47	153	829	1468	1879	1230	472	75	2	0	0	6162
NE	16	115	380	1154	828	911	890	255	27	1	0	0	4577
ENE	20	118	322	515	290	394	237	47	5	6	0	0	1954
E	21	111	260	388	189	261	247	40	18	2	0	0	1537
ESE	11	115	200	273	145	206	265	75	19	3	3	0	1315
SE	9	77	182	349	167	254	387	148	43	15	0	0	1631
SSE	8	64	161	357	193	304	502	157	52	12	0	0	1810
S	7	51	150	396	307	433	625	306	105	20	1	0	2401
SSW	7	22	101	344	437	686	1007	510	170	7	1	0	3292
SW	2	20	64	280	428	1096	1965	984	227	12	1	0	5079
WSW	0	10	34	83	188	402	1391	1658	905	113	9	0	4793
W	2	11	17	40	59	153	520	571	267	36	5	0	1681
WNW	0	6	8	20	32	165	455	272	108	7	0	0	1073
NW	2	7	11	29	35	163	756	542	104	1	0	0	1650
NNW	1	9	17	51	45	178	733	567	140	2	0	0	1743
Totals	115	811	2112	5289	5110	8199	12159	7057	2324	239	20	0	43435

Number of Calm Hours for this Table	3
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	385
Number of Valid Hours for this Table	43435
Total Hours for the Period	43823

Table 2.3-92

SUMMARY OF SHORT-TERM X/Q (SEC/M3) RESULTS AT 549 METER EAB				
Period of Record	Data Source	1-hour 5% Direction Independent	1-hour 5% Direction Dependent	1-hour 5% Direction Independent
1999	SSES Tower	6.5E-4	8.4E-4	1.2E-4
2000	SSES Tower	6.5E-4	8.2E-4	1.3E-4
2001	SSES Tower	6.6E-4	8.3E-4	1.4E-4
2002	SSES Tower	6.6E-4	8.4E-4	1.2E-4
2003	SSES Tower	4.9E-4	7.9E-4	1.2E-4
5-Year Combined	SSES Tower	6.5E-4	8.3E-4	1.3E-4

Table 2.3-93

1999 Probability values for 1 hour at SSES EAB

Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	DIRECTION															
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
3.50E-09	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.00E-08	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
2.50E-08	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
7.00E-08	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.00E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.50E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
2.20E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
3.20E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
4.80E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
7.00E-07	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.00E-06	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.50E-06	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
2.00E-06	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
3.00E-06	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.0626	0.0313	0.0177	0.0306	0.0393
4.00E-06	0.0616	0.0747	0.0962	0.1615	0.0758	0.0447	0.0445	0.0366	0.0519	0.0665	0.1017	0.0611	0.0307	0.0177	0.0306	0.0393
5.00E-06	0.0616	0.0739	0 096	0.1615	0.0758	0.0446	0.0444	0.0366	0.0518	0.0663	0.0997	0.0572	0.0289	0.0169	0.0304	0.0393
7.00E-06	0.0604	0.0725	0.0947	0.1612	0.0758	0.0446	0.0436	0.036	0.0502	0 063	0 092	0.055	0.0272	0.0166	0.0304	0.0391
8.50E-06	0.0604	0.0719	0.0937	0.1611	0.0757	0.0444	0.0422	0.0358	0 049	0.0614	0.0905	0.0547	0.0272	0.0166	0.0304	0.039
1.00E-05	0.0602	0.0717	0.0935	0.1608	0.0755	0.0444	0.0416	0.0349	0.0481	0.0609	0.0889	0.054	0.0272	0.0166	0.0303	0.039
1.50E-05	0.0596	0.0708	0.0921	0.1601	0.0751	0.0438	0.0414	0.0347	0.0475	0.0602	0.0861	0.0529	0.0263	0.0164	0.03	0.0389
2.00E-05	0.0592	0.0695	0.0916	0.16	0.0743	0.0433	0.0411	0.0347	0.0469	0.0594	0.0836	0.0501	0.0258	0.0159	0.0298	0.0386
2.50E-05	0.0584	0.0688	0.0901	0.1599	0.0741	0.0429	0.0407	0.0344	0.0459	0.0587	0 082	0.049	0.0251	0.0157	0.0297	0.0382
3.00E-05	0.0573	0.0673	0 089	0.1594	0.074	0.0424	0.0404	0.0337	0.0456	0.0579	0.0807	0.0469	0.0237	0.0157	0.0292	0.0381
3.50E-05	0.0571	0.0662	0.0886	0.1592	0.0739	0.0422	0.0403	0.0337	0.0455	0.0575	0.0795	0.0456	0.0233	0.0155	0.029	0.0373
4.00E-05	0.0564	0.0655	0.0882	0.1587	0.0737	0.0421	0.0392	0.0336	0.0453	0.0565	0 078	0.0417	0.0225	0.015	0.0286	0.0347
5.00E-05	0.051	0.0633	0.0872	0.158	0.0728	0.0419	0.0385	0.0326	0.0446	0.0555	0.0739	0.0333	0.0193	0.0136	0.0257	0.0281
6.00E-05	0.0409	0.0603	0.0861	0.1577	0.0725	0.0417	0.0373	0.0325	0.0442	0.0545	0.0653	0.0255	0.015	0.0112	0.0205	0.0212
7.00E-05	0.0325	0.0555	0.0842	0.1569	0.0721	0.0412	0.0365	0.0308	0.0429	0.0534	0.0581	0.0214	0.0119	0.0088	0.0163	0.0164
8.50E-05	0.0214	0.0432	0.0763	0.1538	0.07	0.0383	0.0336	0.0286	0.0397	0.0467	0.0455	0.0167	0.0084	0.0048	0.0095	0.0099
1.00E-04	0.0153	0.0338	0.0679	0.1506	0.0683	0.0359	0.0314	0.0248	0.0351	0.0398	0 038	0.0119	0.0062	0.0036	0.0067	0.0067
1.30E-04	0.0087	0.0201	0.0534	0.1447	0.0647	0.0337	0.0257	0.0195	0.0267	0.0266	0.0185	0.0056	0.0033	0.0017	0.0021	0.0021
1.70E-04	0.0056	0.0144	0 046	0.1399	0.0612	0.031	0.0225	0.0166	0.0224	0.0183	0.0123	0.003	0.0019	0.0009	0.0011	0.0007
2.00E-04	0.0046	0.0111	0.04	0.1356	0.0571	0.0287	0.02	0.0146	0.0188	0.0125	0.0091	0.0021	0.0015	0.0005	0.0007	0.0006
2.50E-04	0.003	0.0071	0.0299	0.1235	0.0531	0.0257	0.0172	0.0112	0.0111	0.0071	0.0041	0.0009	0.0008	0.0002	0.0003	0.0003
3.00E-04	0.0023	0.0052	0.0237	0.1102	0.0479	0.0234	0.0147	0.0094	0.0081	0.0049	0 003	0.0006	0.0006	0	0.0002	0.0002
3.50E-04	0.0016	0.0034	0.0177	0.0935	0.039	0.0171	0.0103	0.0056	0.0058	0.0022	0.0017	0.0005	0.0003	0	0	0.0002
4.00E-04	0.0009	0.0028	0.0144	0.0784	0.0317	0.0142	0.0081	0.0038	0.0036	0 001	0.0011	0.0002	0.0001	0	0	0.0001
5.00E-04	0.0006	0.0022	0.0106	0.0544	0.0259	0.011	0.0056	0.0019	0.0021	0.0005	0.0006	0.0002	0	0	0	0.0001
6.00E-04	0.0006	0.0017	0.0078	0.0268	0.015	0.008	0.0036	0.0011	0.0009	0.0002	0.0002	0	0	0	0	0.0001
7.00E-04	0.0003	0.0009	0 004	0.0133	0.0078	0.0052	0.0021	0.0007	0.0008	0.0002	0.0001	0	0	0	0	0.0001
8.50E-04	0.0001	0.0005	0.0018	0.0046	0.004	0.0029	0.0013	0.0006	0.0003	0.0001	0	0	0	0	0	0.0001
1.00E-03	0.0001	0.0002	0 001	0.0023	0.0025	0.0015	0.0007	0.0001	0.0002	0.0001	0	0	0	0	0	0
1.40E-03	0	0	0.0001	0.0003	0.0003	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-94
2000 Probability values for 1 hour at SSES EAB
Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
3.50E-09	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.00E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
2.50E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
7.00E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.00E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.50E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
2.20E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
3.20E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
4.80E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
7.00E-07	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.00E-06	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.50E-06	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
2.00E-06	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
3.00E-06	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0556	0.0296	0.0235	0.0344	0.0479
4.00E-06	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0438	0.0365	0.0622	0.0669	0.0974	0.0546	0.0295	0.0235	0.0344	0.0479
5.00E-06	0.054	0.0683	0.0977	0.1611	0.0783	0.0403	0.0435	0.0364	0.0618	0.0666	0.095	0.0534	0.029	0.0234	0.0344	0.0479
7.00E-06	0.0535	0.0663	0.0967	0.161	0.0783	0.0402	0.0434	0.0363	0.0597	0.065	0.089	0.053	0.0288	0.0234	0.0342	0.0479
8.50E-06	0.0534	0.0661	0.0961	0.161	0.0782	0.0401	0.0433	0.0358	0.0589	0.064	0.0866	0.0526	0.0288	0.0234	0.0342	0.0478
1.00E-05	0.0531	0.0656	0.0955	0.1607	0.0782	0.0398	0.043	0.0356	0.0581	0.0634	0.0856	0.0519	0.0283	0.0234	0.0342	0.0476
1.50E-05	0.0524	0.0651	0.0944	0.1605	0.0779	0.0394	0.0429	0.0352	0.0574	0.0624	0.0828	0.0499	0.0265	0.0228	0.0339	0.0474
2.00E-05	0.0523	0.064	0.0938	0.16	0.0774	0.0389	0.0427	0.0349	0.0568	0.062	0.0801	0.0485	0.026	0.0226	0.0338	0.0469
2.50E-05	0.0518	0.0634	0.0934	0.1598	0.0773	0.0385	0.0425	0.0347	0.0564	0.061	0.078	0.0475	0.0256	0.0225	0.0338	0.0468
3.00E-05	0.0513	0.0627	0.093	0.1597	0.0771	0.0382	0.0424	0.0345	0.0554	0.0602	0.0766	0.0453	0.0251	0.0223	0.0337	0.0467
3.50E-05	0.0509	0.0623	0.0919	0.1594	0.0771	0.038	0.0422	0.0345	0.0547	0.0589	0.0753	0.0432	0.0244	0.0221	0.0336	0.0465
4.00E-05	0.05	0.0622	0.0912	0.1591	0.0768	0.0377	0.0422	0.0342	0.0546	0.0584	0.0733	0.0393	0.0242	0.021	0.0331	0.0451
5.00E-05	0.0467	0.0615	0.0905	0.1588	0.0767	0.0366	0.0418	0.034	0.0537	0.058	0.0689	0.0315	0.0215	0.0185	0.0303	0.0381
6.00E-05	0.0411	0.0608	0.0897	0.1584	0.0763	0.0362	0.0414	0.0338	0.0527	0.0567	0.0632	0.025	0.0174	0.0158	0.0236	0.0297
7.00E-05	0.0355	0.0588	0.0892	0.1582	0.0758	0.0357	0.041	0.0336	0.0521	0.0561	0.0575	0.0205	0.014	0.0124	0.0168	0.0218
8.50E-05	0.0225	0.049	0.0828	0.1547	0.074	0.0341	0.0394	0.0321	0.0477	0.0513	0.0441	0.0138	0.0079	0.0073	0.0084	0.0112
1.00E-04	0.0175	0.0406	0.0726	0.1514	0.0696	0.0318	0.0361	0.0295	0.043	0.0451	0.0349	0.0097	0.005	0.0042	0.0062	0.0078
1.30E-04	0.0097	0.0297	0.0599	0.1467	0.0651	0.0293	0.0306	0.0248	0.0356	0.0301	0.0177	0.0053	0.0027	0.001	0.0024	0.003
1.70E-04	0.0051	0.0193	0.0495	0.1395	0.0618	0.0269	0.0265	0.021	0.028	0.0207	0.0092	0.0027	0.0016	0.0007	0.0014	0.0018
2.00E-04	0.0039	0.0139	0.0424	0.1317	0.0574	0.0245	0.0224	0.0183	0.0226	0.0144	0.0056	0.0015	0.0009	0.0005	0.0008	0.001
2.50E-04	0.0023	0.009	0.0316	0.1169	0.051	0.0201	0.0183	0.0132	0.0147	0.0086	0.0029	0.0003	0.0007	0.0002	0.0002	0.0005
3.00E-04	0.0011	0.0061	0.0257	0.1024	0.0446	0.0166	0.0152	0.0098	0.0107	0.0057	0.0017	0.0001	0.0006	0.0001	0.0002	0.0002
3.50E-04	0.0007	0.0042	0.0196	0.0813	0.0381	0.014	0.0114	0.0068	0.007	0.003	0.001	0.0001	0.0003	0.0001	0.0001	0.0001
4.00E-04	0.0005	0.003	0.0161	0.0685	0.0311	0.011	0.0091	0.0053	0.0047	0.0023	0.0006	0.0001	0.0003	0.0001	0.0001	0.0001
5.00E-04	0.0002	0.0015	0.0122	0.0438	0.0218	0.0073	0.0058	0.0032	0.0023	0.001	0.0006	0	0.0003	0.0001	0.0001	0
6.00E-04	0.0001	0.0011	0.0079	0.025	0.0148	0.0051	0.0042	0.0017	0.0011	0.0009	0.0002	0	0.0003	0.0001	0	0
7.00E-04	0	0.0008	0.0049	0.013	0.0075	0.0021	0.0025	0.0007	0.0002	0.0006	0	0	0.0001	0.0001	0	0
8.50E-04	0	0.0005	0.0016	0.0031	0.0027	0.001	0.001	0.0001	0.0001	0.0001	0	0	0.0001	0	0	0
1.00E-03	0	0.0002	0.0009	0.0016	0.0014	0.0002	0.0006	0.0001	0	0	0	0	0	0	0	0
1.40E-03	0	0	0.0001	0.0002	0.0001	0	0	0	0	0	0	0	0	0	0	0
2.00E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-95																
2001 Probability values for 1 hour at SSES EAB																
Probability that the X/Q is Greater than the Adjacent Quantized Level																
	DIRECTION															
QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0 00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0 0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
3.50E-09	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0 0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
1.00E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0 0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
2.50E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0 0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
7.00E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0 0507	0.0465	0.0659	0.0674	0.1048	0.0554	0.0296	0.0235	0.0344	0.0479
1.00E-07	0.0508	0.0585	0.0751	0.1698	0.0853	0.0466	0 0506	0.0465	0.0654	0.0669	0.0998	0.0526	0.0284	0.0234	0.0344	0.0478
1.50E-07	0.0485	0.0562	0.0738	0.1697	0.0851	0.0465	0 0496	0.0457	0.0629	0.0645	0.0875	0.0495	0.0264	0.0226	0.0339	0.0476
2.20E-07	0.0482	0.0542	0.0718	0.1685	0.0846	0.0457	0 0473	0.0436	0.0596	0.0591	0.08	0.0485	0.0259	0.0225	0.0338	0.0471
3.20E-07	0.048	0.053	0.0707	0.1672	0.0835	0.0448	0 0455	0.0422	0.0575	0.0569	0.0768	0.0481	0.0258	0.0225	0.0337	0 047
4.80E-07	0.0477	0.0528	0.0698	0.1658	0.0825	0.0442	0.045	0.0417	0.0568	0.0559	0.0756	0.0476	0.0256	0.0225	0.0337	0.0469
7.00E-07	0.0474	0.0524	0.0697	0.1656	0.0818	0.0436	0.045	0.0416	0.0565	0.0558	0.0741	0.0458	0.0251	0.0224	0.0336	0.0467
1.00E-06	0.0454	0.0521	0.0695	0.1656	0.0818	0.0436	0.045	0.0415	0.0561	0.0554	0.0721	0.0445	0.0249	0.0218	0.0334	0.0466
1.50E-06	0.0453	0.052	0.0692	0.1654	0.0815	0.0434	0 0447	0.0415	0.055	0.0545	0.0706	0.042	0.0243	0.0215	0.0333	0.0462
2.00E-06	0.0451	0.0515	0.0688	0.1648	0.0813	0.043	0 0446	0.0413	0.0542	0.054	0.0681	0.0345	0.0229	0.0201	0.0316	0.0418
3.00E-06	0.0322	0.0483	0.0674	0.1633	0.081	0.0429	0.043	0.0404	0.0534	0.0523	0.0545	0.0201	0.0136	0.0116	0.0156	0.0204
4.00E-06	0.02	0.0421	0.0646	0.1624	0.0795	0.0411	0 0394	0.0385	0.0497	0.0485	0.0428	0.0137	0.0072	0.0068	0.008	0.0104
5.00E-06	0.0166	0.0367	0.0622	0.1606	0.0774	0.039	0 0362	0.0348	0.0438	0.0447	0.0374	0.0103	0.005	0.0042	0.0061	0.0078
7.00E-06	0.0129	0.0302	0.0555	0.1564	0.0747	0.0367	0 0324	0.03	0.0386	0.0373	0.0259	0.0058	0.0027	0.0024	0.005	0.0062
8.50E-06	0.0097	0.0243	0.0511	0.1536	0.0721	0.0354	0 0297	0.0264	0.034	0.0307	0.0169	0.0038	0.0019	0.0015	0.0023	0.0029
1.00E-05	0.007	0.0194	0.0473	0.1502	0 07	0.0327	0 0275	0.0241	0.0304	0.0244	0.0133	0.003	0.0017	0.0007	0.0015	0.0019
1.50E-05	0.0032	0.0112	0.0368	0.1387	0.0639	0.0281	0 0217	0.0178	0.0206	0.0118	0.0063	0.0013	0.0008	0.0002	0.0007	0.0008
2.00E-05	0.0018	0.0063	0.0301	0.1264	0.057	0.0238	0 0167	0.0124	0.0129	0.0062	0.0033	0.0002	0.0007	0.0001	0.0002	0.0005
2.50E-05	0.0014	0.0041	0.0243	0.1159	0.0492	0.0198	0 0117	0.0082	0.0086	0.0044	0.0024	0.0002	0.0006	0.0001	0.0002	0.0002
3.00E-05	0.001	0.0028	0.0202	0.1037	0.043	0.0163	0 0093	0.0064	0.0074	0.003	0.0016	0.0001	0.0005	0.0001	0.0002	0.0001
3.50E-05	0.0007	0.0024	0.0162	0.0921	0.0381	0.0132	0 0074	0.0057	0.0062	0.0023	0.0014	0	0.0005	0.0001	0.0001	0
4.00E-05	0.0006	0.0016	0.0139	0.0783	0.0346	0.011	0 0063	0.0044	0.0043	0.0016	0.0011	0	0.0003	0.0001	0	0
5.00E-05	0.0003	0.0011	0.0109	0.0588	0.0284	0.0092	0 0048	0.003	0.0024	0.001	0.0007	0	0.0002	0.0001	0	0
6.00E-05	0.0003	0.0009	0.0077	0.0393	0.0201	0.0067	0 0028	0.0017	0.0014	0.0009	0.0005	0	0.0002	0.0001	0	0
7.00E-05	0.0001	0.0008	0.0051	0.0248	0.0133	0.0046	0 0021	0.0014	0.0008	0.0005	0.0003	0	0.0001	0.0001	0	0
8.50E-05	0.0001	0.0002	0.0029	0.0107	0.0072	0.0018	0 0013	0.0003	0.0001	0.0001	0.0003	0	0.0001	0	0	0
1.00E-04	0.0001	0.0002	0.0016	0.0037	0.0034	0.0017	0 0011	0.0002	0	0	0.0001	0	0	0	0	0
1.30E-04	0	0.0001	0.0001	0.0002	0.0002	0.0001	0 0003	0	0	0	0	0	0	0	0	0
1.70E-04	0	0	0	0.0001	0	0	0	0	0	0	0	0	0	0	0	0
2.00E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-96

2002 Probability values for 1 hour at SSES EAB

Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
3.50E-09	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.00E-08	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
2.50E-08	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
7.00E-08	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.00E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.50E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
2.20E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
3.20E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
4.80E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
7.00E-07	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.00E-06	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.50E-06	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
2.00E-06	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
3.00E-06	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1142	0.0627	0.0314	0.0204	0.0296	0.0398
4.00E-06	0.0491	0.0718	0.0827	0.1446	0.0676	0.0451	0.0424	0.0462	0.0672	0.0821	0.1114	0.061	0.0314	0.0204	0.0295	0.0395
5.00E-06	0.0477	0.0707	0.0827	0.1446	0.0676	0.0447	0.042	0.0458	0.0661	0.0803	0.1064	0.059	0.031	0.0204	0.0295	0.0392
7.00E-06	0.0466	0.0699	0.0823	0.1446	0.0674	0.0447	0.0418	0.0456	0.0655	0.0768	0.1001	0.058	0.0309	0.0204	0.0295	0.039
8.50E-06	0.0465	0.0694	0.0816	0.1446	0.0674	0.0446	0.0418	0.0455	0.0655	0.0756	0.0981	0.0575	0.0309	0.0204	0.0295	0.0388
1.00E-05	0.0463	0.0693	0.0813	0.1443	0.0674	0.0446	0.0418	0.0454	0.0649	0.0752	0.0964	0.0568	0.0307	0.0204	0.0295	0.0386
1.50E-05	0.0451	0.0685	0.0805	0.1437	0.0672	0.0443	0.0417	0.0451	0.0639	0.0741	0.0903	0.0538	0.0303	0.0201	0.0292	0.0378
2.00E-05	0.0441	0.0677	0.0802	0.1436	0.0669	0.0443	0.0414	0.0451	0.0634	0.0727	0.0848	0.0514	0.0299	0.0201	0.029	0.0373
2.50E-05	0.0438	0.0669	0.08	0.1435	0.0667	0.0443	0.0414	0.0447	0.0625	0.0712	0.0825	0.0504	0.0297	0.0201	0.0289	0.0369
3.00E-05	0.0429	0.0663	0.0794	0.1435	0.0666	0.0443	0.041	0.0447	0.0622	0.0707	0.0808	0.0496	0.0287	0.0201	0.0288	0.0365
3.50E-05	0.0427	0.0661	0.0793	0.1433	0.0665	0.044	0.041	0.0443	0.0618	0.07	0.0793	0.0478	0.0277	0.0194	0.0285	0.0362
4.00E-05	0.0423	0.0652	0.0792	0.1432	0.0663	0.0439	0.0408	0.044	0.0612	0.0696	0.0775	0.0451	0.0266	0.0186	0.0277	0.0348
5.00E-05	0.0418	0.0644	0.0786	0.1431	0.0659	0.0433	0.0406	0.0437	0.0604	0.0688	0.0719	0.0372	0.0218	0.0146	0.0234	0.0295
6.00E-05	0.0384	0.0635	0.0782	0.1429	0.0657	0.043	0.04	0.0431	0.0583	0.0676	0.0641	0.0295	0.0173	0.0118	0.0181	0.0235
7.00E-05	0.0338	0.0614	0.0772	0.1428	0.0655	0.0423	0.0388	0.0415	0.0554	0.0651	0.0572	0.0237	0.0148	0.0092	0.0135	0.0184
8.50E-05	0.022	0.0513	0.0716	0.1416	0.064	0.0402	0.0353	0.0362	0.0514	0.0582	0.0414	0.0171	0.0099	0.0047	0.0067	0.0092
1.00E-04	0.0171	0.0432	0.0632	0.1386	0.0618	0.0371	0.0309	0.032	0.0448	0.0482	0.0311	0.0124	0.0061	0.0033	0.0047	0.0074
1.30E-04	0.0091	0.0261	0.0549	0.1349	0.0584	0.0338	0.0258	0.0259	0.0331	0.0288	0.0136	0.0055	0.0029	0.0016	0.0021	0.0033
1.70E-04	0.0054	0.0175	0.0459	0.1306	0.0545	0.0308	0.0224	0.0205	0.0252	0.0165	0.0066	0.0027	0.0018	0.001	0.0009	0.0018
2.00E-04	0.0032	0.0134	0.0399	0.1268	0.052	0.028	0.0194	0.0176	0.0196	0.0114	0.0043	0.0014	0.0014	0.0006	0.0006	0.0015
2.50E-04	0.0022	0.0089	0.032	0.1183	0.0473	0.024	0.0152	0.0127	0.0122	0.007	0.0021	0.0008	0.0005	0.0005	0.0001	0.0007
3.00E-04	0.0016	0.0067	0.0277	0.1093	0.0415	0.0219	0.012	0.0106	0.0082	0.0045	0.0015	0.0003	0	0.0003	0.0001	0.0002
3.50E-04	0.0009	0.005	0.0213	0.0929	0.035	0.0168	0.0093	0.0078	0.0055	0.0028	0.0008	0.0002	0	0.0003	0.0001	0.0002
4.00E-04	0.0007	0.0037	0.0179	0.0801	0.0308	0.0142	0.0074	0.0061	0.0035	0.0017	0.0006	0.0002	0	0.0001	0.0001	0.0002
5.00E-04	0.0005	0.0029	0.0119	0.0568	0.0233	0.0108	0.0046	0.0038	0.0015	0.0007	0.0003	0.0001	0	0	0	0.0001
6.00E-04	0.0003	0.0018	0.0071	0.0329	0.0146	0.0073	0.0031	0.0016	0.0008	0.0005	0.0003	0.0001	0	0	0	0
7.00E-04	0.0002	0.0012	0.0032	0.0145	0.0073	0.0038	0.0017	0.0014	0.0002	0.0001	0.0001	0.0001	0	0	0	0
8.50E-04	0.0001	0.0005	0.0015	0.0041	0.0022	0.0016	0.0006	0.0003	0.0001	0.0001	0.0001	0.0001	0	0	0	0
1.00E-03	0.0001	0.0005	0.0008	0.0014	0.0009	0.0007	0.0003	0.0001	0	0	0	0.0001	0	0	0	0
1.40E-03	0	0	0	0	0.0001	0.0001	0	0	0	0	0	0	0	0	0	0
2.00E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.00E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-97

2003 Probability values for 1 hour at SSES EAB

Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
3.50E-09	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.00E-08	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
2.50E-08	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
7.00E-08	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.00E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.50E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
2.20E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
3.20E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
4.80E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
7.00E-07	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.00E-06	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.50E-06	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
2.00E-06	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
3.00E-06	0.0391	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1002	0.0619	0.0297	0.0214	0.0287	0.0348
4.00E-06	0.039	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0682	0.0974	0.0605	0.0293	0.0213	0.0282	0.034
5.00E-06	0.0384	0.0764	0.1089	0.1414	0.0673	0.0497	0.0612	0.0468	0.0599	0.0674	0.096	0.0592	0.0289	0.021	0.0277	0.0333
7.00E-06	0.038	0.075	0.1082	0.1413	0.0672	0.0496	0.0609	0.0464	0.0584	0.0656	0.0924	0.0575	0.0286	0.0205	0.0277	0.0331
8.50E-06	0.038	0.075	0.1081	0.1412	0.0671	0.0494	0.0609	0.046	0.058	0.0644	0.0908	0.0565	0.0285	0.0203	0.0277	0.0326
1.00E-05	0.038	0.0749	0.1078	0.1411	0.067	0.0493	0.0606	0.0455	0.0573	0.0629	0.0894	0.0559	0.0282	0.0202	0.0277	0.0325
1.50E-05	0.0376	0.0746	0.1073	0.1408	0.0665	0.0491	0.0605	0.045	0.0566	0.0614	0.0867	0.0538	0.0277	0.0195	0.0273	0.032
2.00E-05	0.0372	0.0742	0.1072	0.1406	0.0657	0.049	0.0601	0.0446	0.056	0.0605	0.0847	0.0524	0.0271	0.0194	0.0273	0.0319
2.50E-05	0.037	0.0741	0.1066	0.1406	0.0655	0.0489	0.0601	0.044	0.056	0.0605	0.0838	0.0523	0.0267	0.0191	0.027	0.0316
3.00E-05	0.0365	0.0739	0.1062	0.1405	0.0654	0.0489	0.0597	0.0439	0.0559	0.0601	0.0829	0.0503	0.0257	0.0188	0.0263	0.0314
3.50E-05	0.0364	0.0738	0.1062	0.1404	0.0652	0.0488	0.0594	0.0436	0.0559	0.0597	0.0816	0.0488	0.0254	0.0174	0.026	0.0314
4.00E-05	0.0362	0.0728	0.1059	0.1398	0.0651	0.0486	0.059	0.0435	0.0558	0.0595	0.0805	0.0453	0.024	0.0164	0.0252	0.0307
5.00E-05	0.0348	0.0719	0.1057	0.1395	0.0648	0.0481	0.0584	0.0431	0.0557	0.0591	0.0751	0.0378	0.021	0.0148	0.0216	0.026
6.00E-05	0.0319	0.071	0.105	0.1389	0.0643	0.0473	0.0568	0.0422	0.0549	0.0581	0.0664	0.0312	0.0165	0.0111	0.0164	0.0195
7.00E-05	0.0289	0.0679	0.103	0.1381	0.0634	0.0464	0.0552	0.0413	0.0529	0.0566	0.0566	0.0258	0.013	0.0099	0.0126	0.0145
8.50E-05	0.0201	0.0561	0.0936	0.1357	0.0617	0.0424	0.0485	0.038	0.0483	0.05	0.0379	0.0179	0.0093	0.0071	0.0076	0.0089
1.00E-04	0.0154	0.0493	0.0858	0.1321	0.0602	0.0393	0.042	0.0338	0.0438	0.043	0.0267	0.0129	0.0063	0.0047	0.0054	0.007
1.30E-04	0.0075	0.032	0.0723	0.1269	0.0561	0.034	0.0362	0.0265	0.0317	0.0258	0.0121	0.006	0.0027	0.002	0.0021	0.0023
1.70E-04	0.0041	0.0217	0.0619	0.1229	0.0528	0.0302	0.03	0.0209	0.0243	0.0158	0.006	0.0029	0.0016	0.0009	0.0013	0.0014
2.00E-04	0.003	0.0151	0.0535	0.1168	0.0499	0.0271	0.0252	0.0176	0.0184	0.0112	0.0041	0.0017	0.0013	0.0007	0.0008	0.0009
2.50E-04	0.0015	0.0084	0.0385	0.1037	0.0441	0.0216	0.0195	0.0123	0.01	0.0054	0.0017	0.0009	0.0006	0.0003	0.0005	0.0006
3.00E-04	0.001	0.0045	0.0318	0.0927	0.0368	0.0173	0.0156	0.0083	0.0067	0.0038	0.0006	0.0005	0.0006	0.0001	0.0002	0.0005
3.50E-04	0.0008	0.0027	0.0243	0.0732	0.0297	0.0128	0.0114	0.0052	0.0038	0.0015	0.0003	0.0002	0.0005	0	0.0001	0.0002
4.00E-04	0.0005	0.0021	0.0212	0.0622	0.0258	0.0113	0.0078	0.0038	0.0027	0.001	0.0002	0.0002	0.0005	0	0.0001	0.0001
5.00E-04	0.0002	0.0013	0.0142	0.0411	0.0183	0.0068	0.0045	0.0014	0.0013	0.0008	0	0.0001	0.0005	0	0.0001	0
6.00E-04	0.0001	0.001	0.0093	0.0225	0.0115	0.0035	0.0031	0.0009	0.0008	0.0003	0	0	0.0003	0	0	0
7.00E-04	0	0.0007	0.0051	0.0093	0.0055	0.0018	0.0017	0.0006	0.0002	0	0	0	0.0001	0	0	0
8.50E-04	0	0.0002	0.0012	0.0023	0.0024	0.0008	0.0003	0.0002	0	0	0	0	0.0001	0	0	0
1.00E-03	0	0.0001	0.0003	0.0008	0.0006	0.0003	0.0002	0.0001	0	0	0	0	0.0001	0	0	0
1.40E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.00E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2.3-98
1999 – 2003 Probability Values for 1 hour at SSES EAB
Probability that the X/Q is Greater than the Adjacent Quantized Level

	DIRECTION															
QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1.00E-10	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
3.50E-09	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
1.00E-08	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
2.50E-08	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
7.00E-08	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
1.00E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
1.50E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0419
2.20E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0418
3.20E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0418
4.80E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0418
7.00E-07	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0417
1.00E-06	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0417
1.50-E-06	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0416
2.00E-06	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1042	0.0599	0.0303	0.0213	0.0315	0.0406
3.00E-06	0.0513	0.0705	0.0923	0.1558	0.0749	0.0453	0.0487	0.0426	0.0618	0.0704	0.1040	0.0597	0.0303	0.0213	0.0315	0.0364
4.00E-06	0.0510	0.0702	0.0923	0.1557	0.0749	0.0453	0.0487	0.0426	0.0616	0.0702	0.1022	0.0584	0.0301	0.0213	0.0314	0.0342
5.00E-06	0.0505	0.0695	0.0921	0.1557	0.0749	0.0452	0.0483	0.0424	0.0610	0.0695	0.0992	0.0564	0.0294	0.0210	0.0313	0.0335
7.00E-06	0.0499	0.0682	0.0912	0.1556	0.0748	0.0451	0.0479	0.0420	0.0594	0.0670	0.0929	0.0553	0.0289	0.0209	0.0312	0.0331
8.50E-06	0.0498	0.0678	0.0905	0.1555	0.0747	0.0450	0.0473	0.0416	0.0586	0.0655	0.0906	0.0548	0.0288	0.0208	0.0312	0.0322
1.00E-05	0.0497	0.0676	0.0901	0.1551	0.0747	0.0448	0.0470	0.0411	0.0578	0.0646	0.0891	0.0541	0.0285	0.0208	0.0312	0.0318
1.50E-05	0.0486	0.0669	0.0893	0.1546	0.0742	0.0444	0.0467	0.0407	0.0570	0.0634	0.0857	0.0521	0.0275	0.0203	0.0309	0.0314
2.00E-05	0.0482	0.0660	0.0888	0.1544	0.0736	0.0440	0.0463	0.0404	0.0564	0.0626	0.0826	0.0502	0.0270	0.0201	0.0307	0.0310
2.50E-05	0.0478	0.0654	0.0863	0.1543	0.0734	0.0438	0.0461	0.0401	0.0559	0.0618	0.0809	0.0493	0.0265	0.0200	0.0306	0.0307
3.00E-05	0.0470	0.0646	0.0876	0.1541	0.0732	0.0436	0.0458	0.0399	0.0554	0.0612	0.0794	0.0475	0.0257	0.0198	0.0303	0.0306
3.50E-05	0.0468	0.0642	0.0873	0.1539	0.0731	0.0434	0.0456	0.0396	0.0550	0.0606	0.0779	0.0457	0.0250	0.0193	0.0301	0.0303
4.00E-05	0.0462	0.0636	0.0869	0.1535	0.0730	0.0432	0.0452	0.0394	0.0547	0.0600	0.0763	0.0421	0.0243	0.0184	0.0295	0.0291
5.00E-05	0.0438	0.0626	0.0862	0.1531	0.0726	0.0427	0.0448	0.0389	0.0540	0.0593	0.0716	0.0343	0.0210	0.0160	0.0263	0.0243
6.00E-05	0.0384	0.0614	0.0855	0.1527	0.0721	0.0423	0.0440	0.0384	0.0529	0.0582	0.0642	0.0272	0.0167	0.0131	0.0204	0.0188
7.00E-05	0.0329	0.0585	0.0843	0.1521	0.0717	0.0417	0.0430	0.0375	0.0514	0.0568	0.0570	0.0224	0.0135	0.0105	0.0152	0.0142
8.50E-05	0.0213	0.0485	0.0778	0.1498	0.0699	0.0393	0.0394	0.0347	0.0474	0.0511	0.0425	0.0159	0.0087	0.0062	0.0081	0.0078
1.00E-04	0.0163	0.0406	0.0703	0.1467	0.0675	0.0366	0.0353	0.0310	0.0421	0.0441	0.0334	0.0113	0.0057	0.0040	0.0058	0.0058
1.30E-04	0.0088	0.0268	0.0589	0.1419	0.0637	0.0333	0.0299	0.0253	0.0326	0.0285	0.0160	0.0055	0.0029	0.0015	0.0022	0.0021
1.70E-04	0.0052	0.0181	0.0503	0.1369	0.0603	0.0307	0.0259	0.0205	0.0258	0.0183	0.0090	0.0028	0.0017	0.0008	0.0012	0.0011
2.00E-04	0.0038	0.0132	0.0433	0.1310	0.0571	0.0280	0.0224	0.0177	0.0207	0.0128	0.0061	0.0016	0.0012	0.0006	0.0007	0.0008
2.50E-04	0.0022	0.0080	0.0328	0.1185	0.0515	0.0237	0.0182	0.0129	0.0129	0.0072	0.0030	0.0006	0.0007	0.0003	0.0003	0.0004
3.00E-04	0.0015	0.0054	0.0270	0.1058	0.0454	0.0205	0.0147	0.0099	0.0090	0.0047	0.0017	0.0003	0.0005	0.0001	0.0002	0.0002
3.50E-04	0.0010	0.0036	0.0204	0.0873	0.0378	0.0161	0.0108	0.0068	0.0059	0.0025	0.0011	0.0002	0.0003	0.0001	0.0001	0.0002
4.00E-04	0.0007	0.0027	0.0170	0.0738	0.0318	0.0134	0.0083	0.0050	0.0040	0.0016	0.0007	0.0002	0.0002	0.0001	0.0001	0.0001
5.00E-04	0.0004	0.0019	0.0118	0.0469	0.0236	0.0093	0.0052	0.0028	0.0019	0.0008	0.0004	0.0001	0.0002	0.0000	0.0001	0.0001
6.00E-04	0.0003	0.0013	0.0077	0.0273	0.0149	0.0062	0.0034	0.0014	0.0010	0.0005	0.0002	0.0000	0.0002	0.0000	0.0000	0.0000
7.00E-04	0.0001	0.0008	0.0042	0.0128	0.0076	0.0032	0.0019	0.0009	0.0003	0.0002	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000
8.50E-04	0.0001	0.0004	0.0015	0.0036	0.0030	0.0016	0.0009	0.0003	0.0001	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
1.00E-03	0.0001	0.0002	0.0007	0.0015	0.0013	0.0007	0.0005	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1.40E-03	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2.00E-03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 2.3-99
1999 Probability values for 1 hour at SSES LPZ
Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
3.50E-09	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
1.00E-08	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
2.50E-08	0.0616	0.0757	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1023	0.063	0.0313	0.0177	0.0306	0.0393
7.00E-08	0.0616	0.0756	0.0964	0.1616	0.0759	0.0447	0.0445	0.0366	0.0521	0.0667	0.1022	0.0623	0.0313	0.0177	0.0306	0.0393
1.00E-07	0.0616	0.0736	0.096	0.1615	0.0758	0.0447	0.0444	0.0366	0.0518	0.0663	0.0997	0.0567	0.029	0.0169	0.0304	0.0393
1.50E-07	0.0597	0.0709	0.0936	0.1611	0.0757	0.0446	0.0436	0.036	0.0498	0.0625	0.0889	0.0528	0.026	0.0161	0.0302	0.0389
2.20E-07	0.0588	0.0688	0.0908	0.1603	0.0751	0.044	0.0412	0.0344	0.0464	0.0594	0.0836	0.051	0.0258	0.0158	0.0297	0.0385
3.20E-07	0.0587	0.0681	0.0892	0.1593	0.0748	0.0431	0.0406	0.0337	0.0458	0.0576	0.0819	0.0507	0.0257	0.0158	0.0297	0.0383
4.80E-07	0.0587	0.0679	0.0891	0.1584	0.0733	0.0424	0.0399	0.0336	0.0455	0.0571	0.0815	0.0497	0.0257	0.0158	0.0297	0.0383
7.00E-07	0.0577	0.067	0.0889	0.1584	0.0731	0.0423	0.0396	0.0335	0.0454	0.0571	0.0807	0.0472	0.0245	0.0157	0.0294	0.038
1.00E-06	0.0568	0.0653	0.0881	0.1583	0.0729	0.0422	0.0396	0.0333	0.0453	0.0564	0.0787	0.0461	0.0236	0.0149	0.0289	0.037
1.50E-06	0.0564	0.0642	0.0873	0.1578	0.0727	0.0419	0.0392	0.0329	0.0443	0.0548	0.0768	0.0445	0.0231	0.0148	0.0288	0.0366
2.00E-06	0.0539	0.0639	0.0872	0.1573	0.0725	0.0414	0.0377	0.0319	0.0435	0.0542	0.074	0.0367	0.0205	0.0142	0.0279	0.0313
3.00E-06	0.0312	0.0546	0.0837	0.1563	0.0717	0.0405	0.0357	0.0303	0.0425	0.0521	0.0567	0.0204	0.0114	0.0086	0.0156	0.0159
4.00E-06	0.0201	0.0423	0.0742	0.1529	0.0695	0.037	0.0331	0.0281	0.0393	0.0458	0.0451	0.0165	0.0079	0.0045	0.0091	0.0088
5.00E-06	0.0155	0.0351	0.0683	0.1503	0.0681	0.0354	0.0314	0.0255	0.0351	0.0399	0.0391	0.0125	0.0062	0.0037	0.0068	0.0067
7.00E-06	0.0122	0.0281	0.0595	0.1451	0.0646	0.0333	0.0264	0.0202	0.0304	0.0336	0.0281	0.0083	0.0047	0.0026	0.005	0.0048
8.50E-06	0.0091	0.0213	0.0537	0.1429	0.0624	0.0317	0.0237	0.0189	0.0268	0.0273	0.019	0.0056	0.0032	0.0017	0.0033	0.0021
1.00E-05	0.0069	0.0177	0.0502	0.1407	0.0592	0.0295	0.0214	0.0163	0.0226	0.0222	0.015	0.0041	0.0021	0.0009	0.0016	0.0011
1.50E-05	0.0038	0.0095	0.0372	0.1321	0.0541	0.0268	0.0183	0.0132	0.0164	0.01	0.0073	0.0018	0.0014	0.0005	0.0007	0.0006
2.00E-05	0.0029	0.006	0.0272	0.1211	0.049	0.0232	0.0147	0.0095	0.0088	0.0061	0.0042	0.001	0.0007	0.0003	0.0003	0.0003
2.50E-05	0.0021	0.0048	0.0231	0.1118	0.0419	0.0169	0.0109	0.006	0.0072	0.0039	0.0031	0.0008	0.0006	0.0001	0	0.0002
3.00E-05	0.0014	0.004	0.0198	0.1021	0.0373	0.0141	0.0093	0.0047	0.0058	0.0029	0.0023	0.0006	0.0003	0	0	0.0001
3.50E-05	0.0013	0.0032	0.0169	0.0923	0.0339	0.0125	0.0073	0.0041	0.0045	0.0021	0.0016	0.0005	0.0002	0	0	0.0001
4.00E-05	0.0009	0.0028	0.0139	0.0812	0.0299	0.0118	0.0063	0.0031	0.003	0.0009	0.0009	0.0002	0.0001	0	0	0.0001
5.00E-05	0.0005	0.0023	0.0111	0.064	0.026	0.0104	0.0056	0.0021	0.0019	0.0005	0.0006	0.0002	0	0	0	0.0001
6.00E-05	0.0005	0.0019	0.0083	0.0394	0.0167	0.0078	0.0033	0.001	0.001	0.0002	0.0002	0	0	0	0	0.0001
7.00E-05	0.0003	0.0013	0.0068	0.0241	0.0111	0.006	0.0026	0.0008	0.0009	0.0002	0.0002	0	0	0	0	0.0001
8.50E-05	0.0002	0.0008	0.0033	0.0108	0.0067	0.0041	0.0016	0.0007	0.0003	0.0001	0	0	0	0	0	0.0001
1.00E-04	0.0001	0.0005	0.0018	0.0046	0.004	0.0029	0.001	0.0006	0.0003	0.0001	0	0	0	0	0	0.0001
1.30E-04	0.0001	0	0.0003	0.0008	0.001	0.0003	0.0003	0.0001	0.0002	0.0001	0	0	0	0	0	0
1.70E-04	0	0	0.0001	0.0001	0.0001	0	0	0	0	0	0	0	0	0	0	0
2.00E-04	0	0	0.0001	0.0001	0.0001	0	0	0	0	0	0	0	0	0	0	0
2.50E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-100
2000 Probability values for 1 hour at SSES LPZ
Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
3.50E-09	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
1.00E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
2.50E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0623	0.0669	0.0986	0.0558	0.0296	0.0235	0.0344	0.0479
7.00E-08	0.0542	0.0685	0.0978	0.1613	0.0783	0.0403	0.0439	0.0365	0.0622	0.0669	0.0985	0.0554	0.0296	0.0235	0.0344	0.0479
1.00E-07	0.0538	0.0682	0.0978	0.1612	0.0783	0.0403	0.0435	0.0364	0.062	0.0663	0.0951	0.0526	0.0284	0.0234	0.0344	0.0478
1.50E-07	0.0525	0.0659	0.0967	0.1607	0.0783	0.0402	0.0432	0.036	0.0594	0.0644	0.0854	0.0495	0.0264	0.0226	0.0339	0.0476
2.20E-07	0.0522	0.0637	0.0942	0.1604	0.0779	0.0393	0.0427	0.0349	0.0571	0.0619	0.0795	0.0485	0.0259	0.0225	0.0338	0.0471
3.20E-07	0.0515	0.0628	0.092	0.1595	0.0775	0.0385	0.0426	0.0346	0.0551	0.059	0.0773	0.0481	0.0258	0.0225	0.0337	0.047
4.80E-07	0.0514	0.0626	0.0916	0.159	0.0767	0.0374	0.0424	0.0345	0.0547	0.0586	0.0771	0.0476	0.0256	0.0225	0.0337	0.0469
7.00E-07	0.0509	0.0623	0.0916	0.1589	0.0764	0.0371	0.0422	0.0344	0.0545	0.0586	0.0764	0.0458	0.0251	0.0224	0.0336	0.0467
1.00E-06	0.0506	0.062	0.0909	0.1588	0.0764	0.0371	0.0421	0.0342	0.0542	0.0583	0.074	0.0445	0.0249	0.0218	0.0334	0.0466
1.50E-06	0.0506	0.0614	0.0896	0.1584	0.0763	0.0368	0.042	0.0339	0.0533	0.0567	0.0713	0.042	0.0243	0.0215	0.0333	0.0462
2.00E-06	0.0491	0.0611	0.0894	0.1582	0.076	0.0364	0.042	0.0337	0.0527	0.0566	0.0691	0.0345	0.0229	0.0201	0.0316	0.0418
3.00E-06	0.0344	0.0583	0.0884	0.1578	0.0755	0.0354	0.0409	0.0332	0.0514	0.0559	0.0564	0.0201	0.0136	0.0116	0.0156	0.0204
4.00E-06	0.0217	0.0476	0.0803	0.1541	0.0734	0.0334	0.0387	0.0318	0.0475	0.051	0.0434	0.0137	0.0072	0.0068	0.008	0.0104
5.00E-06	0.0174	0.0408	0.0726	0.1513	0.0694	0.0317	0.036	0.0298	0.0435	0.046	0.0357	0.0103	0.005	0.0042	0.0061	0.0078
7.00E-06	0.0122	0.0322	0.0621	0.1465	0.0647	0.029	0.0309	0.0244	0.0374	0.0368	0.0247	0.0058	0.0027	0.0024	0.005	0.0062
8.50E-06	0.0091	0.0261	0.0547	0.1425	0.0622	0.0274	0.0276	0.0219	0.0338	0.0301	0.0152	0.0038	0.0019	0.0015	0.0023	0.0029
1.00E-05	0.0072	0.0224	0.0505	0.1384	0.0584	0.0253	0.0239	0.0205	0.0309	0.0241	0.0112	0.003	0.0017	0.0007	0.0015	0.0019
1.50E-05	0.0029	0.0122	0.0377	0.1264	0.0517	0.0194	0.0184	0.0153	0.0204	0.0128	0.004	0.0013	0.0008	0.0002	0.0007	0.0008
2.00E-05	0.0022	0.0075	0.0282	0.1123	0.0454	0.0164	0.015	0.0102	0.012	0.0076	0.0029	0.0002	0.0007	0.0001	0.0002	0.0005
2.50E-05	0.0014	0.0058	0.0226	0.1022	0.0394	0.0132	0.0112	0.0068	0.0087	0.0053	0.0017	0.0002	0.0006	0.0001	0.0002	0.0002
3.00E-05	0.0008	0.0042	0.0202	0.0927	0.035	0.011	0.0095	0.0057	0.0073	0.0038	0.001	0.0001	0.0005	0.0001	0.0002	0.0001
3.50E-05	0.0006	0.0034	0.0182	0.0793	0.0314	0.0088	0.0075	0.0048	0.0056	0.0023	0.0008	0	0.0005	0.0001	0.0001	0
4.00E-05	0.0003	0.0027	0.0156	0.068	0.0273	0.0081	0.0063	0.0038	0.0035	0.0019	0.0006	0	0.0003	0.0001	0	0
5.00E-05	0.0003	0.0015	0.0126	0.0519	0.0216	0.0068	0.0051	0.0029	0.0023	0.001	0.0006	0	0.0002	0.0001	0	0
6.00E-05	0.0001	0.0014	0.0089	0.0329	0.016	0.0046	0.004	0.0017	0.0011	0.0009	0.0002	0	0.0002	0.0001	0	0
7.00E-05	0	0.0011	0.0066	0.0217	0.0105	0.0032	0.0027	0.001	0.0008	0.0006	0	0	0.0001	0.0001	0	0
8.50E-05	0	0.0006	0.0035	0.009	0.0055	0.0016	0.0018	0.0002	0.0001	0.0005	0	0	0.0001	0	0	0
1.00E-04	0	0.0005	0.0015	0.0027	0.0024	0.001	0.0008	0.0001	0.0001	0.0001	0	0	0	0	0	0
1.30E-04	0	0	0.0001	0.0002	0.0006	0	0.0003	0	0	0	0	0	0	0	0	0
1.70E-04	0	0	0	0	0.0001	0	0	0	0	0	0	0	0	0	0	0
2.00E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-101																
2001 Probability values for 1 hour at SSES LPZ																
Probability that the X/Q is Greater than the Adjacent Quantized Level																
	DIRECTION															
QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1 00E-10	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0.0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
3.50E-09	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0.0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
1 00E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0.0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
2.50E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0.0507	0.0465	0.0659	0.0674	0.1049	0.0558	0.0296	0.0235	0.0344	0.0479
7 00E-08	0.0515	0.0592	0.0751	0.1698	0.0853	0.0466	0.0507	0.0465	0.0659	0.0674	0.1048	0.0554	0.0296	0.0235	0.0344	0.0479
1 00E-07	0.0508	0.0585	0.0751	0.1698	0.0853	0.0466	0.0506	0.0465	0.0654	0.0669	0.0998	0.0526	0.0284	0.0234	0.0344	0.0478
1.50E-07	0.0485	0.0562	0.0738	0.1697	0.0851	0.0465	0.0496	0.0457	0.0629	0.0645	0.0875	0.0495	0.0264	0.0226	0.0339	0.0476
2 20E-07	0.0482	0.0542	0.0718	0.1685	0.0846	0.0457	0.0473	0.0436	0.0596	0.0591	0.08	0.0485	0.0259	0.0225	0.0338	0.0471
3 20E-07	0.048	0.053	0.0707	0.1672	0.0835	0.0448	0.0455	0.0422	0.0575	0.0569	0.0768	0.0481	0.0258	0.0225	0.0337	0.047
4.80E-07	0.0477	0.0528	0.0698	0.1658	0.0825	0.0442	0.045	0.0417	0.0568	0.0559	0.0756	0.0476	0.0256	0.0225	0.0337	0.0469
7 00E-07	0.0474	0.0524	0.0697	0.1656	0.0818	0.0436	0.045	0.0416	0.0565	0.0558	0.0741	0.0458	0.0251	0.0224	0.0336	0.0467
1 00E-06	0.0454	0.0521	0.0695	0.1656	0.0818	0.0436	0.045	0.0415	0.0561	0.0554	0.0721	0.0445	0.0249	0.0218	0.0334	0.0466
1.50E-06	0.0453	0.052	0.0692	0.1654	0.0815	0.0434	0.0447	0.0415	0.055	0.0545	0.0706	0.042	0.0243	0.0215	0.0333	0.0462
2 00E-06	0.0451	0.0515	0.0688	0.1648	0.0813	0.043	0.0446	0.0413	0.0542	0.054	0.0681	0.0345	0.0229	0.0201	0.0316	0.0418
3 00E-06	0.0322	0.0483	0.0674	0.1633	0.081	0.0429	0.043	0.0404	0.0534	0.0523	0.0545	0.0201	0.0136	0.0116	0.0156	0.0204
4 00E-06	0.02	0.0421	0.0646	0.1624	0.0795	0.0411	0.0394	0.0385	0.0497	0.0485	0.0428	0.0137	0.0072	0.0068	0.008	0.0104
5 00E-06	0.0166	0.0367	0.0622	0.1606	0.0774	0.039	0.0362	0.0348	0.0438	0.0447	0.0374	0.0103	0.005	0.0042	0.0061	0.0078
7 00E-06	0.0129	0.0302	0.0555	0.1564	0.0747	0.0367	0.0324	0.03	0.0386	0.0373	0.0259	0.0058	0.0027	0.0024	0.005	0.0062
8.50E-06	0.0097	0.0243	0.0511	0.1536	0.0721	0.0354	0.0297	0.0264	0.034	0.0307	0.0169	0.0038	0.0019	0.0015	0.0023	0.0029
1 00E-05	0.007	0.0194	0.0473	0.1502	0.07	0.0327	0.0275	0.0241	0.0304	0.0244	0.0133	0.003	0.0017	0.0007	0.0015	0.0019
1.50E-05	0.0032	0.0112	0.0368	0.1387	0.0639	0.0281	0.0217	0.0178	0.0206	0.0118	0.0063	0.0013	0.0008	0.0002	0.0007	0.0008
2 00E-05	0.0018	0.0063	0.0301	0.1264	0.057	0.0238	0.0167	0.0124	0.0129	0.0062	0.0033	0.0002	0.0007	0.0001	0.0002	0.0005
2.50E-05	0.0014	0.0041	0.0243	0.1159	0.0492	0.0198	0.0117	0.0082	0.0086	0.0044	0.0024	0.0002	0.0006	0.0001	0.0002	0.0002
3 00E-05	0.001	0.0028	0.0202	0.1037	0.043	0.0163	0.0093	0.0064	0.0074	0.003	0.0016	0.0001	0.0005	0.0001	0.0002	0.0001
3.50E-05	0.0007	0.0024	0.0162	0.0921	0.0381	0.0132	0.0074	0.0057	0.0062	0.0023	0.0014	0	0.0005	0.0001	0.0001	0
4 00E-05	0.0006	0.0016	0.0139	0.0783	0.0346	0.011	0.0063	0.0044	0.0043	0.0016	0.0011	0	0.0003	0.0001	0	0
5 00E-05	0.0003	0.0011	0.0109	0.0588	0.0284	0.0092	0.0048	0.003	0.0024	0.001	0.0007	0	0.0002	0.0001	0	0
6 00E-05	0.0003	0.0009	0.0077	0.0393	0.0201	0.0067	0.0028	0.0017	0.0014	0.0009	0.0005	0	0.0002	0.0001	0	0
7 00E-05	0.0001	0.0008	0.0051	0.0248	0.0133	0.0046	0.0021	0.0014	0.0008	0.0005	0.0003	0	0.0001	0.0001	0	0
8.50E-05	0.0001	0.0002	0.0029	0.0107	0.0072	0.0018	0.0013	0.0003	0.0001	0.0001	0.0003	0	0.0001	0	0	0
1 00E-04	0.0001	0.0002	0.0016	0.0037	0.0034	0.0017	0.0011	0.0002	0	0	0.0001	0	0	0	0	0
1.30E-04	0	0.0001	0.0001	0.0002	0.0002	0.0001	0.0003	0	0	0	0	0	0	0	0	0
1.70E-04	0	0	0	0.0001	0	0	0	0	0	0	0	0	0	0	0	0
2 00E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-102

2002 Probability values for 1 hour at SSES LPZ

Probability that the X/Q is Greater than the Adjacent Quantized Level

QUANTIZED LEVEL	DIRECTION															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
3.50E-09	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
1.00E-08	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
2.50E-08	0.0499	0.072	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.083	0.1147	0.0628	0.0314	0.0204	0.0296	0.0398
7.00E-08	0.0495	0.0719	0.0827	0.1446	0.0676	0.0451	0.0424	0.0463	0.0678	0.0829	0.1131	0.0624	0.0314	0.0204	0.0296	0.0397
1.00E-07	0.0476	0.0707	0.0827	0.1446	0.0676	0.045	0.042	0.0458	0.0663	0.0807	0.1052	0.0582	0.031	0.0204	0.0295	0.0387
1.50E-07	0.045	0.0689	0.0822	0.1446	0.0674	0.0447	0.0418	0.0455	0.0648	0.076	0.0916	0.0539	0.0303	0.0202	0.0292	0.0377
2.20E-07	0.0439	0.0674	0.0807	0.1442	0.0673	0.0444	0.0415	0.0451	0.0632	0.0723	0.0838	0.0524	0.03	0.0202	0.0292	0.0376
3.20E-07	0.0435	0.0664	0.0793	0.1433	0.0667	0.044	0.041	0.0444	0.0626	0.0704	0.0817	0.0521	0.0297	0.0201	0.0292	0.0375
4.80E-07	0.0435	0.0663	0.0792	0.1431	0.0658	0.0436	0.0408	0.0441	0.0617	0.0702	0.0816	0.0512	0.0295	0.0201	0.029	0.0372
7.00E-07	0.043	0.0661	0.0792	0.1431	0.0656	0.0436	0.0407	0.044	0.0612	0.0699	0.0805	0.0496	0.0292	0.0201	0.0288	0.0365
1.00E-06	0.0423	0.0651	0.0791	0.1431	0.0656	0.0436	0.0405	0.044	0.0607	0.0694	0.0776	0.0483	0.029	0.0199	0.0287	0.0363
1.50E-06	0.0423	0.0643	0.0782	0.1429	0.0656	0.0435	0.0402	0.0436	0.0603	0.0687	0.0755	0.0473	0.0278	0.0196	0.0284	0.0357
2.00E-06	0.0422	0.0637	0.0778	0.1427	0.0652	0.0429	0.04	0.0435	0.0602	0.0682	0.074	0.0412	0.0243	0.0164	0.0257	0.0319
3.00E-06	0.0329	0.0609	0.0768	0.142	0.0649	0.0416	0.0386	0.0407	0.0558	0.0648	0.0558	0.0232	0.0139	0.0088	0.0126	0.0173
4.00E-06	0.0214	0.0508	0.0705	0.1407	0.0636	0.0399	0.0344	0.0355	0.0515	0.058	0.0407	0.0163	0.0097	0.0043	0.0068	0.0095
5.00E-06	0.0173	0.0435	0.0632	0.1383	0.0618	0.037	0.0307	0.032	0.0453	0.0503	0.0326	0.0131	0.0065	0.0033	0.0053	0.0078
7.00E-06	0.0136	0.0335	0.0563	0.1344	0.058	0.0334	0.0255	0.0269	0.0377	0.0384	0.0224	0.0071	0.004	0.0025	0.003	0.0046
8.50E-06	0.01	0.025	0.0521	0.1315	0.0552	0.0312	0.0231	0.0244	0.0323	0.0295	0.0133	0.0047	0.0031	0.0018	0.0016	0.0028
1.00E-05	0.0071	0.0206	0.0488	0.13	0.0533	0.0292	0.0209	0.0224	0.0289	0.0239	0.0096	0.0038	0.002	0.0013	0.0012	0.0021
1.50E-05	0.0029	0.0121	0.0368	0.124	0.0486	0.0251	0.0172	0.0156	0.0172	0.0104	0.004	0.0012	0.001	0.0005	0.0006	0.0009
2.00E-05	0.0021	0.0077	0.0301	0.1159	0.043	0.022	0.013	0.0116	0.0104	0.0068	0.0022	0.0006	0.0002	0.0003	0.0001	0.0005
2.50E-05	0.0012	0.0063	0.0262	0.1095	0.0361	0.0169	0.0093	0.0089	0.0081	0.0051	0.0014	0.0003	0.0001	0.0003	0.0001	0.0003
3.00E-05	0.0009	0.0052	0.0236	0.1016	0.0332	0.0146	0.0077	0.0083	0.0067	0.0033	0.0012	0.0002	0	0.0003	0.0001	0.0002
3.50E-05	0.0006	0.0044	0.0201	0.0916	0.0311	0.0135	0.0074	0.0074	0.005	0.0024	0.0008	0.0002	0	0.0002	0.0001	0.0002
4.00E-05	0.0005	0.0036	0.0166	0.0793	0.0281	0.0126	0.0067	0.0056	0.0029	0.0017	0.0005	0.0002	0	0	0.0001	0.0002
5.00E-05	0.0003	0.0029	0.0119	0.0621	0.0225	0.0104	0.0046	0.0037	0.0015	0.0009	0.0002	0.0001	0	0	0	0.0001
6.00E-05	0.0003	0.0018	0.0084	0.0432	0.0151	0.0071	0.0031	0.0018	0.001	0.0005	0.0002	0.0001	0	0	0	0
7.00E-05	0.0002	0.0015	0.0061	0.0273	0.01	0.0048	0.0023	0.0015	0.0003	0.0001	0.0002	0.0001	0	0	0	0
8.50E-05	0.0002	0.0008	0.0025	0.0107	0.0041	0.0024	0.0009	0.0008	0.0001	0.0001	0.0001	0.0001	0	0	0	0
1.00E-04	0.0001	0.0005	0.0015	0.0038	0.0017	0.0015	0.0005	0.0003	0	0.0001	0.0001	0.0001	0	0	0	0
1.30E-04	0	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	0	0	0	0	0	0	0	0	0
1.70E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-103																
2003 Probability values for 1 hour at SSES LPZ																
Probability that the X/Q is Greater than the Adjacent Quantized Level																
DIRECTION																
QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.00E-10	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
3.50E-09	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
1.00E-08	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
2.50E-08	0.0392	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.1004	0.0621	0.0297	0.0214	0.0287	0.0348
7.00E-08	0.039	0.0769	0.1096	0.1414	0.0673	0.0497	0.062	0.0474	0.061	0.0683	0.0996	0.0615	0.0297	0.0213	0.0287	0.0346
1.00E-07	0.0385	0.0764	0.109	0.1414	0.0673	0.0497	0.0613	0.0469	0.0603	0.0677	0.096	0.0587	0.0287	0.021	0.0274	0.0331
1.50E-07	0.0377	0.0746	0.108	0.1412	0.067	0.0494	0.0607	0.0461	0.0579	0.0656	0.09	0.0549	0.028	0.0196	0.0273	0.0323
2.20E-07	0.0373	0.0743	0.1068	0.141	0.0666	0.049	0.0603	0.0448	0.0564	0.0619	0.0854	0.053	0.0273	0.0191	0.0271	0.032
3.20E-07	0.0371	0.0739	0.1064	0.1405	0.0657	0.0489	0.0598	0.044	0.056	0.0601	0.0846	0.0527	0.0272	0.019	0.0271	0.0318
4.80E-07	0.0371	0.0737	0.1063	0.1397	0.065	0.0482	0.0595	0.0437	0.0557	0.0595	0.0843	0.0523	0.027	0.019	0.0271	0.0318
7.00E-07	0.0365	0.0737	0.106	0.1397	0.0649	0.0482	0.0595	0.0436	0.0554	0.0594	0.0829	0.0516	0.0266	0.0189	0.0266	0.0314
1.00E-06	0.0363	0.0728	0.1059	0.1397	0.0649	0.0482	0.0591	0.0435	0.0553	0.0591	0.0808	0.0513	0.0266	0.0188	0.0264	0.0314
1.50E-06	0.0361	0.0725	0.1056	0.1397	0.0649	0.0479	0.0587	0.0432	0.0553	0.0587	0.0799	0.0485	0.0255	0.0174	0.026	0.0314
2.00E-06	0.0353	0.0724	0.1055	0.1391	0.0648	0.0479	0.0583	0.043	0.0551	0.0581	0.0779	0.0416	0.0222	0.0152	0.0231	0.0292
3.00E-06	0.0286	0.0667	0.1025	0.138	0.0633	0.0463	0.0549	0.0413	0.0522	0.0558	0.0551	0.0258	0.0124	0.0098	0.0121	0.0141
4.00E-06	0.0198	0.0551	0.0928	0.1353	0.0618	0.0428	0.0481	0.0377	0.0475	0.0496	0.037	0.0182	0.0092	0.0066	0.0071	0.0086
5.00E-06	0.016	0.0499	0.0868	0.1322	0.0604	0.0392	0.0421	0.0346	0.0441	0.0438	0.0279	0.0139	0.0066	0.0048	0.0055	0.0074
7.00E-06	0.0108	0.0379	0.0753	0.1285	0.0566	0.0353	0.0364	0.0288	0.0358	0.034	0.0179	0.0081	0.0038	0.0027	0.0035	0.0051
8.50E-06	0.0075	0.0318	0.0688	0.1251	0.0542	0.0318	0.0324	0.024	0.0299	0.025	0.0106	0.0055	0.0025	0.0017	0.0022	0.0022
1.00E-05	0.0058	0.025	0.0633	0.1215	0.0512	0.029	0.0289	0.0219	0.0256	0.0189	0.008	0.0043	0.0018	0.001	0.0015	0.0013
1.50E-05	0.0024	0.0123	0.0485	0.1126	0.0446	0.0228	0.0226	0.0149	0.0146	0.0097	0.0037	0.0014	0.001	0.0006	0.0006	0.0008
2.00E-05	0.0014	0.0066	0.0358	0.0989	0.0382	0.0182	0.0165	0.01	0.0082	0.0053	0.0017	0.0007	0.0005	0.0002	0.0003	0.0006
2.50E-05	0.0013	0.0046	0.0303	0.0893	0.0302	0.0129	0.0118	0.0056	0.0059	0.0029	0.0009	0.0002	0.0005	0	0.0001	0.0003
3.00E-05	0.0008	0.003	0.0272	0.0823	0.0271	0.0114	0.0086	0.0046	0.0045	0.0023	0.0002	0.0002	0.0005	0	0	0.0001
3.50E-05	0.0005	0.0027	0.0236	0.0709	0.0229	0.0091	0.0066	0.0038	0.0033	0.0016	0	0.0001	0.0005	0	0	0.0001
4.00E-05	0.0002	0.0021	0.0209	0.0604	0.0212	0.0084	0.0053	0.003	0.0024	0.0009	0	0.0001	0.0005	0	0	0.0001
5.00E-05	0.0002	0.0014	0.0152	0.0448	0.0175	0.0066	0.0043	0.0015	0.0013	0.0007	0	0.0001	0.0003	0	0	0
6.00E-05	0.0002	0.0012	0.0109	0.0322	0.012	0.0035	0.003	0.0009	0.001	0.0005	0	0	0.0002	0	0	0
7.00E-05	0	0.001	0.0081	0.019	0.0071	0.0025	0.0018	0.0007	0.0006	0	0	0	0.0001	0	0	0
8.50E-05	0	0.0005	0.0036	0.006	0.0038	0.0012	0.0009	0.0005	0.0001	0	0	0	0.0001	0	0	0
1.00E-04	0	0.0002	0.0012	0.0023	0.0021	0.0007	0.0003	0.0002	0	0	0	0	0.0001	0	0	0
1.30E-04	0	0	0.0001	0	0	0	0.0001	0	0	0	0	0	0	0	0	0
1.70E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3-104																
1999 - 2003 Average Probability Values for 1 hour at SSES LPZ																
Probability that the X/Q is Greater than the Adjacent Quantized Level																
	DIRECTION															
QUANTIZED LEVEL	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.00E+00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1 00E-10	5.13E-02	7.05E-02	9.23E-02	1.56E-01	7.49E-02	4.53E-02	4.87E-02	4.26E-02	6.18E-02	7.04E-02	1.04E-01	5.99E-02	3.03E-02	2.13E-02	3.15E-02	4.20E-02
3 50E-09	5.13E-02	7.05E-02	9.23E-02	1.56E-01	7.49E-02	4.53E-02	4.87E-02	4.26E-02	6.18E-02	7.04E-02	1.04E-01	5.99E-02	3.03E-02	2.13E-02	3.15E-02	4.20E-02
1 00E-08	5.13E-02	7.05E-02	9.23E-02	1.56E-01	7.49E-02	4.53E-02	4.87E-02	4.26E-02	6.18E-02	7.04E-02	1.04E-01	5.99E-02	3.03E-02	2.13E-02	3.15E-02	4.20E-02
2 50E-08	5.13E-02	7.05E-02	9.23E-02	1.56E-01	7.49E-02	4.53E-02	4.87E-02	4.26E-02	6.18E-02	7.04E-02	1.04E-01	5.99E-02	3.03E-02	2.13E-02	3.15E-02	4.20E-02
7 00E-08	5.12E-02	7.04E-02	9.23E-02	1.56E-01	7.49E-02	4.53E-02	4.87E-02	4.26E-02	6.18E-02	7.04E-02	1.04E-01	5.94E-02	3.03E-02	2.13E-02	3.15E-02	4.19E-02
1 00E-07	5.05E-02	6.95E-02	9.21E-02	1.56E-01	7.49E-02	4.53E-02	4.83E-02	4.24E-02	6.12E-02	6.96E-02	9.92E-02	5.58E-02	2.91E-02	2.10E-02	3.12E-02	4.14E-02
1 50E-07	4.87E-02	6.73E-02	9.09E-02	1.55E-01	7.47E-02	4.51E-02	4.78E-02	4.18E-02	5.90E-02	6.66E-02	8.87E-02	5.21E-02	2.74E-02	2.02E-02	3.09E-02	4.08E-02
2 20E-07	4.81E-02	6.57E-02	8.89E-02	1.55E-01	7.43E-02	4.45E-02	4.66E-02	4.05E-02	5.65E-02	6.29E-02	8.25E-02	5.07E-02	2.70E-02	2.00E-02	3.07E-02	4.05E-02
3 20E-07	4.78E-02	6.48E-02	8.75E-02	1.54E-01	7.37E-02	4.38E-02	4.59E-02	3.98E-02	5.54E-02	6.08E-02	8.05E-02	5.03E-02	2.68E-02	2.00E-02	3.07E-02	4.03E-02
4 80E-07	4.77E-02	6.47E-02	8.72E-02	1.53E-01	7.27E-02	4.31E-02	4.55E-02	3.95E-02	5.49E-02	6.03E-02	8.00E-02	4.97E-02	2.67E-02	2.00E-02	3.06E-02	4.02E-02
7 00E-07	4.71E-02	6.43E-02	8.71E-02	1.53E-01	7.24E-02	4.29E-02	4.54E-02	3.94E-02	5.46E-02	6.02E-02	7.89E-02	4.80E-02	2.61E-02	1.99E-02	3.04E-02	3.99E-02
1 00E-06	4.63E-02	6.35E-02	8.67E-02	1.53E-01	7.23E-02	4.29E-02	4.52E-02	3.93E-02	5.43E-02	5.97E-02	7.66E-02	4.69E-02	2.58E-02	1.94E-02	3.02E-02	3.96E-02
1 50E-06	4.62E-02	6.29E-02	8.60E-02	1.53E-01	7.22E-02	4.27E-02	4.49E-02	3.90E-02	5.36E-02	5.87E-02	7.48E-02	4.49E-02	2.50E-02	1.90E-02	3.00E-02	3.92E-02
2 00E-06	4.51E-02	6.25E-02	8.57E-02	1.52E-01	7.20E-02	4.23E-02	4.45E-02	3.87E-02	5.31E-02	5.82E-02	7.26E-02	3.77E-02	2.26E-02	1.72E-02	2.80E-02	3.52E-02
3 00E-06	3.19E-02	5.78E-02	8.38E-02	1.52E-01	7.13E-02	4.13E-02	4.26E-02	3.72E-02	5.11E-02	5.62E-02	5.57E-02	2.19E-02	1.30E-02	1.01E-02	1.43E-02	1.76E-02
4 00E-06	2.06E-02	4.76E-02	7.65E-02	1.49E-01	6.96E-02	3.88E-02	3.87E-02	3.43E-02	4.71E-02	5.06E-02	4.18E-02	1.57E-02	8.24E-03	5.80E-03	7.80E-03	9.54E-03
5 00E-06	1.66E-02	4.12E-02	7.06E-02	1.47E-01	6.74E-02	3.65E-02	3.53E-02	3.13E-02	4.24E-02	4.49E-02	3.45E-02	1.20E-02	5.86E-03	4.04E-03	5.96E-03	7.50E-03
7 00E-06	1.23E-02	3.24E-02	6.17E-02	1.42E-01	6.37E-02	3.35E-02	3.03E-02	2.61E-02	3.60E-02	3.60E-02	2.38E-02	7.02E-03	3.58E-03	2.52E-03	4.30E-03	5.38E-03
8 50E-06	9.08E-03	2.57E-02	5.61E-02	1.39E-01	6.12E-02	3.15E-02	2.73E-02	2.31E-02	3.14E-02	2.85E-02	1.50E-02	4.68E-03	2.52E-03	1.64E-03	2.34E-03	2.58E-03
1 00E-05	6.80E-03	2.10E-02	5.20E-02	1.36E-01	5.84E-02	2.91E-02	2.45E-02	2.10E-02	2.77E-02	2.27E-02	1.14E-02	3.64E-03	1.86E-03	9.19E-04	1.46E-03	1.66E-03
1 50E-05	3.04E-03	1.15E-02	3.94E-02	1.27E-01	5.26E-02	2.44E-02	1.96E-02	1.54E-02	1.78E-02	1.09E-02	5.06E-03	1.40E-03	1.00E-03	4.00E-04	6.60E-04	7.80E-04
2 00E-05	2.08E-03	6.82E-03	3.03E-02	1.15E-01	4.65E-02	2.07E-02	1.52E-02	1.07E-02	1.05E-02	6.40E-03	2.86E-03	5.40E-04	5.60E-04	2.00E-04	2.20E-04	4.80E-04
2 50E-05	1.48E-03	5.12E-03	2.53E-02	1.06E-01	3.94E-02	1.59E-02	1.10E-02	7.10E-03	7.70E-03	4.32E-03	1.90E-03	3.40E-04	4.80E-04	1.20E-04	1.20E-04	2.40E-04
3 00E-05	9.80E-04	3.84E-03	2.22E-02	9.65E-02	3.51E-02	1.35E-02	8.88E-03	5.94E-03	6.34E-03	3.06E-03	1.26E-03	2.40E-04	3.60E-04	9.99E-05	1.00E-04	1.20E-04
3 50E-05	7.40E-04	3.22E-03	1.90E-02	8.52E-02	3.15E-02	1.14E-02	7.24E-03	5.16E-03	4.92E-03	2.14E-03	9.21E-04	1.60E-04	3.40E-04	8.00E-05	6.00E-05	7.98E-05
4 00E-05	5.00E-04	2.56E-03	1.62E-02	7.34E-02	2.82E-02	1.04E-02	6.18E-03	3.98E-03	3.22E-03	1.40E-03	6.20E-04	9.99E-05	2.40E-04	4.01E-05	1.99E-05	7.98E-05
5 00E-05	3.20E-04	1.84E-03	1.23E-02	5.63E-02	2.32E-02	8.68E-03	4.88E-03	2.64E-03	1.88E-03	8.20E-04	4.21E-04	7.99E-05	1.40E-04	4.01E-05	0.00E+00	4.00E-05
6 00E-05	2.80E-04	1.44E-03	8.84E-03	3.74E-02	1.60E-02	5.94E-03	3.24E-03	1.42E-03	1.10E-03	6.00E-04	2.20E-04	1.99E-05	1.20E-04	4.01E-05	0.00E+00	2.00E-05
7 00E-05	1.20E-04	1.14E-03	6.54E-03	2.34E-02	1.04E-02	4.22E-03	2.30E-03	1.08E-03	6.81E-04	2.81E-04	1.40E-04	1.99E-05	6.00E-05	4.01E-05	0.00E+00	2.00E-05
8 50E-05	9.99E-05	5.80E-04	3.16E-03	9.44E-03	5.46E-03	2.22E-03	1.30E-03	5.00E-04	1.40E-04	1.61E-04	7.99E-05	1.99E-05	6.00E-05	0.00E+00	0.00E+00	2.00E-05
1 00E-04	5.99E-05	3.80E-04	1.52E-03	3.42E-03	2.72E-03	1.56E-03	7.41E-04	2.80E-04	8.02E-05	6.01E-05	3.99E-05	1.99E-05	1.99E-05	0.00E+00	0.00E+00	2.00E-05
1 30E-04	2.00E-05	3.99E-05	1.60E-04	3.00E-04	4.01E-04	1.20E-04	2.40E-04	2.00E-05	4.01E-05	2.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.70E-04	0.00E+00	0.00E+00	2.00E-05	4.00E-05	4.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2 00E-04	0.00E+00	0.00E+00	2.00E-05	2.00E-05	2.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2 50E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 50E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4 00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5 00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6 00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7 00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8 50E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1 00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2 00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4 00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 2.3-105

SUMMARY OF LONG-TERM X/Q (SEC/M3) RESULTS AT 4827 METER LPZ

Period of Record	USNRC Reg. Guide1.145 Interpolation Methodology								Annual Average	
	0-8 hours		8-24 hours		24-96 hours		96-720 hours		8760 hours	
	0.5%*	50%**	0.5%*	50%**	0.5%*	50%**	0.5%*	50%**	Direction Dependent	Direction Independent
1999	5.4E-05	4.6E-06	3.8E-05	3.7E-06	1.8E-05	2.3E-06	6.3E-06	1.1E-06	1.7E-06	4.8E-07
2000	4.9E-05	4.8E-06	3.5E-05	3.8E-06	1.7E-05	2.3E-06	6.0E-06	1.1E-06	1.7E-06	4.8E-07
2001	5.0E-05	5.4E-06	3.6E-05	4.3E-06	1.7E-05	2.6E-06	6.1E-06	1.3E-06	1.7E-06	5.3E-07
2002	5.0E-05	4.5E-06	3.6E-05	3.6E-06	1.7E-05	2.2E-06	6.1E-06	1.1E-06	1.7E-06	4.5E-07
2003	4.6E-05	4.7E-06	3.3E-05	3.7E-06	1.6E-05	2.2E-06	5.9E-06	1.1E-06	1.7E-06	4.4E-07
5-year Combined	4.9E-05	4.8E-06	3.5E-05	3.8E-06	1.7E-05	2.3E-06	6.1E-06	1.1E-06	1.7E-06	4.7E-07

*direction dependent values (see Figure 2.3-10)
**direction independent values (see Figure 2.3-10)

TABLE 2.3-106
DISTANCES AND TERRAIN/RECIRCULATION CORRECTION FACTORS FOR SSES 2003 LAND USE CENSUS LOCATIONS

RESIDENCE			GARDEN		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
N	1.3	2.15	N	3.2	2.19
NNE	1	2.50	NNE	2.3	2.55
NE	0.9	2.33	NE	2.7	2.47
ENE	2.1	2.42	ENE	2.4	2.48
E	1.4	2.09	E	1.8	2.07
ESE	0.5	2.58	ESE	2.5	2.00
SE	0.5	2.43	SE	0.6	2.44
SSE	0.6	2.71	SSE	1.5	2.44
S	1	2.46	S	1.1	2.43
SSW	0.9	2.39	SSW	1.2	2.35
SW	1.5	2.14	SW	1.9	2.11
WSW	1.3	2.32	WSW	1.3	2.32
W	1.2	2.18	W	1.2	2.18
WNW	0.8	2.74	WNW		
NW	0.8	3.30	NW	1.8	3.06
NNW	0.6	2.53	NNW	4	2.40

PRODUCTION ANIMAL			DAIRY ANIMAL		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
NNE	2.3	2.55	E	4.5	1.80
ENE	2.4	2.48	ESE	2.7	1.96
E	1.4	2.09	ESE	4.2	1.58
SSW	3	2.35	SSW	3	2.11
SSW	3.5	1.88	SSW	3.1	2.06
WSW	1.7	2.34	SSW	3.5	1.88
NW	1.8	3.06	SSW	14.01	1.03
			WSW	1.7	2.34
			W	5	1.46
			NNW	4.2	2.4

Distances to the nearest garden, residence, dairy animal and production animal in each of the affected sectors was provided by the 2003 SSES Land Use Census. The terrain/recirculation correction factors listed for the distances in the above tables were mathematically interpolated from the terrain/recirculation factors quoted for standard distances in the SSES Final Safety Analysis Report.

Table 2.3-107

1999 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	5.57E-06	5.55E-06	5.03E-06	1.75E-08
NNE	0.78	3.88E-06	3.86E-06	3.43E-06	1.51E-08
NE	0.7	4.40E-06	4.39E-06	3.93E-06	2.70E-08
ENE	0.86	1.50E-06	1.50E-06	1.32E-06	1.29E-08
E	0.8	8.48E-07	8.46E-07	7.50E-07	6.68E-09
ESE	0.5	1.13E-06	1.13E-06	1.03E-06	9.26E-09
SE	0.43	2.39E-06	2.39E-06	2.21E-06	1.97E-08
SSE	0.41	3.14E-06	3.14E-06	2.91E-06	2.88E-08
S	0.38	6.71E-06	6.70E-06	6.25E-06	4.66E-08
SSW	0.39	1.07E-05	1.07E-05	9.96E-06	5.41E-08
SW	0.61	1.13E-05	1.13E-05	1.02E-05	2.86E-08
WSW	1.22	1.28E-05	1.27E-05	1.10E-05	1.66E-08
W	1.03	7.68E-06	7.61E-06	6.67E-06	1.00E-08
WNW	0.61	1.04E-05	1.04E-05	9.38E-06	1.72E-08
NW	0.66	7.44E-06	7.40E-06	6.67E-06	1.70E-08
NNW	0.59	5.14E-06	5.12E-06	4.64E-06	1.42E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

Table 2.3-108

2000 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY

Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	6.83E-06	6.80E-06	6.16E-06	2.10E-08
NNE	0.78	4.35E-06	4.33E-06	3.86E-06	1.51E-08
NE	0.7	4.17E-06	4.16E-06	3.73E-06	2.61E-08
ENE	0.86	1.40E-06	1.39E-06	1.23E-06	1.14E-08
E	0.8	8.89E-07	8.86E-07	7.86E-07	6.31E-09
ESE	0.5	1.57E-06	1.56E-06	1.43E-06	1.23E-08
SE	0.43	2.60E-06	2.60E-06	2.40E-06	2.20E-08
SSE	0.41	4.09E-06	4.09E-06	3.79E-06	3.52E-08
S	0.38	6.21E-06	6.20E-06	5.78E-06	4.11E-08
SSW	0.39	1.22E-05	1.22E-05	1.14E-05	4.90E-08
SW	0.61	1.24E-05	1.24E-05	1.12E-05	2.90E-08
WSW	1.22	1.24E-05	1.23E-05	1.07E-05	1.65E-08
W	1.03	7.62E-06	7.55E-06	6.61E-06	1.03E-08
WNW	0.61	8.27E-06	8.23E-06	7.45E-06	1.55E-08
NW	0.66	8.40E-06	8.36E-06	7.53E-06	1.68E-08
NNW	0.59	5.99E-06	5.96E-06	5.41E-06	1.41E-08

The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.

TABLE 2.3-109

2001 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	7.27E-06	7.24E-06	6.56E-06	2.22E-08
NNE	0.78	4.18E-06	4.16E-06	3.70E-06	1.52E-08
NE	0.7	4.34E-06	4.33E-06	3.87E-06	2.77E-08
ENE	0.86	1.35E-06	1.34E-06	1.19E-06	1.16E-08
E	0.8	7.05E-07	7.03E-07	6.24E-07	5.37E-09
ESE	0.5	1.17E-06	1.17E-06	1.07E-06	8.69E-09
SE	0.43	2.89E-06	2.88E-06	2.66E-06	2.37E-08
SSE	0.41	3.85E-06	3.84E-06	3.56E-06	3.06E-08
S	0.38	6.07E-06	6.06E-06	5.65E-06	3.90E-08
SSW	0.39	1.01E-05	1.01E-05	9.35E-06	4.23E-08
SW	0.61	1.07E-05	1.06E-05	9.60E-06	2.23E-08
WSW	1.22	1.37E-05	1.36E-05	1.18E-05	1.74E-08
W	1.03	8.94E-06	8.86E-06	7.76E-06	1.12E-08
WNW	0.61	1.09E-05	1.08E-06	9.77E-06	1.79E-08
NW	0.66	8.76E-06	8.72E-06	7.85E-06	1.94E-08
NNW	0.59	7.07E-06	7.04E-06	6.38E-06	1.80E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-110

2002 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	6.61E-06	6.58E-06	5.97E-06	2.28E-08
NNE	0.78	4.44E-06	4.43E-06	3.94E-06	1.87E-08
NE	0.7	4.03E-06	4.02E-06	3.60E-06	3.03E-08
ENE	0.86	1.58E-06	1.57E-06	1.39E-06	1.28E-08
E	0.8	9.13E-07	9.10E-07	8.08E-07	6.69E-09
ESE	0.5	1.30E-06	1.30E-06	1.19E-06	1.07E-08
SE	0.43	2.10E-06	2.10E-06	1.94E-06	1.90E-08
SSE	0.41	3.28E-06	3.28E-06	3.04E-06	2.91E-08
S	0.38	5.71E-06	5.70E-06	5.31E-06	3.78E-08
SSW	0.39	1.24E-05	1.23E-05	1.15E-05	5.14E-08
SW	0.61	1.13E-05	1.13E-05	1.02E-05	2.45E-08
WSW	1.22	1.26E-05	1.25E-05	1.08E-05	1.48E-08
W	1.03	6.95E-06	6.89E-06	6.04E-06	8.88E-09
WNW	0.61	1.02E-05	1.02E-05	9.19E-06	1.74E-08
NW	0.66	7.22E-06	7.18E-06	6.46E-06	1.63E-08
NNW	0.59	6.63E-06	6.61E-06	5.99E-06	1.79E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-111

2003 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	6.10E-06	6.08E-06	5.51E-06	2.05E-08
NNE	0.78	3.87E-06	3.86E-06	3.43E-06	1.54E-08
NE	0.7	3.70E-06	3.69E-06	3.30E-06	2.65E-08
ENE	0.86	1.61E-06	1.61E-06	1.42E-06	1.27E-08
E	0.8	9.09E-07	9.06E-07	8.04E-07	6.37E-09
ESE	0.5	1.33E-06	1.33E-06	1.22E-06	1.12E-08
SE	0.43	2.09E-06	2.09E-06	1.93E-06	1.84E-08
SSE	0.41	2.80E-06	2.80E-06	2.59E-06	2.55E-08
S	0.38	4.69E-06	4.69E-06	4.37E-06	2.97E-08
SSW	0.39	1.28E-05	1.28E-05	1.19E-06	5.49E-08
SW	0.61	1.45E-05	1.45E-05	1.31E-05	3.25E-08
WSW	1.22	1.10E-05	1.09E-05	9.46E-06	1.45E-08
W	1.03	6.36E-06	6.31E-06	5.53E-06	8.85E-09
WNW	0.61	9.16E-06	9.12E-06	8.25E-06	1.91E-08
NW	0.66	9.36E-06	9.32E-06	8.39E-06	2.37E-08
NNW	0.59	6.10E-06	6.08E-06	5.51E-06	1.83E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-112

1999 - 2003 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY

Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.59	6.47E-06	6.45E-06	5.85E-06	2.08E-08
NNE	0.78	4.15E-06	4.13E-06	3.67E-06	1.59E-08
NE	0.7	4.13E-06	4.12E-06	3.69E-06	2.75E-08
ENE	0.86	1.49E-06	1.48E-06	1.31E-06	1.23E-08
E	0.8	8.53E-07	8.50E-07	7.55E-07	6.28E-09
ESE	0.5	1.30E-06	1.30E-06	1.19E-06	1.05E-08
SE	0.43	2.42E-06	2.41E-06	2.23E-06	2.06E-08
SSE	0.41	3.43E-06	3.43E-06	3.18E-06	2.98E-08
S	0.38	5.88E-06	5.87E-06	5.47E-06	3.88E-08
SSW	0.39	1.16E-05	1.16E-05	1.08E-05	5.03E-08
SW	0.61	1.21E-05	1.20E-05	1.09E-05	2.74E-08
WSW	1.22	1.25E-05	1.24E-05	1.07E-05	1.60E-08
W	1.03	7.51E-06	7.45E-06	6.52E-06	9.85E-09
WNW	0.61	9.78E-06	9.73E-06	8.81E-06	1.74E-08
NW	0.66	8.24E-06	8.19E-06	7.38E-06	1.86E-08
NNW	0.59	6.19E-06	6.16E-06	5.59E-06	1.65E-08

The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.

TABLE 2.3-113

1999 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.23E-05	1.23E-05	1.15E-05	4.43E-08
NNE	0.34	1.09E-05	1.09E-05	1.02E-05	5.21E-08
NE	0.34	1.18E-05	1.18E-05	1.10E-05	8.56E-08
ENE	0.34	5.60E-06	5.60E-06	5.25E-06	5.80E-08
E	0.34	2.98E-06	2.98E-06	2.80E-06	2.81E-08
ESE	0.34	2.16E-06	2.16E-06	2.03E-06	1.92E-08
SE	0.34	3.39E-06	3.39E-06	3.18E-06	2.94E-08
SSE	0.34	4.01E-06	4.00E-06	3.76E-06	3.82E-08
S	0.34	7.75E-06	7.74E-06	7.27E-06	5.51E-08
SSW	0.34	1.32E-05	1.32E-05	1.24E-05	6.85E-08
SW	0.34	2.50E-05	2.49E-05	2.34E-05	7.10E-08
WSW	0.34	6.81E-05	6.80E-05	6.38E-05	1.06E-07
W	0.34	4.22E-05	4.22E-05	3.96E-05	6.73E-08
WNW	0.34	2.38E-05	2.37E-05	2.23E-05	4.43E-08
NW	0.34	1.96E-05	1.96E-05	1.84E-05	5.20E-08
NNW	0.34	1.03E-05	1.03E-05	9.68E-06	3.23E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-114

2000 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.50E-05	1.50E-05	1.41E-05	5.30E-08
NNE	0.34	1.23E-05	1.23E-05	1.15E-05	5.22E-08
NE	0.34	1.14E-05	1.13E-05	1.06E-05	8.26E-08
ENE	0.34	5.29E-06	5.29E-06	4.96E-06	5.14E-08
E	0.34	3.16E-06	3.15E-06	2.96E-06	2.66E-08
ESE	0.34	3.00E-06	3.00E-06	2.82E-06	2.55E-08
SE	0.34	3.69E-06	3.69E-06	3.47E-06	3.30E-08
SSE	0.34	5.22E-06	5.22E-06	4.89E-06	4.66E-08
S	0.34	7.17E-06	7.17E-06	6.72E-06	4.85E-08
SSW	0.34	1.50E-05	1.50E-05	1.41E-05	6.20E-08
SW	0.34	2.74E-05	2.74E-05	2.57E-05	7.20E-08
WSW	0.34	6.45E-05	6.45E-05	6.05E-05	1.05E-07
W	0.34	4.12E-05	4.11E-05	3.86E-05	6.93E-08
WNW	0.34	1.88E-05	1.87E-05	1.76E-05	4.00E-08
NW	0.34	2.21E-05	2.21E-05	2.07E-05	5.14E-08
NNW	0.34	1.19E-05	1.19E-05	1.12E-05	3.22E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-115

2001 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.61E-05	1.60E-05	1.51E-05	5.61E-08
NNE	0.34	1.17E-05	1.17E-05	1.10E-05	5.26E-08
NE	0.34	1.19E-05	1.18E-05	1.11E-05	8.78E-08
ENE	0.34	5.14E-06	5.14E-06	4.82E-06	5.23E-08
E	0.34	2.51E-06	2.51E-06	2.35E-06	2.26E-08
ESE	0.34	2.23E-06	2.23E-06	2.09E-06	1.80E-08
SE	0.34	4.12E-06	4.12E-06	3.86E-06	3.54E-08
SSE	0.34	4.90E-06	4.90E-06	4.60E-06	4.05E-08
S	0.34	7.01E-06	7.00E-06	6.57E-06	4.61E-08
SSW	0.34	1.23E-05	1.23E-05	1.16E-05	5.35E-08
SW	0.34	2.34E-05	2.34E-05	2.20E-05	5.53E-08
WSW	0.34	7.16E-05	7.15E-05	6.71E-05	1.11E-07
W	0.34	4.83E-05	4.83E-05	4.53E-05	7.56E-08
WNW	0.34	2.44E-05	2.43E-05	2.28E-05	4.62E-08
NW	0.34	2.29E-05	2.29E-05	2.15E-05	5.93E-08
NNW	0.34	1.40E-05	1.40E-05	1.31E-05	4.10E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-116

2002 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.45E-05	1.45E-05	1.36E-05	5.77E-08
NNE	0.34	1.25E-05	1.25E-05	1.17E-05	6.47E-08
NE	0.34	1.10E-05	1.10E-05	1.03E-05	9.60E-08
ENE	0.34	5.93E-06	5.93E-06	5.56E-06	5.79E-08
E	0.34	3.20E-06	3.20E-06	3.00E-06	2.82E-08
ESE	0.34	2.48E-06	2.48E-06	2.32E-06	2.22E-08
SE	0.34	2.99E-06	2.99E-06	2.81E-06	2.84E-08
SSE	0.34	4.19E-06	4.19E-06	3.93E-06	3.86E-08
S	0.34	6.58E-06	6.57E-06	6.17E-06	4.47E-08
SSW	0.34	1.52E-05	1.52E-05	1.42E-05	6.51E-08
SW	0.34	2.51E-05	2.51E-05	2.36E-05	6.08E-08
WSW	0.34	6.65E-05	6.64E-05	6.24E-05	9.45E-08
W	0.34	3.72E-05	3.71E-05	3.49E-05	5.98E-08
WNW	0.34	2.32E-05	2.31E-05	2.17E-05	4.47E-08
NW	0.34	1.91E-05	1.90E-05	1.79E-05	4.97E-08
NNW	0.34	1.33E-05	1.33E-05	1.25E-05	4.09E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-117

2003 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.34E-05	1.34E-05	1.26E-05	5.19E-08
NNE	0.34	1.08E-05	1.08E-05	1.02E-05	5.33E-08
NE	0.34	1.00E-05	1.00E-05	9.38E-06	8.40E-08
ENE	0.34	5.94E-06	5.93E-06	5.57E-06	5.73E-08
E	0.34	3.18E-06	3.18E-06	2.98E-06	2.68E-08
ESE	0.34	2.53E-06	2.53E-06	2.38E-06	2.33E-08
SE	0.34	2.97E-06	2.97E-06	2.79E-06	2.75E-08
SSE	0.34	3.56E-06	3.56E-06	3.34E-06	3.38E-08
S	0.34	5.41E-06	5.40E-06	5.07E-06	3.51E-08
SSW	0.34	1.57E-05	1.57E-05	1.47E-05	6.96E-08
SW	0.34	3.21E-05	3.21E-05	3.01E-05	8.07E-08
WSW	0.34	5.65E-05	5.65E-05	5.30E-05	9.25E-08
W	0.34	3.37E-05	3.37E-05	3.16E-05	5.96E-08
WNW	0.34	2.05E-05	2.05E-05	1.92E-05	4.93E-08
NW	0.34	2.43E-05	2.43E-05	2.28E-05	7.25E-08
NNW	0.34	1.21E-05	1.21E-05	1.14E-05	4.18E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-118

1999 - 2003 AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.43E-05	1.43E-05	1.34E-05	5.26E-08
NNE	0.34	1.16E-05	1.16E-05	1.09E-05	5.50E-08
NE	0.34	1.12E-05	1.12E-05	1.05E-05	8.72E-08
ENE	0.34	5.58E-06	5.58E-06	5.23E-06	5.54E-08
E	0.34	3.01E-06	3.00E-06	2.82E-06	2.65E-08
ESE	0.34	2.48E-06	2.48E-06	2.33E-06	2.16E-08
SE	0.34	3.43E-06	3.43E-06	3.22E-06	3.08E-08
SSE	0.34	4.38E-06	4.37E-06	4.11E-06	3.96E-08
S	0.34	6.78E-05	6.78E-06	6.36E-06	4.59E-08
SSW	0.34	1.43E-05	1.43E-05	1.34E-05	6.37E-08
SW	0.34	2.66E-05	2.66E-05	2.49E-05	6.80E-08
WSW	0.34	6.54E-05	6.54E-05	6.14E-05	1.02E-07
W	0.34	4.05E-05	4.05E-05	3.80E-05	6.64E-08
WNW	0.34	2.21E-05	2.21E-05	2.07E-05	4.49E-08
NW	0.34	2.16E-05	2.16E-05	2.02E-05	5.70E-08
NNW	0.34	1.23E-05	1.23E-05	1.16E-05	3.76E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 2.3-119

1999 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	1.72E-06	1.71E-06	1.47E-06	4.44E-09
2	NNE	1	2.85E-06	2.83E-06	2.48E-06	1.04E-08
3	NE	0.9	3.07E-06	3.05E-06	2.69E-06	1.77E-08
4	ENE	2.1	4.03E-07	4.01E-07	3.32E-07	3.06E-09
5	E	1.4	3.28E-07	3.27E-07	2.80E-07	2.30E-09
6	ESE	0.5	1.13E-06	1.13E-06	1.03E-06	9.24E-09
7	SE	0.5	1.90E-06	1.90E-06	1.74E-06	1.51E-08
8	SSE	0.6	1.87E-06	1.87E-06	1.69E-06	1.58E-08
9	S	1	1.69E-06	1.68E-06	1.47E-06	9.42E-09
10	SSW	0.9	3.23E-06	3.21E-06	2.83E-06	1.35E-08
11	SW	1.5	3.06E-06	3.03E-06	2.59E-06	6.42E-09
12	WSW	1.3	1.16E-05	1.15E-05	9.90E-06	1.49E-08
13	W	1.2	5.96E-06	5.90E-06	5.12E-06	7.54E-09
14	WNW	0.8	7.13E-06	7.08E-06	6.30E-06	1.12E-08
15	NW	0.8	6.11E-06	6.06E-06	5.40E-06	1.34E-08
16	NNW	0.6	5.02E-06	5.00E-06	4.52E-06	1.38E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	4.61E-07	4.52E-07	3.61E-07	9.99E-10
2	NNE	2.3	8.50E-07	8.40E-07	6.92E-07	2.73E-09
3	NE	2.7	6.27E-07	6.21E-07	5.02E-07	3.07E-09
4	ENE	2.1	4.03E-07	4.01E-07	3.32E-07	3.06E-09
5	E	1.8	2.21E-07	2.20E-07	1.84E-07	1.52E-09
6	ESE	2.5	7.59E-08	7.54E-08	6.14E-08	4.97E-10
7	SE	0.6	1.46E-06	1.46E-06	1.32E-06	1.11E-08
8	SSE	1.5	4.28E-07	4.26E-07	3.63E-07	2.99E-09
9	S	1.1	1.45E-06	1.44E-06	1.25E-06	7.92E-09
10	SSW	1.2	2.07E-06	2.06E-06	1.78E-06	8.11E-09
11	SW	1.9	2.15E-06	2.12E-06	1.78E-06	4.38E-09
12	WSW	1.3	1.16E-05	1.15E-05	9.90E-06	1.49E-08
13	W	1.2	5.96E-06	5.90E-06	5.12E-06	7.54E-09
14	WNW	(1)	-	-	-	-
15	NW	1.8	1.71E-06	1.69E-06	1.43E-06	3.19E-09
16	NNW	4	2.87E-07	2.80E-07	2.18E-07	5.10E-10

(1) No garden within 5 miles for this sector

***Locations use the 2003 Land Use Census Locations**

TABLE 2.3-120

2000 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	2.11E-06	2.10E-06	1.81E-06	5.31E-09
2	NNE	1	3.19E-06	3.18E-06	2.78E-06	1.04E-08
3	NE	0.9	2.89E-06	2.88E-06	2.54E-06	1.71E-08
4	ENE	2.1	3.66E-07	3.64E-07	3.01E-07	2.71E-09
5	E	1.4	3.42E-07	3.40E-07	2.91E-07	2.17E-09
6	ESE	0.5	1.56E-06	1.56E-06	1.43E-06	1.23E-08
7	SE	0.5	2.07E-06	2.06E-06	1.89E-06	1.69E-08
8	SSE	0.6	2.44E-06	2.44E-06	2.20E-06	1.94E-08
9	S	1	1.56E-06	1.55E-06	1.35E-06	8.29E-09
10	SSW	0.9	3.69E-06	3.67E-06	3.24E-06	1.22E-08
11	SW	1.5	3.33E-06	3.30E-06	2.82E-06	6.51E-09
12	WSW	1.3	1.13E-05	1.12E-05	9.65E-06	1.49E-08
13	W	1.2	5.92E-06	5.87E-06	5.09E-06	7.77E-09
14	WNW	0.8	5.68E-06	5.64E-06	5.02E-06	1.00E-08
15	NW	0.8	6.90E-06	6.85E-06	6.10E-06	1.32E-08
16	NNW	0.6	5.84E-06	5.82E-06	5.27E-06	1.37E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	5.63E-07	5.53E-07	4.41E-07	1.20E-09
2	NNE	2.3	9.52E-07	9.41E-07	7.75E-07	2.74E-09
3	NE	2.7	5.76E-07	5.70E-07	4.62E-07	2.96E-09
4	ENE	2.1	3.66E-07	3.64E-07	3.01E-07	2.71E-09
5	E	1.8	2.30E-07	2.29E-07	1.92E-07	1.44E-09
6	ESE	2.5	1.04E-07	1.03E-07	8.43E-08	6.62E-10
7	SE	0.6	1.58E-06	1.58E-06	1.43E-06	1.25E-08
8	SSE	1.5	5.59E-07	5.56E-07	4.73E-07	3.65E-09
9	S	1.1	1.34E-06	1.33E-06	1.16E-06	6.97E-09
10	SSW	1.2	2.37E-06	2.36E-06	2.04E-06	7.34E-09
11	SW	1.9	2.33E-06	2.31E-06	1.93E-06	4.44E-09
12	WSW	1.3	1.13E-05	1.12E-05	9.65E-06	1.49E-08
13	W	1.2	5.92E-06	5.87E-06	5.09E-06	7.77E-09
15	NW	1.8	1.93E-06	1.91E-06	1.61E-06	3.15E-09
16	NNW	4	3.36E-07	3.27E-07	2.55E-07	5.09E-10

(1) No garden within 5 miles for this sector

***Locations use the 2003 Land Use Census Locations**

TABLE 2.3-121

2001 ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	2.24E-06	2.22E-06	1.92E-06	5.62E-09
2	NNE	1	3.07E-06	3.06E-06	2.68E-06	1.05E-08
3	NE	0.9	3.00E-06	2.99E-06	2.63E-06	1.82E-08
4	ENE	2.1	3.52E-07	3.50E-07	2.89E-07	2.75E-09
5	E	1.4	2.71E-07	2.70E-07	2.31E-07	1.85E-09
6	ESE	0.5	1.17E-06	1.16E-06	1.07E-06	8.67E-09
7	SE	0.5	2.28E-06	2.28E-06	2.09E-06	1.82E-08
8	SSE	0.6	2.30E-06	2.29E-06	2.07E-06	1.68E-08
9	S	1	1.51E-06	1.51E-06	1.32E-06	7.88E-09
10	SSW	0.9	3.06E-06	3.05E-06	2.69E-06	1.05E-08
11	SW	1.5	2.88E-06	2.86E-06	2.44E-06	5.00E-09
12	WSW	1.3	1.24E-05	1.23E-05	1.06E-05	1.57E-08
13	W	1.2	6.95E-06	6.88E-06	5.97E-06	8.47E-09
14	WNW	0.8	7.49E-06	7.43E-06	6.62E-06	1.16E-08
15	NW	0.8	7.21E-06	7.16E-06	6.37E-06	1.52E-08
16	NNW	0.6	6.90E-06	6.87E-06	6.22E-06	1.75E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	5.95E-07	5.84E-07	4.66E-07	1.26E-09
2	NNE	2.3	9.17E-07	9.06E-07	7.46E-07	2.75E-09
3	NE	2.7	6.01E-07	5.94E-07	4.81E-07	3.15E-09
4	ENE	2.1	3.52E-07	3.50E-07	2.89E-07	2.75E-09
5	E	1.8	1.82E-07	1.81E-07	1.51E-07	1.23E-09
6	ESE	2.5	7.86E-08	7.80E-08	6.36E-08	4.66E-10
7	SE	0.6	1.74E-06	1.74E-06	1.57E-06	1.34E-08
8	SSE	1.5	5.27E-07	5.25E-07	4.47E-07	3.17E-09
9	S	1.1	1.30E-06	1.29E-06	1.12E-06	6.63E-09
10	SSW	1.2	1.98E-06	1.96E-06	1.70E-06	6.34E-09
11	SW	1.9	2.03E-06	2.00E-06	1.68E-06	3.41E-09
12	WSW	1.3	1.24E-05	1.23E-05	1.06E-05	1.57E-08
13	W	1.2	6.95E-06	6.88E-06	5.97E-06	8.47E-09
14	NWW	(1)	-	-	-	-
15	NW	1.8	2.03E-06	2.01E-06	1.69E-06	3.63E-09
16	NNW	4	4.02E-07	3.91E-07	3.05E-07	6.48E-10

(1) No garden within 5 miles for this sector

***Locations use the 2003 Land Use Census Locations**

TABLE 2.3-122

2002 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	2.06E-06	2.04E-06	1.76E-06	5.79E-09
2	NNE	1	3.26E-06	3.25E-06	2.84E-06	1.29E-08
3	NE	0.9	2.78E-06	2.77E-06	2.44E-06	1.99E-08
4	ENE	2.1	4.18E-07	4.15E-07	3.43E-07	3.05E-09
5	E	1.4	3.55E-07	3.53E-07	3.02E-07	2.30E-09
6	ESE	0.5	1.30E-06	1.30E-06	1.19E-06	1.07E-08
7	SE	0.5	1.67E-06	1.67E-06	1.53E-06	1.46E-08
8	SSE	0.6	1.96E-06	1.95E-06	1.76E-06	1.60E-08
9	S	1	1.45E-06	1.44E-06	1.26E-06	7.63E-09
10	SSW	0.9	3.73E-06	3.71E-06	3.27E-06	1.28E-08
11	SW	1.5	3.03E-06	3.00E-06	2.56E-06	5.50E-09
12	WSW	1.3	1.14E-05	1.13E-05	9.74E-06	1.33E-08
13	W	1.2	5.41E-06	5.36E-06	4.65E-06	6.70E-09
14	WNW	0.8	7.00E-06	6.95E-06	6.19E-06	1.12E-08
15	NW	0.8	5.92E-06	5.88E-06	5.23E-06	1.28E-08
16	NNW	0.6	6.47E-06	6.45E-06	5.84E-06	1.74E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	5.51E-07	5.42E-07	4.31E-07	1.30E-09
2	NNE	2.3	9.70E-07	9.61E-07	7.90E-07	3.39E-09
3	NE	2.7	5.50E-07	5.45E-07	4.41E-07	3.44E-09
4	ENE	2.1	4.18E-07	4.15E-07	3.43E-07	3.05E-09
5	E	1.8	2.38E-07	2.37E-07	1.99E-07	1.52E-09
6	ESE	2.5	8.95E-08	8.89E-08	7.24E-08	5.74E-10
7	SE	0.6	1.28E-06	1.28E-06	1.15E-06	1.07E-08
8	SSE	1.5	4.46E-07	4.44E-07	3.78E-07	3.02E-09
9	S	1.1	1.25E-06	1.24E-06	1.08E-06	6.42E-09
10	SSW	1.2	2.40E-06	2.39E-06	2.07E-06	7.71E-09
11	SW	1.9	2.13E-06	2.11E-06	1.76E-06	3.76E-09
12	WSW	1.3	1.14E-05	1.13E-05	9.74E-06	1.33E-08
13	W	1.2	5.41E-06	5.36E-06	4.65E-06	6.70E-09
14	NWW	(1)	-	-	-	-
15	NW	1.8	1.65E-06	1.63E-06	1.38E-06	3.05E-09
16	NNW	4	3.82E-07	3.73E-07	2.90E-07	6.46E-10

(1) No garden within 5 miles for this sector

***Locations use the 2003 Land Use Census Locations

TABLE 2.3-123

2003 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	1.89E-06	1.87E-06	1.61E-06	5.20E-09
2	NNE	1	2.85E-06	2.83E-06	2.48E-06	1.06E-08
3	NE	0.9	2.56E-06	2.55E-06	2.25E-06	1.74E-08
4	ENE	2.1	4.35E-07	4.32E-07	3.57E-07	3.02E-09
5	E	1.4	3.53E-07	3.51E-07	3.01E-07	2.19E-09
6	ESE	0.5	1.33E-06	1.33E-06	1.21E-06	1.12E-08
7	SE	0.5	1.66E-06	1.66E-06	1.52E-06	1.42E-08
8	SSE	0.6	1.68E-06	1.67E-06	1.51E-06	1.40E-08
9	S	1	1.20E-06	1.20E-06	1.05E-06	5.99E-09
10	SSW	0.9	3.92E-06	3.90E-06	3.44E-06	1.37E-08
11	SW	1.5	3.91E-06	3.88E-06	3.31E-06	7.30E-09
12	WSW	1.3	1.00E-05	9.93E-06	8.56E-06	1.30E-08
13	W	1.2	4.96E-06	4.91E-06	4.26E-06	6.68E-09
14	WNW	0.8	6.33E-06	6.29E-06	5.59E-06	1.24E-08
15	NW	0.8	7.72E-06	7.67E-06	6.82E-06	1.86E-08
16	NNW	0.6	5.96E-06	5.94E-06	5.37E-06	1.78E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	4.97E-07	4.89E-07	3.89E-07	1.17E-09
2	NNE	2.3	8.48E-07	8.39E-07	6.90E-07	2.79E-09
3	NE	2.7	5.08E-07	5.04E-07	4.07E-07	3.01E-09
4	ENE	2.1	4.35E-07	4.32E-07	3.57E-07	3.02E-09
5	E	1.8	2.38E-07	2.37E-07	1.99E-07	1.45E-09
6	ESE	2.5	8.98E-08	8.92E-08	7.27E-08	6.03E-10
7	SE	0.6	1.27E-06	1.27E-06	1.15E-06	1.04E-08
8	SSE	1.5	3.88E-07	3.86E-07	3.29E-07	2.65E-09
9	S	1.1	1.03E-06	1.03E-06	8.95E-07	5.04E-09
10	SSW	1.2	2.53E-06	2.52E-06	2.18E-06	8.24E-09
11	SW	1.9	2.75E-06	2.72E-06	2.28E-06	4.98E-09
12	WSW	1.3	1.00E-05	9.93E-06	8.56E-06	1.30E-08
13	W	1.2	4.96E-06	4.91E-06	4.26E-06	6.68E-09
14	NWW	-	-	-	-	-
15	NW	1.8	2.18E-06	2.16E-06	1.82E-06	4.44E-09
16	NNW	4	3.42E-07	3.34E-07	2.60E-07	6.60E-10

(1) No garden within 5 miles for this sector

*Locations use the 2003 Land Use Census Locations

TABLE 2.3-124

1999 - 2003 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	1.3	2.00E-06	1.99E-06	1.71E-06	5.27E-09
2	NNE	1	3.05E-06	3.03E-06	2.65E-06	1.10E-08
3	NE	0.9	2.86E-06	2.85E-06	2.51E-06	1.81E-08
4	ENE	2.1	3.95E-07	3.92E-07	3.24E-07	2.92E-09
5	E	1.4	3.30E-07	3.28E-07	2.81E-07	2.16E-09
6	ESE	0.5	1.30E-06	1.30E-06	1.19E-06	1.04E-08
7	SE	0.5	1.92E-06	1.92E-06	1.75E-06	1.58E-08
8	SSE	0.6	2.05E-06	2.05E-06	1.85E-06	1.64E-08
9	S	1	1.48E-06	1.48E-06	1.29E-06	7.84E-09
10	SSW	0.9	3.53E-06	3.51E-06	3.09E-06	1.25E-08
11	SW	1.5	3.24E-06	3.21E-06	2.74E-06	6.15E-09
12	WSW	1.3	1.14E-05	1.13E-05	9.70E-06	1.43E-08
13	W	1.2	5.84E-06	5.79E-06	5.02E-06	7.43E-09
14	WNW	0.8	6.73E-06	6.68E-06	5.94E-06	1.13E-08
15	NW	0.8	6.77E-06	6.72E-06	5.98E-06	1.46E-08
16	NNW	0.6	6.04E-06	6.01E-06	5.44E-06	1.60E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	3.2	5.34E-07	5.24E-07	4.17E-07	1.19E-09
2	NNE	2.3	9.07E-07	8.98E-07	7.39E-07	2.88E-09
3	NE	2.7	5.72E-07	5.67E-07	4.59E-07	3.13E-09
4	ENE	2.1	3.95E-07	3.92E-07	3.24E-07	2.92E-09
5	E	1.8	2.22E-07	2.21E-07	1.85E-07	1.43E-09
6	ESE	2.5	8.76E-08	8.70E-08	7.09E-08	5.60E-10
7	SE	0.6	1.47E-06	1.47E-06	1.32E-06	1.16E-08
8	SSE	1.5	4.70E-07	4.68E-07	3.98E-07	3.10E-09
9	S	1.1	1.27E-06	1.27E-06	1.10E-06	6.60E-09
10	SSW	1.2	2.27E-06	2.26E-06	1.95E-06	7.55E-09
11	SW	1.9	2.28E-06	2.25E-06	1.89E-06	4.20E-09
12	WSW	1.3	1.14E-05	1.13E-05	9.70E-06	1.43E-08
13	W	1.2	5.84E-06	5.79E-06	5.02E-06	7.43E-09
14	NWW	(1)	-	-	-	-
15	NW	1.8	1.90E-06	1.88E-06	1.58E-06	3.49E-09
16	NNW	4	3.50E-07	3.41E-07	2.65E-07	5.94E-10

(1) No garden within 5 miles for this sector

*****Locations use the 2003 Land Use Census Locations

TABLE 2.3-125

1999 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST MEAT ANIMAL. DAIRY LOCATIONS
AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION
WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	8.50E-07	8.40E-07	6.92E-07	2.73E-09
4	ENE	2.4	3.37E-07	3.35E-07	2.74E-07	2.55E-09
5	E	1.4	3.28E-07	3.27E-07	2.80E-07	2.30E-09
10	SSW	3	4.70E-07	4.63E-07	3.71E-07	1.58E-09
10	SSW	3.5	3.30E-07	3.25E-07	2.56E-07	1.05E-09
12	WSW	1.7	7.90E-06	7.82E-06	6.61E-06	9.71E-09
15	NW	1.8	1.71E-06	1.69E-06	1.43E-06	3.19E-09

ALL DAIRY LOCATIONS WITHIN A 5-MILE RADIUS OF SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	4.62E-08	4.56E-08	3.46E-08	2.66E-10
6	ESE	2.7	6.54E-08	6.50E-08	5.24E-08	4.19E-10
6	ESE	4.2	2.64E-08	2.61E-08	2.00E-08	1.49E-10
10	SSW	3	4.70E-07	4.63E-07	3.71E-07	1.58E-09
10	SSW	3.1	4.37E-07	4.31E-07	3.43E-07	1.46E-09
10	SSW	3.5	3.30E-07	3.25E-07	2.56E-07	1.05E-09
12	WSW	1.7	7.90E-06	7.82E-06	6.61E-06	9.71E-09
13	W	5	5.49E-07	5.28E-07	4.03E-07	4.36E-10
16	NNW	4.2	2.69E-07	2.62E-07	2.03E-07	4.68E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands / EIC	0.7	4.40E-06	4.39E-06	3.93E-06	2.70E-08
12	WSW	Tower's Club	0.5	4.06E-05	4.05E-05	3.71E-05	5.97E-08
5	E	East Gate	0.5	1.70E-06	1.70E-06	1.55E-06	1.48E-08

*****Locations use the 2003 Land Use Census Locations

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (l/m^2)

TABLE 2.3-126

2000 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS
AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION
WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	9.52E-07	9.41E-07	7.75E-07	2.74E-09
4	ENE	2.4	3.04E-07	3.02E-07	2.47E-07	2.26E-09
5	E	1.4	3.42E-07	3.40E-07	2.91E-07	2.17E-09
10	SSW	3	5.36E-07	5.28E-07	4.23E-07	1.43E-09
10	SSW	3.5	3.77E-07	3.70E-07	2.92E-07	9.52E-10
12	WSW	1.7	7.71E-06	7.63E-06	6.45E-06	9.69E-09
15	NW	1.8	1.93E-06	1.91E-06	1.61E-06	3.15E-09

ALL DAIRY LOCATIONS WITHIN A 5-MILE RAIDUS OF SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	4.78E-08	4.70E-08	3.58E-08	2.51E-10
6	ESE	2.7	8.98E-08	8.90E-08	7.20E-08	5.58E-10
6	ESE	4.2	3.60E-08	3.55E-08	2.72E-08	1.99E-10
10	SSW	3	5.36E-07	5.28E-07	4.23E-07	1.43E-09
10	SSW	3.1	4.99E-07	4.91E-07	3.92E-07	1.32E-09
10	SSW	3.5	3.77E-07	3.70E-07	2.92E-07	9.52E-10
12	WSW	1.7	7.71E-06	7.63E-06	6.45E-06	9.69E-09
13	W	5	5.35E-07	5.15E-07	3.93E-07	4.49E-10
16	NNW	4.2	3.15E-07	3.06E-07	2.37E-07	4.68E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands/EIC	0.7	4.17E-06	4.16E-06	3.73E-06	2.61E-08
12	WSW	Towers Club	0.5	3.88E-05	3.87E-05	3.54E-05	5.96E-08
5	E	East Gate	0.5	1.79E-06	1.79E-06	1.63E-06	1.39E-08

*Locations use the 2003 Land Use Census Locations. Only sectors with animals or dairy within 5 miles are shown.

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-127

2001 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS
AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	9.17E-07	9.06E-07	7.46E-07	2.75E-09
4	ENE	2.4	2.93E-07	2.91E-07	2.38E-07	2.30E-09
5	E	1.4	2.71E-07	2.70E-07	2.31E-07	1.85E-09
10	SSW	3	4.46E-07	4.39E-07	3.52E-07	1.24E-09
10	SSW	3.5	3.13E-07	3.08E-07	2.42E-07	8.22E-10
12	WSW	1.7	8.49E-06	8.40E-06	7.10E-06	1.02E-08
15	NW	1.8	2.03E-06	2.01E-06	1.69E-06	3.63E-09

ALL DAIRY LOCATIONS WITHIN A 5-MILE RADIUS OF SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	3.70E-08	3.64E-08	2.77E-08	2.14E-10
6	ESE	2.7	6.77E-08	6.71E-08	5.42E-08	3.93E-10
6	ESE	4.2	2.71E-08	2.67E-08	2.05E-08	1.40E-10
10	SSW	3	4.46E-07	4.39E-07	3.52E-07	1.24E-09
10	SSW	3.1	4.15E-07	4.08E-07	3.26E-07	1.14E-09
10	SSW	3.5	3.13E-07	3.08E-07	2.42E-07	8.22E-10
12	WSW	1.7	8.49E-06	8.40E-06	7.10E-06	1.02E-08
13	W	5	6.35E-07	6.11E-07	4.66E-07	4.89E-10
16	NNW	4.2	3.76E-07	3.66E-07	2.84E-07	5.95E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands/EIC	0.7	4.34E-06	4.33E-06	3.87E-06	2.77E-08
12	WSW	Towers Club	0.5	4.29E-05	4.28E-05	3.92E-05	6.28E-08
5	E	East Gate	0.5	1.42E-06	1.42E-06	1.30E-06	1.19E-08

*Locations use the 2003 Land Use Census Locations. Only sectors with animals or dairy within 5 miles are shown

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-128

2002 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS
AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	9.70E-07	9.61E-07	7.90E-07	3.39E-09
4	ENE	2.4	3.48E-07	3.45E-07	2.82E-07	2.54E-09
5	E	1.4	3.55E-07	3.53E-07	3.02E-07	2.30E-09
10	SSW	3	5.49E-07	5.40E-07	4.33E-07	1.50E-09
10	SSW	3.5	3.87E-07	3.80E-07	2.99E-07	1.00E-09
12	WSW	1.7	7.78E-06	7.70E-06	6.51E-06	8.69E-08
15	NW	1.8	1.65E-06	1.63E-06	1.38E-06	3.05E-09

ALL DAIRY LOCATIONS WITHIN A 5-MILE RADIUS OF SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	4.86E-08	4.79E-08	3.64E-08	2.66E-10
6	ESE	2.7	7.72E-08	7.66E-08	6.19E-08	4.85E-10
6	ESE	4.2	3.11E-08	3.07E-08	2.36E-08	1.72E-10
10	SSW	3	5.49E-07	5.40E-07	4.33E-07	1.50E-09
10	SSW	3.1	5.11E-07	5.03E-07	4.01E-07	1.38E-09
10	SSW	3.5	3.87E-07	3.80E-07	2.99E-07	1.00E-09
12	WSW	1.7	7.78E-06	7.70E-06	6.51E-06	8.69E-09
13	W	5	4.98E-07	4.78E-07	3.65E-07	3.87E-10
16	NNW	4.2	3.58E-07	3.49E-07	2.70E-07	5.93E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands / EIC	0.7	4.03E-06	4.02E-06	3.60E-06	3.03E-08
12	WSW	Tower's Club	0.5	3.97E-05	3.96E-05	3.63E-05	5.34E-08
5	E	East Gate	0.5	1.82E-06	1.82E-06	1.67E-06	1.48E-08

*Locations use the 2003 Land Use Census Locations. Only sectors with animals or dairy within 5 miles are shown.

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-129

2003 ATMOSPHERIC DISPERSION ESTIMATES
FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS
AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	8.48E-07	8.39E-07	6.90E-07	2.79E-09
4	ENE	2.4	3.62E-07	3.60E-07	2.94E-07	2.52E-09
5	E	1.4	3.53E-07	3.51E-07	3.01E-07	2.19E-09
10	SSW	3	5.71E-07	5.63E-07	4.51E-07	1.61E-09
10	SSW	3.5	4.00E-07	3.94E-07	3.10E-07	1.07E-09
12	WSW	1.7	6.85E-06	6.77E-06	5.73E-06	8.50E-09
15	NW	1.8	2.18E-06	2.16E-06	1.82E-06	4.44E-09

ALL DAIRY LOCATIONS NEAR SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	4.99E-08	4.90E-08	3.73E-08	2.53E-10
6	ESE	2.7	7.74E-08	7.67E-08	6.20E-08	5.09E-10
6	ESE	4.2	3.10E-08	3.06E-08	2.35E-08	1.81E-10
10	SSW	3	5.71E-07	5.63E-07	4.51E-07	1.61E-09
10	SSW	3.1	5.30E-07	5.23E-07	4.17E-07	1.48E-09
10	SSW	3.5	4.00E-07	3.94E-07	3.10E-07	1.07E-09
12	WSW	1.7	6.85E-06	6.77E-06	5.73E-06	8.50E-09
13	W	5	4.42E-07	4.25E-07	3.25E-07	3.86E-10
16	NNW	4.2	3.20E-07	3.13E-07	2.42E-07	6.07E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands / EIC	0.7	3.70E-06	3.69E-06	3.30E-06	2.65E-08
12	WSW	Tower's Club	0.5	3.41E-05	3.40E-05	3.11E-05	5.22E-08
5	E	East Gate	0.5	1.82E-06	1.81E-06	1.66E-06	1.41E-08

*Locations use the 2003 Land Use Census Locations

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-130

1999 - 2003 ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS AND SPECIAL RECEPTORS*

ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	2.3	9.07E-07	8.98E-07	7.39E-07	2.88E-09
4	ENE	2.4	3.29E-07	3.26E-07	2.67E-07	2.43E-09
5	E	1.4	3.30E-07	3.28E-07	2.81E-07	2.16E-09
10	SSW	3	5.14E-07	5.07E-07	4.06E-07	1.47E-09
10	SSW	3.5	3.61E-07	3.55E-07	2.80E-07	9.79E-10
12	WSW	1.7	7.75E-06	7.66E-06	6.48E-06	9.36E-09
15	NW	1.8	1.90E-06	1.88E-06	1.58E-06	3.49E-09

ALL DAIRY LOCATIONS NEAR SSES

SECTOR NUMBER	AFFECTED SECTOR	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	4.5	4.59E-08	4.52E-08	3.44E-08	2.50E-10
6	ESE	2.7	7.55E-08	7.49E-08	6.05E-08	4.73E-10
6	ESE	4.2	3.03E-08	2.99E-08	2.29E-08	1.68E-10
10	SSW	3	5.14E-07	5.07E-07	4.06E-07	1.47E-09
10	SSW	3.1	4.78E-07	4.71E-07	3.76E-07	1.35E-09
10	SSW	3.5	3.61E-07	3.55E-07	2.80E-07	9.79E-10
12	WSW	1.7	7.75E-06	7.66E-06	6.48E-06	9.36E-09
13	W	5	5.32E-07	5.12E-07	3.90E-07	4.29E-10
16	NNW	4.2	3.28E-07	3.19E-07	2.47E-07	5.46E-10

SPECIAL RECEPTOR LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3	NE	Riverlands / EIC	0.7	4.13E-06	4.12E-06	3.69E-06	2.75E-08
12	WSW	Tower's Club	0.5	3.92E-05	3.91E-05	3.58E-05	5.75E-08
5	E	East Gate	0.5	1.71E-06	1.71E-06	1.56E-06	1.39E-08

*Locations use the 2003 Land Use Census Locations. Only sectors with animals or dairy within 5 miles are shown.

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-131

1999 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
12	WSW	Maximum (X/Q) Site Boundary	1.22	1.28E-05	1.27E-05	1.10E-05	1.66E-08
9	S	Closest (X/Q) Site Boundary	0.38	6.71E-06	6.70E-06	6.25E-06	4.66E-08
12	WSW	Maximum (X/Q) Residence	1.3	1.16E-05	1.15E-05	9.90E-06	1.49E-08
3	NE	Maximum (D/Q) Residence	0.9	3.07E-06	3.05E-06	2.69E-06	1.77E-08
12	WSW	Maximum (D/Q) Garden	1.3	1.15E-05	9.90E-06	1.49E-08	1.16E-05
12	WSW	Maximum (D/Q) Dairy	1.7	7.90E-06	7.82E-06	6.61E-06	9.71E-09
12	WSW	Maximum (D/Q) Meat Producer	1.7	7.90E-06	7.82E-06	6.61E-06	9.71E-09
3	NE	Riverlands / EIC	0.7	4.40E-06	4.39E-06	3.93E-06	2.70E-08
12	WSW	Tower's Club	0.5	4.06E-05	4.05E-05	3.71E-05	5.97E-08
5	E	East Gate	0.5	1.70E-06	1.70E-06	1.55E-06	1.48E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-132

2000 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
12	WSW	Maximum (X/Q) Site Boundary	1.22	1.24E-05	1.23E-05	1.07E-05	1.65E-08
9	S	Closest (X/Q) Site Boundary	0.38	6.21E-06	6.20E-06	5.78E-06	4.11E-08
12	WSW	Maximum (X/Q) Residence	1.3	1.13E-05	1.12E-05	9.65E-06	1.49E-08
3	NE	Maximum (D/Q) Residence	0.6	2.44E-06	2.44E-06	2.20E-06	1.94E-08
12	WSW	Maximum (D/Q) Garden	1.3	1.13E-05	1.12E-05	9.65E-06	1.49E-08
12	WSW	Maximum (D/Q) Dairy	1.7	7.71E-06	7.63E-06	6.45E-06	9.69E-09
12	WSW	Maximum (D/Q) Meat Producer	1.7	7.71E-06	7.63E-06	6.45E-06	9.69E-09
3	NE	Riverlands / EIC	0.7	4.17E-06	4.16E-06	3.73E-06	2.61E-08
12	WSW	Tower's Club	0.5	3.88E-05	3.87E-05	3.54E-05	5.96E-08
5	E	East Gate	0.5	1.79E-06	1.79E-06	1.63E-06	1.39E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-133

2001 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
12/WSW	Maximum (X/Q) Site Boundary	1.22	1.37E-05	1.36E-05	1.18E-05	1.74E-08
9/S	Closest (X/Q) Site Boundary	0.38	6.07E-06	6.06E-06	5.65E-06	3.90E-08
12/WSW	Maximum (X/Q) Residence	1.3	1.24E-05	1.23E-05	1.06E-05	1.57E-08
3/NE	Maximum (D/Q) Residence	0.9	3.00E-06	2.99E-06	2.63E-06	1.82E-08
12/WSW	Maximum (D/Q) Garden	1.3	1.24E-05	1.23E-05	1.06E-05	1.57E-08
12/SW	Maximum (D/Q) Dairy	1.7	8.49E-06	8.40E-06	7.10E-06	1.02E-08
12/WSW	Maximum (D/Q) Meat Producer	1.7	8.49E-06	8.40E-06	7.10E-06	1.02E-08
3/NE	Riverlands / EIC	0.7	4.34E-06	4.33E-06	3.87E-06	2.77E-08
12/WSW	Tower's Club	0.5	4.29E-05	4.28E-05	3.92E-05	6.28E-08
5/E	East Gate	0.5	1.42E-06	1.42E-06	1.30E-06	1.19E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-134

2002 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
12/WSW	Maximum (X/Q) Site Boundary	1.22	1.26E-05	1.25E-05	1.08E-05	1.48E-08
9/S	Closest (X/Q) Site Boundary	0.38	5.71E-06	5.70E-06	5.31E-06	3.78E-08
12/WSW	Maximum (X/Q) Residence	1.3	1.14E-05	1.13E-05	9.74E-06	1.33E-08
3/NE	Maximum (D/Q) Residence	0.9	2.78E-06	2.77E-06	2.44E-06	1.99E-08
12/WSW	Maximum (D/Q) Garden	1.3	1.14E-05	1.13E-05	9.74E-06	1.33E-08
12/SW	Maximum (D/Q) Dairy	1.7	7.78E-06	7.70E-06	6.51E-06	8.69E-09
12/WSW	Maximum (D/Q) Meat Producer	1.7	7.78E-06	7.70E-06	6.51E-06	8.69E-09
3/NE	Riverlands / EIC	0.7	4.03E-06	4.02E-06	3.60E-06	3.03E-08
12/WSW	Tower's Club	0.5	3.97E-05	3.96E-05	3.63E-05	5.34E-08
5/E	East Gate	0.5	1.82E-06	1.82E-06	1.67E-06	1.48E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-135

2003 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
11WS	Maximum (X/Q) Site Boundary	0.61	1.45E-05	1.45E-05	1.31E-05	3.25E-08
9/S	Closest (X/Q) Site Boundary	0.38	4.69E-06	4.69E-06	4.37E-06	2.97E-08
12/WSW	Maximum (X/Q) Residence	1.3	1.00E-05	9.93E-06	8.56E-06	1.30E-08
15/NW	Maximum (D/Q) Residence	0.8	7.72E-06	7.67E-06	6.82E-06	1.86E-08
12/WSW	Maximum (D/Q) Garden	1.3	1.00E-05	9.93E-06	8.56E-06	1.30E-08
12/SW	Maximum (D/Q) Dairy	1.7	6.85E-06	6.77E-06	5.73E-06	8.50E-09
12/WSW	Maximum (D/Q) Meat Producer	1.7	6.85E-06	6.77E-06	5.73E-06	8.50E-09
3/NE	Riverlands / EIC	0.7	3.70E-06	3.69E-06	3.30E-06	2.65E-08
12/WSW	Tower's Club	0.5	3.41E-05	3.40E-05	3.11E-05	5.22E-08
5/E	East Gate	0.5	1.82E-06	1.81E-06	1.66E-06	1.41E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-136

1999 - 2003 ATMOSPHERIC DISPERSION ESTIMATES
AT SELECTED LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
12/WSW	Maximum (X/Q) Site Boundary	1.22	1.25E-05	1.24E-05	1.07E-05	1.60E-08
9/S	Closest (X/Q) Site Boundary	0.38	5.88E-06	5.87E-06	5.47E-06	3.88E-08
12/WSW	Maximum (X/Q) Residence	1.3	1.14E-05	1.13E-05	9.70E-06	1.43E-08
3/NE	Maximum (D/Q) Residence	0.9	2.86E-06	2.85E-06	2.51E-06	1.81E-08
12/WSW	Maximum (D/Q) Garden	1.3	1.14E-05	1.13E-05	9.70E-06	1.43E-08
12/WSW	Maximum (D/Q) Dairy	1.7	7.75E-06	7.66E-06	6.48E-06	9.36E-09
12/WSW	Maximum (D/Q) Meat Producer	1.7	7.75E-06	7.66E-06	6.48E-06	9.36E-09
3/NE	Riverlands / EIC	0.7	4.13E-06	4.12E-06	3.69E-06	2.75E-08
12/WSW	Tower's Club	0.5	3.92E-05	3.91E-05	3.58E-05	5.75E-08
5/E	East Gate	0.5	1.71E-06	1.71E-06	1.56E-06	1.39E-08

(1) Relative concentration (sec/m^3)
(2) Decayed and undepleted, half-life 2.26 days (sec/m^3)
(3) Decayed and depleted, half-life 8 days (sec/m^3)
(4) Relative deposition rate (1/m^2)

TABLE 2.3-137

1999-2003 SSES RELATIVE CONCENTRATIONS NO DECAY, UNDEPLETED X/Q X/Q ACCUMULATION FOR GROUND AVERAGE (seconds per cubic meter)										
Direction From	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	4.13E-06	7.83E-07	3.25E-07	1.71E-07	1.10E-07	4.05E-08	1.11E-08	5.34E-09	3.35E-09	2.37E-09
NNE	8.11E-06	1.63E-06	7.28E-07	3.91E-07	2.53E-07	9.40E-08	2.59E-08	1.27E-08	8.10E-09	5.80E-09
NE	1.71E-05	3.22E-06	1.47E-06	8.32E-07	5.51E-07	2.18E-07	6.61E-08	3.32E-08	2.14E-08	1.55E-08
ENE	4.96E-05	9.15E-06	4.48E-06	2.66E-06	1.78E-06	7.05E-07	2.06E-07	9.99E-08	6.47E-08	4.76E-08
E	2.24E-05	4.08E-06	1.80E-06	1.02E-06	6.83E-07	2.78E-07	8.81E-08	4.46E-08	2.88E-08	2.10E-08
ESE	1.27E-05	2.45E-06	1.11E-06	6.23E-07	4.13E-07	1.67E-07	4.64E-08	2.04E-08	1.31E-08	9.49E-09
SE	1.26E-05	2.48E-06	1.13E-06	6.41E-07	4.25E-07	1.74E-07	4.35E-08	1.61E-08	1.03E-08	7.42E-09
SSE	9.08E-06	1.77E-06	7.87E-07	4.42E-07	2.98E-07	1.28E-07	3.37E-08	1.21E-08	7.71E-09	5.55E-09
S	7.81E-06	1.65E-06	8.08E-07	4.70E-07	3.23E-07	1.50E-07	4.18E-08	1.44E-08	9.23E-09	6.63E-09
SSW	8.36E-06	1.69E-06	7.78E-07	4.42E-07	2.94E-07	1.22E-07	3.21E-08	1.23E-08	7.80E-09	5.59E-09
SW	6.65E-06	1.34E-06	6.36E-07	3.65E-07	2.45E-07	1.08E-07	2.80E-08	9.42E-09	5.96E-09	4.23E-09
WSW	3.41E-06	6.56E-07	3.05E-07	1.79E-07	1.23E-07	5.80E-08	1.82E-08	6.82E-09	3.49E-09	1.91E-09
W	1.58E-06	2.99E-07	1.30E-07	7.11E-08	4.67E-08	1.91E-08	5.18E-09	2.10E-09	1.31E-09	9.15E-10
WNW	1.20E-06	2.19E-07	8.80E-08	4.60E-08	2.93E-08	1.08E-08	2.93E-09	1.39E-09	8.58E-10	5.96E-10
NW	2.03E-06	3.78E-07	1.50E-07	7.66E-08	4.86E-08	1.75E-08	4.62E-09	2.18E-09	1.34E-09	9.32E-10
NNW	2.58E-06	4.83E-07	2.04E-07	1.08E-07	6.83E-08	2.38E-08	5.94E-09	2.82E-09	1.75E-09	1.22E-09

TABLE 2.3-138

1999-2003 SSES RELATIVE CONCENTRATIONS, 2.26-DAY DECAY UNDEPLETED X/Q
X/Q ACCUMULATION FOR GROUND DECAYED SECTOR AVERAGE (seconds per cubic meter)

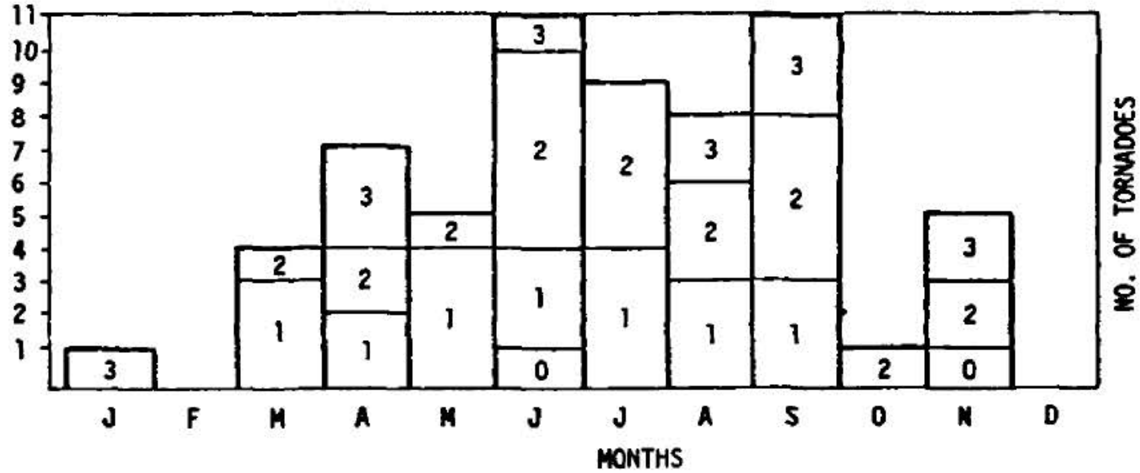
	MILES									
Direction From	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	4.13E-06	7.79E-07	3.22E-07	1.69E-07	1.08E-07	3.94E-08	1.04E-08	4.84E-09	2.92E-09	1.98E-09
NNE	8.09E-06	1.62E-06	7.19E-07	3.84E-07	2.47E-07	9.06E-08	2.40E-08	1.12E-08	6.80E-09	4.63E-09
NE	1.71E-05	3.19E-06	1.45E-06	8.15E-07	5.37E-07	2.08E-07	6.03E-08	2.85E-08	1.73E-08	1.18E-08
ENE	4.95E-05	9.06E-06	4.41E-06	2.60E-06	1.73E-06	6.72E-07	1.87E-07	8.55E-08	5.21E-08	3.60E-08
E	2.23E-05	4.03E-06	1.77E-06	9.95E-07	6.60E-07	2.62E-07	7.85E-08	3.69E-08	2.21E-08	1.49E-08
ESE	1.26E-05	2.43E-06	1.09E-06	6.06E-07	3.99E-07	1.57E-07	4.12E-08	1.67E-08	9.93E-09	6.65E-09
SE	1.26E-06	2.45E-06	1.11E-06	6.25E-07	4.12E-07	1.64E-07	3.90E-08	1.34E-08	7.95E-09	5.33E-09
SSE	9.05E-06	1.75E-06	7.75E-07	4.33E-07	2.89E-07	1.22E-07	3.06E-08	1.03E-08	6.16E-09	4.16E-09
S	7.79E-06	1.64E-06	7.97E-07	4.61E-07	3.15E-07	1.44E-07	3.84E-08	1.26E-08	7.59E-09	5.16E-09
SSW	8.34E-06	1.68E-06	7.69E-07	4.35E-07	2.88E-07	1.18E-07	2.99E-08	1.09E-08	6.64E-09	4.54E-09
SW	6.64E-06	1.33E-06	6.31E-07	3.61E-07	2.41E-07	1.05E-07	2.65E-08	8.60E-09	5.25E-09	3.59E-09
WSW	3.41E-06	6.53E-07	3.03E-07	1.78E-07	1.21E-07	5.67E-08	1.73E-08	6.30E-09	3.13E-09	1.66E-09
W	1.58E-06	2.98E-07	1.29E-07	7.03E-08	4.60E-08	1.86E-08	4.91E-09	1.92E-09	1.16E-09	7.79E-10
WNW	1.20E-06	2.18E-07	8.73E-08	4.55E-08	2.89E-08	1.06E-08	2.80E-09	1.28E-09	7.67E-10	5.16E-10
NW	2.03E-06	3.76E-07	1.49E-07	7.58E-08	4.80E-08	1.72E-08	4.42E-09	2.03E-09	1.22E-09	8.19E-10
NNW	2.57E-06	4.81E-07	2.02E-07	1.07E-07	6.74E-08	2.33E-08	5.67E-09	2.61E-09	1.57E-09	1.06E-09

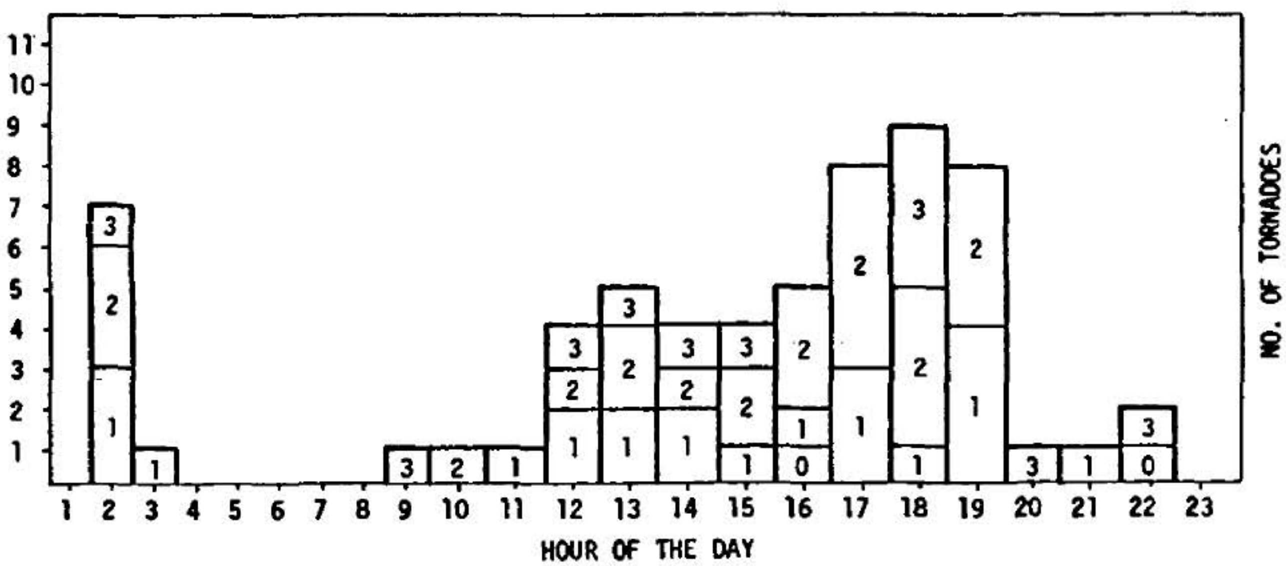
TABLE 2.3-139

1999-2003 SSES RELATIVE CONCENTRATIONS 8-DAY DECAY, DEPLETED X/Q X/Q ACCUMULATION FOR DECAYED DEPLETION (seconds per cubic meter)										
	MILES									
Direction From	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	3.78E-06	6.63E-07	2.63E-07	1.33E-07	8.22E-08	2.82E-08	6.81E-09	2.87E-09	1.61E-09	1.03E-09
NNE	7.41E-06	1.38E-06	5.88E-07	3.02E-07	1.89E-07	6.52E-08	1.59E-08	6.80E-09	3.86E-09	2.50E-09
NE	1.56E-05	2.73E-06	1.19E-06	6.43E-07	4.12E-07	1.51E-07	4.04E-08	1.76E-08	1.01E-08	6.61E-09
ENE	4.53E-05	7.74E-06	3.61E-06	2.05E-06	1.33E-06	4.88E-07	1.25E-07	5.28E-08	3.05E-08	2.02E-08
E	2.04E-05	3.45E-06	1.46E-06	7.89E-07	5.09E-07	1.92E-07	5.34E-08	2.34E-08	1.34E-08	8.78E-09
ESE	1.16E-05	2.07E-06	8.96E-07	4.80E-07	3.08E-07	1.15E-07	2.81E-08	1.07E-08	6.07E-09	3.94E-09
SE	1.15E-05	2.10E-06	9.15E-07	4.95E-07	3.17E-07	1.20E-07	2.64E-08	8.44E-09	4.79E-09	3.10E-09
SSE	8.29E-06	1.50E-06	6.35E-07	3.42E-07	2.22E-07	8.87E-08	2.05E-08	6.38E-09	3.62E-09	2.35E-09
S	7.13E-06	1.40E-06	6.53E-07	3.64E-07	2.41E-07	1.04E-07	2.56E-08	7.67E-09	4.37E-09	2.84E-09
SSW	7.63E-06	1.43E-06	6.29E-07	3.42E-07	2.20E-07	8.50E-08	1.97E-08	6.55E-09	3.73E-09	2.42E-09
SW	6.07E-06	1.13E-06	5.15E-07	2.83E-07	1.84E-07	7.50E-08	1.72E-08	5.07E-09	2.88E-09	1.86E-09
WSW	3.12E-06	5.56E-07	2.47E-07	1.39E-07	9.20E-08	4.04E-08	1.12E-08	3.68E-09	1.69E-09	8.43E-10
W	1.45E-06	2.54E-07	1.05E-07	5.51E-08	3.50E-08	1.33E-08	3.20E-09	1.13E-09	6.33E-10	4.01E-10
WNW	1.10E-06	1.86E-07	7.12E-08	3.57E-08	2.20E-08	7.53E-09	1.81E-09	7.49E-10	4.16E-10	2.63E-10
NW	1.86E-06	3.20E-07	1.22E-07	5.94E-08	3.64E-08	1.22E-08	2.86E-09	1.18E-09	6.54E-10	4.13E-10
NNW	2.35E-06	4.09E-07	1.65E-07	8.40E-08	5.12E-08	1.66E-08	3.67E-09	1.52E-09	8.48E-10	5.37E-10

TABLE 2.3-140

1999-2003 SSES RELATIVE DEPOSITION D/Q X/Q ACCUMULATION FOR DEPOSITION (per square meter)										
	MILES									
Direction From	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	2.57E-08	3.78E-09	1.55E-09	7.35E-10	4.34E-10	1.38E-10	3.29E-11	1.21E-11	6.47E-12	4.06E-12
NNE	3.31E-08	5.13E-09	2.23E-09	1.06E-09	6.23E-10	1.94E-10	4.53E-11	1.67E-11	8.89E-12	5.59E-12
NE	4.05E-08	6.11E-09	2.61E-09	1.27E-09	7.51E-10	2.42E-10	5.93E-11	2.18E-11	1.16E-11	7.31E-12
ENE	7.28E-08	1.13E-08	5.04E-09	2.46E-09	1.46E-09	4.61E-10	1.05E-10	3.68E-11	1.96E-11	1.23E-11
E	3.40E-08	4.96E-09	2.02E-09	9.65E-10	5.76E-10	1.90E-10	4.81E-11	1.77E-11	9.45E-12	5.94E-12
ESE	2.36E-08	3.57E-09	1.52E-09	7.36E-10	4.40E-10	1.46E-10	3.31E-11	1.07E-11	5.71E-12	3.59E-12
SE	3.04E-08	4.62E-09	2.02E-09	9.97E-10	5.98E-10	2.02E-10	4.21E-11	1.15E-11	6.14E-12	3.86E-12
SSE	2.52E-08	3.76E-09	1.60E-09	7.92E-10	4.83E-10	1.73E-10	3.79E-11	1.01E-11	5.38E-12	3.38E-12
S	2.61E-08	4.19E-09	1.97E-09	1.01E-09	6.30E-10	2.44E-10	5.69E-11	1.46E-11	7.80E-12	4.90E-12
SSW	3.58E-08	5.48E-09	2.46E-09	1.24E-09	7.53E-10	2.63E-10	5.84E-11	1.67E-11	8.89E-12	5.59E-12
SW	4.76E-08	7.56E-09	3.56E-09	1.84E-09	1.14E-09	4.28E-10	9.66E-11	2.46E-11	1.31E-11	8.25E-12
WSW	3.14E-08	4.84E-09	2.26E-09	1.21E-09	7.69E-10	3.17E-10	8.93E-11	2.58E-11	1.13E-11	5.54E-12
W	1.29E-08	1.93E-09	8.36E-10	4.17E-10	2.54E-10	9.10E-11	2.22E-11	6.96E-12	3.71E-12	2.33E-12
WNW	9.68E-09	1.40E-09	5.63E-10	2.69E-10	1.60E-10	5.17E-11	1.28E-11	4.71E-12	2.51E-12	1.58E-12
NW	1.67E-08	2.45E-09	9.82E-10	4.57E-10	2.70E-10	8.57E-11	2.06E-11	7.57E-12	4.04E-12	2.54E-12
NNW	2.15E-08	3.19E-09	1.35E-09	6.51E-10	3.81E-10	1.16E-10	2.62E-11	9.63E-12	5.14E-12	3.23E-12





Fugita Intensity Classification

F-Scale	Wind Speed (MPH)	Description
0	40-75	Very Weak Tornado (light damage)
1	73-112	Weak Tornado
2	113-154	Strong Tornado
3	155-206	Severe Tornado
4	207-260	Devasting Tornado
5	261-318	Incredible Tornado
6	319 and higher	Inconceivable Tornado

FSAR REV. 65

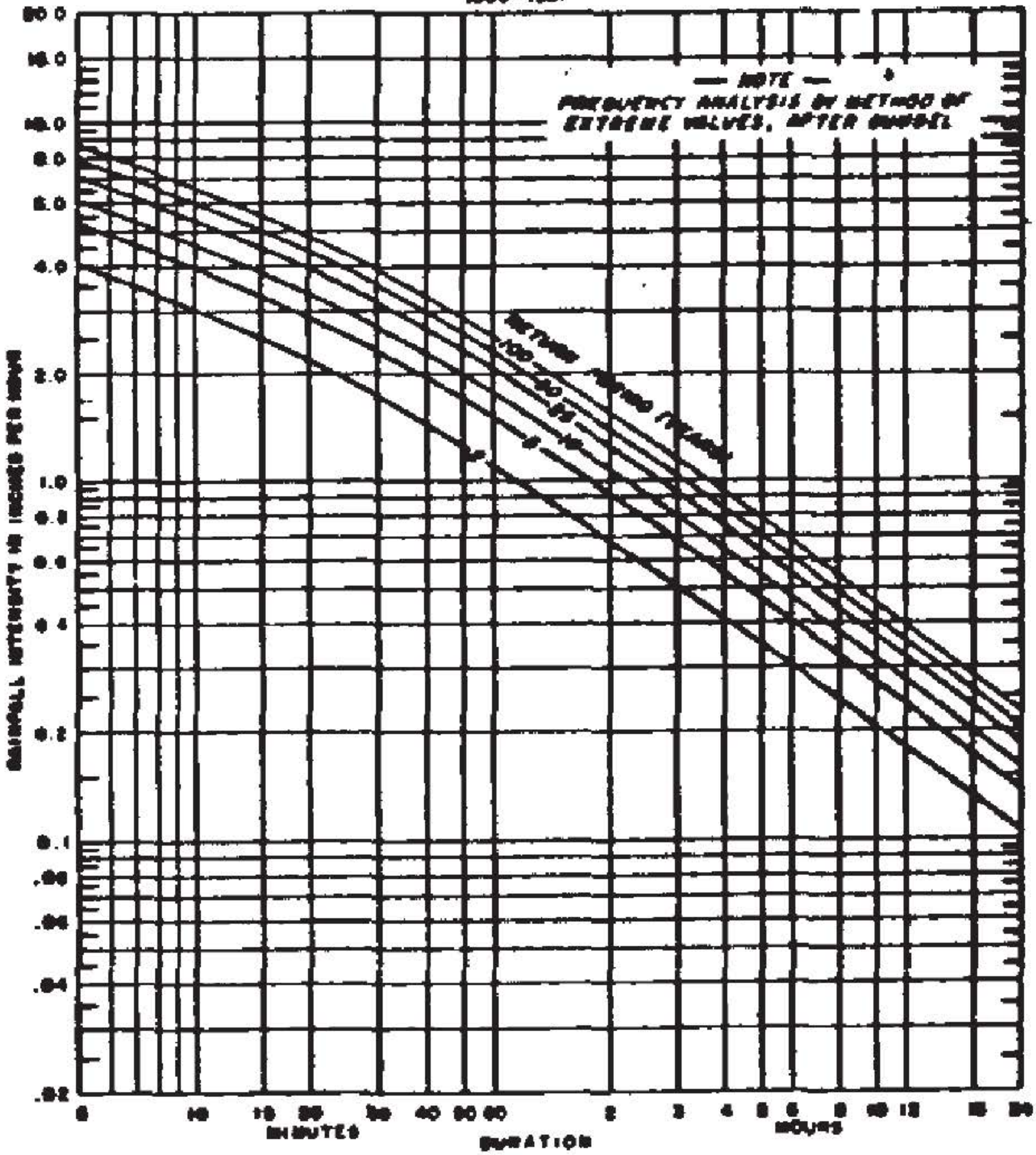
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

TORNADO OCCURRENCE
AND INTENSITY IN
SUSQUEHANNA REGION

FIGURE 2.3-1, Rev 47

AutoCAD: Figure Fsar 2_3_1.dwg

SCRANTON, PENNSYLVANIA



FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

TP 25
RAINFALL INTENSITY-DURATION
FREQUENCY CURVES
USDC WB, 1955

FIGURE 2.3-2, Rev 47

AutoCAD: Figure Fsar 2_3_2.dwg

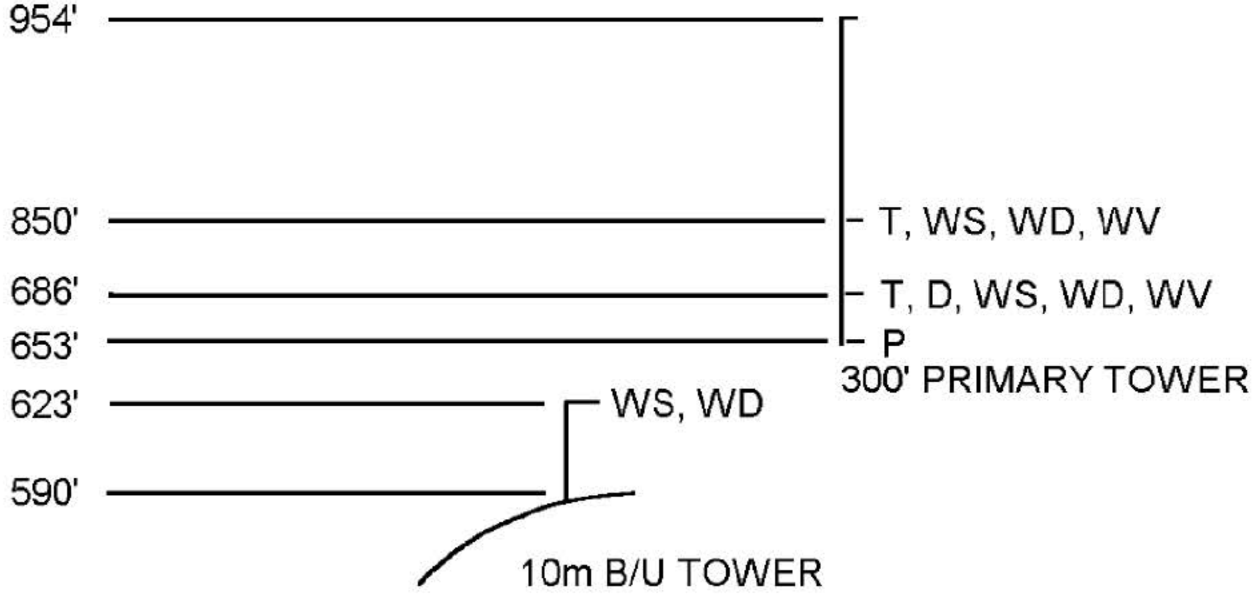
Security-Related Information
Figure Withheld Under 10 CFR 2.390

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

TOPOGRAPHY WITHIN 5 MILES

FIGURE 2.3-3, Rev 55

AutoCAD: Figure Fsar 2_3_3.dwg



KEY TO INSTRUMENTATION

T = TEMPERATURE
D = DEW POINT TEMPERATURE
WS = WIND SPEED
WD = WIND DIRECTION
WV = WIND VARIABILITY (NOTE 1)
P = PRECIPITATION

NOTE:

1. WIND VARIABILITY IS NOT A DIRECT MEASUREMENT AT THE TOWER, BUT TRANSLATED AT THE MAINFRAME IN THE TOWER BUILDING FROM WD DATA.

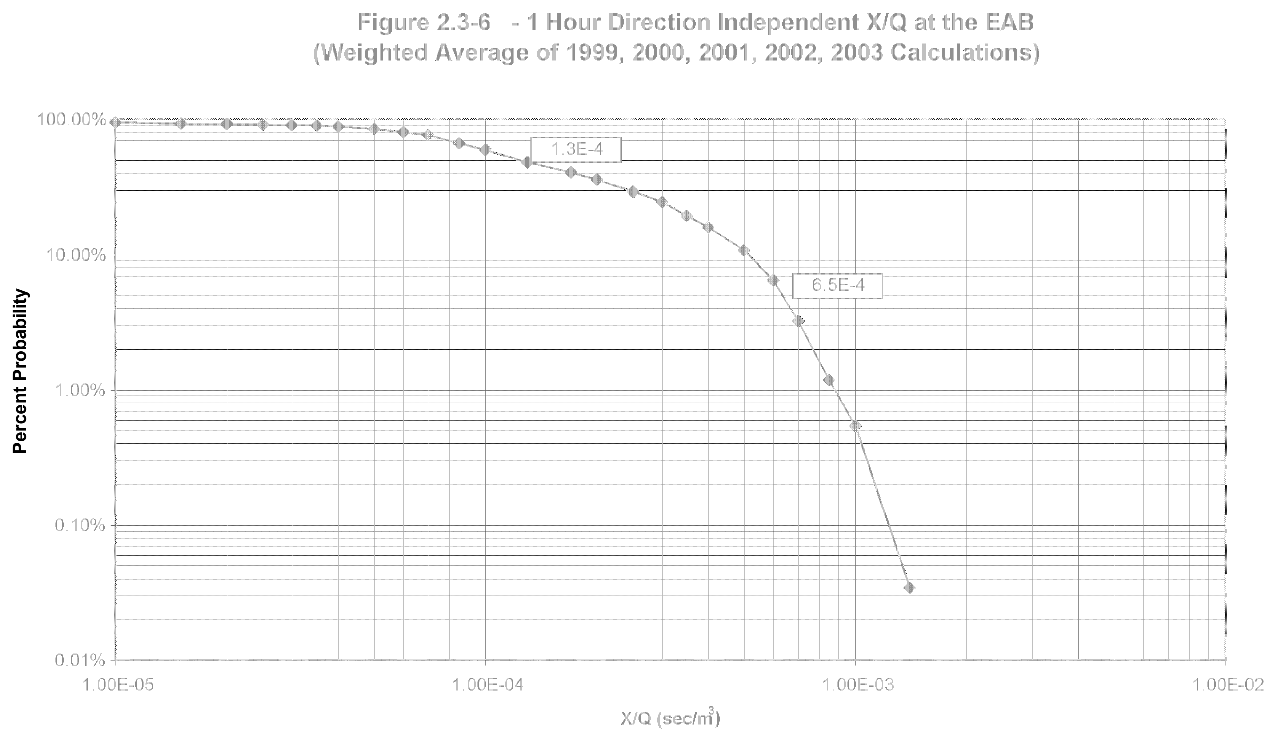
FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

SCHEMATIC OF INSTRUMENTATION

FIGURE 2.3-5, Rev 54

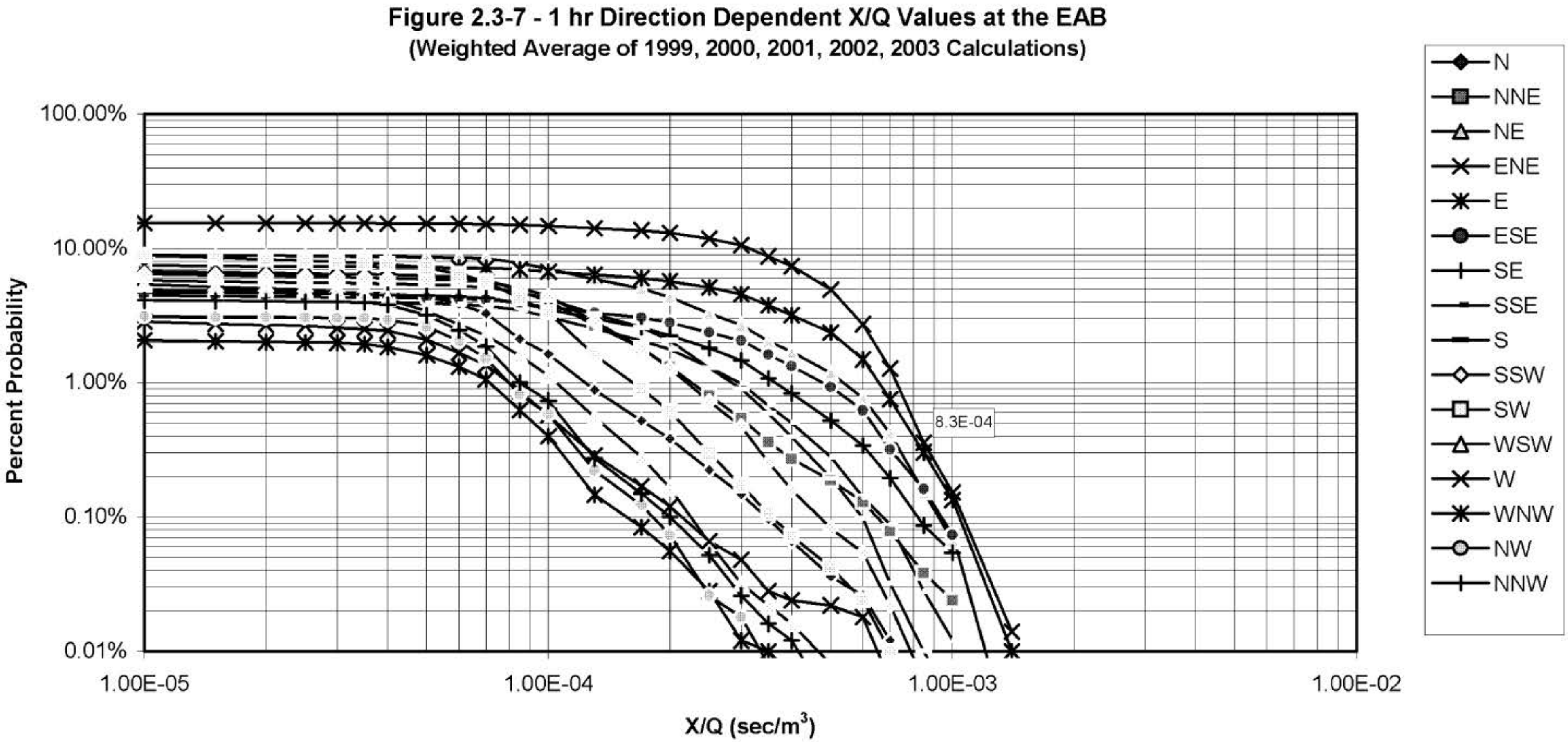
AutoCAD: Figure Fsar 2_3_5.dwg



FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
ONE HOUR DIRECTION INDEPENDENT X/Q AT THE EAB (WEIGHTED AVERAGE OF 1999, 2000, 2001, 2002, 2003 CALCULATIONS) FIGURE 2.3-6, Rev 1

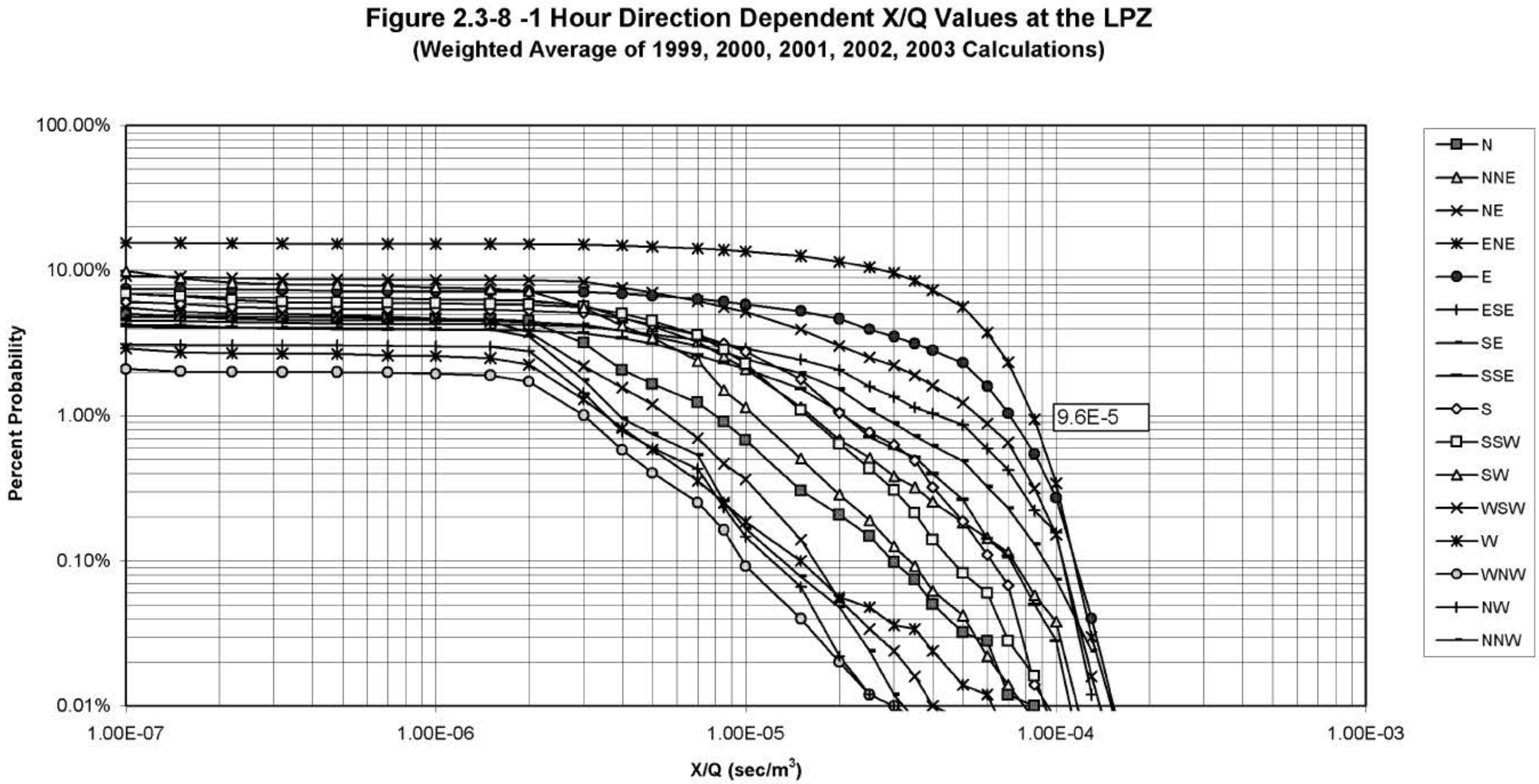
AutoCAD: Figure Fsar 2_3_6.dwg



FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
ONE HOUR DIRECTION DEPENDENT X/Q VALUES AT THE EAB (WEIGHTED AVERAGE OF 1999, 2000, 2001, 2002, 2003 CALCULATIONS) FIGURE 2.3-7, Rev 1

AutoCAD: Figure Fsar 2_3_7.dwg

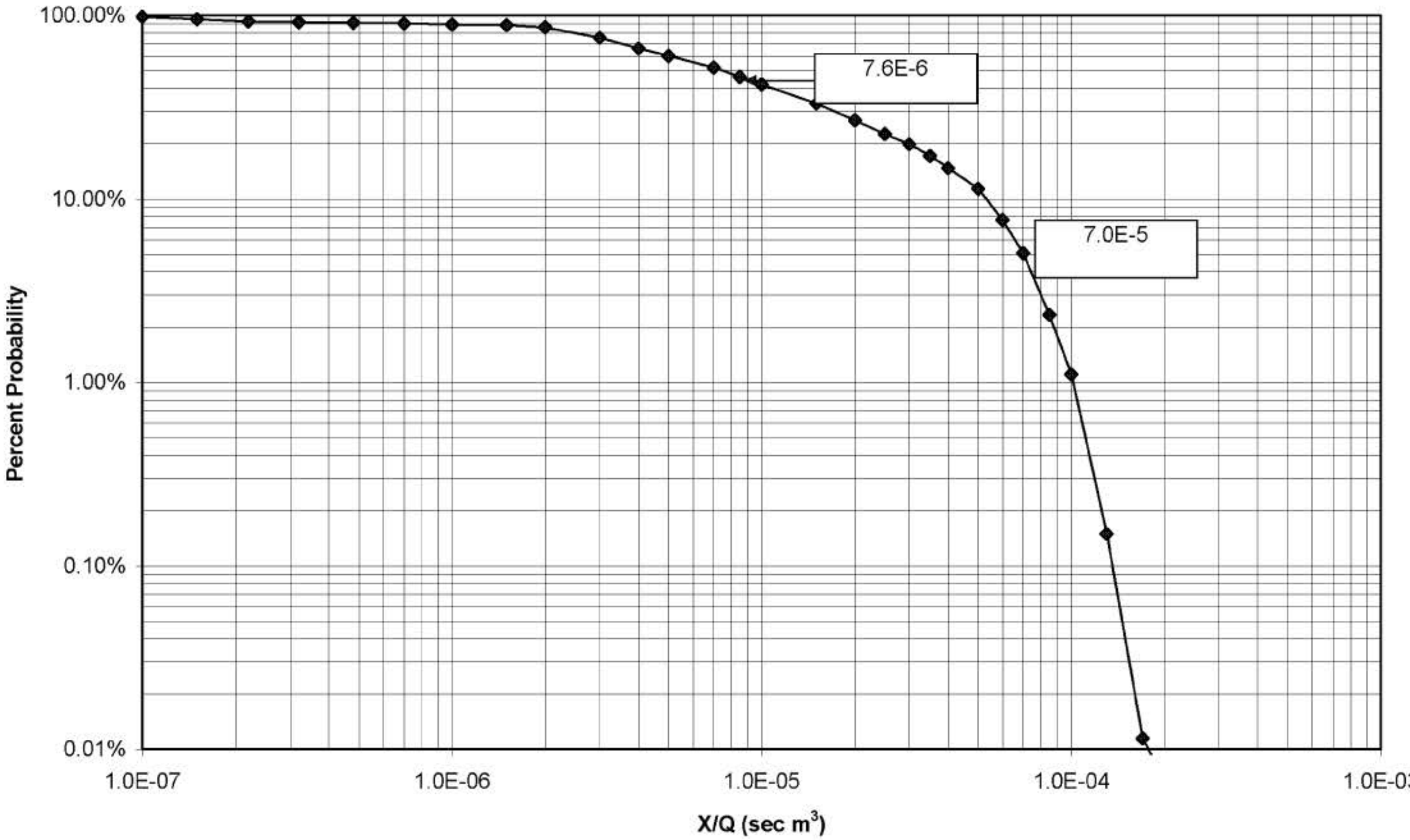


FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
ONE HOUR DIRECTION DEPENDENT X/Q VALVES AT THE LPZ (WEIGHTED AVERAGE OF 1999, 2000, 2001, 2002, 2003 CALCULATIONS)
FIGURE 2.3-8, Rev 1

AutoCAD: Figure Fsar 2_3_8.dwg

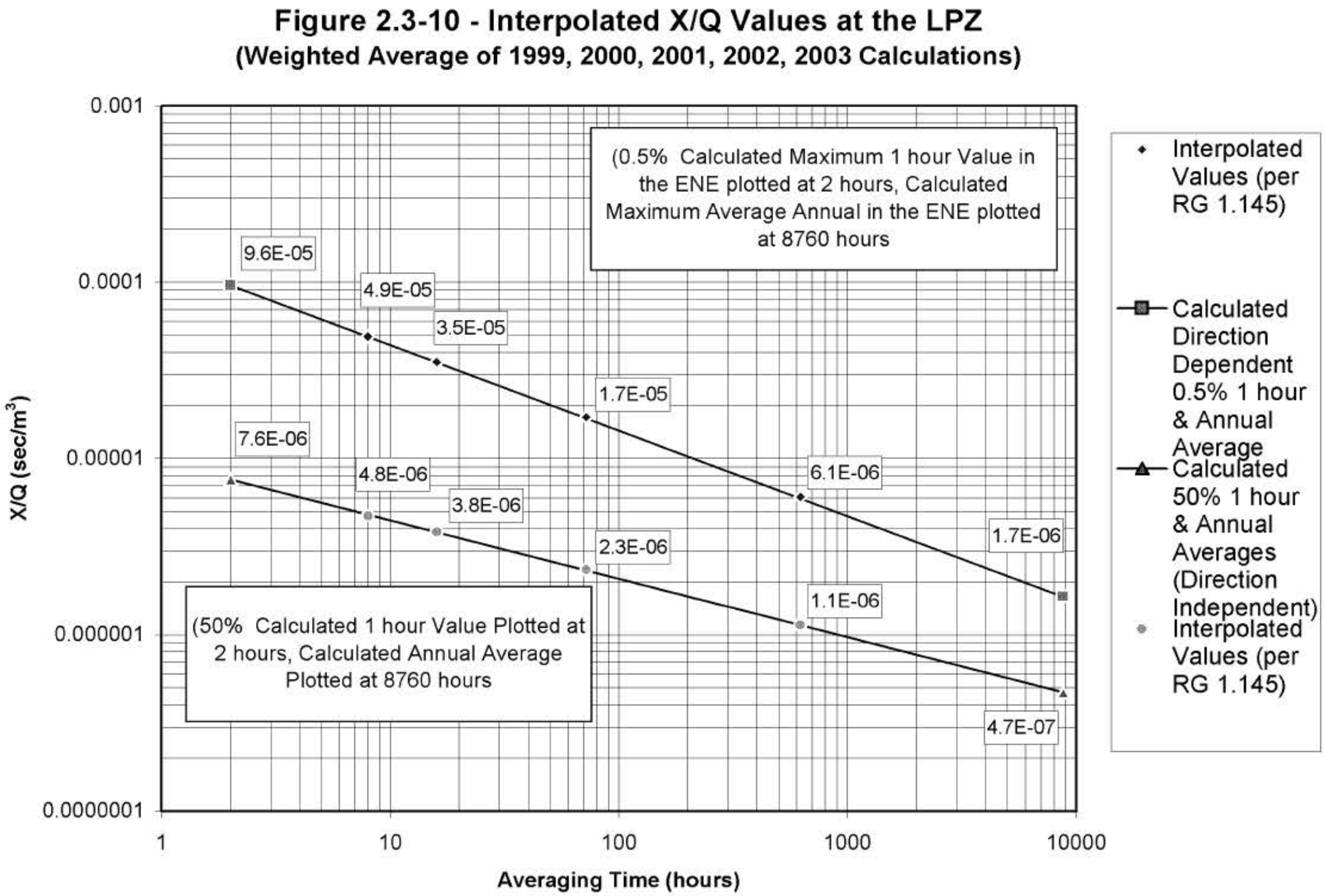
Figure 2.3-9 - 1 Hour Direction Independent X/Q at the LPZ
(weighted average of 1999, 2000, 2001, 2002, 2003 Calculations)



FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
ONE HOUR DIRECTION DEPENDENT X/Q AT THE LPZ (WEIGHTED AVERAGE OF 1999, 2000, 2001, 2002, 2003 CALCULATIONS) FIGURE 2.3-9, Rev 1

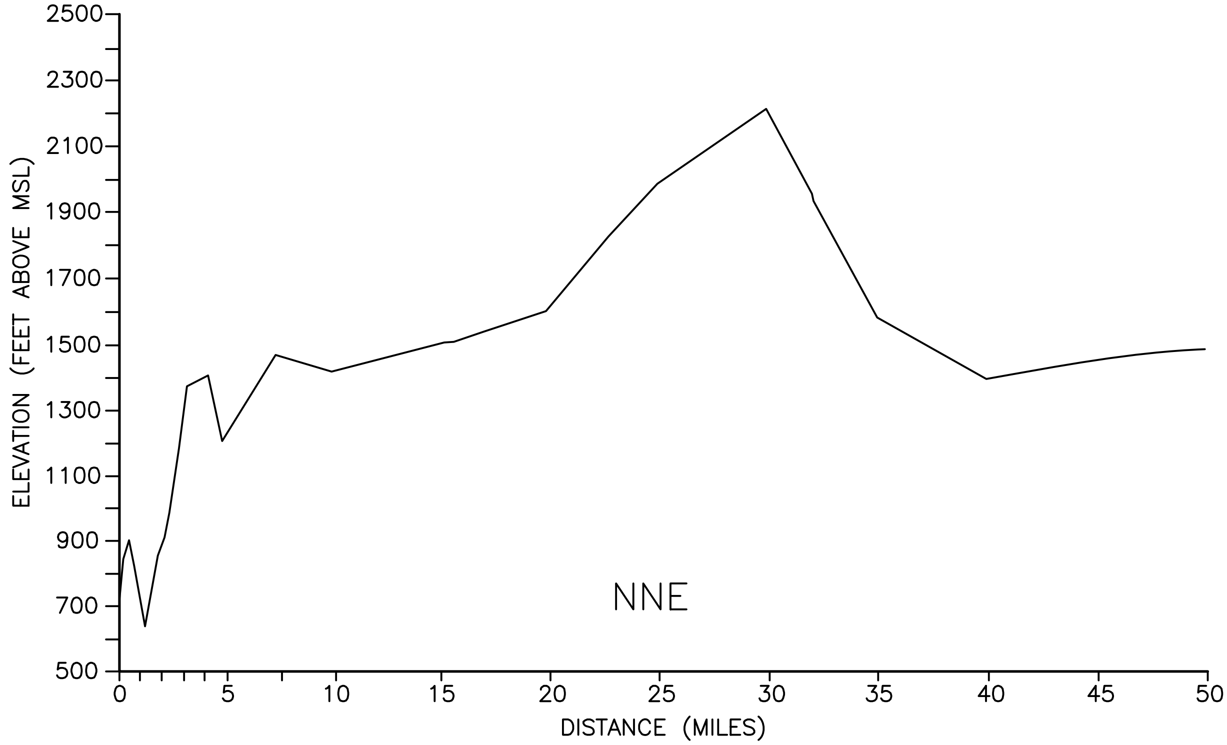
AutoCAD: Figure Fsar 2_3_9.dwg

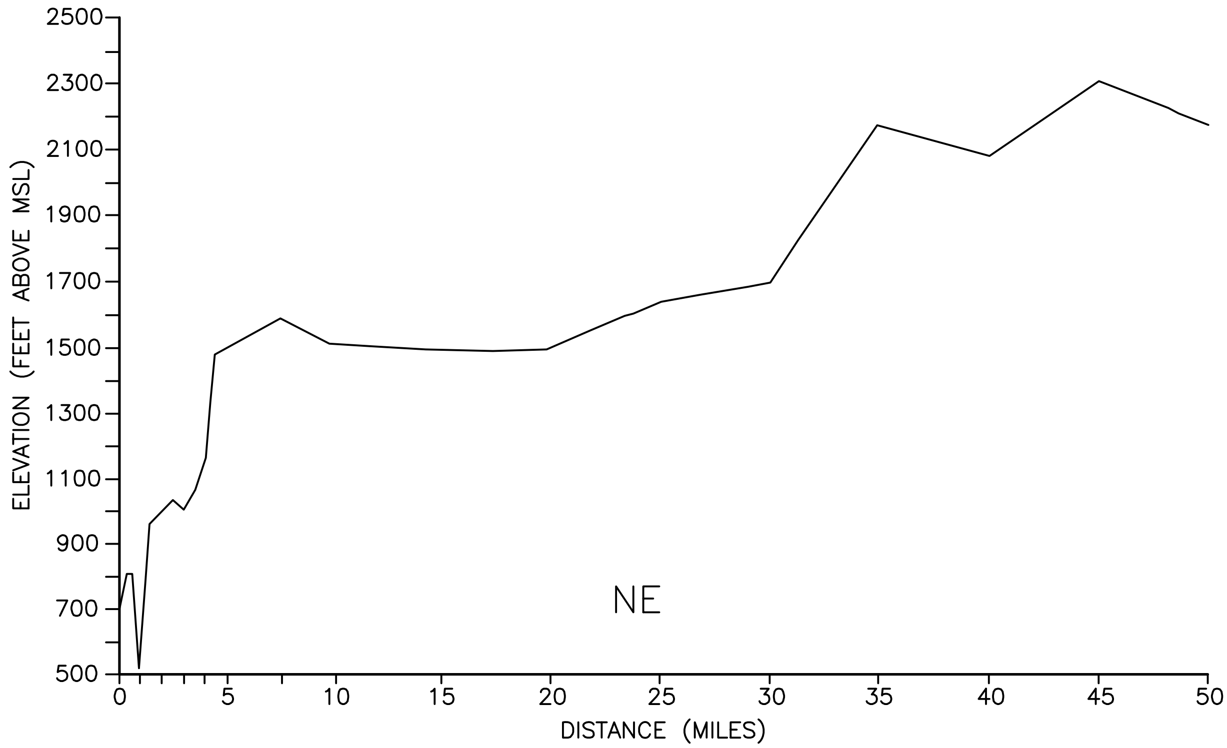


FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
INTERPOLATED X/Q VALUES AT THE LPZ (WEIGHTED AVERAGE OF 1999, 2000, 2001, 2002, 2003 CALCULATIONS)
FIGURE 2.3-10, Rev 1

AutoCAD: Figure Fsar 2_3_10.dwg





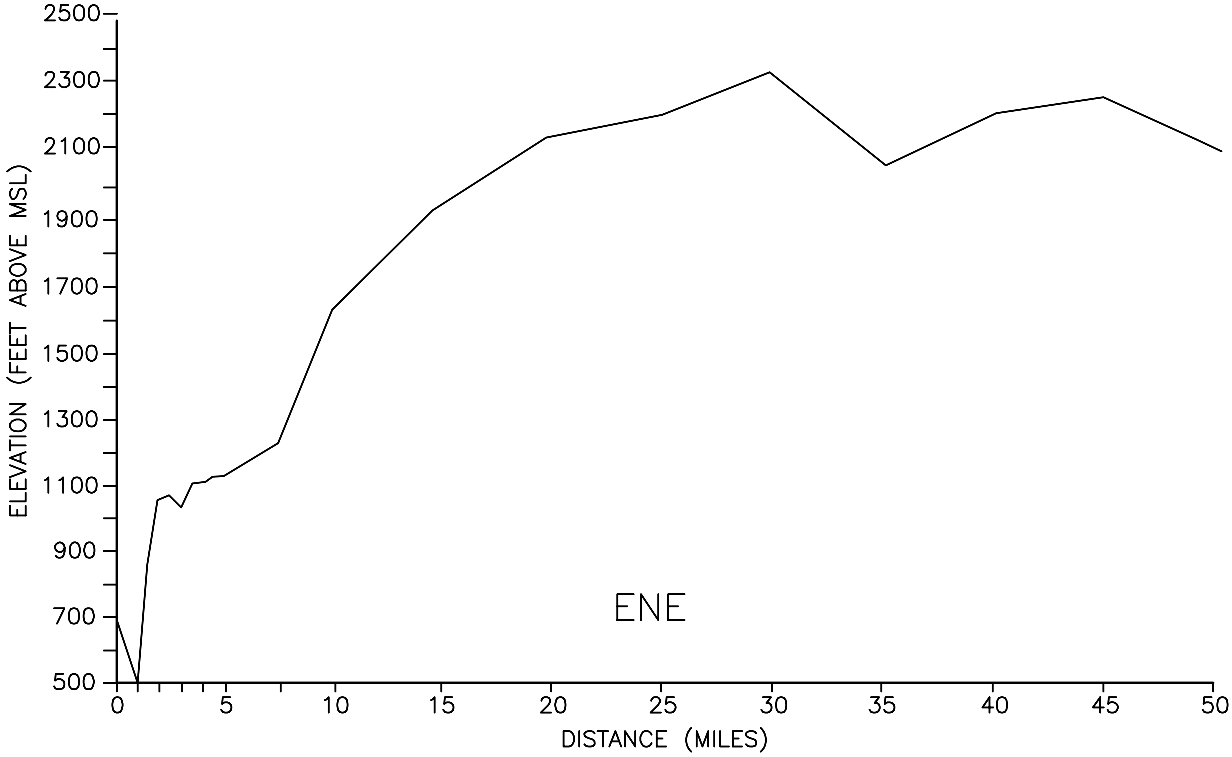
FSAR REV. 65

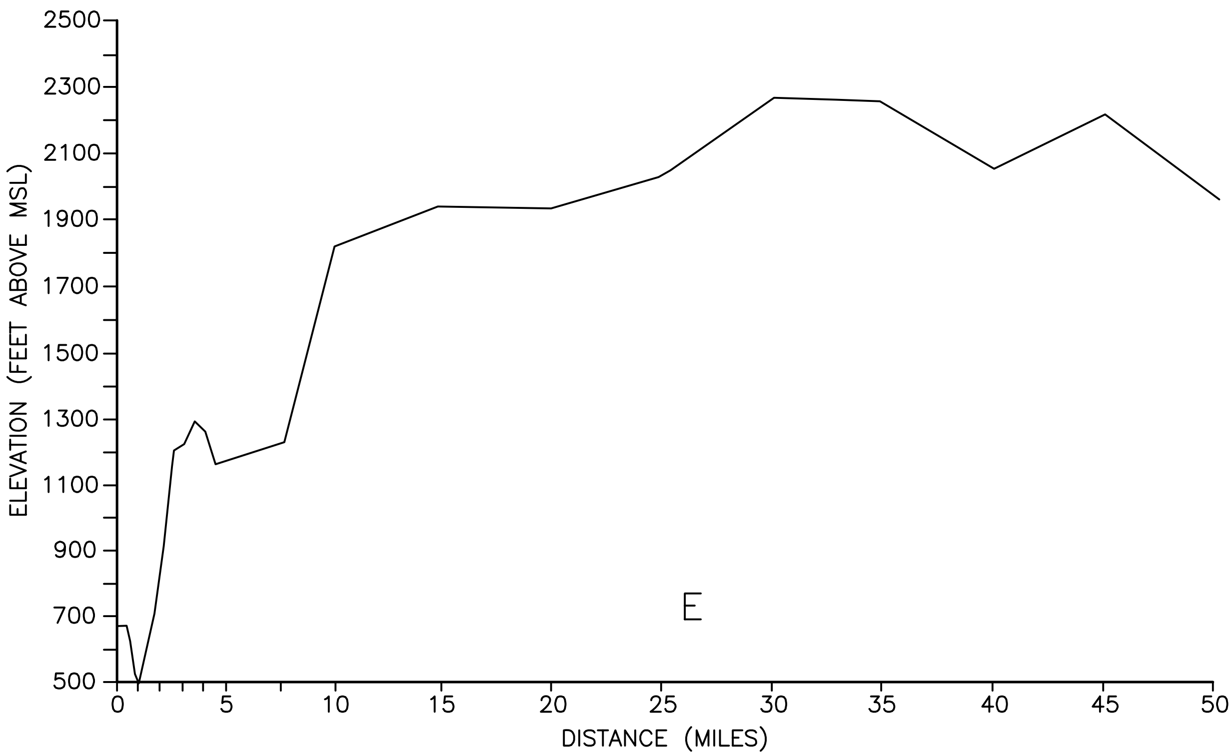
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-1, Rev 47 Sh. 1 of 8

AutoCAD: Figure Fsar 2_3_4_1.dwg





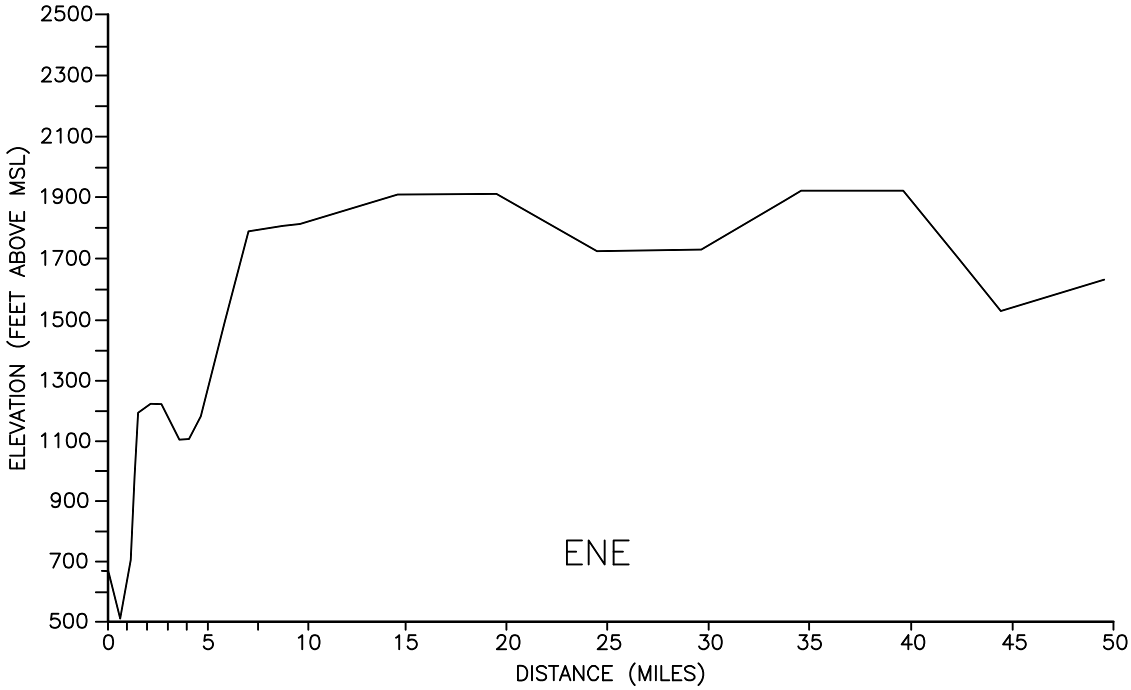
FSAR REV. 65

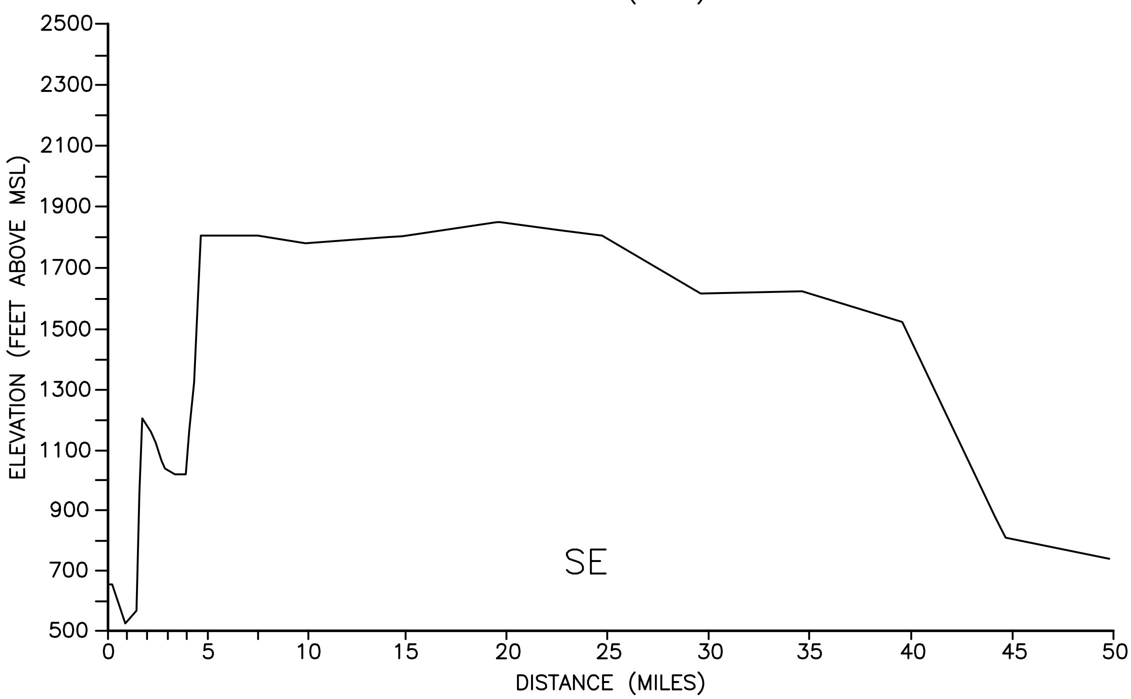
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-2, Rev 47 (Cont'd) Sh. 2 of 8

AutoCAD: Figure Fsar 2_3_4_2.dwg





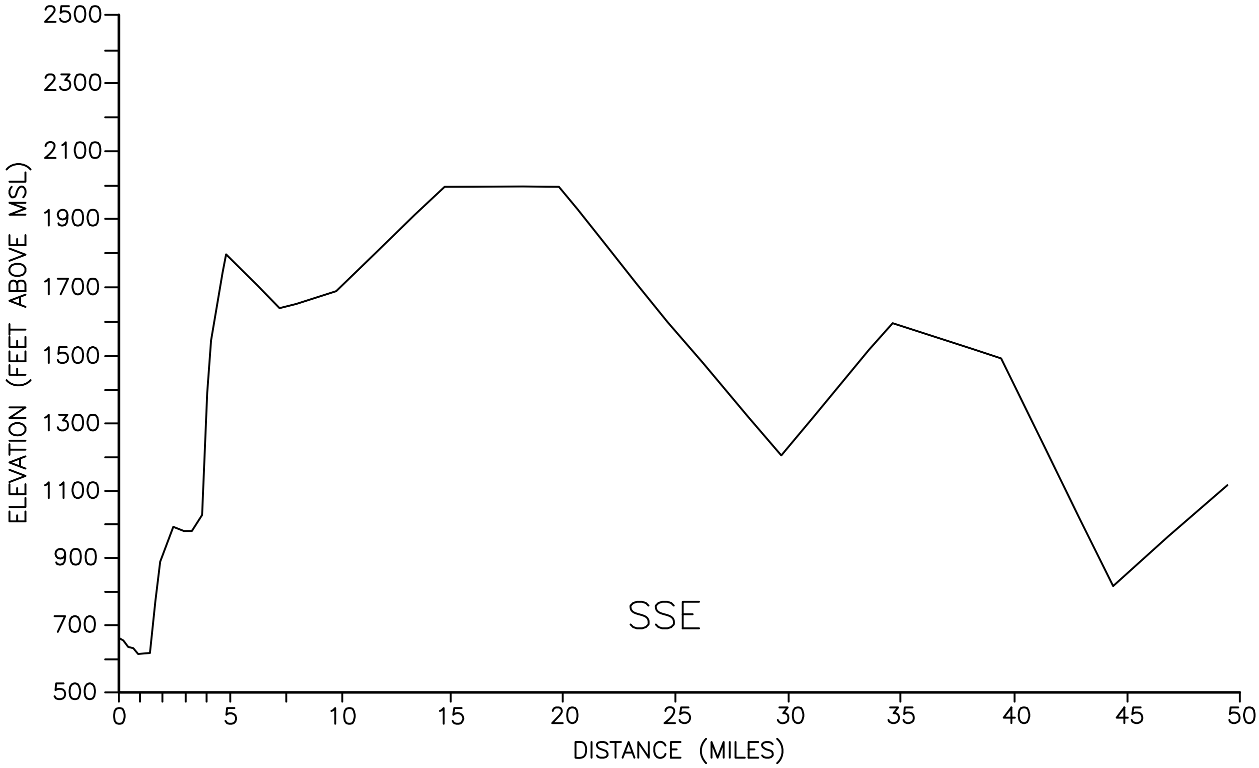
FSAR REV. 65

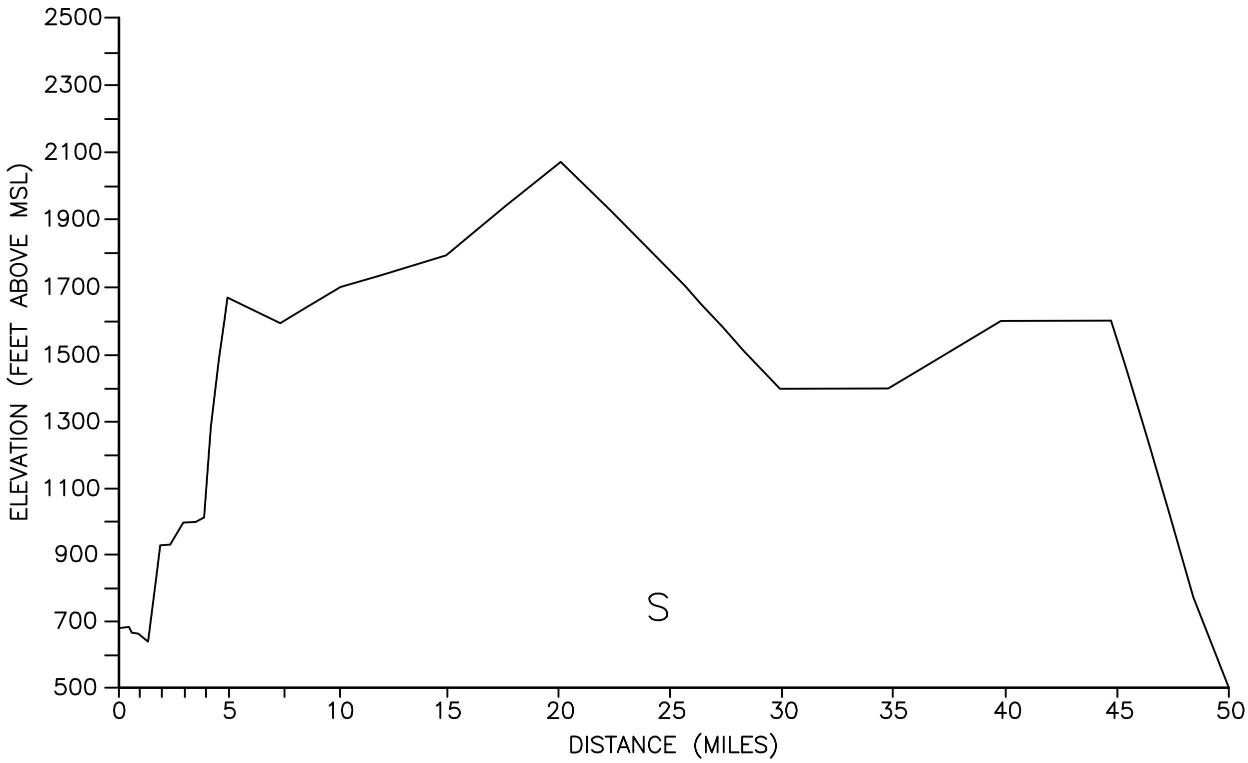
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-3, Rev 47 Sh. 3 of 8

AutoCAD: Figure Fsar 2_3_4_3.dwg





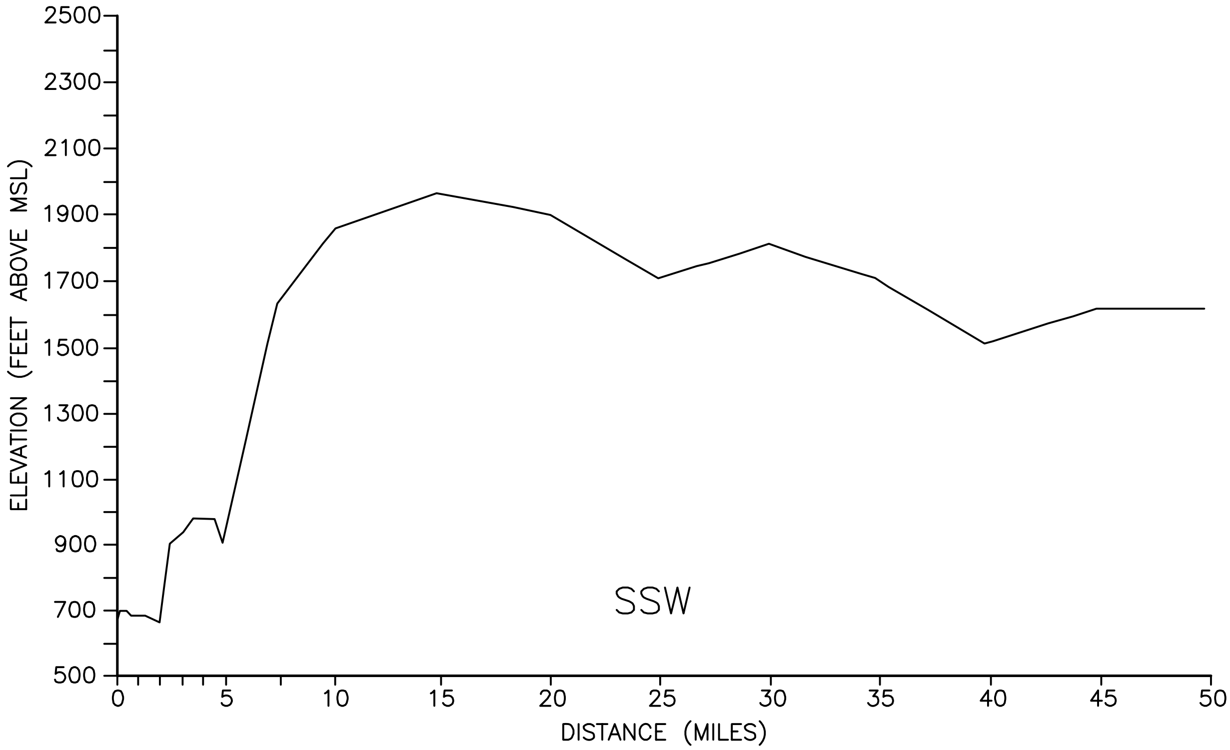
FSAR REV. 65

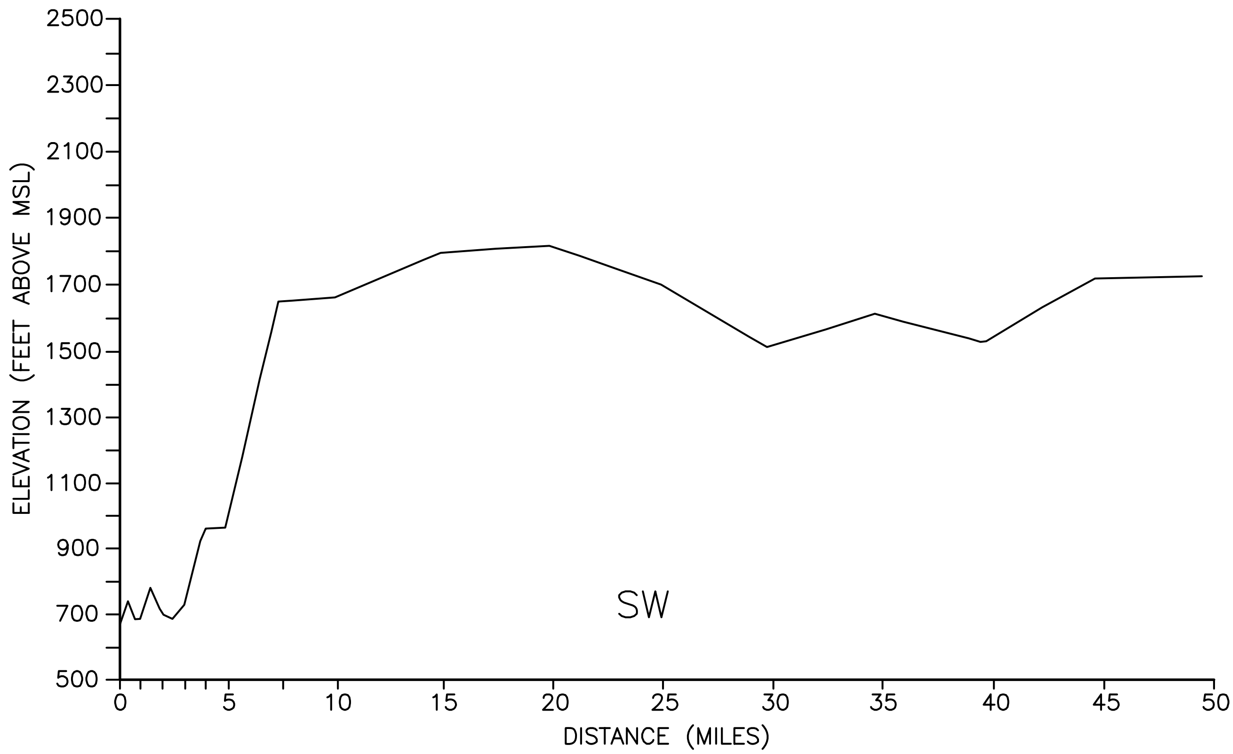
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-4, Rev 47 Sh. 4 of 8

AutoCAD: Figure Fsar 2_3_4_4.dwg





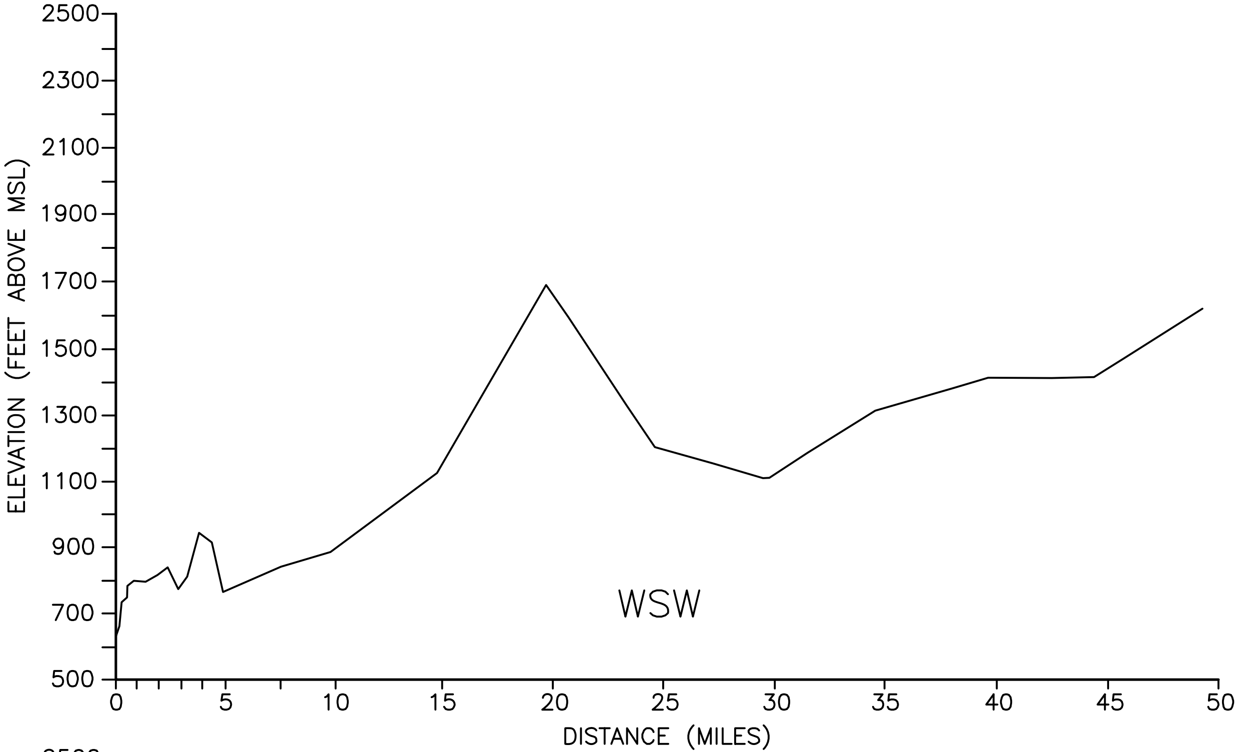
FSAR REV. 65

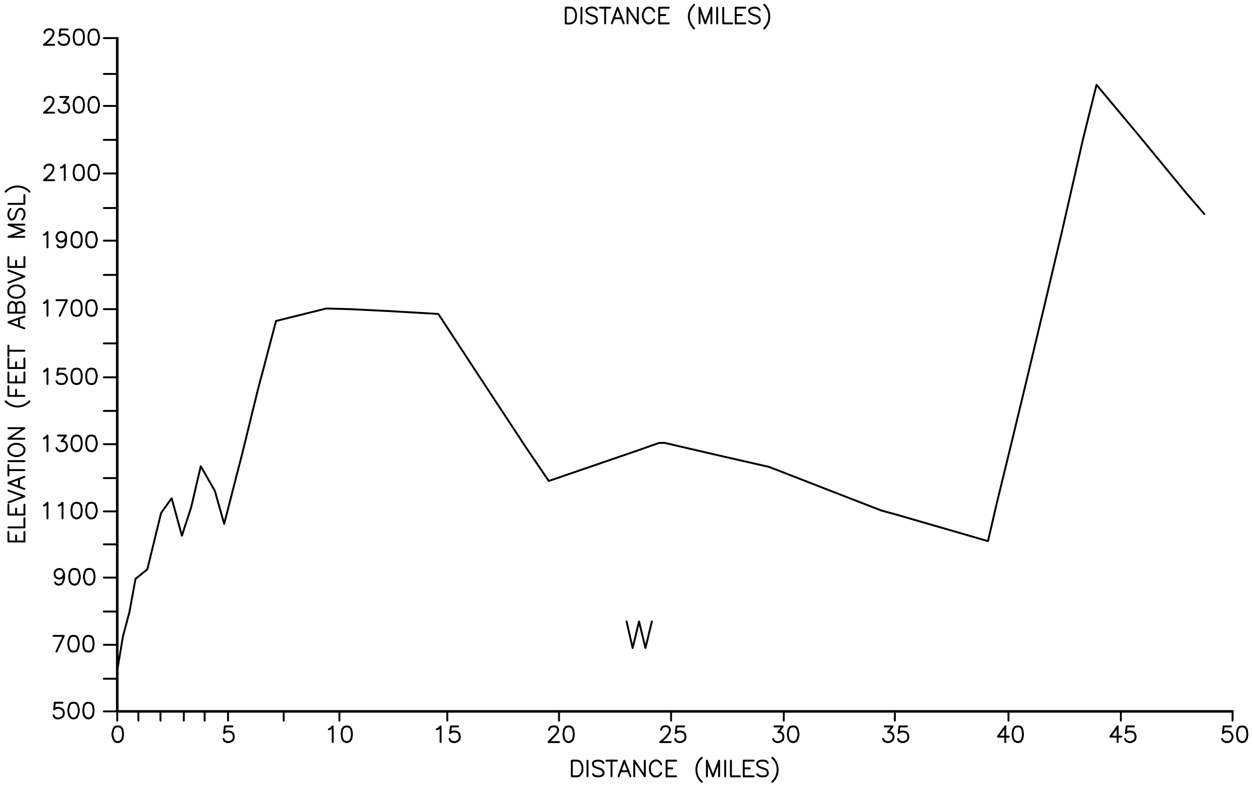
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-5, Rev 47 Sh. 5 of 8

AutoCAD: Figure Fsar 2_3_4_5.dwg





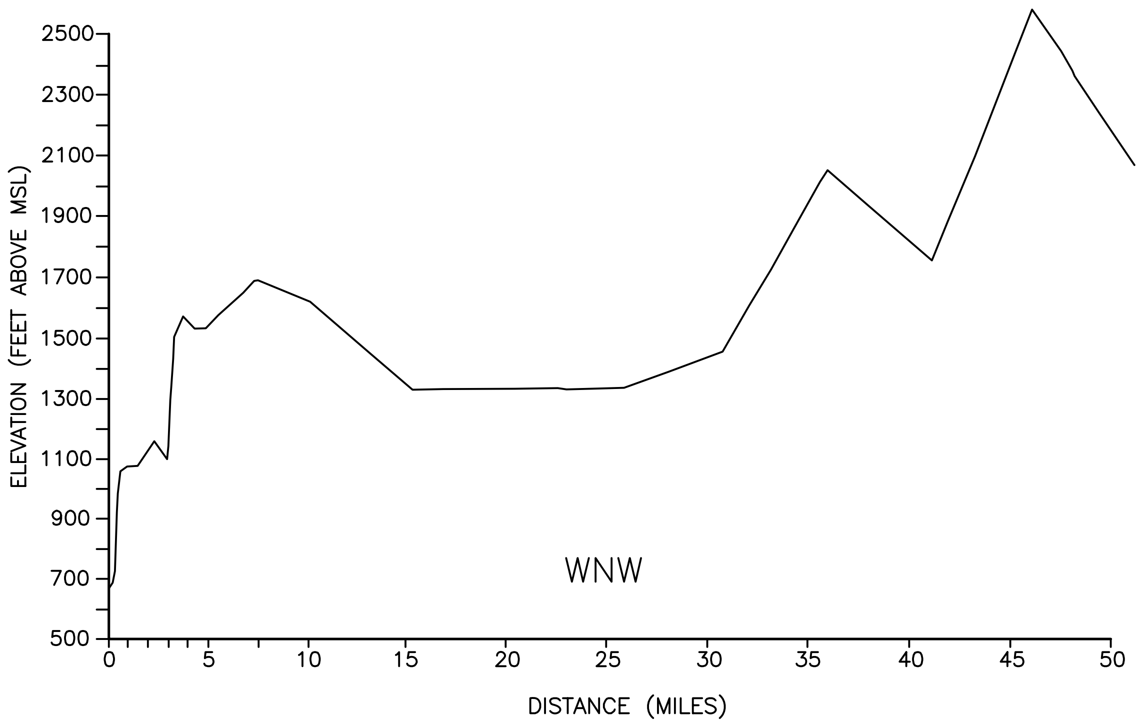
FSAR REV. 65

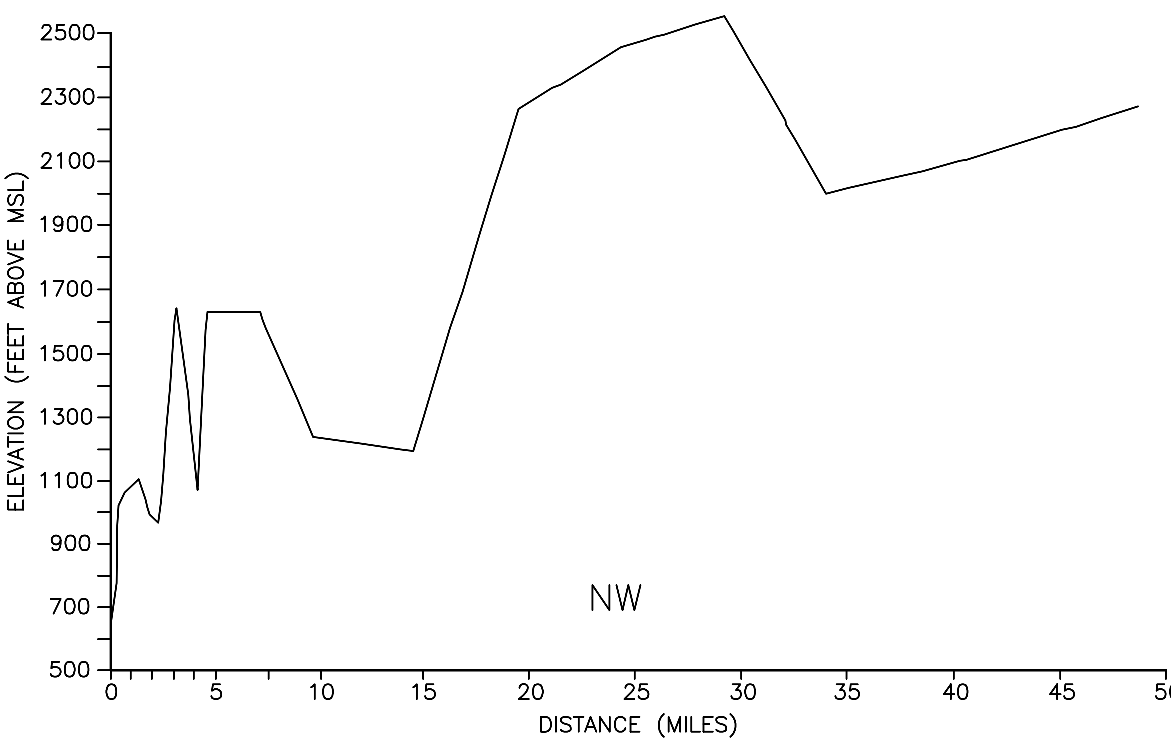
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-6, Rev 47 Sh. 6 of 8

AutoCAD: Figure Fsar 2_3_4_6.dwg





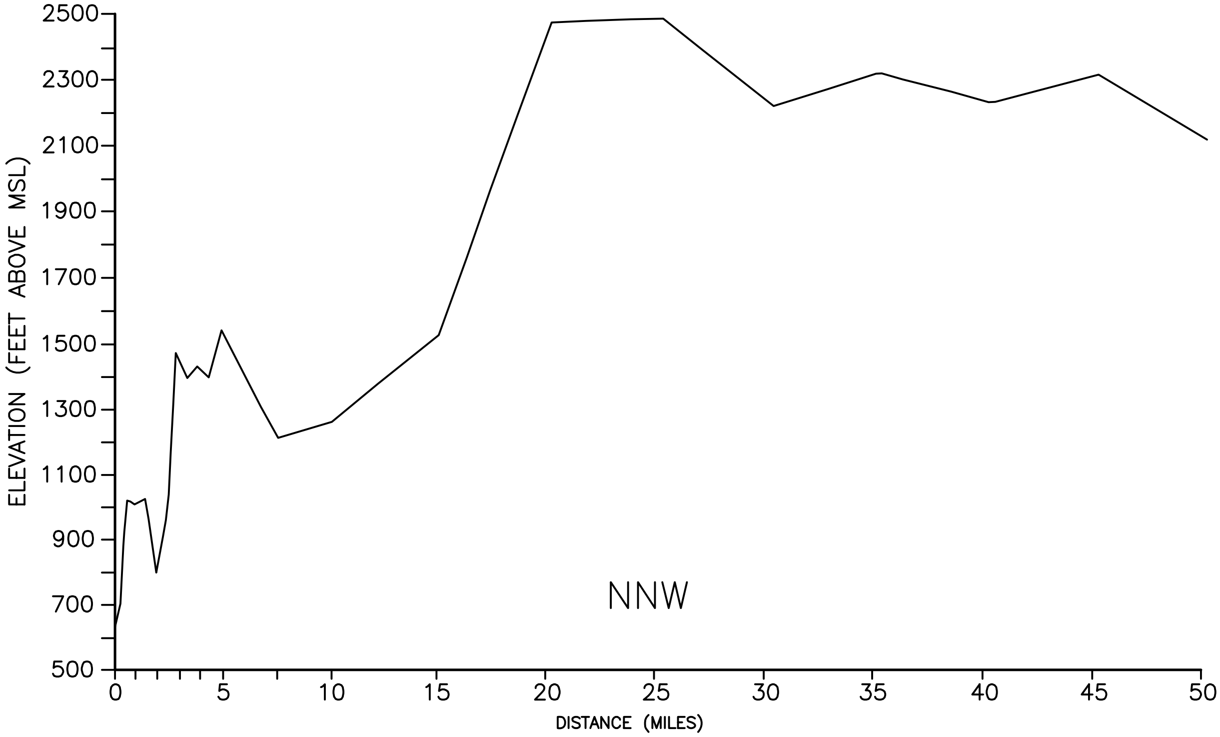
FSAR REV. 65

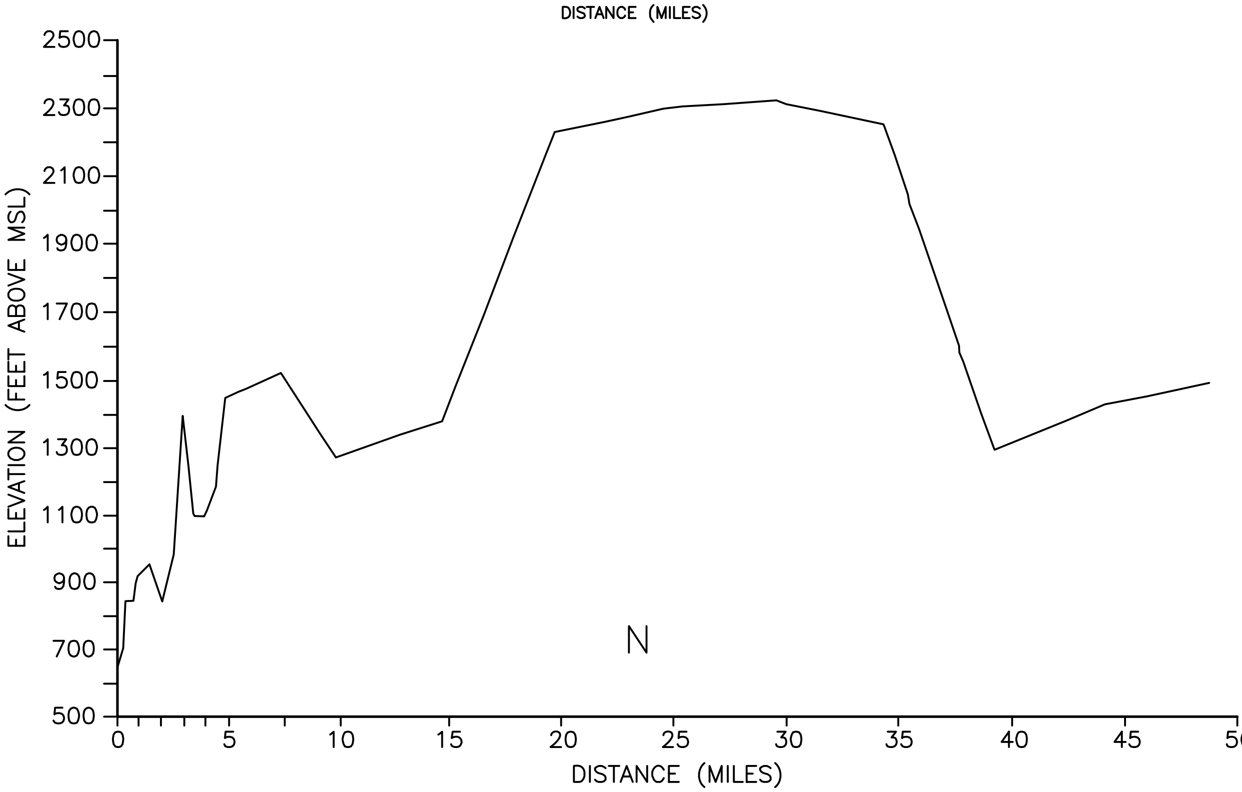
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-7, Rev 47 — Sh. 7 of 8

AutoCAD: Figure Fsar 2_3_4_7.dwg





FSAR REV. 65

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

MAXIMUM TERRAIN ELEVATION
VERSUS
DISTANCE BY SECTOR

FIGURE 2.3-4-8, Rev 47 Sh. 8 of 8

AutoCAD: Figure Fsar 2_3_4_8.dwg

2.4 HYDROLOGIC ENGINEERING

2.4.1 HYDROLOGIC DESCRIPTION

2.4.1.1 Site and Facilities

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.1.2 Hydrosphere

Included in this section is a description of the location, size, shape and other hydrologic characteristics of the streams and reservoirs comprising the surface water hydrosphere. A description of the groundwater environments influencing plant siting is included in Subsection 2.4.13.1.

2.4.1.2.1 Rivers and Streams

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.1.2.2 Dams and Reservoirs

Security-Related Information
Text Withheld Under 10 CFR 2.390

START HISTORICAL

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

<u>2.4.1.2.3 Downstream Water Uses</u>

Information has been collected for known points of water use within a 50 mile water route distance from the Susquehanna SES site as required by 10 CFR 50 Appendix I. Included are users on or near the Main Branch downstream of the site, since these are the only locations where detectable amounts of radioactivity could possibly affect such use. The types of use found are municipal water supply, industrial use, and recreation. Most of this information was obtained from the Pennsylvania Department of Environmental Resources (DER) (Ref. 2.4-9 through 2.4-13). Listed in Table 2.4-3 are known water users on or near the Main Branch of the Susquehanna with their location, type of use, radial and water route distance from the station site, present total and consumptive use and, where available, projected use with sources and dates of projections. The locations of the water users in Table 2.4-3 are indicated on the map of the river presented in Figure 2.4-7. Users on the map can be identified by the column entitled "map code" in Table 2.4-3.

Information on municipal water users was provided by the Pennsylvania DER through Water Company Consolidated Inventory Report (Ref. 2.4-9), Surface Water Use Summary Reports (Ref. 2.4-10) and Personal Communication (Ref. 2.4-11). Four municipal water supply companies withdrawing directly from the reach of the Susquehanna downstream of the station site have been identified. These four companies serve the towns of Berwick, Danville, Sunbury, and Shamokin Dam. Projected use for these water companies is presented in Table 2.4-3; however, many water companies in the area have multiple sources and it is not possible to project that their entire use will be drawn from the Susquehanna River. Groundwater is presently the primary source of water supply in the region. The Susquehanna and its tributaries provide a secondary source, but as water demand increases, direct withdrawal from the Susquehanna is expected to increase.

Information concerning industrial water users is also supplied by the Pennsylvania DER (Ref. 2.4-12). Name and type of company, location, water source, and total withdrawal is given in Table 2.4-3. Information on water return to the river or future water demand for these companies is not generally available. The Pennsylvania DER does have estimates of consumptive use vs. total use and also future water demand estimates on an area wide basis for various types of use (municipal, manufacturing, mining, etc.) (Ref. 2.4-13). For the region under study, the consumptive use for manufacturing is about eight percent of the total water use. Total and consumptive use for manufacturing is projected to increase 15 percent by 1970 to 1990. Therefore, a rough estimate of 30 percent may be used for industrial water use increase in the general area over the station life. Of course, these values should be used only as guidelines, as they pertain to industry for the area *in general and not necessarily to those companies withdrawing water from the Susquehanna. A tabulation of groundwater users is included in Subsection 2.4.13.2.*

Points of known recreational use along the Main Branch of the Susquehanna within 50 miles of the station site are listed in Table 2.4-3. Five of the locations are considered to be good fishing locations. Four of these five are listed in the "100 Best Bass Spots in Pennsylvania," a brochure distributed by the Pennsylvania Fish Commission (Ref. 2.4-14). The remaining recreational area is Shikellamy State Park and Marina. The marina is located on the southern tip of Packer's Island at the confluence of the West and Main Branches of the Susquehanna. This portion of the river is called Lake Augusta, a 3,000 acre lake created by the Sunbury Fabridam located 3 miles downstream of the confluence. The Lake Augusta is heavily used for boating activities, including water skiing.

END HISTORICAL

2.4.2 FLOODS

2.4.2.1 Flood History

This Subsection discusses the historical flood events which have occurred on the Main Branch of the Susquehanna River in the vicinity of the Susquehanna SES site. The most severe flood event for this region occurred in June 1972 as the result of the passage of Tropical Storm Agnes through Pennsylvania. In spite of the fact that this flood produced discharges of nearly 1.4 times as great as those of the previous flood on record, the Susquehanna SES site remained over 150 feet above the flood crest. This very substantial margin of safety is additionally reinforced by findings of the flood mechanism evaluations discussed in the following sections. Therefore the classification of the Susquehanna SES as a "dry" site is therefore justified.

2.4.2.1.1 Flood Records

Detailed records of historical floods in the immediate vicinity of the Susquehanna SES do not exist. Data is available, however, from USGS Gaging Stations located at Wilkes-Barre (about 22 miles upstream of the site) and at Danville (about 31 miles downstream). The Corps of Engineers has compiled flood stage and discharge information for the Susquehanna River at Wilkes-Barre (Ref. 2.4-15). These data are based on records of flood stages dating from 1891. Data for the four most severe floods on record are presented in Table 2.4-4. Table 2.4-4 also includes the stages and discharges for floods at Danville. Discharges at the Susquehanna SES site are linearly interpolated between the reported Wilkes-Barre and Danville discharges on the basis of drainage areas. Corresponding river stages at the site are estimated by use of the stage-discharge curve presented as Figure 2.4-8. The development of this curve is discussed in Subsection 2.4.3.5.

2.4.2.1.2 Tropical Storm Agnes

The passage of Tropical Storm Agnes through Pennsylvania on June 22 and 23, 1972 resulted in record flood levels in the Susquehanna River Basin. Flood crests exceeded the previous record flood level of 1936 at Wilkes-Barre by 7.5 feet. At Danville, a local maximum gage level resulting from a 1904 ice jam was exceeded by 1.6 feet. Peak discharge at Wilkes-Barre was an estimated 345,000 cfs or a unit discharge of 34.6 cubic feet per second per square mile (cfsm). Accumulated runoff for the drainage area above Wilkes-Barre for the period of 0000 hours, June 21, 1972 through 2200 hours, June 27, 1972 totaled 4.32 inches (Ref. 2.4-16 through 2.4-18).

High water marks were recorded at two locations in the vicinity of the site (river mile 165.6). A downstream flood mark of 506.0 ft msl was noted at Beach Haven (river mile 161.5). An upstream flood mark of 525.6 ft msl was noted at Shickshinny (river mile 170.1) (Ref. 2.4-16). A profile of the June 1972 flood in the vicinity of the site is provided as Figure 2.4-9. This profile shows the site to be at least 150 feet above the high water level. The river gaging station maintained at the site biological laboratory recorded a flood crest elevation of 516.6 ft. msl on June 23, 1972.

2.4.2.1.3 Flood Resulting from Ice Jams

The only recorded instance of ice related-flooding on the Susquehanna River in the vicinity of the Susquehanna SES occurred near Danville on March 9, 1904. This jam resulted in a local maximum flood level of 462.0 ft msl which was not exceeded until the June 1972 flood (Ref. 2.4-19 and 2.4-20). Additional discussion of ice jams is found in Subsections 2.4.7 and 2.4.11.2.

2.4.2.2 Flood Design Considerations

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.2.3 Effects of Local Intense Precipitation

The effects of local intense precipitation were investigated to ensure that flooding at the plant site, if any, produced by a probable maximum precipitation (PMP) would not endanger the integrity of the safety-related facilities and that adequate drainage systems are provided for the roofs of all safety related buildings. Drainage systems for the roofs are designed so that hydrostatic loadings on the roofs resulting from a local PMP are within the design limit.

The all-season 24-hr PMP was derived using the procedures suggested by the National Weather Service (formerly US Weather Bureau) (Ref. 2.4-21). The maximum 6-hr precipitation was disaggregated into one-half hour increments in accordance with a time distribution proposed by the US Army Corps of Engineers (Ref 2.4-22) and is presented in Table 2.4-5. For storms less than one-half hour, the rainfall increments were determined using the ratios suggested by the National Weather Service (Ref. 2.4-23), and are shown in Table 2.4-6.

The grading and natural topography of the plant site area are such that storm runoff is directed away from safety related buildings by a system of culverts, surface drainage channels, and underground storm drains. In the evaluation of the effects of the PMP relative to the flooding of the safety-related facilities, all the culverts and underground storm drains, except the culverts in the emergency spillway for the spray pond were assumed to be blocked by debris or ice accumulation. The runoff from the PMP was assumed to occur only as surface flows, traversing the plant site in drainage channels or over low sections in the roads (Figure 2.4-10).

Drainage areas are based from the “Existing Stormwater Report for PPL SSES in Salem Township, Luzerne County, Pennsylvania,” (Ref 2.4-100).

The peak flood discharges resulting from the PMP were computed at a number of locations and for the roofs of the safety related structures using the "rational" formula:

$$Q = CIA \qquad \text{(Equation 2.4-1)}$$

where:

Q is the peak rate of runoff in cubic feet per second at the section of interest

C is the runoff coefficient depending on the characteristics of the drainage area: conservatively assumed to be 1.0 for all impervious surfaces such as a paved area or roof surface, and 0.9 for all other types of surfaces for PMP conditions

I is the rainfall intensity in inches per hour for a storm duration equal to the time of concentration for the location of interest

A is the drainage area, in acres, contributing to the flow at the point of interest

The points of interest and their corresponding flow cross-sections are shown on Figures 2.4-11, 2.4-12 and 2.4-13.

The flow depth in a drainage channel was calculated using Manning's equation:

$$AR^{2/3} = \frac{Qn}{1.49\,(S)} 1/2 \qquad \text{Equation (2.4-2)}$$

where:

A is the cross-sectional area of the flow in square feet, at the check location perpendicular to the flow direction

R is the hydraulic radius at the check location in feet

Q is the peak flood discharge in cubic feet per second

n is the Manning's roughness coefficient

S is the slope of the energy gradient in feet per foot.

The peak discharges resulting from the local PMP and the corresponding flow depths at the check sections are shown on Figures 2.4-11 through 2.4-13.

Pressure resisting doors are provided to prevent water from reaching safety-related equipment should any water build up or ponding occur adjacent to the power block. These doors are 1-3/4 inch thick, flush type, hollow steel doors with 12 ga. pressed steel frames and 12 and 14 ga. steel face sheets. Hinges are heavy duty, stainless steel, locksets are heavy duty mortise type and strikes are wrought box type. Gaskets are provided between doors and bearing (sealing) surfaces of frames and thresholds. Door and frame assemblies are designed to withstand various combinations of seating and unseating pressures depending on their locations in the plant. Prototype assemblies are tested to insure their conformance to the specified performance criteria. The performance criteria includes testing the seating and unseating pressure at the specified temperature as well as testing the leakage rate of each prototype. The results of these tests are documented. The flood flow is from the 61-acre area north of the spray pond and would be diverted away by a periphery channel. The channel is designed to accommodate the peak discharge of 1,259 cfs resulting from the local PMP as shown on Figure 2.4-13. Therefore, the possibility of flooding any of the safety-related facilities due to PMP is precluded.

The peak rates of runoff from the roofs of these buildings resulting from the all-season PMP are presented in Table 2.4-7.

Direct rainfall on the roofs of the reactor building, diesel generator buildings, and control structure is drained by a system of roof drains, supplemented by a series of scuppers and/or openings in the parapet walls forming the perimeters of the roofs of the buildings. The dimensions of the scuppers and parapet openings required are shown in Table 2.4-7.

In the evaluation of the effects of the local PMP, the roof drains were assumed to be blocked by debris or ice accumulation and only the scuppers or parapet openings remain functional. The rating curve for each parapet opening or unsubmerged scupper was derived using the equation:

$$Q = CLH^{1.5} \qquad \text{(Equation 2.4-3)}$$

where:

Q is the discharge capacity of the parapet opening or unsubmerged scupper in cubic feet per second

C is the discharge coefficient assumed to be 2.5 for a broad-crested weir condition

L is the effective length in feet of the parapet opening or scupper, taking flow contraction at entrance into consideration

H is the head in feet of water above the invert of the parapet opening or scupper

To compute the flow capacity of a submerged scupper, the flow equation for an orifice was used:

$$Q = CA\,(2gh)^{1/2} \qquad \text{(Equation 2.4-4)}$$

where:

Q is the discharge through the submerged scupper

C is the discharge coefficient conservatively assumed to be 0.45 because of the limited submergence conditions encountered

A is the cross-sectional area of the scupper inlet in square feet

g is the gravitational acceleration equal to 32.2 ft/sec/sec

h is the upstream head in feet of water measured to the centerline of the flow through the scupper

Ice accumulation could affect the site drainage by blocking drains and culverts. This effect has been considered in the overall evaluation of the effect of the local PMP described in the section.

2.4.3 PROBABLE MAXIMUM FLOOD (PMF) ON STREAMS AND RIVERS

The conditions producing the PMF are defined by the Corps of Engineers as the "hypothetical flood characteristics (peak discharge, volume, and hydrograph shape) that are considered to be the most severe reasonably possible at a particular location, based on a relatively comprehensive hydrometeorological analysis of critical runoff-producing precipitation (and snowmelt, if pertinent) and hydrologic factors favorable for maximum flood runoff" (Ref. 2.4-25). The PMF for the Susquehanna SES was derived for the only water system, except local runoff that could affect site flooding, the Susquehanna River. A maximum PMF water elevation on the Susquehanna River with coincident wind-generated waves of 548.0 ft msl was calculated in the site vicinity, which is over 120 feet below site grade elevation of 670 ft msl. There are no other adjacent streams that would have an impact on plant flooding.

The guidelines provided in Appendix A of Regulatory Guide 1.59 were followed throughout the analyses. Because the Susquehanna SES is a flood-dry site, conservative assumptions and baseline conditions were adopted to maximize the PMF water elevations.

2.4.3.1 Probable Maximum Precipitation

To determine the PMF for this study, the Probable Maximum Precipitation (PMP) storm location, magnitude and temporal distribution were taken directly from Corps data (Ref. 2.4-26).

The Corps had previously computed the Standard Project Flood (SPF) at Wilkes-Barre (Ref. 2.4-27). Both the storm pattern used on the basin (Ref. 2.4-26) and the magnitude and distribution of precipitation (Ref. 2.4-28) were derived by the Corps. The storm pattern thus obtained was laid over a map of the basin, the sub-basin outlines were drawn on the map and, by inspection, an average value of total rainfall on each sub-basin was estimated from the storm pattern isohyets. This is shown on Figure 2.4-14. The 12 six-hour time segments into which the 72-hour PMP storm was divided (Ref. 2.4-26) were converted into 18 four-hour time segments. This division allowed direct use of the available unit hydrographs previously derived by the Corps of Engineers (Ref. 2.4-29) as discussed in Subsection 2.4.3.3.

2.4.3.2 Precipitation Losses

In order to determine the PMP rainfall excess for the Susquehanna River drainage basin, an initial loss of 1.0 inch followed by an infiltration loss rate of 0.05 inches per hour were adopted (Ref. 2.4-30 and 2.4-31). These precipitation losses are consistent with values reported in the Susquehanna River Basin Study (Ref. 2.4-32). Since the maximum PMF water elevation computed in Subsection 2.4.3.6 is over 120 feet below the site, precipitation losses are not a critical factor in the derivation of the PMF. The assumed values represent reasonable conservative basin conditions appropriate for use with the PMP.

2.4.3.3 Runoff and Stream Course Models

In a previous study (Ref. 2.4-29), the Corps computed the SPF from actual storm data, synthesized four-hour unit hydrographs for 68 sub-basins and determined routing coefficients from observed flood hydrograph movement using the Coefficient Method of Routing (Ref. 2.4-28) for some 105 reaches in the Susquehanna River Basin above Wilkes-Barre, Pennsylvania. A tabulation of the drainage areas and unit hydrograph characteristics for each sub-basin is shown on Table 2.4-8. These sub-basins are delineated and numbered on Figure 2.4-12. Table 2.4-9 provides the flood routing coefficients used in the basin runoff model (Ref. 2.4-32).

Since the previously derived PMP was divided into 18 four-hour periods, this division allowed direct use of the available unit hydrographs previously derived (Ref. 2.4-29). These hydrographs were combined and routed in accordance with the procedures developed in Reference 2.4-29. The site is over 120 feet above the PMF water level as determined in Subsection 2.4.3.6. Because of this substantial margin of safety against river flooding, no adjustments of the unit hydrographs for non-linearity were made.

2.4.3.4 Probable Maximum Flood Flow

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.3.5 Water Level Determination

Backwater computations have been carried out for the reach of the Susquehanna River in the vicinity of the site shown in Figure 2.4-16. The developed stage discharge curves for river cross-section 2 (Berwick Bridge) and upstream of river cross-section 7 (site) are shown on Figures 2.4-17 and 2.4-18 respectively. The procedures for developing the stage discharge relationships are described in the following Subsection.

2.4.3.5.1 Hydraulic Characteristics of Channel and Overbank

The excellent discharge records of the flood profile from the March 20, 1936 flood (Ref. 2.4-34), combined with the channel cross-section data (Ref. 2.4-35) and the USGS topographic maps (Berwick Quadrangle), allowed computation of the hydraulic characteristics of the channel and of the overbank area in the vicinity of the site. The profile data (Ref. 2.4-34) are shown on Figure 2.4-18. The river mile locations of the selected eight Sections (Ref. 2.4-35) are also shown on Figure 2.4-18 and on Table 2.4-10. The configurations of river cross-sections 1 through 8 are shown on Figure 2.4-19. The cross-section of the river at the site is shown on Figure 2.4-20. Since the 1937 survey (Ref. 2.4-35) there has been no construction (roads, bridges, excavation, etc.) which would have appreciably modified the cross-sections. Therefore, it is assumed that these sections are still representative. The 1936 flood level elevations of the Sections were taken from the plotted profile Figure 2.4-18. Elevations of the river bank edge, that is, the level which separates channel flow characteristics and overbank flow characteristics, were estimated by site inspection and from the data on Figures 2.4-19 and 2.4-20. Levels of about 12 to 16 feet above the main river channel bottom were selected on this basis. The bank elevations of the Sections are shown on the profile Figure 2.4-18 (Ref. 2.4-31).
The Corps of Engineers Method I backwater curve calculations (Ref. 2.4-36) were used to estimate Manning "n" values between pairs of river cross-sections using the 1936 flood profile data. This method is a trial and error computation procedure applicable to situations in which channel and overbank reach lengths may be assumed as equal (Ref. 2.4-31).

Discharge values of the sections were estimated by linear interpolation along the river between the maximum discharge values of 232,000 cfs and 250,000 cfs at Wilkes-Barre and Danville, respectively (Ref. 2.4-31).

The values for "n" thus estimated are shown on Table 2.4-10. Because of rather small contribution of the overbank flow to the total flow it was impractical to determine separately the "n" values for the overbank and the channel. Therefore, it was assumed that the overbank "n" was consistently 0.10 and the channel "n" values were then computed. Even doubling an assumed overbank "n" value to 0.20 did not result in significantly different channel "n" values. Table 2.4-10 shows that the channel "n" values range from 0.027 to 0.052. This range of values might be attributed to changes in the channel configuration. References to Figure 2.4-19 show river cross-sections 1, 2, 7 and 8 to have relatively flat river bank slopes. The channel between river cross-sections 3 through 6 has steep bank slopes (Ref. 2.4-31).

Backwater curve calculations using the Corps of Engineers Method III (Ref. 2.4-36), a graphic solution technique described below, reproduced the 1936 flood almost exactly when the computer "n" values of Table 2.4-10 were used. Thus, these "n" values were adopted. The head loss of the 1936 flood passing through the Berwick Bridge, as computed by the Yarnell Method (Ref. 2.4-37), was only 0.05 ft. Thus, all head losses due to this channel construction were subsequently ignored (Ref. 2.4-31).

2.4.3.5.2 Backwater Curve Calculations

Upon initial inspection, it was apparent that the Susquehanna River would not reach a critical depth level, irrespective of discharge, at any point downstream of the site. Therefore, it was necessary to select some arbitrary point downstream from which to begin the backwater calculations. The point selected was river cross-section 1, downstream from the Berwick Highway Bridge. Two different sets of backwater curves were calculated; one with the Berwick Bridge completely washed out and the other with the bridge intact. Both profiles are shown on Figure 2.4-16. The procedure used was that suggested in Reference 2.4-36. That is, at several assigned values of discharge, including the PMF, backwater curve calculations were begun at river cross-section 1 using an assumed elevation and carried upstream to river cross-section 8. The error resulting from an incorrectly assumed trial starting elevation will tend to diminish as computations progress upstream. Additional sets of computations were made beginning at the same downstream location, but at a different trial starting elevation. If the starting location is sufficiently far downstream, and if the assumed trial starting elevations are reasonably near to the true elevation, the corresponding backwater curves will merge into one before the computations have progressed to the reach for which the back water curve is desired. This procedure was followed until the backwater curves conveyed, indicating that the derived water surface elevations are reasonably correct (Ref. 2.4-31).

The backwater curve calculations were performed in accordance with standard procedures (Ref. 2.4-36). The increase in wetted perimeter at river cross-section 2 was considered because of the bridge piers remaining intact. The backwater curve for PMF is shown on Figure 2.4-17 (Ref. 2.4-31).

It was conservatively assumed that the Berwick Highway Bridge (a truss) would remain intact and that the truss would be completely covered with debris. Thus, there would be no appreciable weir overflow over the bridge deck. This was considered to be the worst possible condition in creating high backwater at the site. On this basis, the water would pass as channel flow and as orifice flow (Ref. 2.4-31).

The Pennsylvania Department of Transportation has replaced the Berwick Bridge with a new structure at a higher level. The new structure results in lower head losses since the orifice flow situation is eliminated. Backwater calculations based on the intact old bridge structure become even more conservative since the bridge has been replaced.

The elevation of the lower edge of the existing bridge deck on the right bank of the river is 531.5 ft, and on the left bank is 509.0 ft. The length of the bridge between abutments is 1517 ft. The discharge at the bridge Section at a water surface elevation of 509.0 ft would be about 530,000 cfs. Any water passing under the bridge at an elevation above 509.0 ft would be partially open channel (some channel and some overbank) and partially orifice discharge. The capacity of the open channel portion was estimated from the stage-discharge relationships obtained from the curve developed with the bridge assumed to be washed out. The orifice discharge was calculated using an orifice coefficient of 0.7 from Reference 2.4-36. Because of the sloping of the bridge deck, the maximum head at each discharge would be at the lowest point or the east end. The orifice discharge was added to the open channel discharge and the stage-discharge curve derived at river cross-section 2, the bridge, is shown on Figure 2.4-17 (Ref. 2.4-31).

At the PMF discharge of 1,100,000 cfs, the existence of the intact bridge raises the water surface elevation about 6 feet at the bridge. Backwater curves were generated upstream from Section 2 with the new elevations. The results for the PMF are shown on the profile Figure 2.4-18 (Ref. 2.4-31).

The profiles of the PMF are shown on Figure 2.4-18 for the two conditions of bridge washed out and bridge intact. The site is at mile 165.6; the elevations reached by the PMF are 544.8 ft for the bridge considered washed out, and 545.7 ft for the bridge intact (Ref. 2.4-31).

START HISTORICAL

2.4.3.6 Coincident Wind Wave Activity

The wind-generated significant waves on the probable maximum water surface elevation would be about 2.3 feet estimated from a crossriver 5,000 ft fetch with an average depth of 45 ft and a wind velocity of 45 mph along the fetch shown in Figure 2.4-21 (Ref. 2.4-31). The Susquehanna SES is located far above any potential flood level. The design basis for river flooding includes a PMF stillwater elevation of 545.7 ft, plus 2.3 ft for setup and wave runup effects for a total elevation of 548.0 ft msl (Ref. 2.4-31).

Consideration is also given to coincident wind wave activity with floods of a more frequent nature. Because of the plant's great safety margin against river flooding, an extremely conservative procedure was adopted to estimate water levels under the combined occurrence of frequent flooding, with coincident probable maximum gradient winds. The analysis procedure considers a 100-year flood level with the maximum supportable wave height, i.e., the breaking wave height and its associated wave runup.

Federal Insurance Administration, Type 15, Flood Insurance Study has been performed for the Susquehanna River Basin Commission (SRBC) in the vicinity of plant. Results of the study have been provided by the SRBC. These results are preliminary in nature until accepted by both the concerned municipalities and the Federal Insurance Administration. However, they represent the most up-to-date 100-year flood profile estimates.

Figure 2.4-9 shows the profile of the 100-year flood in the vicinity of the Susquehanna SES as estimated by the Flood Insurance Study. The 100-year flood level at the site is 513.6 ft. At this level, the water depth to the river bed is 33.6 ft. The maximum wave height which is physically possible is the breaking wave height. This wave height is 26.2 ft. based on a 33.6 ft. water depth (Ref. 2.4-42). The bank slope is estimated to be 1:30 (V:H). Wave runup associated with the breaking wave height on this slope is estimated to be 5.2 ft. (Ref. 2.4-42). The maximum water level at the site, under the effects of a 100-year flood with coincident wind wave activity resulting from the simultaneous occurrence of an extreme wind, is very conservatively estimated to be 539.8 ft. at the breaking wave height. This level is well below the plant grade elevation of 670 ft. The *simplified, albeit, very conservative approach is, therefore, justified. This water level is also below the PMF level of 548 ft.*

Dynamic effects of wind waves are not considered in this section since there are no safety-related facilities in the Susquehanna Flood Plain.

END HISTORICAL

2.4.4 POTENTIAL DAM FAILURES SEISMICALLY INDUCED

Security-Related Information
Text Withheld Under 10 CFR 2.390

START HISTORICAL

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

nd

Security-Related Information
Text Withheld Under 10 CFR 2.390

Security-Related Information
Text Withheld Under 10 CFR 2.390

END HISTORICAL

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.5 PROBABLE MAXIMUM SURGE AND SEICHE FLOODING

The Susquehanna River is the only major water body in the vicinity of the site. Consideration of seiche flooding potential is therefore not applicable in this case. The site is located about 165 miles upstream of the mouth of the Susquehanna River in Chesapeake Bay. Flooding through propagation of an open coast surge upstream to the site is also not applicable.

Wind waves and associated wave run-up acting in conjunction with a 100-year flood are discussed in Subsection 2.4.3.6. The very conservative analysis for these conditions results in a maximum wave height of 23.4 ft with an associated wave run-up of 9.4 ft. The maximum water level for the 100-year flood with coincident wind wave activity is 519.4 ft msl. This level is 28 ft below the PMF level and 150 ft below the plant grade. Based on the great margin of safety against flooding obtained through this simple but very conservative analysis, a detailed wave analysis including probable maximum hurricane winds is not considered necessary.

Consideration of flooding mechanisms in the spray pond are discussed in Subsection 2.4.8. The very short fetch lengths involved prevent the development of any significant wave activity in the spray pond.

2.4.6 PROBABLE MAXIMUM TSUNAMI FLOODING

Not applicable to the Susquehanna Site.

2.4.7 ICE EFFECTS

Portions of the Susquehanna River are subject to freezing during the months of November through April. Information on river freezing at Harrisburg for the period of 1870-1955 has been compiled by the Weather Bureau Airport Station at Harrisburg, Pennsylvania (Ref. 2.4-39). This information is provided in Table 2.4-11. The Susquehanna River remained open all winter during 22 of the 86 years of record. During the remaining years, 98 instances of freeze-over were noted. Thirty six of these freeze-overs were for periods lasting 14 consecutive days or less. There have been only 9 occasions when the river has remained frozen over for more than 60 consecutive days.

Flooding due to ice jams or "gorges" caused by ice break-up and subsequent re-freezing is sometimes a problem in the late winter months. Jamming may occur at locations where floating ice is retained and builds-up, such as at bridges, dams, narrow bends in the river, islands and reaches of the river with shallow rocky bottoms. Neither the Baltimore District Corps of Engineers nor the National Weather Service Mid-Atlantic River Forecast Center at Harrisburg currently have programs for systematically recording details of ice jam occurrences. Ice jams receive mention only when they cause flooding conditions.

Instances of ice jam-related flooding on the Susquehanna River have been recorded at Danville and at Wilkes-Barre. The dates of these occurrences and the resulting stages are provided in Table 2.4-12. Three such events have occurred at Danville over a 58 year period of record, or about once every 19 years. Seven ice-related flooding events have occurred at Wilkes-Barre over a 68 year period of record, or about once every 10 years. (Ref. 2.4-40.) Information on ice jams in the immediate vicinity of the site is not available. However, the regional data suggest an average recurrence on the order of 10 to 19 years. The most severe ice-related flooding occurred at Danville in 1904. Gage heights of 26.2 ft on January 25, 24.6 ft on February 10, and 30.7 ft on March 9 were recorded (Ref. 2.4-19, 2.4-20, and 2.4-40). All levels exceeded the Danville Flood Stage of 20 ft. The flood stage of March 9, 1904 remained the maximum gage height of record up until the flooding resulting from Tropical Storm Agnes in June 1972 (Ref. 2.4-41).

Remaining incidents of ice jam-related flooding have occurred substantially downstream of the Susquehanna SES. Probably the most damaging of these ice jam floods occurred in February 1963 at Duncannon, near the confluence of the Juniata and Susquehanna Rivers. Ice layers broke up and fused upstream of Duncannon causing a severe jam resulting in flood levels higher than the 1936 flood. Damage was reported from the mouth of the Juniata to Newport, 12 miles upstream. The jam was so severe that it diverted the flow of the Juniata River to the Susquehanna River upstream of the mouth.

The above discussion, along with reference to Tables 2.4-4 and 2.4-12, show that ice-related flooding in the general vicinity of the Susquehanna SES has resulted in flood stages comparable to precipitation-related flood stages. These stages are, however, appreciably below the estimated PMF water level, which is itself over 120 feet below the plant grade. Ice jam flooding is, therefore, no threat to any safety-related facilities.

Ice jam flooding or low water as a result of upstream jams on the river do not affect the availability of essential cooling water supplies. Any potential damage to the river intake structure from ice jamming in no way effects the safety of the plant. The plant can be safely shut down without the use of makeup water from the river. Design for potential icing conditions in the spray pond is discussed in Subsection 9.2.7.

2.4.8 COOLING WATER CANALS AND RESERVOIRS

2.4.8.1 General

The purpose of the spray pond system is to satisfy the ultimate heat sink criteria outlined in Regulatory Guide 1.27 (Rev. 2, 1/76). In this section, only the hydrologic and hydraulic design aspects of the spray pond system are considered.

2.4.8.2 General Description of the Spray Pond System

The spray pond system is located northwest of the cooling towers and the reactor-turbine building. The pond is freeform in shape. Embankments and ditches are provided to direct surface water runoff in a controlled manner. The bottom elevation of the pond is 668 ft msl. Under normal operating conditions, the water surface elevation in the pond is at elevation 679 ft msl, and is controlled by an overflow weir in the ESSW pumphouse with crest at elevation 678.5 ft msl. The pond and ESSW Pumphouse are described in more detail in Subsection 3.8.4.1 and shown on Dwgs. M-284, Sh. 1, C-64, Sh. 1, C-65, Sh. 1, C-66, Sh. 1, and C-67, Sh. 1. The water level is maintained by (a) rainfall (primary), (b) separate makeup pumped through a pipe adjacent to the ESSW pumphouse (secondary), or (c) cooling tower blowdown (backup as required). An uncontrolled spillway is located at the east end of the spray pond and has a bottom width of 30 ft and side slopes of 10 to 1. Invert elevation at the entrance is 680.5 ft and the longitudinal slope of the exit channel is 0.5 percent with side slopes of 2 to 1.

A railroad embankment is located some 159 feet downstream from the outlet of the spray pond. At this location, the channel is replaced by four 6 ft. x 3 ft. concrete box culverts with security gratings installed at both ends. The channel has a drop some 133 feet downstream of the culverts before merging with the drainage ditch located just to the north of the spray pond, and discharges into a natural waterway leading to the Susquehanna River. If this natural water course could become blocked, safety-related structures will not be affected. The drop in the spillway channel is designed to prevent any possible backwater effect which could develop from flows in the drainage ditch and which could affect the hydraulic performance of the spillway channel. The channel upstream of the box culverts is concrete-lined to a depth of 3.5 feet to prevent any possible erosion that could cause a blockage in the culverts. Downstream from the culvert, the channel is grass-lined. A longitudinal section of the spillway channel is shown in Figure 2.4-27.

2.4.8.3 Design Bases for the Capacity of the Spray Pond

The design bases for the capacity of the spray pond are addressed in Subsection 9.2.7.

2.4.8.4 Hydrologic Design Bases for the Spray Pond System

The spray pond system is designed to remain functional under the most adverse hydrometeorological conditions such as the probable maximum storm (Subsection 2.4.2.3) and tornado, or the hydrodynamic loadings resulting from waves generated by the safe shutdown or operating basis earthquake (Section 3.7).

2.4.8.4.1 Design Basis Flood Level (DBFL)

The Design Basis Flood Level (DBFL) for the spray pond was determined in accordance with Regulatory Guide 1.59 (Rev. 1 4/76) by superimposing the effects of coincident wind-generated wave activity on the various flood levels; namely:

1) A sustained 40 mph wind on the probable maximum flood (PMF) level
2) The worst wind of record at Avoca on the standard project flood (SPF) level
3) A probable maximum gradient wind on a 10-year flood level.

The probable maximum flood was derived from the probable maximum storm (Subsection 2.4.2.3) assuming no rainfall losses on the land portion of the drainage area. Since the longest distance from the drainage divide to the edge of the pond is only about 400 ft with a slope of 3 to 1, no time lag between rainfall and runoff to the pond was assumed. The inflow probable-maximum-flood hydrograph was derived by assuming that the entire probable maximum precipitation (PMP) on the 18.6-acre drainage area runs off instantly. The resulting hydrograph is shown on Figure 2.4-24.

The probable maximum flood was routed through the spray pond under the following assumptions:

a) A normal operating water level of 679.0 ft is maintained in the spray pond.

b) Blowdown water from the cooling towers may be routed through the spray pond at a constant rate of 10,000 gpm (22.3 cfs).

c) The blowdown outlet conduit at the ESSW pumphouse, which serves as the exit for the excess water in the spray pond, has a maximum capacity of about 41 cfs.

Figure 2.4-25 shows the rating curve of the spillway channel, assuming no blockage of the culverts by debris or ice accumulation. The spillway rating curve was derived by assuming a discharge, computing the corresponding critical depth at the downstream control point, calculating a water surface profile upstream to the spray pond, adding an entrance velocity head and associated losses to obtain the proper spray pond water surface. The entrance loss for the channel was assumed to be 0.5 of the velocity head and that for the culverts was estimated using data suggested by the Bureau of Public Roads (Ref. 2.4-97). Manning's equation:

$$Q=\frac{1.486}{n}AR^{2/3}S^{1/2} \qquad \text{(Equation 2.4.8-1)}$$

was used to determine the channel resistance. In this equation,

Q is the discharge, in cfs

n is Manning's roughness coefficient assumed to be as follows:

0.06 for the grassed channel downstream from the culverts and upstream from the confluence with the drainage ditch. 0.015 for the concrete-lined spillway channel upstream from the culvert inlet. 0.013 for the concrete box culvert.

A is the cross-sectional area of the flow in sq ft.

R is the hydraulic radius in ft.

S is the slope of the energy gradeline.

The blowdown-water outlet in the ESSW pumphouse is a submerged orifice, 2 ft in diameter, with the centerline at elevation 674.75 ft and is located 8 ft downstream of the overflow weir. The rating curve of the blowdown water outlet shown on Figure 2.4-25 was derived using the equation:

$$Q = 0.6A\,(2gh)^{1/2} \qquad \text{(Equation 2.4.8-2)}$$

where

Q is the discharge in cfs.

A is the cross-sectional area of the submerged orifice in sq ft.

g is the gravitational acceleration equal to 32.2 ft/sec^2.

h is the upstream head in feet of water measured to the centerline of the submerged orifice.

The elevation-area-storage capacity curves of the spray pond are shown on Figure 2.4-26.

The results of the flood routing studies are shown in Table 2.4-13. The maximum water level under the PMF condition was found to be at elevation 682.3 ft.

The maximum water levels in the spray pond for the Standard Project Flood (SPF) defined as one-half of the PMF, and the 10-year flood conditions, were also calculated and found to be 681.8 ft and 679.6 ft msl, respectively (Table 2.4-13). In deriving the maximum water level under the SPF condition, a coincident earthquake was assumed (Regulatory Guide 1.59, Rev. 1, 4/76) causing failure of the blowdown discharge conduit downstream from the ESSW pumphouse. The 10-year flood level was derived assuming that the entire 10-year flood runoff from the spray pond watershed would be stored in the pond. In deriving the 10-year flood volume, the 24-hour 10-year rainfall suggested by the US Weather Bureau (Ref. 2.4-23) was used assuming that 50 percent of the rainfall on the level portion of the spray pond drainage area would run off.

The worst winds of record at Avoca were found to be 65 mph and the probable maximum gradient wind for the site area was estimated to be 80 mph, the derivation of which is presented in Section 2.3.

The effects of the coincident wind-generated wave activity were estimated in accordance with methods suggested by the US Army Corps of Engineers (Ref. 2.4-42). Wind setup in the spray pond was found to be negligible. The results of these computations are presented in Table 2.4-14.

Assuming a standing wave condition at the ESSW pumphouse, the DBFL resulting from a 1 percent wave will be at 684.8 ft. This water level does not represent a threat to any safety-related facility because all the safety-related equipment is located at elevation 685.5 ft. or higher and is protected from splash effects by the walls of the pumphouse and slab at top elevation 685.5 ft. (refer to Dwg. M-274, Sh. 1). The run-up elevation on the side of the spray pond from a 1 percent wave will be 684.6 ft. The side of the spray pond is protected by a concrete lining up to elevation 685.5 ft. This protection will preclude any erosion of the bank due to wind wave action.

Wave forces on the ESSW pumphouse and the pipe supports were also estimated for the different flood water levels under the assumed coincident wind wave activities using methods suggested by the US Army Corps of Engineers (Ref. 2.4-42). In estimating the wave forces on the ESSW pumphouse, the water level inside the pumphouse was assumed to be at the corresponding static water level in the spray pond. Table 2.4-15 presents the results of the wave force computations on the ESSW pumphouse and pipe supports. The force due to hydrostatic pressure is not included.

The peak outflow through the spillway channel during the design flood condition (Case 2, Table 2.4-13) is estimated to be 150 cfs. The calculated water surface profile along the spillway channel for the peak outflow is shown in Figure 2.4-27. It was derived using the standard-step method (Ref. 2.4-24), with the assumption that critical depth occurs at the drop located upstream from the confluence between the spillway channel and the drainage ditch north of the spray pond.

A minimum of 3 ft of freeboard is provided in the spillway channel. At most points along the chute, the actual freeboard is greater than 3 ft because it is governed by the elevation of the bottom of the chute relative to the adjacent ground surface. This amount of freeboard exceeds recommended practice by the US Bureau of Reclamation (Ref. 2.4-43) and the US Army Corps of Engineers (Ref. 2.4-44) for similar design conditions.

Consideration was also given to the possibility of having a wave propagated into the channel coincident with the occurrence of a probable maximum storm. The critical maximum breaking-wave height, coincident with a 40 mph wind, was found to be approximately 1 ft and would not affect the freeboard allowance stated previously.

2.4.8.4.2 Safe Shutdown and Operating Basis Earthquakes

The safe shutdown and operating basis earthquakes (SSE and OBE) for the project are presented in Section 3.7. In accordance with the design criteria set forth in Regulatory Guide 1.59 (Rev. 1, 4/76), the SSE and OBE were assumed to occur coincidentally with a 25-year flood and a standard project flood (one-half of a PMF), respectively. Since the spray pond discharge conduit is not designed to withstand an earthquake, it is conceivable that a portion of this conduit could collapse causing a blockage. It was, therefore, assumed that no water would pass through the discharge conduit following a design earthquake condition.

Assuming failure of the discharge conduit, the maximum water levels in the spray pond during a 25-year and a standard project flood (SPF) event were estimated to be at elevation 681.4 and 681.8 ft, respectively. The 25-year flood level was derived by routing the 25-year flood (peak flow 45 cfs) through the spray pond. The peak discharge through the spillway channel was estimated to be 65 cfs. In deriving the 25-year flood peak, the rainfall duration-frequency atlas published by the US Weather Bureau (Ref. 2.4-23) was used assuming that 50 percent of the rainfall on the land portion of the spray pond drainage area would run off. The derivation of the SPF level was presented in Subsection 2.4.8.4.1.

At the ESSW pumphouse, the wave heights generated during the SSE and OBE under the stipulated hydrologic conditions were estimated to be 2.9 and 1.6 ft, respectively. These wave heights were computed using the equation developed by Biesel (Equation 2.4.8-3) for a piston type of wave generator (Ref. 2.4-45).

$$H = 2S\frac{2Sinh^2(2\pi d/L)}{(2\pi d/L) + (Sinh(2\pi d/L))Cosh(2\pi d/L)} \qquad \text{(Equation 2.4.8-3)}$$

where:

H is the wave height generated in ft.

S is the design displacement (amplitude) caused by the earthquake in ft.

d is the initial depth of water in ft.

L is the wave length in ft and is a function of the period of the design basis earthquake.

In this computation, the design displacement (amplitude) and period were derived from Figures 2.4-28 and 2.4-29 as 10.1 in. and 2.7 sec for the SSE, and 5.4 in. and 2.7 sec for the OBE, respectively.

Assuming a standing wave condition at the ESSW pumphouse, the maximum forces and moments about the base of the structure were estimated to be 75.6 kips and 1156 ft-kips during the SSE and 61.7 kips and 871.5 ft-kips during the OBE, respectively, using the methods suggested by the US Army Corps of Engineers (Ref. 2.4-42).

At the pipe supports near the center of the pond, it is possible that the earthquake-generated waves coming from the opposing sides of the spray pond could be in-phase. For this condition, the maximum wave heights during the SSE and OBE were conservatively estimated to be 5.5 ft and 3.2 ft, respectively. The wave forces and moments at the base of each support would be 1.1 kips and 13.3 ft-kips for the SSE and 0.5 kips and 5.2 ft-kips for the OBE conditions, respectively.

The resultant maximum hydrodynamic force acting on the pipe supports as a result of earthquake shaking was estimated using the equation (Ref. 2.4-45):

$$F = C_m \rho V a_x \qquad \text{(Equation 2.4.8-4)}$$

where:

F is the maximum hydrodynamic force due to earthquake.

C_m is the virtual mass coefficient assumed to be 1.5 (Ref. 2.4-44).

ρ is the mass density of the water equal to 1.94 slugs/cu ft.

V is the volume of the submerged structure (displaced water) in cu ft.

a_x is the maximum horizontal acceleration due to earthquake in ft/sec/sec.

For the case of the ESSW pumphouse, the equation used is that suggested by Tennessee Valley Authority (Ref. 2.4-46) for a rigid structure with water fronting on one side:

$$F = 36.5H^2 \frac{a_x}{g} \qquad \text{(Equation 2.4.8-5)}$$

where:

F is the maximum hydrodynamic loading in lb/lf.
H is the depth of water fronting the pumphouse in ft.

a_x is the maximum horizontal bedrock acceleration due to earthquake in ft/sec/sec.

g is the gravitational acceleration equal to 32.2 ft/sec/sec.

For earthquakes with motion along the east-west axis, the ESSW pumphouse was analyzed as a rigid body. The maximum hydrodynamic loading exerted on the wing-walls adjacent to the embankment was estimated using Equation 2.4.8-4. In this case, the virtual mass coefficient (C_m) adopted was 0.32 as given by Sarpkaya (Ref. 2.4-47).

The maximum hydrodynamic loadings resulting from the design basis earthquakes are presented in Table 2.4-16. These loadings do not include those due to hydrostatic or earth pressures, or impact from the earthquake-generated waves originating from the sides of the pond.

Since the natural period of the water body in the spray pond is substantially larger than that of the design earthquakes, the formation of seiches in the spray pond due to earthquakes is not possible.

START HISTORICAL

2.4.9 CHANNEL DIVERSIONS

The drainage basin of the Susquehanna River upstream of the site lies within the physiographic provinces of the Appalachian Plateau, and the Appalachian Valley and Ridge. Within the Appalachian Plateau Province, the terrain is characterized by deeply eroded, steep-sided flat bottom valleys and flat to gently rolling plateaus. At Pittston near the mouth of the Lackawanna River, the Susquehanna River enters the Appalachian Valley and Ridge Province and flows through the Wyoming Valley which is lined by even crested ridges on both sides (Ref. 2.4-39). Near

Wilkes-Barre, the Susquehanna River flows through a broad, flat plain which is bounded by moderately steep mountains. In the general vicinity of the site, the terrain is steeply sloped on both banks with dense forests and wooded areas (Ref. 2.4-15). The Upper Susquehanna is thus characterized as possessing a stable stream course flowing through well defined ridge and valley topography. As such, this portion of the Susquehanna River is not subject to major meandering realignment and diversion by natural causes.

END HISTORICAL

2.4.10 FLOODING PROTECTION REQUIREMENTS

As discussed in Subsections 2.4.1.1 and 2.4.2.2, the safety-related structures and facilities are secure from flooding. Hence, flooding protection requirements are not necessary.

2.4.11 LOW WATER CONSIDERATIONS

2.4.11.1 Low Flow in Rivers and Streams

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.11.1.1 Low Flow Resulting from Hydrometeorological Events

The low flow and water level design bases consider the fact that the Susquehanna River is used as a source for non-essential water supplies only. Essential water supplies are provided for the Engineered Safeguards Service Water System from the spray pond located on the site. The statistically derived one day low flow with a 100-year recurrence interval is taken as a satisfactory definition of the low flow resulting from a 100-year drought. This value is taken to be the low flow design basis for operation.

For purposes of this study, the available flow data for the USGS Wilkes-Barre stream gage (station 01536500) were used. The drainage area above the Susquehanna SES is some 2.4 percent greater than the drainage area above the Wilkes-Barre gage. Use of the Wilkes-Barre flow data thus provides a conservative estimate the low flows at the Susquehanna SES Site. Frequency analysis of the Wilkes-Barre gage data for the years 1900-1967 yield a one day 100-year low flow of 520 cfs (Ref. 2.4-31). Recent log Pearson Type III frequency analysis, performed by the USGS using flow data for the years 1900-1972, resulted in a one day 100-year low flow of 520.7 cfs at Wilkes-Barre. Peak consumptive use for the Susquehanna SES as described in Subsection 2.4.11.4.2 amounts to 74.7 cfs. This usage represents less than 15 percent of the one day 100-year low flow. The Susquehanna River is thus an adequate source of non-safety related water during the 100-year drought. The stage-discharge relationship for the Susquehanna River in the vicinity of the site is provided in Figures 2.4-5 (0-3,000 cfs) and 2.4-6 (1,000-37,000 cfs). Stage levels were measured at the site by means of a gage installed for this particular purpose. Discharges corresponding to the measured stages were obtained by direct interpolation between the mean daily discharges at Danville and Wilkes-Barre as reported by the USGS. As shown on the Figure 2.4-5, the stage discharge curve was extrapolated down to zero discharge by constructing the curve so as to intersect the zero discharge at an elevation of 480 ft msl which is the bottom of the stream channel at the site. There were no observations at interpolated discharge values of less than 1200 cfs (Ref. 2.4-30 and 2.4-31).

Based on the stage-discharge relationship of Figure 2.4-30, the stage elevation for the one day 100-year low flow at the Susquehanna SES site is 483.5 ft msl. This elevation is the low water level design basis for non safety-related water supplies. Essential water supplies are provided by the spray pond. The low water design basis for these supplies are discussed in Subsection 9.2.7.

2.4.11.1.2 Low Flow Resulting from Dam Failures

Security-Related Information
Text Withheld Under 10 CFR 2.390

2.4.11.2 Low Water Resulting from Surges, Seiches, or Tsunami

The Susquehanna River serves only as the source of non-essential makeup water for the plant. Safety-related water supplies are drawn from the spray pond described in Subsection 9.2.7. Therefore, low water levels on the Susquehanna River resulting from the occurrence of probable maximum meteorological or geoseismic events, do not affect the ability of safety-related features to function adequately. Ice formation or possible ice jams on the Susquehanna River also affect only non-essential water supplies.

In order to demonstrate the adequacy of this non safety-related water supply even in extreme conditions, a conservative set down analysis was performed. The 100-year fastest mile wind of 80 mph as derived in Section 2.3 is taken as a steady wind blowing directly across the river away from the intake structure. This wind condition is assumed coincident with a 100-year low flow condition in the Susquehanna River. The resulting setdown amounts to 0.22 ft.

Even though makeup from the river is not required for any safety function, the intake is designed so that the top of the intake water passage is submerged 1 ft during the 100-year low flow condition (see Figure 2.4-52). The discharge diffusers are also below the river low flow level (see Figure 2.4-53).

Because of its location and small size, consideration of the effects of seiche and tsunami is not applicable to the spray pond. The very short effective fetch lengths which are available in the spray prevent the development of any significant wave and setdown. Thus, severe wind conditions as would result during a Probable Maximum Hurricane, would not create a low water condition in the spray pond which could affect the dependability of this safety-related water supply. Design features which assure the availability of safety-related water supplies are discussed in Subsection 9.2.7.

2.4.11.3 Historical Low Water

Flow data on historical low flows available in the records of the Wilkes-Barre gage (Station 01536500) is used in Subsection 2.4.11.1 to estimate the one day 100-year low flow at the Susquehanna SES site. The instantaneous minimum flow of record for this station is 528 cfs. This flow, as well as the lowest mean daily discharge of 532 cfs, occurred on September 27, 1964 (Ref. 2.4-6 and 2.4-49). Since statistical methods were not used to extrapolate flows and/or levels to provable minimum conditions, no further discussion is presented.

2.4.11.4 Future Controls

2.4.11.4.1 Legal Consumptive Use Restrictions

On September 30, 1976, an amendment to 18 CFR Part 803 (Susquehanna River Basin Commission, Part 803 - Review of Projects Consumptive Use of Water) was published in the Federal Register (Ref. 2.4-50). This amendment requires compensation in an amount equal to the projects total consumptive use when the stream flow at the intake equals or is anticipated to equal a specified low flow criterion. This criterion includes the 7-day 10-year low flow plus the projects total consumptive use and dedicated augmentation. Compensation may be provided by one or a combination of the following means:

1. Construction or acquisition of storage facilities
2. Purchase of available water supply storage in public or private facilities
3. Purchase of water to be released as required from a water purveyor
4. Releases from existing facilities owned and operated by the applicant
5. Other alternatives including reducing or halting consumptive water use and using alternative source unaffected by the compensation requirement

The provisions of this regulation apply to consumptive uses initiated since January 23, 1971. Consumptive uses beginning after this date must comply with the requirement within a time period to be determined by the Susquehanna River Basin Commission at the time of the permit application review. This compliance delay feature was included in the amendment with specific consideration of the Susquehanna SES project.

The low flow criterion value will be specified at the time of the permit application review. The Q7-10 flow, being a statistical quantity, will not vary substantially as additional years of base data are included in its computation. The Q7-10 value of 820 cfs for Wilkes-Barre (Ref. 2.4-51) can thus be taken as an approximation of the value which will be included in the low flow criterion. Dedicated augmentation and the plant consumptive use must also be added to determine low flow criterion.

2.4.11.4.2 Changes in Consumptive Use Upstream

Information on present and projected values of consumptive water use including inter-basin transfer is available from the New York State Department of Environmental Conservation (DEC) and the Pennsylvania DER (Ref. 2.4-13 and 2.4-52). Total consumptive use plus inter-basin transfer for the drainage area upstream of the Susquehanna SES for the period 1970-1974 was 81.4 cfs. Projections for this same area for the period 2010-2020 set the consumptive use at 364.2 cfs or an increase of 282.8 cfs over the 1970's level. These projections included the originally-estimated average Susquehanna SES consumptive use of 62 cfs. A substantial increase in projected acreage of irrigated farm land in the Chemung and East Susquehanna River Basins account for about two-thirds of the estimated 2010-2020 consumptive water use.

The "Environmental Report - Operating License Stage" (ER-OL, Ref. 2.4-98) estimated a design maximum cooling tower evaporative loss of 28,700 gpm. The "Final Environmental Statement" (FES, Ref. 2.4-99) gave a conservative estimate of 600 gpm for all other consumptive uses, independent of power level. The maximum total consumptive use is the sum, 29,300 gpm or 65.3 cfs.

With power uprate the maximum cooling tower evaporative loss is expected to approach 32,900 gpm. Adding the 600 gpm FES estimate for other consumptive uses results in an uprated maximum total consumptive use of 33,500 gpm, or 74.7 cfs.

2.4.11.5 Plant Requirements

The safety-related cooling water is supplied by the ESW system and the RHRSW system. These systems are described in Subsections 9.2.5 and 9.2.6.

The minimum safety-related cooling water flow required is approximately 7,000 gpm for the ESW system and approximately 8000 gpm each for the Unit 1 and 2 RHRSW systems. Each of these systems has been designed with sufficient capacity and redundancy so that no single active or passive failure in either system will prevent the system from achieving its safety objective.

The cooling water for both the ESW and RHRSW systems is pumped from a concrete lined spray pond, the configuration of which is shown on Figure 2.4-2. This pond has a normal water surface area of approximately 8 acres and contains approximately 25 x 10^6 gal of water. The pond is designed to supply ESW and RHRSW for both units for 30 days after shutdown initiation without receiving makeup water. A complete discussion of pond design capability is given in Subsection 9.2.7.

The elevation of the bottom of the pond is 668 ft above msl and the minimum water level during normal operation is at elevation 678 ft-6 in. above msl. The ESSW pumphouse is located at the edge of the spray pond as shown on Figure 2.4-2. The top of the pumphouse foundation mat is at elevation 660 ft above msl. The minimum water level which will satisfy NPSH requirements at all flows of the vertical ESW and RHRSW pumps are at elevations 667 ft and 668 ft above msl, respectively. Therefore, sufficient NPSH is always available.

Details of the pumps are in Subsections 9.2.5 and 9.2.6.

2.4.11.6 Heat Sink Dependability Requirements

The water supply for normal shutdown is provided by:

a) The cooling tower pond, which supplies cooling water to the condensers and service water system by means of the circulating water pumps and service water pumps, respectively (see Subsection 10.4.5).

b) The spray pond, which supplies cooling water to the RHRSW system for dissipating reactor decay heat in the RHR heat exchangers.

The water supply for emergency shutdown is provided by the spray pond, which is the ultimate heat sink, and provides cooling water to both the ESW pumps and the RHRSW pumps as described in Subsections 9.2.5 and 9.2.6.

Subsection 9.2.7 describes the design bases for operation and normal or accident shutdown and cooldown under the following conditions:

a) The most severe natural and site-related accident phenomena

b) Reasonable combinations of less severe phenomena

c) Single failures of man-made structural components

The ultimate heat sink and the piping network located in it are designed to conform with Regulatory Guide 1.27 (Rev. 2, 1/76), which requires that the system operate both during and after the most severe natural phenomenon. Makeup water to both the cooling tower basin and the spray pond is provided by the Susquehanna River by pumps located in the river intake structure as described in Subsection 9.2.7.2.2.

Low level alarms are provided in the river intake structure, in the cooling tower basin, and in the RHRSW and ESW pump chambers.

The river water make-up pumps are tripped at the river low low level alarm setpoint of 485'-4". A low level alarm is provided and set at 485'-0" to alert the operator to a potential low river flow.

The volume of water to be contained within the pond was selected because various water losses (see Subsection 9.2.7) can be absorbed over a 30-day period without makeup. This absorption takes place when the pond is being used simultaneously to cool down one unit that has undergone a design basis accident and to safely shut down the second unit.

During the 30-day period, it is estimated that the decay heat generated for each core which has to be removed by the RHRSWS (Section 9.2.6) will be 2.5×10^{10} BTUs.

Table 9.2-3 lists all users of the ESWS (Subsection 9.2.5); Tables 2.4-18 and 9.2-4 relate users to time for two types of shutdown.

Tables 2.4-18 and 9.2-4 are based on one of the four aligned diesels being taken out of operation and placed on standby status after 24 hours of operation. The cooling load (Tables 2.4-18 and 9.2-4) is carried out to 30 days after the shutdown initiation; 30 days is the design life of the ultimate heat sink for operation without makeup water. The operation of all equipment listed at the cooling duty shown represents design conditions. Under actual operating conditions certain pieces of equipment may be shut down or operated under reduced loads.

The ultimate heat sink is used solely as a cooling water supply for the RHRSW and ESW systems. No interdependent water supply systems are used.

START HISTORICAL

2.4.12 DISPERSION DILUTION AND TRAVEL TIME OF ACCIDENTAL RELEASES OF LIQUID EFFLUENTS IN SURFACE WATERS

The Susquehanna River is the only major surface water body in the vicinity of the station which could potentially be affected by the highly unlikely postulated spillage of liquid radwastes. The ability of the Susquehanna River to disperse, dilute as well as transport these wastes which reach it, is discussed with primary emphasis on the reach of the river extending from the station downstream to Danville, a channel distance of approximately 31 miles. The bulk of the potential dilution of such effluent releases occurs within this reach. In addition, standby and active uses of river water, as identified in Subsection 2.4.1.2.3, first occur within this reach.

Table 2.4-3 presents water users and uses within 50 miles downstream of the station. The location of these users is provided on Figure 2.4-7. Of principal importance to this discussion is the municipal water usage at Berwick (7 miles downstream), Bloomsburg (19 miles downstream) and Danville (31 miles downstream). Of these only Danville maintains active usage of the river water. Both Bloomsburg and Berwick maintain river intakes for use as standby water supplies. Five industrial users and one recreational usage have also been identified in this reach.

The following paragraphs provide a discussion of certain hydraulic characteristics of the Susquehanna River which are important to the dilution and transport of radionuclide releases. Accident conditions which result in such releases are postulated. Finally, estimates of the dilution of these wastes are provided.

END HISTORICAL

2.4.12.1 River Flow Characteristics

2.4.12.1.1 Flow Duration

The flow past a particular point represents a measure of the dilution potential of the stream. For the Susquehanna River the average flow past the station is about 13,600 cfs. A more complete description of the flow is provided in Figure 2.4-30. This figure shows the flow duration curves of daily discharge for the Susquehanna River gauging stations located at Wilkes-Barre and Danville. Flow duration characteristics at the stations can be interpolated from this figure. Such flow values are suitable for estimating the dilution of routine low level radioactive releases from the station. For accidental releases, however, a more conservative approach must be taken. The determination of a suitable low flow value is described in the following sections.

START HISTORICAL

2.4.12.1.2 Extreme Low Flow

The minimum historic daily low flow rates were recorded on September 27, 1964 at both the Wilkes-Barre and Danville gages. The flows were 532 cfs and 558 cfs respectively (Ref. 2.4-49). The minimum historic daily low flow at the Susquehanna SES is estimated to be 538 cfs. This value is obtained by interpolation between the Wilkes-Barre and Danville values on the basis of drainage basin area. For comparison purposes, the 100-year low flow at the site is estimated to be 520 cfs (see Subsection 2.4.11.1.1).

No modification of this value was made for purposes of evaluation. Increased consumptive use of the Susquehanna River is projected to occur during the operational life of the station. Legislation described in Subsection 2.4.11.4.1, however, prohibits uncompensated consumptive water use when the flow rate approaches the 7 day, 10-year low flow value. The 7-day 10-year low flow value at the site is 820 cfs.

The major impact of new consumptive water uses initiated after regulation specified date of January 23, 1971 will essentially be limited to periods when the flow exceeds the 7-day, 10-year low flow value. Since no significant upstream changes in consumptive use occurred between the recorded historic low flows of 1964 and the controlling legislation date of 1971, the consumptive use situation which existed in 1964 is essentially preserved with respect to its influence on extreme low flows. Use of the unmodified historic low flows for purposes of discussion of dilutions of accidental liquid radwaste releases is considered to be reasonable.

2.4.12.1.3 Travel Times

Time-of-travel studies have been conducted by the USGS which include the reach of the Susquehanna River downstream of the station (Ref. 2.4-53). These dye studies were conducted between 1965 and 1967 during periods of low to medium flow. Data for the reach of the Susquehanna River between Shickshinny (about 4 miles upstream) and Danville (about 31 miles downstream) are presented in Figure 2.4-31.

Time-of-travel values for both the leading edge of the dye cloud, as well as for its peak concentration, are plotted. Discharge values are those for flow rates at Shickshinny, the dye injection point. For the historic low flow case with a flow of about 537 cfs at Shickshinny, Figure 2.4-31 indicates a range of travel times of about 135 through 155 hours. Proportioning these times on the basis of channel length, the travel times for the reach from the Susquehanna SES to Danville under historic low flow conditions range from 120 to 138 hours.

The flow velocity for this reach can be estimated through use of the peak concentration time-of-travel (138 hrs); the average flow velocity is 0.3 ft/sec. The 18 hour difference between the *occurrence of the dye cloud leading edge and the peak concentration is a measure of the longitudinal dispersion which could contribute to the dilution of transient effluent releases.*

END HISTORICAL

2.4.12.2 Accidental Releases

Because of the subsurface location of the radwaste tanks and processing facilities, as well as the procedures for handling radwastes at the Susquehanna SES, a direct release of liquid radioactive wastes via surface pathways to the Susquehanna River is not considered.

However, a highly improbable release of liquid radwastes into the Susquehanna River via a groundwater pathway has been postulated. A detailed discussion of the groundwater transport of the radionuclides is provided in Section 2.4.13.3. A brief description of the postulated accidental release along with the estimated radionuclide concentrations entering the river are provided in the following paragraphs.

The largest radionuclide concentrations in the radwaste system are found in the two 7,400-gallon Reactor Water Clean-Up (RWCU) Phase Separator Tanks. These tanks are located in the Radwaste Building and are entirely below grade. The postulated accident consists of a rupture of one of these tanks and a release of its contents into the groundwater system. The contaminated groundwater then moves downgradient toward the Susquehanna River. The location of the aquifer discharge into the river is shown on Dwg. FF62005, Sh. 1.

The aquifer rate of discharge to the river is estimated to be about 108 cubic feet/day per foot of aquifer width. Analysis performed under Section 2.4.13.3 indicated that the estimated radionuclide concentrations at the point of discharge into the river dropped off to below one percent of the peak centerline concentrations within a width of about 640 feet. Taking this value as the width of the contaminated flow, the inflow of contaminated groundwater to the river is calculated as 69,120 cubic feet/day (0.8 cfs).

Table 2.4-38 presents the estimated peak concentrations of radionuclides in the groundwater entering the Susquehanna River as a result of the postulated rupture of one of the RWCU Phase Separator tanks. As shown in the table the estimated peak concentrations for Sr-90 and Pu-239 at the point of entry into the river exceed the effluent concentration limits (ECL) for an unrestricted area as defined in 10 CFR 20 Appendix B. The remaining radionuclides analyzed in Section 2.3.13.3 have activity concentrations at the river that are at least an order of magnitude lower than their associated effluent concentration limits. When consideration is given to the downstream dilution effects discussed in the Subsection 2.4.12.3, in no case does the estimated peak concentration of any of the analyzed radionuclide exceed the effluent concentration limits given in 10 CFR 20 at the nearest downriver public potable water supply (Danville).

2.4.12.3 Effluent Dilution

The groundwater accident discussed above results in a release of contaminated water to the Susquehanna River over an extended period of time. For such a continuous release condition, lateral as opposed to longitudinal diffusion becomes the more important mixing mechanism. The maximum potential dilution occurs when cross-sectional homogeneity of concentration is achieved.

For the case of the contaminated groundwater entering the river during the extreme low flow occurrence, the maximum potential dilution ratio, is 1:650, which is the ratio of the groundwater flow (0.8 cfs) to the estimated 100-year low river flow at the site of 520 cfs (Section 2.4.12.1.2).

A relatively simple model was used to quantify the dilution downstream of the station. A steady state analytical streamtube model (Ref. 2.4-56) was employed for that purpose. The model is applicable to non-tidal rivers where the flow is assumed to be uniform and approximately steady. Such conditions occurred during the low flows of September 1964. Flow variation was within 10 percent of the minimums for 3 preceding days at Danville to 11 preceding days at Wilkes-Barre (Ref. 2.4-49). Similar flow behavior can be expected during future drought conditions severe enough to result in these low flow rates. The model is further limited to portions of the river removed from the influences of the discharge. For the groundwater release condition, the lack of momentum at the discharge location makes this model applicable for the entire reach downstream of the discharge.

Figure 2.4-33 shows a cross-section at the groundwater release point. The contaminated groundwater is seen to flow toward the river and flow into the river through the bank and bottom approximately to the mid-stream line. The contaminated groundwater inflow can be approximated as a line source perpendicular to the river flow. Equation 8 of Reference 2.4-56 provides the closed form solution for this type of release.

Additional conservative assumptions are made in the application of the model. The channel is taken to be straight, thereby removing any possible increase in cross stream diffusion at river bends. Effluent concentrations in the river are not reduced through any potential sorption of the radionuclides by suspended and bottom sediments. The analysis also conservatively neglects any additional dilution provided by tributary inflow at downstream locations along the Susquehanna River.

Flow characteristics at 32 cross-sections between the site and Danville were estimated from a HEC-2 computer simulation of the historic low flow condition as described in Subsection 2.4.12.1.2. These flow characteristics provide the basis for the determination of the diffusion factor D at each of these cross-sections. The longitudinal variation of D within this reach is relatively small. Therefore, the mean value of D is used to calculate the radioisotope concentration as a function of distance from the site.

The model results indicate that a fully mixed flow condition is approached within about 47 miles downstream of the station. Concentrations of the radionuclides at Berwick, Bloomsburg and Danville are reduced to 1.29, 1.02 and about 1.0 times the final fully mixed flow concentrations. The estimated concentrations at Danville of the three most important radionuclides are presented below relative to the limits presented in 10CFR20, Appendix B, Table 2

	Estimated (μ Ci/ml)	10 CFR 20 Effluent Concentrations (μ Ci/ml)
Sr-90	1.2×10^{-8}	5×10^{-7}
Cs-137	1.3×10^{-9}	1×10^{-6}
Pu-239	4.6×10^{-10}	2×10^{-8}

In summary, a simple analytical model was used together with conservative assumptions in order to roughly approximate the dilution of the contaminated groundwater entering the Susquehanna River. It was found that dilutions approaching the fully mixed flow limit of 1:650 were achieved at Danville where the first active municipal water usage downstream of the station is found. Concentrations of all radionuclides released in the postulated accident are substantially below their effluent concentration limits.

START HISTORICAL

2.4.13 GROUNDWATER

2.4.13.1 Description and Onsite Use

2.4.13.1.1 Regional Groundwater Conditions

From the point of view of groundwater, the region will be defined in this report to be the area within a 20-mile radius of the Susquehanna SES. Included in this area are the major portions of Luzerne and Columbia Counties, the northern portion of Schuylkill County, the northwestern corner of Carbon County, and the southeastern corner of Sullivan County.

The region lies in the Appalachian Highlands, which is made up of the Appalachian Plateau Province and the Valley and Ridge Province. The Valley and Ridge Province makes up almost the entire region, while the Appalachian Plateau occupies only the northernmost three percent of the area as shown on Figure 2.4-34.

In the region, the geologic formations of hydrologic significance are either consolidated formations of Paleozoic age or unconsolidated deposits laid down during the glacial age. In the Appalachian Plateau Province, the Paleozoic formations are nearly flat lying, while to the south in the Valley and Ridge Province, these formations have experienced pronounced folding. This folding, which occurred at the close of the Paleozoic Era, produced a number of northeast-southwest trending anticlines and synclines accompanied by the development of a number of normal and thrust faults.

As seen in Figure 2.4-34, seven major folds occur in the region. From north to south, they are the shallow syncline on the crest of North Mountain (in the Appalachian Plateau Province) the Milton anticline the Lackawanna syncline (including the Wyoming Valley) the Berwick anticline (on which the Susquehanna SES is located) the synclinorium of the Eastern Middle Basin in the vicinity of Hazleton the Selinsgrove anticline and the Mahanoy Basin, a synclinorium (Ref. 2.4-57). Faults, *striking generally along the axis of the folds, occur within the Lackawanna syncline, the Berwick anticline, the Eastern Middle Basin and the Mahanoy Basin (Ref. 2.4-58).*

With the exception of some of the Pleistocene deposits, no formation in the region has a high primary transmissivity. Both the primary porosity and permeability of the consolidated Paleozoic rocks are generally low. Thus, the joint systems, faults and solution channels caused by tectonic processes, weathering or solution activity subsequent to the deposition of these formations, take on considerable importance in enhancing the rocks' ability to transmit groundwater. Systems of fractures or solution channels in bedrock can serve as groundwater pathways over distances of many miles, provided the openings have not been filled by precipitates or other solid matter.

In addition, the presence of sharply folded anticlines and synclines in the region in some cases provides special constraints on the flow of groundwater. Dips in the region range from 0^o to 40^o, with the maximum dips found on the rims and within the synclinal basins (Ref. 2.4-57). Groundwater will tend to flow within a specific formation to the extent that continuous pathways, fractures or solution channels occur preferentially in that formation. This would be particularly true of solution channels in limestone formations. In such cases, artesian or flowing wells are common, particularly in synclinal valleys (Ref. 2.4-57). However, to the extent that fracture systems extend across several adjacent formations, groundwater will not be confined to a particular formation, and the dip of the formation will provide no constraint on the flow of groundwater. In such a case, the alignment and interconnections of the joints or faults provides a major constraint on the flow, along with the direction and magnitude of the hydraulic gradient.

In general, groundwater in the Paleozoic rock formations of the Appalachian Highlands flows from the topographically higher areas (recharge areas) to the valleys (Ref. 2.4-57). It is believed that this groundwater discharges to springs and to the streams and rivers of the region, except at flood stage. However, no quantitative data in the form of piezometric contour maps are available to convey an accurate picture of the local or regional groundwater flow for any of the consolidated formations. In addition, there is no information at all on the flow of deep groundwater in the region.

An aquifer is defined as a rock unit or unconsolidated deposit that is saturated at least over a portion of its thickness, and is capable of transmitting groundwater through it readily. In the region around the Susquehanna SES, few of the bedrock formations have regularly yielded 100 gpm or more to an individual well. Yet, few, if any, of the formations can be considered to be aquitards, or non-aquifers. All the rock units to be described in this section are tapped by wells that provide, at the least, small domestic supplies of a few gallons per minute. This is because all the rock formations of the region contain to a greater or lesser extent the fracture systems or solution channels common to bedrock in the Valley and Ridge Province. To aid in the appraisal of the groundwater resources of the region, the discussion to follow will divide the geologic units into two groups, primary aquifers and secondary aquifers.

Primary aquifers are those generally tapped by the higher yielding industrial or municipal wells, and on the average, produce higher yields than secondary aquifers. Secondary aquifers generally provide water to only low-yielding domestic wells. The primary aquifers of the region include:

1) *Pleistocene-age outwash deposits and kame terrace deposits*
2) *The Pottsville Formation*
3) *The Mauch Chunk Formation*
4) *Upper Silurian Formations*

The secondary aquifers include:

1) *The Llewellyn Formation*
2) *The Pocono Formation*
3) *The Catskill Formation*
4) *Marine Beds (Devonian age)*
5) *The Mahantango, Marcellus and Onondaga Formations*
6) *The Bloomsburg Formation*

The only geologic units exposed in the region that are not included in the discussion to follow are those belonging to the Clinton Formation, the oldest group outcropping in the region. These units are exposed along the axis of the Berwick anticline about 11 miles southwest of the site, as seen in Figure 2.4-34. They are relatively unimportant with respect to groundwater, as they form a high ridge in outcrop (Ref. 2.4-57).

The extent of outcrop, or subcrop, of the consolidated rock units is shown on the bedrock geologic map (Fig. 2.4-34). The location of sand and gravel deposits laid down in the glacial age is shown in Figure 2.4-35. The stratigraphic relationships of the different geologic units of the region are given in Table 2.4-21, along with their groundwater yield characteristics.

2.4.13.1.1.1 Primary Aquifers of the Region Pleistocene - Age Deposits

Where there is sufficient saturated thickness, Pleistocene sand and gravel deposits generally serve as the highest yielding aquifers in the region. Figure 2.4-35 shows the location of the major surficial sand and gravel deposits in the region. These are, in general, part of the stratified drift resulting from the last (Wisconsin) ice invasion of the area. The location of the Wisconsin terminal moraine, indicating the farthest advance of the ice, is also shown on Figure 2.4-35.

From the point of view of groundwater, two types of stratified drift deposits generally serve as good aquifers, outwash sediments and kame terraces, both being confined to the valleys or low-lying areas. Outwash sediments were laid down by melt waters flowing ahead of the ice front. They consist of fine-grained well-sorted gravels (Ref. 2.4-59). Outwash sediments in the region are found chiefly in the valleys of Huntington and Fishing Creeks and along the Susquehanna River (Ref. 2.4-57). Kame terraces were formed by running water at the contact of the ice and the valley walls. They are commonly not as well sorted as the outwash sediments, and, hence may exhibit lower permeability. Kame terraces occur along the margins of the Susquehanna River valley (Ref. 2.4-60) and also in the smaller tributary valleys (Ref. 2.4-59). Not all of such small tributary deposits are shown in Figure 2.4-35.

The glacial sand and gravel deposits directly overlie the bedrock formations, or local colluvium. They are in places overlain by recent alluvium, which is generally either unsaturated or too thin to be considered important as a groundwater source. The thickness of the glacial sand and gravel varies widely from place to place. In some places, old deep valleys have been filled in primarily with glacial materials. In the Wyoming Valley of the Lackawanna Syncline (Figure 2.4-34), for example, such stratified deposits including clay layers, reach thicknesses of up to 300 feet (Ref. 2.4-57). In general, the stratified drift deposits usable as aquifers in the region range from 20 to 150 feet in thickness (Ref. 2.4-57).

Aquifer tests of four wells tapping the sand and gravel deposits of the Wyoming Valley indicated transmissivities ranging from 1,400 to 72,000 ft^2/day, and horizontal hydraulic conductivities ranging from 240 to 530 ft/day (Ref. 2.4-60). Storage coefficients obtained from the tests, with one exception, ranged from 0.01 to 0.13 indicating water-table conditions. In the one case, the aquifer was locally confined by a clay layer, and the storage coefficient obtained was $2.0x10^{-4}$.

Water levels in the sand and gravel deposits are responsive to both recharge from precipitation and the river or stream stage of the water body in the valley in which they are located. The water level in a well tapping a gravel and sand deposit in the Wyoming Valley, responded to the high stages of the Susquehanna River, during the Agnes storm in 1972 by rising from 16 feet below ground to 16 feet above ground (Ref. 2.4-61). Normally, in the deposits in the Wyoming Valley, the water table ranges from less than 10 feet below ground near the Susquehanna River to more than 30 feet below ground in the areas underlain by kame terraces or alluvial fans (Ref. 2.4-60). Seasonal water-level fluctuations were measured from 1965 to 1967 in shallow observation wells in this valley (Ref. 2.4-60). The amplitude ranged from 7 to 14 feet with the peaks occurring in the spring of the year. Water levels have been recorded in the USGS observation well (Lu-309) located in the Borough of Wyoming, north of the Susquehanna River and tapping outwash sand and gravel. In 1975, the water level in the well fluctuated between 9.8 and 20.3 feet below ground (Ref. 2.4-62). Groundwater discharge from these deposits to the stream or river generally tends to occur at most times except during flood stage.

Recharge to the sand and gravel deposits of the region occurs primarily by direct infiltration of precipitation and by infiltration from the stream and river beds during periods of high stage. The groundwater moves generally from areas of recharge to areas or points of discharge, whether a stream, spring, marsh, or a pumping well. The average hydraulic gradient in the glacial deposits over a section of the Wyoming Valley was determined to be 11 feet per mile (Ref. 2.4-60). Based on this and on an average transmissivity of about 8000 ft^2/day, it was estimated that the average rate of discharge from the aquifer to the Susquehanna River is approximately 15 inches per year, amounting to 39 percent of the average annual precipitation. The amount has been equated approximately to the average rate of recharge to these deposits (Ref. 2.4-60).

Because of the variability in the saturated thickness of the aquifer and in the quality of local well construction, well yields range widely. In Luzerne County yields from 6 to more than 1,000 gallons per minute (gpm) are reported for glacial sand and gravel deposits (Ref. 2.4-57 and 2.4-62). The gravel-packed wells near Pittston in the Wyoming Valley were tested at 1,280 gpm each with a drawdown of only nine to ten feet after eight hours of pumping (Ref. 2.4-57). In Columbia County, two wells along Fishing Creek tapping glacial sand and gravel deposits were reported to yield 140 and 830 gpm (Ref. 2.4-57). For the region as a whole, the median yield of wells tapping Pleistocene sand and gravel deposits is 100 gpm, based on 26 wells for which data were available (Ref. 2.4-57 and 2.4-62). Seaber's analysis indicates that where sufficient saturated thickness of *these glacial deposits occur, 75 percent of properly constructed wells should yield 250 gpm or more (Ref. 2.4-63).*

The Pottsville Formation

The Pottsville Formation is generally a hard quartzose unit consisting of gray conglomerate as well as white, gray or brownish sandstone (Ref. 2.4-57). Because of its resistance to weathering, it commonly forms ridges or mountains where it crops out. This is illustrated by the inner hills ringing the western part of the Wyoming Valley and by the hills aligned in an ENE-WSW direction in the Hazleton area. The Pottsville Formation underlies the Lackawanna syncline (Wyoming Valley), the Eastern Middle Basin in the vicinity of Hazleton and the Mahanoy Basin, but is absent elsewhere in the region. The Pottsville Formation, where it is not exposed in these basins, directly underlies the Llewellyn Formation, which is a Post-Pottsville formation and which is the primary coal-bearing unit of the region.

The Pottsville is of significantly greater thickness in the southern basins than in the Lackawanna syncline. In the Western Middle Basin, it is about 850 feet thick and in the Hazleton area it is about 500 feet thick, while in the Wyoming Valley its thickness ranges from only 150 to 300 feet (Ref. 2.4-57).

Of the 35 wells tapping the Pottsville in Luzerne County and for which recent data are available, 12 are reported to be flowing wells (Ref. 2.4-63). The static water level in the remaining wells is reported to range from 4 to 220 feet below ground, the wide range no doubt reflecting differences in topographic position and in the season of year when the measurement was taken. Of seven Pottsville wells studied in the 1930's in Schuylkill County, two were flowing and the static water levels in the remaining wells ranged from 10 to 32 feet below ground (Ref. 2.4-57). Large seasonal fluctuations in the water level are common in the region (Ref. 2.4-63).

No tests to estimate the aquifer parameters of the Pottsville Formation have been reported. Over a large part of the area where the formation occurs in the region, the fractured beds of sandstone and conglomerate are good water producers. In Luzerne County reported well yields range from less than 5 gpm to 160 gpm, with a median yield of 50 gpm (Ref. 2.4-63). The many flowing wells reportedly have large flows, but yield data are lacking. In Schuylkill County, yields ranging from 65 to 125 gpm have been reported, depending on the season. Here, a few deep wells in the Pottsville have been unsuccessful because of the absence of fractures in the formation at those locations (Ref. 2.4-57).

The Mauch Chunk Formation

The Mauch Chunk Formation consists of red, green, yellow or brown shale with some sandstones (Ref. 2.4-57). It is easily weathered and eroded and, consequently, has formed valleys or lowlands in the area where it outcrops in the region. As shown on Figure 2.4-34, its outcrops area comprises a large portion of the southern one-third of the region, surrounding the Eastern Middle Basin and the Mahanoy Basin. It crops out as a relatively narrow band around the Lackawanna syncline, making up a narrow valley between the hills of the Pottsville Formation and those of the Pocono Formation. These hills act as the double rim enclosing the western end of the Wyoming Valley. The Mauch Chunk Formation underlies the Pottsville Formation within the Synclinal basins, and is underlain by the Pocono Formation. In the region it is missing in the Berwick anticline area and north of the Lackawanna syncline.

The thickness of the Mauch Chunk Formation ranges from more than 2,000 feet in the southern part of the region to only 200 to 300 on the north side of the Wyoming Valley (Ref. 2.4-57). Northeast of Pittston, outside the region but still in the Lackawanna syncline, the Mauch Chunk is absent and the Pottsville Formation directly overlies the Pocono Formation.

Of the 51 wells tapping the Mauch Chunk in Luzerne County and for which recent data are available, seven are reported to be flowing wells (Ref. 2.4-63). The static water levels for the others are reported to range from 1 to 202 feet below ground, the wide range again reflecting differences in topographic position and the season of measurement. Data taken in the 1930's indicated that water levels in 48 wells tapping the Mauch Chunk in the portions of Carbon, Columbia, and Schuylkill Counties included in the region ranged from 1 to 130 feet below ground (Ref. 2.4-57). Only two of these had water levels at depths greater than 60 feet. In addition, six wells were reported as flowing.

No tests to determine the aquifer parameters of the Mauch Chunk Formation have been reported. The fractured beds of shale and sandstone in this formation yield moderate to relatively large supplies of water. The formation is particularly important as a source of groundwater because of the large areal extent of its outcrop in the southern part of the region. Well yields from the Mauch Chunk in Luzerne County range from 5 to 250 gpm (Ref. 2.4-63). Most wells in the county of more than 200-foot depth yield 25 gpm or more. The sandstone beds appear to be more productive than the fractured shale. In 50 wells tapping the Mauch Chunk in the portions of Carbon, Columbia, and Schuylkill Counties included in the region, yields in the 1930's were reported to range from 4 to 375 gpm (Ref. 2.4-57). The median yield based on 101 wells in the region for which data were available is 22 gpm (Ref. 2.4-57 and 2.4-63).

Upper Silurian Formations

Included in the Upper Silurian Formations in the region, in order of increasing age, are the Keyser Formation the Tonoloway Formation and the Wills Creek Formation. The Keyser Formation consists of alternating beds of sandy limestone and calcareous sandstone, some conglomeritic sandstone and a bed of soft shaly limestone (Ref. 2.4-57). The Tonoloway Limestone is about 100 to 150 feet thick and consists primarily of platy, laminated and argillaceous limestones with thick beds occurring locally at the top (Ref. 2.4-57 and 2.4-58). The Wills Creek Formation is made up of about 300 feet of alternating limestone, limy shales, and fissile shales (Ref. 2.4-57 and 2.4-58).

Some of the units included under these three formations and underlying the Onondaga Formation have been mapped as the Helderberg Formation (Ref. 2.4-57 and 2.4-58) assumed to be lower Devonian. More recent work by the Pennsylvania Geological Survey does not use the term Helderberg (for more information, refer to Subsection 2.5.1).

These formations crop out within the Berwick anticline from Berwick through Bloomsburg. They are underlain by the Bloomsburg Formation. Outside the Berwick anticline, the Upper Silurian Formations are overlain by the Onondaga Formation and the Marcellus Shale.

Groundwater in the Keyser and Tonoloway Formations occurs chiefly in solution channels and in some places in bedding planes and fractures enlarged by solution (Ref. 2.4-57). Static water levels of wells tapping these formations in the region are reported to range from 12 to 42 feet below ground in the 1930's (Ref. 2.4-57).

Some large yields have been recorded for wells tapping these formations. Within the region, recorded yields in four wells range from 16 to 250 gpm, and three of them yielded 125 gpm or more (Ref. 2.4-57). In addition, two wells tapping these formations near Berwick are reported to yield large, although unmeasured, supplies, with small drawdowns. A large spring, probably issuing from either the Tonoloway limestone or the Keyser Formation, is reported to occur in the bed of the Susquehanna River at the foot of the cliff below Berwick (Ref. 2.4-57).

2.4.13.1.1.2 Secondary Aquifers of the Region Llewellyn Formation

The Llewellyn Formation consists of sandstone, conglomerate, shale, fire clay, slate and numerous anthracite coal beds (Ref. 2.4-63). Beds of conglomerate and, in places, fireclay occur between the coal beds, which are the primary source for coal in the region (Ref. 2.4-57). The Llewellyn Formation in the region occurs only in the central portions of the Lackawanna syncline, the Eastern Middle Basin and the Mahanoy Basin. It is directly underlain by the Pottsville Formation. The thickness of the formation is about 700 feet in the Hazleton area, 2,000 feet in the Mahanoy Basin, and nearly 2,200 feet in the Wyoming Valley (Ref. 2.4-57 and 2.4-60). The reported depths to water level in the Llewellyn range widely, from 1 to 342 feet, with four of the eight wells having reported water levels at depth greater than 150 feet (Ref. 2.4-63). No tests to determine aquifer parameters have been reported.

Small to moderate yields are obtainable from the fractured sandstone and conglomerate beds. Yields of wells tapping the Llewellyn Formation in the portions of Luzerne and Schuylkill Counties in the region range from 2 to 80 gpm (Ref. 2.4-57 and 2.4-63). The median yield of the 11 wells for which data were reported is 10 gpm. In the vicinity of the mining operations, some of the formation water drains into the mines. In addition, because of proximity to the mining operations, the quality of the groundwater is commonly poor. Highly acidic water results from the oxidation of pyrite found in the coal (Ref. 2.4-57).

Pocono Formation

The Pocono Formation consists of a hard massive gray sandstone and conglomerate, including some shale layers (Ref. 2.4-57). It is highly resistant to weathering and, consequently, over its outcrop area makes up the predominant ridges or hills of the region. These include, from north to south, North Mountain, Huntington Mountain/Shickshinny Mountain, Lee Mountain/Penobscot Mountain, Catawissa Mountain, Nescopeck Mountain, Little Mountain, and Broad Mountain. Huntington Mountain/Shickshinny Mountain and Lee Mountain/Penobscot Mountain serve as the outer rim of the Wyoming Valley. The Pocono Formation underlies most of the southern part of the region as well as the Lackawanna syncline. It is absent in the Berwick anticline Formation underlies the Mauch Chunk Formation and directly overlies the Catskill Formation. The Pocono Formation ranges in thickness from over 1,000 feet in the southern part of the region to about 600 feet in the north (Ref. 2.4-57).

Data from 10 wells tapping the Pocono Formation in the region indicate that four of the wells were flowing (Ref. 2.4-57 and 2.4-63). The depth to the static water level in the remaining wells, with one exception, ranges from 14 to 80 feet. One well yielding 133 gpm had a reported water-level depth of 300 feet (Ref. 2.4-63) which may more properly represent a pumping water level.

According to the available literature, no tests have been performed to estimate the aquifer parameters of the Pocono Formation. Moderate yields are obtainable when wells penetrate well-fractured saturated zones. Most all the wells tapping the Pocono in the region are in Luzerne County, and many of these are located along the north rim of the Wyoming Valley (Ref. 2.4-57).

The formation is reported to be a productive aquifer on the Appalachian Plateau when it occurs below drainage level and has a significant saturated thickness (Ref. 2.4-92). In this area, but probably outside of the region to the northwest, yields from the Pocono of more than 200 gpm are likely (Ref. 2.4-92). Within the region, reported yields range from 3 to 133 gpm (Ref. 2.4-63). Neglecting the one high flow of 133 gpm, the average yield is about 10 gpm.

The Catskill Formation

The Catskill Formation consists of red to brownish shales, red and gray crossbedded sandstone, and gray to green sandstone tongues (Ref. 2.4-58 and 2.4-63). As seen in outcrop (Figure 2.4-34) it forms the outer limbs of the Milton, Berwick and Selinsgrove anticlines, and underlies about 75 percent of the region. It directly underlies the Pocono Formation, and is, in turn, underlain by the Devonian Marine Beds. The maximum exposed thickness of the formation over the major part of the region is about 1,700 feet. There is evidence, however, that the thickness may increase to 3,000 to 4,000 feet in the southernmost part of the region (Ref. 2.4-57).

Out of 75 wells tapping the Catskill Formation in Luzerne County for which data are available, six wells were reported as flowing (Ref. 2.4-63). Static water levels in the remainder ranged from 6 to 215 feet below ground, with 62 of the wells having water levels within 70 feet of the surface. During 1976, water levels in a USGS observation well (LU-243) tapping the Catskill Formation in the northern part of Luzerne County fluctuated between 49.5 and 55.1 feet below ground (Ref. 2.4-62). Water levels in Catskill wells located in Columbia and Carbon Counties were reported in the 1930's to range from 6 to 60 feet below ground (Ref. 2.4-57).

In general, the hard fractured sandstones of the Catskill Formation yield more water than do the shale beds of the formation (Ref. 2.4-57). The range of reported yields of wells tapping Catskill beds in Luzerne County is 2 to 325 gpm (Ref. 2.4-63). For the 63 wells in the county for which data are available, the median yield is 12 gpm, and 75 percent of the wells yield 25 gpm or less (Ref. 2.4-63). Seventeen Catskill wells in Columbia County and the portion of Carbon County included in the region were reported in the 1930's to yield from 1 to 75 gpm (Ref. 2.4-57). Seventy-five percent of these wells yielded 10 gpm or less.

Marine Beds

The Devonian Marine Beds, together with the Catskill Formation, has in the past been mapped as an undifferentiated unit termed the Susquehanna Group (Ref. 2.4-58). Within the region, the primary constituent of the Marine Beds is Trimmers Rock, which consists principally of hard gray to greenish-gray massive to flaggy sandstone containing little shale (Ref. 2.4-57). Brallier Shale and Harrell Shale are minor members of the Marine Beds and they appear to be missing over at least a portion of the region. The Marine Beds are present in most of the region, and are overlain by the Catskill Formation except within the Milton and Berwick anticlines. The Marine Beds overlie the Mahantango Formation. The total known thickness of the Marine Beds in the region ranges from about 1,500 to 3,000 feet, of which nearly the entire thickness of Trimmers Rock (Ref. 2.4-57).

Out of 16 wells tapping the Marine Beds in Luzerne County for which data are available, two were flowing wells (Ref. 2.4-63). The remaining wells have static water levels ranging from 18 to 63 feet below ground. Static water levels for wells tapping Marine Beds in Columbia County were reported in the 1930's to range from 3 to 50 feet below ground, with one of the 15 wells studied being a flowing well (Ref. 2.4-57).

Low yields are obtainable from wells tapping fracture zones in the Marine Beds. The range of the measured yields of 21 wells tapping Marine Beds in the region ranged from less than 1 to 15 gpm, with a median yield of 5 gpm (Ref. 2.4-57 and 2.4-63). Newport states that some of the wells tapping the Marine Beds are reported to yield large supplies, however, no measurement has been made (Ref. 2.4-62).

<u>The Mahantango, Marcellus and the Onondaga Formations</u>

On a regional scale, the Mahantango Formation and the Marcellus Shale have been mapped together as the Hamilton Group (Ref. 2.4-58). The Mahantango Formation is the youngest unit, and overlies the Marcellus Shale, which in turn overlies the Onondaga Formation.

Within the region, the Mahantango Formation is about 1,100 feet thick and consists chiefly of bluish-gray to brownish sandy shale, with some interbedded sandstones, and locally thin bluish-gray limestone (Ref. 2.4-57 and 2.4-58). The underlying Marcellus Shale consists of about 400 feet of black, gray or dark-blue fissile shale (Ref. 2.4-57). The Onondaga Formation generally consists of a non-cherty limestone member overlying a gray calcareous shale (Ref. 2.4-57). It is reported to be 140 feet thick in the Selinsgrove anticline (Ref. 2.4-57).

The Mahantango Formation crops out in the vicinity of the Susquehanna SES and underlies almost the entire region, with the exception of the central portion of the Berwick anticline between Berwick and Bloomsburg (Ref. 2.4-58). These formations are underlain by Upper Silurian Formations, and except within the central portions of the Milton and Berwick anticlines, are overlain by the Marine Beds.

Water levels in the Hamilton Group Formations have been reported to range from 7 to 40 feet below ground (Ref. 2.4-57 and 2.4-63). One well in Columbia County was reported in the 1930's to be flowing (Ref. 2.4-57). Yields have been reported to range from 2 to 21 gpm (Ref. 2.4-57 and 2.4-63) although one well in Columbia County tapping the Mahantango Formation (or possibly Marine Beds) was reported to have a "large" yield at a large drawdown (Ref. 2.4-57).

<u>Bloomsburg Formation</u>

The Bloomsburg Formation is about 800 feet thick in the region. It consists of dark-red sandy shale with a few thin layers of bright-green shale and a few beds of red sandstone (Ref. 2.4-57). The underlying McKenzie Formation is about 150 feet thick and consists of red to green shale, gray calcareous shale and some dark blue limestone (Ref. 2.4-57). It underlies essentially the entire region and immediately overlies units of the Clinton Formation. Except in the core of the Berwick anticline, the Upper Silurian formations overlie the Bloomsburg Formation.

Static water levels in the 1930's of four wells tapping the Bloomsburg in the region ranged between 12 and 55 feet below ground. During 1976, water levels in a USGS observation well (Co-45) tapping the Bloomsburg Formation and located near the Town of Bloomsburg, fluctuated between

81.0 and 86.3 feet below ground (Ref. 2.4-62). Yields of the Bloomsburg Formation range from 5 to 20 gpm, although one well was reported to give a "large" though unmeasured supply (Ref. 2.4-57).

2.4.13.1.2 Local Groundwater Conditions

The local area is herein defined as the area within a two-mile radius of the Susquehanna SES. Within a two-mile radius of the Susquehanna SES, three rock formations crop out and are tapped for groundwater supply. These are, from south to north, the Mahantango Formation, the Trimmers Rock Formation and the Catskill Formation, shown on Figure 2.4-36. In addition, several wells tap unconsolidated deposits, including Pleistocene sand and gravel, Holocene alluvium and residual soil. Most of these are located on the Susquehanna River flood plain. No withdrawal greater than 3,000 gallons per day is made from any existing well within two miles of the station. The general description of these formations and deposits is given in Subsection 2.4.13.1.1.

A door-to-door inventory of wells and springs utilized for water supply within two miles of the Susquehanna SES was performed in March 1977. Details of the results of this inventory are presented in Tables 2.4-22 and 2.4-23. The locations of the wells and springs are shown on Figures 2.4-37 and 2.4-38, respectively.

The Mahantango Formation, a blue-gray siltstone, underlies more than half of the two-mile radius area and is found immediately beneath the Susquehanna SES (Figure 2.4-36). On the north side, along its contact with the Trimmers Rock Formation, it is commonly a limey siltstone. In the vicinity of the station, boring log and pressure test information indicate the rock to be moderately well fractured in the upper 10 to 20 feet, with significantly fewer fractures at greater depth. Thus, in many locations in the local area, one would expect that wells tapping the Mahantango may obtain most of their supply from the upper 10 to 20 feet of rock.

Table 2.4-22 indicates that out of a total of 185 wells inventoried within the two-mile radius, 125 tap the Mahantango Formation. Of 114 Mahantango wells for which data were obtained, the range of depths is 20 to 354 feet with a median depth of 90 feet. Neglecting two large questionable values, reported yields from Mahantango wells range from 2 to 130 gpm with a median value of 15 gpm. Reported estimates of depth to static water level indicate a range of 1 to 100 feet with a median of 20 feet. Eighty local residents having wells tapping the Mahantango Formation (comprising nearly 70 percent of those giving water quality information) report their well water to be hard. Of these, 14 stated the water also contained iron, a sulfide, or both. The quality of water in three of these wells is so poor it cannot be used for drinking.

Table 2.4-23 indicates that out of a total of 33 springs used for water supply in the local area, only six are believed to issue from the Mahantango Formation.

The Trimmers Rock Formation in the local area consists of thinly laminated siltstone or silty shale and hard, often flaggy, fine-grained sandstone. Groundwater occurs primarily in the rock fractures, as the primary porosity of the rock is essentially nil. The contact between the Mahantango and the Trimmers Rock Formation is located about 1,500 feet north of the center of the Susquehanna SES plant area.

Forty-five of the 185 wells inventoried in the two-mile radius are believed to tap Trimmers Rock, and 15 of the 33 springs utilized for water supply are believed to issue from this formation. As taken *from Table 2.4-22, the range in well depths is 20 to 460 feet, and the median depth is 150 feet, significantly greater than that for Mahantango wells (90 feet). The difference may be due in part to the fact that the area underlain by Trimmers Rock is topographically higher than that underlain by the Mahantango Formation.*

The data given in Table 2.4-22 indicate that of seven wells for which data were reported, the well yields from Trimmers Rock range from 6 to 60 gpm with the median value 9 gpm. The largest yielding developed spring in the local area is owned by the Citizens Water Company of Wapwallopen and is given as No. 7 in Table 2.4-23. It is believed to issue from the Trimmers Rock Formation and supplies about 8,200 gpd.

The reported depths to static water level in Trimmers Rock wells in the local area range from 0 to 50 feet with a median of 22 feet. Water from approximately 55 percent of the Trimmers Rock wells is reported to be hard; and of these, 40 percent are reported to contain iron, a sulfide or both. The quality of water in three of the wells is so poor that it cannot be used for drinking.

The Catskill Formation in the local area consists of reddish-brown to maroon sandstone, siltstone or mudrock, and greenish-gray or olive-gray fine-grained sandstone, siltstone, silty shale or shale. The size of the area underlain by this formation within the two-mile radius is small (Figure 2.4-36). None of the wells inventoried in the area appear to tap the Catskill Formation. One spring believed to be issuing from the Catskill Formation is utilized for water supply (No. 33 in Table 2.4-23).

The primary source for relatively large groundwater supplies in the local area is Pleistocene sand and gravel deposits. However, only 10 existing wells within two miles of the station are believed to tap these deposits; and they withdraw only small quantities, for domestic or stock watering purposes as seen in Table 2.4-22. Essentially all the Pleistocene deposits within two miles of the station are mapped as kame terrace deposits. As seen on Figure 2.4-36, the kame terrace deposits (Qkt) cover nearly one-fourth of the two-mile radius area. In addition, the sand and gravel deposits commonly underlying the Holocene alluvium (Qal) are, in all likelihood, kame terrace deposits.

The major portion of the kame terrace deposits consists of stratified sand and gravel, including varying amounts of silt, grading with cobbles and boulders particularly in the lower part of the deposit. The overlying portion commonly consists of well-sorted fine to medium sand, or fine sand and silt, which exhibit both simple and complex bedding structure. In general, thicker sequences of the deposits would be expected to occur close to the river. The permeability of the kame terrace deposits can vary considerably areally and with depth.

The ten wells in the local area tapping these deposits range in depth from 20 to 100 feet with a median depth of 22 to 24 feet. The wells are mostly dug wells two to three feet in diameter. The reported static water level ranges from 5 to 75 feet below ground with the median value of 12 feet. Eighty percent of the well owners having wells tapping kame terrace deposits reported the water to be soft and of good quality.

Four other wells within two miles of the site tap unconsolidated deposits other than kame terrace deposits. Two are believed to tap Holocene alluvium, one along Wapwallopen Creek and the other along Walker Run. These have shallow depths ($\leq$18 feet) and have reported static water levels of two feet below the surface. North of the site there are two dug wells apparently completed in the *residual soil or the upper highly weathered portion of the underlying Trimmers Rock. These are of shallow depth (<15 feet) with a reported static water level just four feet below the surface.*

END HISTORICAL

2.4.13.1.3 Onsite Use of Groundwater

Plant use of groundwater is anticipated during the operation of the plant. Two production wells, TW-1 and TW-2, exist on site and are located about 1,200 feet northeast of the turbine building. They have been used for construction purposes, and have an approximate capacity of 50 gpm and 150 gpm, respectively. During plant operation, these wells fill the clarified water storage tank and the domestic water storage tank and supply seal water for the circulating water pumps and the service water pumps. Clarified river water may occasionally be used to supply some of these needs.

Two 30 gpm wells exist at the River Water Make Up facility and are utilized for seal water to the River Water Make Up pumps. These wells are located about 200 feet north of the River Water Make Up facility.

START HISTORICAL

2.4.13.2 Sources

2.4.13.2.1 Water Well Inventory

A complete water well inventory in the local area was performed by making a house-to-house survey within two miles of the Susquehanna SES during March 1977. The results of this inventory with the available well data are presented in Table 2.4-22. The locations of these wells are given in Figure 2.4-37. Wherever springs were utilized for water supply they were tabulated separately. The pertinent information on the springs used locally is given in Table 2.4-23 and their locations are shown in Figure 2.4-38. A summary discussion of the information given in these two tables is provided in Subsection 4.13.1.2. Estimates of present withdrawal rates from each well or spring were calculated on the daily per-person or per-animal consumption rate shown at the bottom of Tables 2.4-22 and 2.4-23, based primarily on Reference 2.4-64.

A total of 185 water wells and 33 developed springs were inventoried in the two-mile radius area. The vast majority of the wells are used for domestic or stock-watering purposes. Nineteen of the wells are used, at least in part, for commercial purposes; seven are currently unused, and one is used as standby for public supply purposes by the Citizens Water Company of Wapwallopen. The largest estimated average withdrawal from a single well in the area is about 2,700 gpd. With one exception, the developed springs in the local area provide supplies of water only for domestic and stock use. At Wapwallopen, the Citizens Water Company withdraws an average of 8,200 gpd from a spring believed to issue from the Trimmers Rock Formation.

In the region, an inventory of major wells (with the exception of public-supply wells) located between 2 and 10 miles from the Susquehanna SES was performed. A major well was defined as *one with a reported tested yield of 15 gpm or more. In addition, an inventory of all public supply wells located between 2 and 20 miles from the station was carried out. The source for both these inventories were a published report (Ref. 2.4-63) and unpublished records and computer printouts from Bureaus of the Pennsylvania Department of Environmental Resources (Ref. 2.4-65 through 2.4-69).*

The results of the major-well inventory are presented in Table 2.4-24 and include well location, owner, use, total depth, probable aquifer tapped, reported well yield, specific capacity and static water level. The locations of these wells are shown on Figure 2.4-39. A total of 77 major wells has been enumerated. Reported well yields range up to 550 gpm, and the median value of those wells for which yields are reported is 20 gpm. With the exception of three industrial wells located near Nanticoke, the remaining wells are used exclusively for domestic or stock-watering purposes.

The results of the inventory of public-supply wells are provided in Table 2.4-25, and their locations are shown in Figure 2.4-40. A total of 213 public-supply wells was enumerated over the 20-mile radius area. The area has a large number of small water-supply companies or municipal departments, and because of the relatively low yield of many wells completed in rock, a considerable number of wells is required. As shown on Figure 2.4-40, the majority of these wells are concentrated either in the vicinity of the Wyoming Valley, northeast of the station, or in the southeastern quadrant, in the Freeland-Hazleton-Mahanoy City area.

<u>2.4.13.2.2 Groundwater Withdrawal</u>

The estimated average groundwater withdrawal rate during 1976 from all wells and springs within a two-mile radius of the site is 56,000 gpd, which is equivalent to only 38.9 gpm. Table 2.4-26 shows the estimated withdrawals from wells and from springs, as well as from individual geologic units within this local area for that year. Approximately 52 percent of the withdrawals is from the Mahantango Formation. Spring withdrawal amounts to about 25 percent of total groundwater use in the area. The values in Table 2.4-26 were obtained by summing up the appropriate figures in the column for "estimated present average withdrawal" in Tables 2.4-22 and 2.4-23.

The estimated projections of groundwater use through the year 2020 in the two-mile radius area are given in Table 2.4-27. It is estimated that by the year 2000, local groundwater withdrawal will amount to about 64,000 gpd. The projections are based on the population projections given in Tables 2.1-7 through 2.1-16.

Estimates of regional groundwater withdrawals are based on records and computer printouts of the Pennsylvania Department of Environmental Resources (Ref. 2.4-70) a personal communication with a water department (Ref. 2.4-71) and the U.S. Census publication for 1970 (Ref. 2.4-72). Tables 2.4-28 and 2.4-29 summarize the information and calculations on which we based the estimate of the groundwater withdrawal rate for 1975 within 20 miles of the station. As shown in Table 2.4-29, the estimated average withdrawal in 1975 from all geologic units by water departments or companies and by industries was 6.3 mgd and that from private domestic wells and springs was 5.2 mgd. Thus, the estimated average withdrawal rate in 1975 was 11.5 mgd for the 20-mile area.

Table 2.4-27 gives the estimated projections of groundwater use in the region through the year 2020. The projections are based on population projections as found in Tables 2.1-15 through

2.1-16. The estimated average groundwater withdrawal rate within 20 miles of the station for the year 2000 is 12.1 mgd.

2.4.13.2.3 Aquifer Characteristics and Groundwater Conditions at the Site

2.4.13.2.3.1 Data Sources

Previous Investigations

As defined herein, the site or site area refers to property owned by PP&L at the Susquehanna SES. A number of borings, observation wells and test or production have been drilled on the PP&L property at the Susquehanna SES as a part of previous investigations. These have been drilled at different times since 1965 under the supervision of different engineering contractors. Data from a total of 328 borings or wells on the property have been used in evaluating the hydrogeologic conditions on site. Their locations, along with those for test pits, are shown in Figures 2.4-41 and 2.4-42.

The data utilized from these borings and wells include boring log data, with lithologic and structural notations, and the results of water pressure tests performed at several borings. In addition, pumping tests of the overburden materials were carried out in the two production wells located on the north side of the property, TW-1 and TW-2. Laboratory tests, including grain-size, dry density and permeability tests, have been performed on a number of soil samples obtained from the borings on site. Water-level data have been obtained in borings in the process of their being drilled, and at frequent intervals in observation wells constructed on the property.

The data from these previous investigations have been obtained from published documents, reports submitted to PP&L, and unpublished records (Ref. 2.4-73 through 2.4-85).

Investigations Performed for this Report

Some of the observation wells constructed during previous investigations were found to be usable for this investigation. They were each confirmed to be in hydraulic continuity with the geologic unit(s) they are open to. This was done by pouring in a slug of water of known volume (two to five gallons) and measuring the rate of recovery of the water level. A total of 11 observation wells (Nos. 2, 8, 11, 19, 109, 124, 1111, 1113, 1114, B-1 and CPW) were found to be in satisfactory condition and have been used for groundwater level monitoring since early November, 1976. The location of these observation wells is shown on Figures 2.4-32 and 2.4-43. Details of their construction are given in Table 2.4-30.

Six new observation wells were constructed in the summer of 1977 as a part of this investigation (Nos. 1200A, 1201, 1204, 1208, 1209A, and 1210). Four of these are overburden wells and tap the overburden and the upper two to three feet of bedrock. The remaining two (1201 and 1209A) are bedrock wells and tap the zone between 4 and 34 feet below the top of bedrock. The location of the new observation wells is along a narrow band running east from the plant area to the river as indicated in Figure 2.4-32. Details of the manner of their construction are given in Table 2.4-30. Figures 2.4-44 through 2.4-49 provide the boring log information and schematic well construction details for each well.

Water pressure tests (packer tests) were performed in both of the bedrock observation wells (Nos. 1201 and 1209A). Pumping tests were conducted for overburden wells 1204 and 1210. The purpose of the water pressure tests (packer tests) and pumping tests was to provide estimates of the horizontal hydraulic conductivity of the upper bedrock and the overburden soils, respectively, along the groundwater path from the plant to the river.

2.4.13.2.3.2 Groundwater Parameters and Movement at the Site

On the PP&L property at the Susquehanna SES, the saturated portion of the overburden serves as an aquifer. The underlying fractured portion of the Upper Mahantango siltstone also contains groundwater, but its generally lower porosity (storage capacity) and permeability make it of only secondary importance as a local aquifer.

The overburden consists primarily of kame terrace Pleistocene deposits. East of Route 11 on the flood plain, these deposits are covered with up to 10 to 20 feet of Holocene alluvial material consisting of silty fine sand or fine sandy silt.

The Pleistocene kame terrace deposits are poorly to moderately well-graded stratified deposits consisting dominantly of sand and gravel, with variable amounts of clay, silt, cobbles and boulders. In portions of the area, the upper layers tend to consist of well-sorted fine to medium sand, or fine sand and silt, exhibiting both simple and complex bedding structures. The lower layers are generally more coarse-grained and more well graded, with cobbles and boulders occurring most abundantly near the top of bedrock. Elsewhere, these deposits consist of alternating layers of: (1) relatively poorly-graded sand and gravel; and (2) a well-graded mixture of clay, silt, sand, gravel, cobbles and boulders.

The lenses and layers of poorly graded (uniform) sand or sandy gravel are most important from a groundwater point of view, as they are high in permeability. Thus, the bulk of the groundwater flow will tend to flow through these layers where they are continuous for some distance. Boring log information indicates that a moderately to highly permeable zone exists within the lower 20 feet of overburden, over considerable distances within the station area.

An isopach map of the Susquehanna SES area, which indicates the approximate thickness of overburden across the site, is given in Figure 2.4-41. The thickness of overburden on site ranges from 0 to 125 feet. By comparison to Figure 2.4-42, which gives the approximate top-of-bedrock contours for the site area, it is seen that the greatest thickness of overburden occurs in the two east-west oriented buried bedrock valleys, which occur on the northern side of the site. One of these valleys (called the "major bedrock valley") appears to extend all the way from the west side of the property to the river, between Pennsylvania coordinates, N341,500 and N342,500. A prominent kame terrace with a thickness of up to 70 feet occurs along the southern flank of this valley, between the plant and Route 11, as seen on Figure 2.4-41. The other important east-west bedrock valley is located about 1500 feet further north and extends from the location of Route 11 to the river. Figure 2.4-42 also shows a secondary bedrock valley extending from the plant in a northeast direction until it joins the major bedrock valley.

Apart from the above described features, the overburden thickness in the site area west of Route 11 is 20 feet or less. On the flood plain, the overburden thickness is seen to range from less than 20 feet up to 125 feet, with the average probably in the range of 50 to 80 feet, clearly higher *than that in the upland area. To illustrate the nature of the topography and the thickness of the overburden over the site area, Figure 2.4-33 shows a geologic cross-section extending eastward from the northern part of the turbine building to the Susquehanna River. The location of the cross-section along a groundwater flow path is shown on Figure 2.4-33.*

Of greater importance than the overall overburden thickness is the height of the groundwater level above the top of bedrock. Where groundwater is unconfined, this corresponds to the saturated thickness which varies from season to season and from year to year depending on the quantity of water recharging the groundwater. Where groundwater is confined, as on the flood plain, the saturated thickness of the aquifer generally remains constant, while the height of the groundwater level fluctuates. The height of groundwater in the overburden at the site ranges from 0 to about 90 feet, and the values at various borings or wells and at different times are given in Tables 2.4-31 and 2.4-32.

On the flood plain, the height of the groundwater level above bedrock in the overburden generally ranges from 30 to 90 feet, with the greatest thickness found along the river and within the two major bedrock valleys, as shown by wells B-1 and CPW in Table 2.4-32. On the uplands, the height of the water level above bedrock ranges from less than zero to about 65 feet. The greater thicknesses are always found in the center of the bedrock valleys; and generally, the greater the distance from the axis of the valleys, the less the thickness. For example, as shown in Table 2.4-32, in early November, 1976, the height of the water level above bedrock at observation well 109 located in the center of the major bedrock valley was 65 feet, while at nearby observation well 124, located on the north flank of that valley, the thickness was only 20 feet. The saturated thickness of unconfined Pleistocene deposits near the center of the major bedrock valley, about 500 feet west of U.S. Route 11 at Well 1208, was found to be 8.8 feet in August 1977. Forty feet to the east at Well 1210, it was only 3.9 feet.

Static water levels measured in 1972 indicate that in the vicinity of the reactor area, turbine building and the cooling towers, the height of the groundwater level above bedrock ranges from 0 to 18 feet. This is shown in Table 2.4-31 for the relevant borings: 116, 202, 205, 206, 209, 211, 215, 301, 312, 317, 319 and 444. With the exception of the June 1972 reading at boring 319, the groundwater levels in this area were only 0 to 8 feet above the top of rock.

At one observation well, No. 1114 located in the spray pond area, groundwater levels in the period 1974 to 1977 were in the bedrock. Tables 2.4-31 and 2.4-32 indicate that static water levels in this well ranged between one to five feet below top of rock.

The approximate height of the groundwater level in the Pleistocene deposits along the assumed groundwater flow path from the northern part of the plant to the river is shown on Figure 2.4-33.

The underlying bedrock at the site consists primarily of the Mahantango siltstone, while the Trimmers Rock sandstone borders the Mahantango on the north, approximately along coordinate N343,500. The logs of borings penetrating up to 250 feet of the Mahantango siltstone were examined. Broken or severely fractured zones commonly occur at the bedrock and alternate between massive and moderately fractured zones. No uniform pattern was observed with respect to the occurrence of fractures at depth. There does, however, appear to be a tendency for the fractures or joints at depth to be filled in with calcite, pyrite or quartz crystals. This is also true of the many brecciated zones occurring in the rock cores. However, open or partially open joints and fractures do occur at depths greater than 20 feet below the top of rock. The joint planes or

cleavage planes examined were nearly always in the range of 30° to 60° from the horizontal, and generally opposing or nearly perpendicular to the bedding planes.
Water pressure tests (packer tests) in the 300-series, 900-series and 1200-series borings on site indicate a clear tendency for the effective rock permeability to decrease with depth within the upper 50 feet of bedrock (Ref. 2.4-75 and 2.5-84). This is shown in Tables 2.4-33 and 2.4-34.

Water level data from the overburden and bedrock wells of the 1200-series indicate this upper relatively permeable bedrock zone is not everywhere in direct hydraulic connection with the overlying Pleistocene deposits. Water levels measured in bedrock Well 1201 have been about 11 feet higher than in overburden Well 1200A, 6.4 feet away, as shown in Table 2.4-30. With the exception of the uppermost fractured bedrock zone of one-to-three-foot thickness (tapped by the overburden wells in the 1200-series), it appears that groundwater filling the underlying bedrock fractures forms in places over the site area a hydraulic system essentially separate from that of the overburden.

Many of the static water level readings presented in Tables 2.4-31 and 2.4-32 were made in borings or observation wells in hydraulic connection with both the bedrock and the overlying overburden. Thus, assuming that water levels in the upper bedrock do not generally coincide with those for the overburden, the water levels in such cases represent composite levels probably dominated by the overburden. This would clearly be the case for borings 7 through 209 and 215 through 319 as given in Table 2.4-31 and for observation wells 8, 109 and 124 in Table 2.4-32.
The fluctuation of the groundwater table at the Susquehanna SES is indicated in Tables 2.4-31 and 2.4-32. From July 1974 to July 1975, water levels in observation wells 1111, 1113 and 1114 fluctuated within a range of five feet, while from November 1976 to late April 1977, they fluctuated within 0.9 to 7.5 feet. For wells 1111 and 1113, groundwater levels were one to eight feet higher between November 1976 and May 1977 than for the same period in 1974-75. At well 1114, on the other hand, groundwater levels were three feet lower in 1976-77 than in 1974-75. This reversal of groundwater level trends in the same general area may possibly be ascribed to the effect of large amount of earth-moving work performed over this period in close proximity to the spray pond area. The construction of the railroad embankment, settlement of fill material and excavations in the immediate vicinity could have a profound affect on the elevation and gradient of the local water table.

For the other seven observation wells for which full records are available, groundwater levels onsite fluctuated within a range of 5.5 to 11.2 feet for the period from early November 1976 until mid-September 1977. The exception to this was Well 109 which experienced a water level decline of 22.2 feet between April 14th and September 20th because of its proximity to the production wells TW-1 and TW-2.

Figure 2.4-50 shows the approximate groundwater contours onsite recorded in June 1971. These contours should be considered largely a composite of overburden and upper bedrock water-level contours, with the overburden levels exerting primary influence. Figures 2.4-32 and 2.4-43 show the groundwater contours in September 1977 and April 1977, respectively, over the portion of the site area for which wells were available. As Wells 1201 and 1209A are clearly bedrock wells, their water level data were not included in the contours shown in Figure 2.4-32. Wells 1111, 1114 and 1115 were destroyed in May 1977 in the process of constructing the spray pond. Hence, data for that area were not available for contouring in Figure 2.4-32. None of the 1200-series wells were contoured in Figure 2.4-43 as they were constructed after April 1977.

The direction of groundwater flow away from the plant area, as shown in Figures 2.4-32, 2.4-43, 2.4-50 and Dwg. FF62005, Sh. 1 is generally toward the northeast, and hence, eastward to the river. There seems to be a clear tendency for the groundwater flow paths to follow the major and minor buried bedrock valleys shown in Figure 2.4-42. A portion of the groundwater flowing eastward discharges as springs along the stream running eastward toward Route 11, approximately along Pennsylvania coordinate N342,100. However, it appears that most of the groundwater discharges ultimately to the Susquehanna River.

Consistent with the topographic relief, the average groundwater gradient is quite high between the plant area and observation Well 1210, located 550 feet west of U.S. Route 11. The average hydraulic gradient over this reach of the groundwater path is about 0.068, based on groundwater levels taken in the fall of 1970 and in September 1977. The average gradient in the flood plain from Well 1210 to the river is estimated to be only 0.0073 based on September 1977 water level readings.

The slope of the piezometric surface toward the east in the upper bedrock between Wells 1201 and l209A had a magnitude of 0.084 in September 1977.

A summary of the aquifer tests and permeability tests carried out in previous investigations in the overburden materials and the upper bedrock on the site is presented in Table 2.4-33. The results of tests performed for this investigation are summarized in Table 2.4-33. It is seen that the estimated horizontal hydraulic conductivity of the Pleistocene kame terrace deposits varies widely, from 0.022 to 200 feet/day, while estimates for the vertical hydraulic conductivity range from 2.3 to 63 feet/day. Horizontal hydraulic conductivity values obtained from packer tests for the upper 20 to 30 feet of bedrock range from 0 to 2.5 feet/day. Table 2.4-33 indicates that the upper 20 feet of bedrock commonly is significantly more permeable than are intervals lower than 20 feet, presumably because of the greater frequency of open joints in the uppermost bedrock zone. The values given for borings 305, 1201 and 1209A shown in Table 2.4-34 support this finding.

Two of the drawdown curves used to obtain estimates of horizontal hydraulic conductivity from the pumping tests of Wells 1204 and 1210 are presented in Figure 2.4-51. Well 1204 was pumped at a constant rate of 25.8 gpm for six hours. The range of values shown in Table 2.4-34 for the pumping test of Well 1204 derive from analysis of the time drawdown curves and the recovery curves for both the pumping Well (No. 1204) and the observation Well (No. 11). Well 1210 was pumped for nearly six hours at a constant rate of 1.1 gpm with no drawdown observable in Well 1208, 40 feet away. Transmissivity and horizontal hydraulic conductivity in the vicinity of Well 1210 were estimated from the recovery curve of the pumped well as shown in Figure 2.4-51. Calculations are shown on the figure.

Slug tests were performed in Wells 1208 and 1210 by quickly introducing 5 gallons of water into the well and measuring the subsequent sudden rise and gradual decline of the water level with time. The results in both cases were analyzed using the formula for a well point filter in a uniform soil given by Lambe and Whitman (Ref. 2.4-93).

To estimate groundwater movement in the Pleistocene deposits from the plant toward the river, it was necessary to divide the groundwater flow path into segments because of the deposits' wide range in horizontal hydraulic conductivity (K_h). Based on the results of pumping tests summarized in Tables 2.4-33 and 2.4-34, values for K_h were selected for each segment. It is reasonable to assign a value of 8 ft/day for K_h for the deposits west of Well 1210. The segment from Well

1210 eastward to Well 1204 is assigned an average K_h of 22 ft/day. And, eastward of well 1204 to the river, the average K_h may be taken as approximately 120 ft/day.
It is difficult to estimate movement of groundwater in the upper bedrock because of uncertainty about the areal extent of the open fractures tested by packer tests in the borings. Based on the results of packer tests summarized in Table 2.4-34, the average horizontal hydraulic conductivity of the upper bedrock over at least the western portion of the groundwater path shown in Dwg. FF62005, Sh. 1 would probably be less than 0.50 ft/day.

As discussed earlier, over much of the site area where there is a significant saturated thickness of Pleistocene deposits, there are overlying layers of lower permeability, consisting commonly of sandy silt or even clayey silt. These layers serve to confine the water in the aquifer materials, at least locally. Indeed, the results of the pumping tests of these deposits at wells TW-1 and TW-2, indicated a storage coefficient ranging from 1×10^{-4} to 4×10^{-4} which implies the aquifer at that location is confined (Ref. 2.4-80).

Similarly, on the flood plain, analysis of the pumping test of Well 1204 indicated the aquifer to be confined with a storage coefficient of 7.0×10^{-5} to 1.5×10^{-4}. But in the vicinity of Well 1210, just west of U.S. Route 11, analysis of slug tests based on the method of Cooper, Bredehoeft and Papadopulos (Ref. 2.4-94) yielded a storage coefficient of about 0.10, indicating the groundwater there is unconfined.

The total porosity of the Pleistocene deposits was estimated from laboratory values for dry density obtained on relatively undisturbed soil samples. The equation used was:

$$n = 1 - \rho_B / \rho_s$$

where:

n is the porosity

ρ_B is the bulk density (dry density) in g/cm^3, and

ρ_s is the particle density assumed to be 2.65 g/cm^3.

Dry density values were obtained for 29 samples taken in the depth range 22 to 75 feet from 16 different borings onsite. The dry density values ranged from 1.57 to 2.31 g/cm^3 and the median value was 1.72 g/cm^3. The corresponding range of total porosity values was 0.13 to 0.41 with a median of 0.35.

The effective porosity (n_e) of the Pleistocene deposits was estimated by applying a factor of 0.90 to the total porosity values. This factor was derived from the results of column studies performed on sandy and loamy soils in which non-reactive tracers were used to estimate the actual fraction of the total porosity that was effective in transporting an aqueous solution through the column (Ref. 2.4-86). The column studies indicated a ratio of effective to total porosity ranging from 0.87 to 0.96. The value of 0.90 was selected as an average value for the saturated Pleistocene deposits at the site. Applying this factor to the foregoing total porosity values, we obtain an estimated effective porosity range of 0.12 to 0.37 with a median of 0.32.

Regarding the Mahantango siltsone, it is difficult, if not impossible, to accurately determine values for the total and effective fracture porosity that are representative of the upper bedrock over a distance of hundreds of feet at the site. Examination of the boring logs from this and previous investigations does, however, provide a basis for making a rough estimate of fracture porosity. In general, the spacing between natural joints and fractures in the Manhantango at the site is in the range of 2 inches to 2 feet or more. Assuming that the average width of opening of a fracture is 0.05 inches, the range of fracture porosity would be about 0.002 to 0.025. In general, the higher porosity figure would apply particularly to the upper foot or two of rock.

The velocity (μ) of groundwater movement in the Pleistocene deposits can be estimated from Darcy's law:

$$\mu = \frac{K_h i}{n_e}$$

where

K_h *is the horizontal hydraulic conductivity*
i *is the hydraulic gradient, and*
n_e *is the effective porosity*

Over the reach of the groundwater flow path from the plant to observation Well 1210, the estimated average gradient is 0.068. Based on the value of 8 feet/day for K_h, and the median value of 0.32 for n_e, an average velocity of 1.7 feet/day was obtained. Between observation Well 1210 and the river, the average hydraulic gradient is 0.0073 and the estimated horizontal hydraulic conductivity is 70 feet/day. The estimated average velocity of groundwater flow for this reach is then 1.6 feet/day.

Preliminary evaluation of the hydraulic gradient of groundwater in the upper bedrock based on bedrock Wells 1201 and l209A, indicates the gradient is close to that for the overburden for the same reaches of groundwater flow. Thus, comparison of groundwater velocities in the two domains can be made on the basis of the ratio K_h/n_e. Derived from field test data, K_h for the upper bedrock is conservatively taken as 0.50 feet/day, while effective porosity is assumed to be 0.02. Thus, K_h/n_e = 25 feet/day. For the overburden, in the reach of the groundwater path from the plant to observation well 1210, K_h/n_e = 8.0/0.32 = 25 feet/day, while over the reach from Well 1210 to the river, K_h/n_e = 70/0.32 = 219 feet/day. Thus, groundwater velocities in the upper bedrock are expected to be approximately the same as those in the overburden over the portion of the flow path from the plant to the western edge of the flood plain. But beneath the flood plain, velocities in the overburden are estimated to be nearly 10 times greater than those in the upper bedrock.

There is virtually no possibility for the groundwater gradient of the overburden or bedrock in the upland area to be reversed. The slope of the underlying bedrock surface is so steep and it controls the groundwater flow so completely, that no condition could conceivably develop that would alter the direction of flow. On the flood plain, the gradient toward the river could be reversed for short periods when the river is in flood stage; and this reversal would no doubt occur only over a few hundred feet west of the river. An example of such a temporary and localized reversal is shown on Figure 2.4-32 (on September 20, 1977, the water level was 1.5 feet higher at Well B-1 than at Well 2). No long-term flow reversal of this type is likely unless an impoundment of the river were effected downstream. In such a case, the entire flood plain area would probably be inundated, and groundwater from the upland area would discharge directly into the reservoir.

Pumpage from regional wells or wells in the vicinity of the site is unlikely to have any effect on groundwater levels or quality in the station area. Pumpage in the Mahantango Formation will probably not affect groundwater levels in the plant area because of the generally low yields of such wells, and consequently, the limited area of influence of such pumpage. As discussed previously, the primary aquifer on site is the saturated Pleistocene deposits located within the major and secondary bedrock valleys. These materials are recharged almost entirely within the PP&L property, and they drain directly toward the river. Thus, they are largely isolated from the effects of the pumpage offsite. Local pumpage in the Pleistocene deposits is low.

As shown in Figure 2.4-37 and in Table 2.4-22, existing wells in the flood plain within a two-mile radius of the plant are used for domestic or small commercial requirements. The estimated current groundwater withdrawal within a two-mile radius is extremely low -- 56,000 gpd. There are no plans for large increases in the level of groundwater pumpage in the future near the property boundaries.

END HISTORICAL

2.4.13.3 Accidents Effects

This Subsection describes the potential effect on groundwater quality of an accidental release of liquid radwaste at the Susquehanna SES.

2.4.13.3.1 Postulated Accident and Potential Flow Paths

The postulated accident to be analyzed is a rupture of one of the two Reactor Water Clean-Up (RWCU) Phase Separator Tanks, which are located in the Radwaste Building at the far northwest corner of the building. The bottoms of the tanks rest on a reinforced concrete slab at elevation 646 feet, approximately 30 feet below the original land surface. The tanks are each ten feet high and approximately 11 feet in diameter, with a total capacity of 7,400 gallons and an assumed fluid volume of 5,920 gallons (80% of tank volume). The two tanks are used to collect backwash sludge from the fuel pool and RWCU demineralizer systems. The tanks are alternated at 12-month intervals, each tank being in the sludge-collection mode for 12 months, and then at rest for 12 months to allow radioactive decay of isotopes with short half lives. Table 2.4-35 provides the expected content of those radionuclides which are a potential concern from a safety and environmental point of view, and which will be evaluated in this section; Mn-54, Fe-55, Co-60, Sr-90, I-131, Cs-137 and Pu-239.

The bottoms of the RWCU Phase Separator tanks are located approximately 14 feet below the top of the original bedrock surface. Boring log information indicates that at this location the upper 15 feet of bedrock is moderately fractured siltstone with some slickensides. It grades to massive below this level. As shown in Table 2.4-34, packer tests performed in a nearby boring (No. 305) reveal that the upper 12 feet of bedrock is nearly ten times as permeable as the underlying 40-foot interval (Ref. 2.4-75). Overlying the bedrock, before the excavation took place, was approximately 18 feet of Pleistocene deposits, consisting, at the bottom, of sandy gravel with cobbles and boulders. The position of the water table in this location was approximately at the bedrock surface plus or minus two feet.

A complete and instantaneous rupture of one of the RWCU Phase Separator tanks, the bottom slab and the adjacent wall of the Radwaste Building is postulated. The liquid contents of the tank would seep out into the zone of coarse rock fill surrounding the Radwaste Building and thence into the upper 10 to 15 feet of fractured bedrock.

The postulated groundwater flow paths (Flowpaths 1 and 2) taken by the groundwater contaminated by the slug of radioactive solution are shown in Dwg. FF62005, Sh. 1. Flowpath 1 is initially toward the north and then follows the east-west valley toward the east to the Susquehanna River. Flowpath 2 parallels Flowpath 1 on the south, but then merges with Flowpath 1 at a point in the stream in the north valley just east of the railroad tracks. A hydrogeologic cross-section along Flowpath 2 to the discharge point at the river is presented in Figure 2.4-33. The selection of the two flow paths was based in part on the groundwater contours shown in Figure 2.4-50 and in part on the top-of-bedrock contours shown in Figure 2.4-42. No wells, other than those owned by PP&L on its property, occur anywhere near the two flow paths.

The possibility of the slug of contaminated liquid following a third flow path to the closest offsite private well was considered. The well is located about 2,300 feet southeast of the RWCU Phase Separator Tanks. However, such a flow path is quite unlikely as the top-of-bedrock contours shown on Fig. 2.4-42 indicate that the pathway would be at least cross-gradient and possibly against the gradient of the top-of-rock surface. It is reasonable to assume that the bottom surface of the highly fractured rock zone making up the top 10 to 15 feet of the bedrock closely reflects the top-of-rock surface shown on Figure 2.4-42. Flow from the RWCU Phase Separator Tanks is far more likely to take the easier course along Flowpath 1, or possibly Flowpath 2.

To reflect the differing hydrogeologic properties along different portions of the two flow paths, they were divided into segments:

FLOWPATH 1

Segment No.	Description
1	RWCU tank north to buried valley
2	Along buried valley to Well TW-2
3	Well TW-2 to stream just east of RR tracks
4	From point in stream to Lake Took-A-While
5	From Lake Took-A-While to River

FLOWPATH 2

Segment No.	Description
1	RWCU tank east to north stream just east of RR tracks
2	From point in stream to Lake Took-A-While
3	From Lake Took-A-While to River

In Flowpath 1, the contaminated slug would migrate northward through Segment 1 in the fractures of the upper 10 to 15 feet of bedrock until it reached the east-west oriented buried valley aquifer located about 800 feet north of the Radwaste Building. At this point it would enter the Pleistocene deposits of the aquifer, and would follow Segment 2 eastward to Well TW-2.

From Well TW-2 it would migrate over Segments 3 and 4 eastward through shallower Pleistocene deposits constrained within a narrow valley to Lake-Took-A-While. The last segment of the flow path to the river would be through the deeper and more permeable Pleistocene deposits beneath the flood plain.

In Flowpath 2, the slug of contaminated water would flow eastward through Segment 1 in the fractures of the upper bedrock. In the vicinity of Boring 348, the bedrock surface dips sharply toward the northeast as shown on Figures 2.4-33 and 2.4-42. At this point, beneath the stream in the north valley just east of the railroad tracks, the slug would emerge from the bedrock into the shallow Pleistocene deposits. The remaining two segments (Segments 2 and 3) of Flowpath 2 are identical to Segments 4 and 5 of Flowpath 1.

2.4.13.3.2 Description of the Models Used

Both a contaminant transport analytical model and a flow and transport numerical model were used in the analysis. The analytical model used was SLUG3D, which was previously certified and utilized in the initial version of this section of the SSES FSAR. The flow and transport numerical model used was the combination of the public-domain codes MODFLOW and MT3D96, as implemented in version 2.2 of the ground-water modeling system, Visual Modflow (Refs. 2.4-86a through 2.4-86c).

SLUG3D, simulating the movement of dissolved solutes in groundwater, was used to predict the likely migration of the radionuclides over the entire lengths of Flowpaths 1 and 2 assuming no effect of the pumping of the station's main supply well TW-2. The combination of the MODFLOW and MT3D96 model was used to simulate the effects of the continuous pumping of Well TW-2 on the fate of the radionuclides passing through the buried-valley aquifer in Flowpath 1. The domain of this finite-difference model was the entire buried-valley aquifer lying north of the plant, which is 3,100 feet long (east to west) with an average width of approximately 500 feet.

The factors affecting solute movement that were incorporated into both models include: the natural downgradient movement of the groundwater, hydrodynamic dispersion of the solutes due to the range of pore-water velocities in the formations, adsorption of cations on the clay minerals present in the Pleistocene deposits, and the decay of radioisotopes with time. One of the assumptions of the SLUG3D model is that solutes can disperse freely in all directions, the extent of dispersion limited only by the magnitude of the velocities and the dispersivity assigned for each dimension. The dispersion results in dilution by mixing in three-dimensional space with native groundwater, assumed to be initially free of the particular isotopes. Recharge of an unconfined aquifer by rainfall increases the saturated thickness of the aquifer and, thus, can provide increased dilution capability. This process was directly incorporated into the numerical simulation in Visual Modflow.

The equation utilized in SLUG3D was derived by the integration over the volume of the slug, of the equation for the instantaneous introduction of a slug having an infinitesimally small volume (Ref. 2.4-87a through Ref. 2.4-87e):

$$C = \frac{mR_f}{n(4\pi D'_X t)^{1/2}\,(4\pi D'_Y t)^{1/2}\,(4\pi D'_Z t)^{1/2}} \exp - \{ \frac{(x - u'_X t)^2}{4D'_X t} + \frac{y^2}{4D'_Y t} + \frac{z^2 +}{4D'_Z t} + \lambda_i t \} \tag{1}$$

for the case where $u_y = u_z = 0$, where,
point of interest (cm)

y = Distance horizontally and normal to flow from the centerline of the flowpath (cm)

z = Distance vertically and normal to flow from the centerline of the flowpath (cm)

λ_i = Decay coefficient = .693/ $T^{1/2}$, where $T^{1/2}$ is the radionuclide half-life in seconds (Sec^{-1})

t = Time since introduction of slug of liquid (Sec)

$u\rho_x$ = The average velocity of the radionuclide in the x direction (cm/sec)

$u\rho_x$ = $(R_f)(u_x)$, where:

u_x = see page velocity in the x direction, (cm/sec)

R_f = the reduction factor due to absorption or cation exchange (dimensionless)

$$1 + (\rho_\beta / n) K_d \qquad \text{(Ref. 2.4-88)}$$

where,

ρ_β = bulk density of the aquifer (gm/ml),

K_d = Distribution coefficient of the radiouclide on the aquifer material (ml/gm)

= (Q!/c)(E), where

Q! = concentration of native cations absorbed on the exchange complex of the aquifer materials (milli-equivalents/g) or (meq/g)

c = total concentration of native cations in the groundwater at equilibrium (meq/ml)

E = equilibrium exchange constant for radionuclide cation displacing native cations on the exchange complex

$D\rho_x$ = reduced dispersion coefficient in the x direction
= D_xR_f (Ref. 2.4-89)

$D\rho_y$ = reduced dispersion coefficient in the y direction
= D_yR_f, and

$D\rho_z$ = reduced dispersion coefficient in the z direction
= D_zR_f,

where,

$D\rho_x$ $D\rho_y$, and $D\rho_z$ are the dispersion coefficients in the x, y, and z directions, respectively, and

D_x = $(I_L)(U_x)$

D_y = $(I_T)(u_y)$

D_z = $(I_v)(u_z)$, where I_L, I_T and I_V are, respectively, the dispersivities in feet in the longitudinal (x) direction), in the horizontal transverse (y) direction and in the vertical (z) transverse direction.

To obtain an expression for the concentration of radionuclides introduced into the groundwater as a finite prismatic volume, at any point (x, y, z) down gradient of the slug origin, equation (1) is integrated with respect to x, y, and z, over the limits $-x_o/2$ to $x_o/2$, $-y_o/2$ to $y_o/2$ and $-z_o/2$ to $+z_o/2$, respectively. Here x_o, y_o and z_o are the dimensions of the slug in the groundwater along the respective axes at time $t_o=0$, and x, y, and z are measured from the center of the prismatic volume of the slug. The resulting expression is given as Equation (2):

$$C = \frac{C_o R_f}{8}\left\{ erf\left(\frac{x + x_o/2 - u'_x t}{\sqrt{4D'_x t}}\right) - erf\left(\frac{x - x_o/2 - u'_x t}{\sqrt{4D'_x t}}\right)\right\}$$

$$\bullet \left\{ erf\left(\frac{y + y_o/2}{\sqrt{4D'_y t}}\right) - erf\left(\frac{y - y_o/2}{\sqrt{4D'_y t}}\right)\right\}$$

$$\bullet \left\{ erf\left(\frac{z + z_o/2}{\sqrt{4D'_z t}}\right) - erf\left(\frac{z - z_o/2}{\sqrt{4D'_z t}}\right)\right\}\left\{ \exp(-\lambda_i t)\right\}$$

Where: C_o = the initial concentration in the interstitial liquid in the slug
= $m/nx_oy_oz_o$

This equation was derived for the case of a slug introduced instantaneously into a saturated porous medium, where the slug has a finite volume at t = 0. The inclusion of the factor, exp $(-\lambda_i t)$, implies that radionuclide decay is accounted for in the calculated concentration (c). SLUG3D was used to calculate the values of concentration at the particular points of interest over the range of time during which the peak occurs.

2.4.13.3.3 Selection of Parameters for SLUG3D Simulations

Conservative parameter values were selected from the range of values determined by field and laboratory tests and from a review of the literature. A summary of the values selected and used in the analysis is given in Table 2.4-36. A description of the parameter-value selection follows.

A sensitivity analysis was previously performed to evaluate what parameter value in each case would yield the highest computed concentration. For all ranges of isotope half life, the results were the same wherever the cation exchange capacity was assumed to be zero. Highest concentration values resulted as the initial slug length approached twice the width, as the total and effective porosities and the dispersion coefficients decreased, and as the flux rate increased. Flux rate is defined as the product of horizontal hydraulic conductivity (K_h) and hydraulic gradient (i). With the cation exchange capacity equal to 0.016 meq/ml, highest concentration values resulted as the initial length of the slug approached twice the width as effective porosity (n_e) decreased as the dispersion coefficients decreased as cation exchange capacity (Q) decreased as the exchange constant (E) decreased as total porosity (n) increased as flux rate increased and as the cation concentration increased.

a. Distance to Discharge Points (x)

As described in Subsection 2.4.13.3.1, the postulated flow paths are shown on Dwg. FF62005, Sh. 1. The calculated distances follow:

Flowpath 1

Flow Path Segment	Description	Distance (x)(feet)
1	RWCU tank north to buried valley	805
1a	RWCU tank north to buried valley model edge	680
2	Along buried valley to Well TW-2	725
3	Well TW-2 to stream just east of RR tracks	860
4	From point in stream to Lake Took-A-While	1,420
5	From Lake Took-A-While to River	1,720

Flowpath 2

Flow Path Segment	Description	Distance (x)(feet)
1	RWCU tank east to stream just east of RR tracks	1,865
2	From point in stream to Lake Took-A-While	1,420
3	Lake Took-A-While to River	1,720

b. Horizontal Hydraulic Conductivity (K_h)

As described in Subsection 2.4.13.2.3, different values of hydraulic conductivity characterize the different segments of the flow paths. Based on the pumping tests and packer tests performed in borings or wells located on or close to the flow path, the following conservative assignment of values has been made:

Flowpath 1

Flow Path Segment	Geologic Unit	Horizontal Hydraulic Conductivity (K_h)
1	Upper 15 ft of bedrock	0.5 ft/day
2	Lower Pleistocene deposits	18.0 ft/day
3	Lower Pleistocene deposits	8.0 ft/day
4	Lower Pleistocene deposits	20.0 ft/day
5	Lower Pleistocene deposits	60.0 ft/day

Flowpath 2

Flow Path Segment	Geologic Unit	Horizontal Hydraulic Conductivity (K_h)
1	Upper 15 ft of bedrock	0.5 ft/day
2	Lower Pleistocene deposits	20.0 ft/day
3	Lower Pleistocene deposits	60.0 ft/day

c. Hydraulic Gradients (i)

Hydraulic gradients were estimated based on the groundwater contours in October 1985 and on a river-level elevation of 491 feet, the latter serving as the groundwater elevation at the discharge point on the Susquehanna River. The elevation of the water table in the vicinity of the RWCU Phase Separator tank was taken as elevation 662 feet, based on water level readings taken in Boring 305 and Boring 116.

The magnitude of water-level elevations at the intermediate points (edge of buried-valley aquifer, Well TW-2, downgradient edge of buried-valley aquifer, and Lake Took-A-While) were taken from the groundwater level data for October 1985 shown on Dwg. FF62005, Sh. 1. The calculated gradients follow:

FLOWPATH 1

Flow Path Segment	Hydraulic Gradient (I) (Dimensionless)
1	0.060
2	0.024
3	0.042
4	0.0388
5	0.0081

FLOWPATH 2

Flow Path Segment	Hydraulic Gradient (I) (Dimensionless)
1	0.055
2	0.0388
3	0.0081

d. Total Porosity (n)

As discussed in Subsection 2.4.13.2.3, based on 29 formation samples obtained from onsite borings, the values of total porosity of the more permeable Pleistocene deposits range between 0.13 and 0.41 with a median of 0.35. Using data from samples taken from borings in the vicinity of the groundwater flow paths, an average value of 0.30 has been selected for the porosity of the lower saturated Pleistocene deposits for the two flow paths. For the first segment of both Flowpaths 1 and 2 through the upper bedrock, a relatively high horizontal hydraulic conductivity (0.50 feet/day) has been estimated for the upper bedrock. Because of this, a relatively high fracture porosity of 0.02 seems justified for the upper bedrock, particularly as the upper 11 feet of bedrock at Boring 305 (located close to the Radwaste Building) was described as severely fractured.

e. Effective Porosity (n_e)

As described in Subsection 2.4.13.2.3, the effective porosity for the Pleistocene deposits was obtained by multiplying the total porosity by a factor of 0.90. This factor is an approximate ratio of effective to total porosity for such materials, based on column studies using non-reactive tracers (Ref. 2.4-86d). Thus, for the Pleistocene deposits, effective porosity is estimated as 0.30 x 0.90, or 0.27. For segment 1 of the flow path, the effective porosity of the fractured bedrock is taken as equal to the estimated total fracture porosity.

f. Dispersivities (α_L, α_T, α_v)

The dispersivities in the longitudinal (x) direction, in the horizontal transverse (y) direction, and in the vertical (z) transverse direction are denoted, respectively, by α_L, α_T, and α_v. Table 4.1.2.2 of Reference 2.4-90 shows values for longitudinal and transverse dispersivities determined at different sites with different rock or sediment materials. Based on this information, the following conservative values for dispersivity have been estimated for the site:

	α_L (ft)	α_T (ft)	α_v (ft)
Upland Flow Paths	10.0	0.5	0.001
Flood Plain	30.0	2.0	0.05

g. Size and Dimensions of the Slug

The volume of liquid involved in the accident is 5,920 gallons or 791.34 cubic feet. It was assumed that the slug would have a thickness of 8 feet in the rock immediately, or very soon after, the rupture occurred. Then, assuming the slug would initially be square in plan view, and taking 0.02 as the upper bedrock total porosity, the initial x_0 (or y_0) dimension of the slug in the ground would be $\{791.34 \text{ cu. ft.}/[(8 \text{ ft.})(0.02)]\}^{1/2}$ or, 70.3 feet.

h. Radionuclides

Seven radionuclides were selected for analysis--Mn-54, Fe-55, Co-60, Sr-90, I-131, Cs-137 and Pu-239. These are believed to be the most significant from the safety and public health point of view and those with half lives on the order of days or years. Table 2.4-35 indicates the radionuclides studied, their half lives and their presumed initial concentrations at the time of the accident.

i. Distribution Coefficients (k_d)

The distribution coefficient (k_d) defines the equilibrium ratio of the mass of a cationic species adsorbed on the exchange complex of geologic materials to that in the interstitial solution. The concentration of native cations adsorbed on the formation material (Q'), concentration of cations in the interstitial fluid (c), and the equilibrium exchange constant (E) for each species are the parameters uniquely involved in the process of adsorption through cation exchange and are related to the distribution coefficient by:

$$k_d = (Q'/c)(E)$$

Considering that the concentration of native cations adsorbed on the formation material would be large compared to that of radionuclide cations of concern here, for purposes of this analysis we have approximated Q' (concentration of adsorbed native cations on the formation) by Q, the total cation exchange capacity. Thus, we have

$$k_d = (Q/c)(E)$$

It is recognized that this model of cation exchange will not strictly imitate the actual cation exchange process that would follow the postulated accident which would simultaneously involve many radionuclide cations from the RWCU Phase Separator tank. However, to minimize the complexity of the adsorption model it was decided to use this equation to model the process assuming a simple binary system of calcium-radionuclide cation and using the native groundwater cation concentration at the site. For conservatism, calcium was chosen as the native cation in solution in the groundwater rather than sodium, as calcium can displace strontium or cesium much more readily than can sodium.

Cation exchange capacity determinations were performed previously on ten soil samples obtained from the lower part of the Pleistocene deposits, in borings, located on or very near the groundwater flow paths. Values ranged from 0.006 to 0.05 milliequivalents/gram (meq/g).

For Segment 1 of both Flowpaths 1 and 2, the cation exchange capacity for the fractured bedrock was assumed to be zero. For the remainder of the two flow paths, occurring in the Pleistocene deposits, estimated Q values ranged from 0.016 to 0.026 meq/g, based on the values obtained for the borings located along the flow paths. An average value for Q for migration through these deposits of 0.021 meq/g was adopted.

Water samples were obtained from observation wells onsite in three different seasons during 1977. Total cation concentration for overburden wells in the vicinity of the flow paths ranged from 7.4×10^{-4} meq/ml to 3.7×10^{-3} meq/ml. A value for C is unnecessary for the analysis of flow in Segment 1 of both Flowpaths 1 and 2, as the cation exchange capacity there is assumed to be zero. It was concluded that the average cation concentration in the groundwater in the Pleistocene deposits along the flow paths ranges from 2.1×10^{-3} to 3.7×10^{-3} meq/ml. An average value for C of 3.0×10^{-3} meq/ml was selected for each segment of the flow paths passing through these deposits.

Considering the case of Strontium-90 first, a simple binary system of Ca-Sr was assumed. Accordingly, an equilibrium exchange constant (E_{Sr}) was estimated from the literature for this condition. An E value of 1.0 was obtained for Strontium-89 and Strontium-90 from Reference 2.4-95a. Thus, the k^d value for Sr-90 in the Pleistocene deposits was calculated to be:

$$(0.021 \text{ meq/g}) (1.0) / (0.003 \text{ meq/ml}) = 7 \text{ ml/g}$$

Reference 2.4-95b indicates that the k_d for cesium on less than 100-μ fraction of sediments from the Savannah River Plant ranged from 18.3 to 130 ml/g. For this analysis, a k_d of 18 ml/g for Cs-137 was selected, which was the lowest of this range.

For Cobalt-60, the estimate for the k_d was based on Table 1.11 of Reference 2.4-96a. In the table, the ratio [k_d(Co-60)]/[k_d(Cs-137)] for adsorption at pH 6.0 on Clinch River Sediment in Tennessee ranged from 0.56 to 0.81. Applying the lowest ratio (0.56) to the estimated k_d for Cs-137 of 18 ml/g, we obtain 10.0 ml/g for Co-60.

For Manganese-54, Appendix B of Reference 2.4-96b indicates that the ratio of Mn-54 adsorbed to large colloids (pre-filter) to that of Co-60 ranged from 0.87 to 2.04. For this analysis, the lowest ratio value, 0.87, was applied to the k_d value estimated for Co-60 of 10 ml/g, to obtain an estimated k_d of 8.7 ml/g for Mn-54.

For Iron-55, Reference 2.4-96c indicates typical k_d values for radioisotopes in desert soils. Relatively high k_d values are given for Strontium, Cesium and Cobalt: 20, 200, and 75 ml/g, respectively. The value given for Iron is 150 ml/g. Using the principal of proportionality based on the values selected in the foregoing paragraphs, the estimated

k_d's for Fe-55 range from 13.5 to 52.5 ml/g. For this analysis, the lowest of these values, or 13.5 ml/g is selected for Fe-55.

No k_d values were estimated for Iodine-131 or Plutonium-239. I-131 has a half life of only 8.04 days and its concentration would be expected to decline below the maximum permissible levels in a period less than the travel time to possible receptors. Because the concentration of Pu-239 in the RWCU Phase Separator tanks, as shown in Table 2.4-35, is only about ten times the limits for unrestricted areas, natural attenuation through dispersion in the course of the migration would be expected to reduce its concentration to acceptable levels without assuming adsorption due to cation exchange.

j. Calculation of Mean Parameter Values to Each Receptor

Because the SLUG3D program provides an analytical solution for the case where the groundwater parameters are assumed constant over the entire flow path, it was necessary to calculate a weighted average for each parameter based on the values from each flow-path segment. The parameter values for each segment of the flow-path were weighted on the basis of the segment length or the time for water to travel over the segment, whichever was most appropriate. Time of travel was the weighting factor in determining the mean horizontal hydraulic conductivity (K_h) and the mean effective porosity (n_e), while the segment length was the weighting factor to determine the mean gradient, the mean dispersivities and the mean k_d values.

2.4.13.3.4 Numerical Model Simulation of Buried-Valley Aquifer

The combination of the MODFLOW and MT3D96 model was used to simulate the effects of the continuous pumping of Well TW–2 on the fate of the radionuclides passing through the buried-valley aquifer along Flowpath 1. The domain of this finite-difference model was the entire buried-valley aquifer lying north of the plant, which is 3,100 feet long (east to west) with an average width of approximately 500 feet.

The aquifer was modeled as a single-layer water-table aquifer, and a finite-difference grid 3,100 feet east to west and 1,000 feet north to south was established. The grid consisted of 36 rows and 13 columns with cell widths ranging from 50 to 100 feet. The finer grid was set up for the area around Well TW-2 located on the eastern side of the grid domain. A series of cells on the northern and southern sides of the grid were set to be inactive so that the boundaries of the aquifer could be approximated as closely as possible. Constant-head boundaries were established at the eastern and western edges of the model. These head values were based on interpolated head values from the October 1985 water-table contour map (Dwg. FF62005, Sh. 1).

The flow model, using MODFLOW, was calibrated under steady-state conditions on the basis of the October 1985 static water-level data and it was verified, or the calibration task was completed, by transient simulations of a 7.11-day pumping test of Well TW-2 performed in December 1992. In the process of calibration, recharge and hydraulic conductivity values were adjusted in several different zones making up the model until satisfactory matching to the measured water levels resulted. Hydraulic conductivity values in the final calibrated model ranged from 4 to 50 ft/day, with the zone in the immediate vicinity of Well TW-2 having a K_h of

18 ft/day. Recharge across the final calibrated model ranged from 0.0003 to 0.0085 ft/day. For the transient calibration, the specific yield, representing the primary storage coefficient, was 0.20.

The calibrated flow model was run in the steady-state mode with Well TW-2 pumping at a series of different rates to determine the maximum long-term pumping rate possible. The maximum pumping rate was found to be 33 gallons per minute (gpm). It was decided to perform the simulations in which MT3D was to be coupled by having TW-2 pump continuously at a conservative rate of 31 gpm (average daily pump rate).

The MT3D component in Visual Modflow was run in conjunction with the steady-state flow model by specifying a number of transport steps. A constant-concentration boundary cell serving as the contaminant source was established at cell (17,8), which was located approximately 680 feet north of the RWCU Phase Separator tanks and along Flowpath 1. This was the edge of the modeled buried-valley aquifer.

A simulation with SLUG3D was employed to evaluate the transport of the slug of contaminated fluid from the tank to cell (17,8) of the numerical model. The duration of the appearance of the contaminants at that point lasted, for all intents and purposes, no longer than 500 days. Based on the results of the SLUG3D simulation, an average concentration for the 500 days for each of the seven radionuclides of concern was computed taking into consideration the rise and decline of concentration with time and the decline of concentration with distance from the center of the slug. These mean concentrations averaged over time and space are given in Table 2.4-37, which presents the parameter values used in the numerical model. The assumed values for dispersivities and k_d's, consistent with the values given in Section 2.4.13.3.3, are also included in Table 2.4-37.

Simulations with the MODFLOW/MT3D model were performed for all the radionuclides of concern except for I-131, which was omitted because the SLUG3D simulation showed that its peak concentration at cell (17,8) was well below the effluent concentration limits for unrestricted use. MT3D was run primarily using the upstream finite-difference option, although in most cases parallel runs were made using the Method of Characteristics (MOC) option as well. The finite-difference method was preferred because it was more stable, it had much lower mass balance errors, and it gave peak concentration values comparable to the MOC method.

An observation point was established in the cell where Well TW-2 was located and in the cell at the far downstream boundary of the model. Concentrations were obtained over time at these observation points, and the transport simulations were run in each case well past the time of the peak concentration for each radionuclide. As shown in Table 2.4-39, for those isotopes for which adsorption was included in the model (Mn-54, Fe-55, Co-60, Sr-90, and Cs-137) the computed time to peak at Well TW-2 ranged from 3,100 to 19,140 days and that for the most downgradient cell 4,050 to 92,110 days. Plutonium-239, for which no adsorption was assumed, was computed to peak at 708 days at Well TW-2 and at 1,740 days at the farthest downgradient cell.

2.4.13.3.5 Discussion of Results of Analysis

The results of the groundwater transport simulations are presented in Tables 2.4-38 and 2.4-39. Table 2.4-38 presents the results of the SLUG3D simulations for the two probable flow paths. Of the radionuclides evaluated the peak concentrations for Sr-90 and Pu-239 are predicted to exceed the 10 CFR 20 Appendix B effluent concentrations values at the entry point to the Susquehanna River via either flow path. The peak concentrations for the other isotopes evaluated are predicted to be well within the regulatory limits prior to discharging into the river.

Table 2.4-39 provides the results of the simulations with the numerical model of the buried-valley aquifer based on MODFLOW and MT3D. All of these simulations include steady state pumping of Well TW-2 at 31 gpm, which was not simulated in the SLUG3D runs. The results of this analysis indicate that most of the contaminated water can be expected to be captured by the onsite TW-2 Well and that of the radionuclides studied, the longer half-life isotopes, Co-60, Sr-90, Cs-137, and Pu-239 would exceed their respective effluent concentration limits. However, at the down-gradient boundary of the aquifer, all isotopes are found to be below their effluent concentration limits for unrestricted or public use.

Since Well TW-2 is on site, access to the use of this water can be restricted if post accident well-water monitoring determines that the radioactive content exceeds the 10CFR 20, Appendix B, Table 1 occupational does limits. As indicated in Subsection 2.4.12.3 the nearest potable water system that utilizes the waters of the Susquehanna River is at Danville, approximately 31 miles downstream of the plant. Dilution due to mixing of the contaminated groundwater with the river water is expected to be in excess of a factor of 650 at Danville. Thus at the nearest potable water system the concentration of all significant radionuclides will be significantly below the effluent concentrations limits for unrestricted public use.

It is believed that flow of groundwater from the RWCU Phase Separator Tanks is more likely to occur along Flowpath 1 rather than Flowpath 2. The bedrock contours shown on Fig. 2.4-42 lend credence to this belief. Thus, if the most likely scenario is for the slug of contaminated fluid to migrate along Flowpath 1 into and through the buried-valley aquifer, then the influence of the constant pumping of Well TW-2 is seen to have a profound effect on the concentrations of radionuclides migrating downgradient of the aquifer through the sediment-filled narrow valley toward the Susquehanna River. Plant records indicate that Well TW-2, sometimes in combination with nearby Well TW-1, withdraws an average of 30,000 to 45,000 gallons a day from the buried-valley aquifer, or an average of 21 to 31 gpm. Should this constant withdrawal be maintained during the months and years following the postulated accident, it should significantly enhance the attenuation of the radionuclides when they appear at the Susquehanna River.

2.4.13.4 Design Bases for Subsurface Hydrostatic Loadings

Plant safety-related structures were designed assuming subsurface hydrostatic loadings caused by a groundwater table at an elevation of 665 ft. This is higher than the expected maximum water table because the groundwater configuration in the region is primarily controlled by topography. At the site the natural topography has been modified by plant excavations. The modified topography in the vicinity of safety-related structures restricts the maximum elevation of the water table to approximately 660 ft. Groundwater levels are further reduced due to a decrease of the effective recharge area by placement of plant structures. These structures and paved other areas intercept rainfall and divert it, reducing infiltration in that area.

At the spray pond, a liner has been designed to restrict the seepage rate from the pond to limit buildup of a groundwater mound in the glacial materials underlying the pond. The pond has been designed for a maximum groundwater elevation of 665 ft. Detailed description of design criteria for control of groundwater levels and seepage at the spray pond, and the stability of the pond, are found in Subsection 2.5.5.

2.4.14 TECHNICAL SPECIFICATION AND EMERGENCY OPERATION REQUIREMENTS

The possibility of adverse hydrologically-related events at the plant site is precluded due to the configuration of the plant site topography. Consequently, there are no emergency protective measures designed to minimize the water associated impact of adverse hydrologically-related events on safety-related facilities. In addition, there is no need for technical specifications for plant shutdown required by accidents resulting from these events. Further discussion may be found in Subsections 2.4.1.1 and 2.4.2.2.

The ultimate heat sink, as described in Subsections 2.4.8 and 9.2.7, has been designed with appropriate consideration to adverse hydrologically-related events.

2.4.15 REFERENCES

2.4-1 ___, Surface Water Supply of the United States, Part 1-3, U.S. Geological Survey, Annual Water Supply Papers through 1960 Water Year.

2.4-2 ___, Water Supply Paper 1302, Compilation of Surface Water Records through September 1950, Part 1-B, U.S. Geological Survey (1960).

2.4-3 ___, Water Supply Paper 1722, Compilation of Surface Water Records, October 1950 to September 1960, Part 1-B, U. S. Geological Survey (1964).

2.4-4 ___, Surface Water Records of Pennsylvania, U.S. Geological Survey Annual Publications, Water Years (1961-1964).

2.4-5 ___, Water Resources Data for Pennsylvania, Part 1, Surface Water Records, U.S. Geological Survey, Annual Publications, Water Years (1965-1974).

2.4-6 ___, Water Resources Data for Pennsylvania, Water Year 1975, Volume 2, Susquehanna and Potomac River Basins, Water-Data Report PA-75-2, U.S. Geological Survey (1976).

2.4-7 ___, Susquehanna River Basin Flood Control Review Study, Reservoir Systems Analysis, U.S. Army Corps of Engineers, Baltimore District (1976).

2.4-8 Personal Communication with Mr. Michael Kenowitz, Baltimore District Corps of Engineers, August 1976.

2.4-9 ___, Pennsylvania Water Company Consolidated Inventory, Pennsylvania Department of Environmental Resources, Bureau of Resources Programming (Unpublished Information).

2.4-10 ___, Pennsylvania Water Company Surface Water Use Inventory, Pennsylvania Department of Environmental Resources, Bureau of Resources Programming (Unpublished Information).

2.4-11 Personal Communication with Mr. Steven Runkle, Pennsylvania Department of Environmental Resources.

2.4-12 ___, Pennsylvania Manufacturing Water Use Report, Pennsylvania Department of Environmental Resources Bureau of Resources Programming (Unpublished Information).

2.4-13 ___, Pennsylvania Consolidated Water Use Report, Pennsylvania Department of Environmental Resources, Bureau of Resources Programming (April 1976) (Unpublished Information).

2.4-14 ___, 100 Best Bass Spots in Pennsylvania (Brochure), Pennsylvania Fish Commission (June 1971).

2.4-15 ___, Flood Plain Information, Luzerne County, Pennsylvania, Susquehanna and Lackawanna Rivers, Luzerne County Planning Commission, Prepared by U.S. Army Corps of Engineers, Baltimore District (June 1974).

2.4-16 Miller, R. A., Hydrologic Data for the June 1972 Flood in Pennsylvania, Water Resources Bulletin No. 9, Commonwealth of Pennsylvania, Department of Environmental Resources (1974).

2.4-17 Bailey, J.F., Patterson, J.L. and Paulhus, J.L.H., Hurricane Agnes, Rainfall and Floods, June - July 1972, Geological Survey Professional Paper 924, U.S. Geological Survey and National Oceanic and Atmospheric Administration (1975).

2.4-18 ___, Tropical Storm Agnes, June 1972, Basins of the Susquehanna and Potomac Rivers and Maryland Portions of Chesapeake Bay and Atlantic Coast, Post Flood Report Volume I Meteorology and Hydrology, U.S. Army Engineer District, Baltimore Corps of Engineers (November 1974).

2.4-19 Hout, J.C., Anderson, R.H., Hydrography of the Susquehanna River Drainage Basin, Water Supply Paper 109, U.S. Geological Survey (1905), p. 175.

2.4-20 Tice, R.H., Magnitude and Frequency of Floods in the United States, Water Supply Paper 1672, Part 1-B, U. S. Geological Survey (1968), p. 376.

2.4-21 US Weather Bureau (1956) Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours, Hydrometeorological Report No. 33 (April).

2.4-22 US Army Corps of Engineers (1965) Standard Project Flood Determination, Engineering Manual (EM) 1110-2-1411, Revised (March).

2.4-23 US Weather Bureau (1961) Rainfall Frequency Atlas of the United States for Durations From 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Paper No. 40 (May).

2.4-24 Ven-te Chow, Open Channel Hydraulics, McGraw Hill Book Company, Inc. New York (1959).

2.4-25 ___, Regulatory Guide 1.59 Design Basis Floods for Nuclear Power Plants, Revision 1, U.S. Nuclear Regulatory Commission, April 1976.

2.4-26 Goodyear, H.V. and Riedel, J.T., Probable Maximum Precipitation, Susquehanna River Drainage above Harrisburg, Pa. Hydrometeorological Report No. 40, U.S. Department of Commerce, Weather Bureau (May 1965).

2.4-27 ___, Standard Project Flood Determinations, Civil Engineering Bulletin No. 52-8, Department of the Army, Office of the Chief of Engineers (1952).

2.4-28 ___, Routing of Floods through River Channels, EM 1110-2-1408, U.S. Army Corps of Engineers (1960).

2.4-29 ___, Unit Hydrographs and Flood Routing, Susquehanna River Basin Study-Draft, U.S. Army Engineer District, Baltimore, Basin Planning Branch (November 1968).

2.4-30 ___, Susquehanna Steam Electric Station Units 1 and 2 Preliminary Safety Analysis Report Amendment No. 4 (1971), pp. 5-29.

2.4-31 ___, Susquehanna Steam Electric Station Units 1 and 2 Preliminary Safety Analysis Report, Pennsylvania Power & Light Company (   ).

2.4-32 ___, Susquehanna River Basin Study Appendix D Hydrology, Susquehanna River Basin Study Coordinating Committee (June 1970), p. D III-38.

2.4-33 ___, HEC-1 Flood Hydrograph Package Computer Program 23-X6-L270, U.S. Army Corps of Engineers, Hydrologic Engineering Center (1969).

2.4-34 ___, The Floods of March 1936, Part 2, Hudson River and Susquehanna River Region, Water Supply Paper 799, U.S. Geological Survey (1937).

2.4-35 ___, Map of Susquehanna River and North Branch, Mile 150-170, U.S. Engineer Office Baltimore (1937).

2.4-36 ___, Backwater Curves in River Channels, EM 1110-2-1409, U.S. Army Corps of Engineers (1959).

2.4-37 Henderson, F.M., Open Channel Flow, Macmillan, (1966), pp. 304-312.

2.4-38 ___, Master Manual for Reservoir Regulation, Susquehanna River Basin, Vol. 1, Upper Basin, U.S. Army.

2.4-39 ___, Susquehanna River Freeze-Over at Harrisburg, Pennsylvania 1870-1955, Weather Bureau Airport Station, Harrisburg, Pennsylvania (January 1956)(Unpublished Information).

2.4-40 Busch, W.F. and Shaw, L.C., Floods in Pennsylvania Frequency and Magnitude Open File Report, U.S. Geological Survey (1960).

2.4-41 ___, Water Resources Data for Pennsylvania Part 1, Surface Water Records, U.S. Geological Survey, Water Year 1971 (1972), p. 105.

2.4-42 US Army Corps of Engineers (1973) Shore Protection Manual, US Government Printing Office, Washington, D.C.

2.4-43 US Bureau of Reclamation (1973) Design of Small Dams, Second Edition.

2.4-44 US Army Corps of Engineers (1970) Hydraulic Design of Flood Control Channels, EM 1110-2-1601.

2.4-45 Wiegel, R.L., Oceanographical Engineering, Prentice- Hall, Inc., New Jersey (1964).

2.4-46 Tennessee Valley Authority (1951) Kentucky Project, Technical Report No. 31, Figure 306.

2.4-47 Sarpkaya, Turgut, Added Mass of Lenses and Parallel Plates, ASCE Proceedings, Journal of the Engineering Mechanics Division, EM3 (June 1960), p. 141.

2.4-48 ___, Comprehensive Water Resources Planning Inventory No. 1, Dams, Reservoirs and Natural Lakes Water Resources Bulletin No. 5, Commonwealth of Pennsylvania, Department of Forests and Waters, Bureau of Engineering, (1970), pp. 49-50.

2.4-49 ___, Surface Water Records for Pennsylvania U.S. Geological Survey (1964), p. 84.

2.4-50 Federal Register, Vol. 41, No. 191, Thursday, September 20, 1976, 41FR43134.

2.4-51 ___, Pennsylvania Streamflow Characteristics, Low-Flow Frequency and Flow Duration, Water Resources Bulletin No. 1, Pennsylvania Department of Forests and Waters (now Department of Environmental Resources) and U.S. Geological Survey (April 1966), p. 99.

2.4-52 ___, Consumptive Water Uses in Chenung and East Susquehanna Basin, New York State Department of Environmental Conservation (Unpublished Information).

2.4-53 Kauffman, C.D., Armbruster, J.T., and Voytik, A., Time-of-Travel Studies Susquehanna River Binghamton, New York to Clarks Ferry, Pennsylvania, Open File Report 76-247, U.S. Geological Survey, Harrisburg, Pa. (March 1976).

2.4-54 Eichert, W.S., Water Surface Profiles Computer Program (HEC-2), Program No. 723-X6-L202A, Hydrologic Engineering Center, U.S. Army Corps of Engineers (19).

2.4-55 Perrego, D.W., Director, Bureau of Design, Pennsylvania Department of Environmental Resources, Harrisburg, Personal Communication (July 1976).

2.4-56 ___, Regulatory Guide 1.113, Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for Purposes of Implementing Appendix I, Revision 1, U.S. Nuclear Regulatory Commission (April 1977).

2.4-57 Lohman, Stanley W., Groundwater in Northeastern Pennsylvania, Harrisburg, Pennsylvania: Pennsylvania Geological Survey Fourth Series, Bulletin W4 (1937).

2.4-58 Gray, C., Shepps, V.C., and others, Geologic Map of Pennsylvania, 1:250,000, Harrisburg, Pennsylvania: Commonwealth of Pennsylvania, Department of Environmental Resources, Topographic and Geologic Survey, Map 1 (1960).

2.4-59 Peltier, Louis C., Pleistocene Terraces of the Susquehanna River, Pennsylvania, Harrisburg, Pennsylvania: Pennsylvania Department of Internal Affairs, Topographic and Geologic Survey, Bulletin G23 (1949).

2.4-60 Hollowell, J.R., Hydrology of the Pleistocene Sediments in the Wyoming Valley, Luzerne County, Pennsylvania, Harrisburg, Pennsylvania: Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Topographic and Geologic Survey, Water Resources Report 28 (1971).

2.4-61 Hollowell, J.R., "Groundwater Conditions Caused by Tropical Storm Agnes", Pennsylvania Geology, The Pennsylvania Geological Survey, 5(2), (1974), pp.2-9.

2.4-62 U.S.G.S., Unpublished data, U.S. Geological Survey, Harrisburg, Pennsylvania (1977).

2.4-63 Newport, Thomas G., Summary of Groundwater Resources of Luzerne County, Pennsylvania, Harrisburg, Pennsylvania: Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Topographic and Geologic Survey, Water Resources Report 40 (1977).

2.4-64 Fairbanks Morse Pump Division, Hydraulic Handbook, Kansas City, Kansas: Fairbanks Morse Pump Division, Colt Industries (1965).

2.4-65 Pennsylvania Department of Environmental Resources, Bureau of Sanitary Engineering, Water Quality Management Information System (WAMIS), Unpublished Computer Printouts of Water Supply Identification Reports (1976).

2.4-66 Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey, Unpublished Computer Printouts of Geo-Survey Groundwater Inventory Reports (1976).

2.4-67 Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey, Unpublished Records of Reports by Drillers Concerning Water Well Completion.

2.4-68 Pennsylvania Department of Environmental Resources, Bureau of Water Quality Management, Unpublished Computer Printouts of Health Groundwater Well Reports (1975).

2.4-69 Pennsylvania Department of Environmental Resources, Bureau of Water Quality Management, Unpublished Computer Printouts of Health Groundwater Spring Reports (1975).

2.4-70 Pennsylvania Department of Environmental Resources, Division of Comprehensive Resources and Planning, Unpublished Records and Computer Printouts Regarding Groundwater Pumpage (1970).

2.4-71 Hillard, R.L., Manager, Hazleton City Authority Water Department, Personal Communication (1977).

2.4-72 U.S. Bureau of the Census, 1970 Census of Population, Number of Inhabitants, Pennsylvania, PC(1)-A40, U.S. Government Printing Office, Washington, D.C.(1971).

2.4-73 Gilbert Associates, Inc., "Preliminary Susquehanna Site Report, Pennsylvania Power & Light Co., Allentown, Pennsylvania," (July 1966).

2.4-74 Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Preliminary Safety Analysis Report, Vol. 1, Allentown, Pennsylvania: Pennsylvania Power & Light Company (April 1971).

2.4-75 Dames & Moore, "Report on Foundation Investigation, Proposed Susquehanna Steam Electric Station, Units 1 and 2, Luzerne County, Pennsylvania, Pennsylvania Power & Light Company" (May 12, 1972).

2.4-76 Dames & Moore, "Progress Report #1, Water Well Construction on Flood Plain, Susquehanna Steam Electric Station, Pennsylvania Power & Light Company" (September 1, 1972).

2.4-77 Ranney Method Western Corporation, "Report on Hydrogeological Survey for Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Berwick, Pennsylvania," (January 31, 1973).

2.4-78 Dames & Moore, "Report on Exploratory Drilling Program for Proposed Water Intake and Discharge Structures, Susquehanna Steam Electric Station, Units 1 and 2, Pennsylvania Power & Light Company" (May 2, 1973).

2.4-79 Dames & Moore, "Report on Supplemental Foundation Investigation, Susquehanna Steam Electric Station, Units 1 and 2, Luzerne County, Pennsylvania, Pennsylvania Power & Light Company," (September 1973).

2.4-80 Dames & Moore, Letter to Pennsylvania Power & Light Company Reporting Results of Water Well Construction and Testing at Susquehanna Steam Electric Station (February 7, 1974).

2.4-81 Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Preliminary Safety Analysis Report, Amendment No. 3, Allentown, Pennsylvania: Pennsylvania Power & Light Company.

2.4-82 Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Preliminary Safety Analysis Report, Amendment No. 4, Allentown, Pennsylvania: Pennsylvania Power & Light Company.

2.4-83 Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Preliminary Safety Analysis Report, Amendment No. 5, Allentown, Pennsylvania: Pennsylvania Power & Light Company.

2.4-84 Pennsylvania Power & Light Company, Susquehanna Steam Electric Station, Units 1 and 2, Preliminary Safety Analysis Report, Amendment No. 17, Allentown, Pennsylvania: Pennsylvania Power & Light Company.

2.4-85 Dames & Moore, Boring Log Records and Field and Laboratory Data Relative to the PP&L Susquehanna Steam Electric Station.

2.4-86 Routsen, R.C. and Serne, R.J., Experimental Support Studies for the PERCOL and Transport Models, Richland Washington: Battelle Pacific Northwest Laboratories, BNWL-1719.

2.4-86a Guiguer, N. and T. Franz, Visual Modflow User's Manual, Version 2.2, Waterloo Hydrogeologic, Inc. Waterloo, Ontario (1996).

2.4-86b McDonald, M.G., and A.W. Harbaugh, A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, Book 6, Modeling Techniques, Chapter A1, Techniques of Water-Resources Investigations of the United States Geological Survey, U.S. Geological Survey, Washington, DC (1988).

2.4-86c S.S. Papadopulos & Associates, Inc., MT3D96, A Modular Three-Dimensional Transport Model for Simulation of Advection, Dispersion and Chemical Reactions of Contaminants in Ground-Water Systems, Documentation and Input Instructions, S.S. Papadopulos & Associates, Inc., Bethesda, Maryland (1996).

2.4-86d Routsen and Serne, R. J. Experimental Support Studies for the PERCOL and Transport Models, Ricland, Washington: Battelle Pacific Northwest Laboratories, BNWL-1719.

2.4-87 Baetsle, L.H. and Souffriau, J., "Installation of Chemical Barriers in Aquifers and their Significance in Accidental Contamination," in Disposal of Radioactive Wastes Into The Ground, Proceedings of a Symposium, 29 May to 2 June, 1967, Vienna, Austria: International Atomic Energy Agency (1967).

2.4-87a Baetsle, L.H., and J. Souffriau, "Installation of Chemical Barriers in Aquifers and Their Significance in Accidental Contamination," in Disposal of Radioactive Wastes into the Ground, Proceedings of a Symposium, 29 May-2 June 1967, International Atomic Energy Agency, Vienna, Austria (1967).

2.4-87b Codell, R., Discussion of "Two-Dimensional Plume in Uniform Ground-Water Flow" by Wilson, J.L. and P. J. Miller, Journal of the Hydraulics Division, ASCE, HY12, pp.1682-1683 (1978).

2.4-87c Freeze, R.A. and J.A. Cherry, Groundwater. Prentice-Hall1 Inc., Englewood Cliffs, NJ (1979).

2.4-87d Wilson, J.L. and P. J. Miller, "Two Dimensional Plume in Uniform Ground-Water Flow," Journal of the Hydraulics Division, ASCE, HY4, pp. 503-514 (1978).

2.4-87e Wilson, J.L. and P. J. Miller, Discussion Closure of "Two-Dimensional Plume in Uniform Ground-Water Flow". Journal of the Hydraulics Division, ASCE, HY12. pp. 1567-1570 (1979).

2.4-88 Kaufman, W.J., "Notes on Radionuclide Pollution of Groundwaters," in Water Resources Engineering Series, University of California, Berkeley, California (1973).

2.4-89 Lai, Sung-Ho and Jurinak, J.J., "The Transport of Cations in Soil Columns at Different Pore Velocities," Soil Science Society of America Proceedings, 36 (1972), pp. 730-733.

2.4-90 Mercer, J.W., Rao, P.S.C., Thomas, S.D., and B. Ross, "Description of Parameters and Data (And Typical Values) Useful for Evaluation of Migration Potential at Hazardous Waste Management Facilities," Letter report to the U.S. Environmental Protection Agency, Contract No. 68-01- 6464 (1982).

2.4-91 Lenda, A. and Zuber, A.,"Tracer Dispersion in Groundwater Experiments," in Isotope Hydrology 1970, Vienna, Austria: International Atomic Energy Agency (1970).

2.4-92 Seaber, Paul R., An Appraisal of the Groundwater Resources of the Upper Susquehanna River Basin in Pennsylvania (An Interim Report), U.S.G.S., Water Resources Division, Prepared in Cooperation with the U.S. Army Corps of Engineers (1968).

2.4-93 Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley and Sons, New York (1969), pp. 284-5.

2.4-94 Cooper H.H., Bredehoeft, J.D., and Papadopulos, I.S., "Response of a Finite-Diameter Well to an Instantaneous Charge of Water," Water Resources Research, 3(1), (1967), pp. 263-269.

2.4-95 Heald, W.R., "Characterization of Exchange Reactions of Strontium or Calcium of Four Clays, "Soil Science Society of American Proceedings," (1960), pp. 103-106.

2.4-95a Heald, W. R., "Characterization of Exchange Reactions of Strontium or calcium of Four Clays," Soil Science Society of American Proceedings, (1960), pp. 103 - 106.

2.4-95b Elprince, A.M., Rich, C.I., and D.C. Martens, "Effect of Temperature and Hydroxy Aluminum Interlayers on the Adsorption of Trace Radioactive Cesium by Sediments Near Water-Cooled Nuclear Reactors," Water Resources Research, 13(2), pp. 375-380 (1977).

2.4-96 Parker, F.L., Strunness, E.G., Tamura, T., Bruscia, G., Morton, R.J., Eastwood, E.R., and Sorathesn, A., "Clinch River Studies," Health Physics Division Annual Progress Report for the Period Ending July 31, 1960, Oak Ridge National Laboratory, ORNL-2994 (1960), pp. 45-57.

2.4-96a Parker, F.L., Strunness, E.G., Tamura, T., Bruscia, G., Morton, R.J., Eastwood, E.R., and Sorathesn, A., "Clinch River Studies," Health Physics Division Annual Progress Report for the Period Ending July 31, 1960, Oak Ridge National Laboratory, ORNL-2994 (1960), pp. 45 - 57.

2.4-96b Buddemeier, R.W. and J.R. Hunt, "Transport of Colloidal Contaminants in Groundwater: Radionuclide Migration at the Nevada Test Site," Applied Geochemistry, 3(5), pp. 535-548 (1988).

2.4-96c Antommaria, P.E. and H.L. Crouse, "Report on Tailings Management Practices at Tailings Pond at Gas Hills, Wyoming," Project RM77-419, D'Appolonia Company, Denver, CO (1977).

2.4-97 U.S. Department of Commerce, Bureau of Public Roads. Hydraulic Charts for the Selection of Highway Culverts. Hydraulic Engineering Circular No. 5, December, 1965.

2.4-98 Pennsylvania Power and Light Company, "Susquehanna Steam Electric Station, Units 1 and 2, Environmental Report - Operating License Stage" (ER-OL), May, 1978.

2.4-99 U. S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation, NUREG-0564, "Final Environmental Statement related to the Operation of Susquehanna Steam Electric Station, Units 1 and 2, Docket Nos. 50-387 and 50-388, Pennsylvania Power and Light Company, Allegheny Electric Cooperative, Inc." (FES), June, 1981.

2.4-100 LandStudies, "Existing Stormwater Report for PPL SSES in Salem Township, Luzerne County, Pennsylvania, "(August 31, 2010), EC-099-1018.